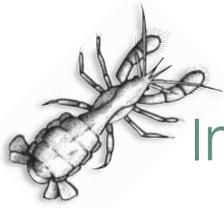




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Important Notes

Welcome to Padilla Bay — students of all ages! Thank you for sharing your time in helping us carry out the day’s activities. Your participation makes our program possible.

Clothing

A cool rain can smell rich, heighten the vividness of natural colors and be very refreshing, or it can turn a potentially invigorating day sour. A raincoat and warm clothes are essential. Layers of clothes help trap insulating air and are best for changing conditions. Hats and gloves are recommended from October to April. Old shoes that tie or snug boots are best for low tide days. Shoes that pull off easily can be a problem in soft mud. It’s often windy and cold on the beach. Please be prepared for the worst and hope for the best!

Food

Eating a high-energy breakfast is a critical beginning to a day in the field. Please advise your class to eat heartily and bring a solid lunch with a “treat”. We have nothing edible to offer here at the Center.

Schedule

The day's program is packed with a variety of activities, flexible enough to work within your time limitations. Our goal is to make the day meaningful to you. It will be most successful if we can complement your curriculum, so please feel free to discuss your specific needs and interests.



Schedule For The Estuary Program

9:30 - 10:30 - Welcome and Orientation

After a welcome outside, the group will meet in the theater for a brief introduction to Padilla Bay. Terms such as “estuary,” “plankton” and “detritus” will be explained through a film and a short skit by the “Estuary Soup” chef.

10:40 - 11:45 - Mud Flat Safari

The class will head down to the water’s edge. Teams of students, each with an adult leader, will explore the different habitats of the estuary by looking for plants and animals on the beach. We will collect plankton and a sample of organisms to investigate with microscopes in the afternoon.

11:45 - 12:15 - Lunch at Bay View State Park

12:30 - 12:45 - Water Drop Jungle: Plankton Viewing

The live plankton sample gathered at the beach will be projected onto a screen for all to view.

12:45 - 1:30 - Interpretive Exhibits

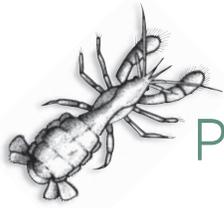
Students take in the exhibits at the Center. There are interactive displays about watersheds and the Padilla Bay estuary, a “hands-on” room for children of all ages, microscopes for individual use, and live saltwater aquaria.

1:30 - 2:00 - Chalk Talk History of NW Estuaries

The “chalk talk” presents human activities in a typical Northwest estuary. This leads to the wrap-up discussion of decisions students make which affect estuaries.

Simulation Game

This optional activity is used with older groups when time allows. Students role play various characters with conflicting interests, and make a decision about development of an estuary.



Parent Page

Thanks for your help!

We hope you gain as much from your visit as your child will. There are several times during the day when we need your help supervising a small group of students. One is during the beach exploration, and the other is during the exhibit tour.

Exploring the Beach

At the beach, your group will have clear instructions and boundaries. Your job will be to keep them together and on task.

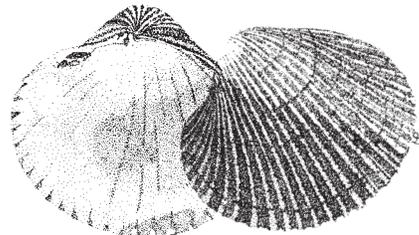
When your group brings something to you and asks, "What is this?"— don't worry about knowing the name. Rather than naming, try returning a question. "Where did you find it? What do you think those feathery things are? Does it have a head? Can you find the name on the field identification sheet?" Open-ended, stimulating questions involve the children and encourage discovery. This trip is about sharing your enthusiasm, watching the excitement of children, and exploring with them.

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 leave 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.

Exhibit Tour

You will also be supervising your group during the exhibit tour. Please remind your students about proper indoor behavior. Interactive exhibits are sturdy, but not indestructible. Make sure students are treating exhibits with respect. In the aquarium room, ask students to not tap on the glass. The vibrations disturb the aquarium animals.





Aquaria Inquiry

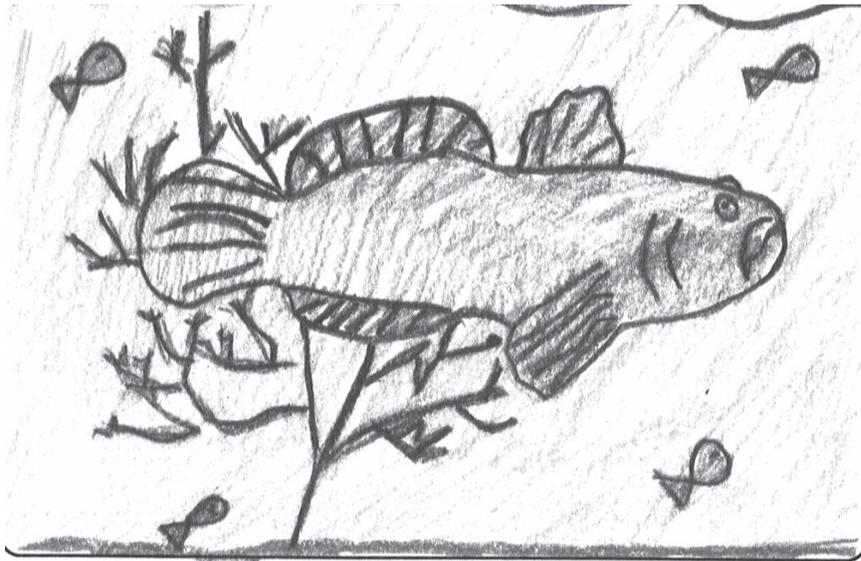
Teachers and adult leaders can use these questions to focus students' attention in the aquarium room.

1. Find an animal that can: squeeze through narrow places. . . hold still and look like a rock . . . bury itself to hide from predators . . . use another's shell for a home.
2. Find 3 animals in the eelgrass that are camouflaged. With your group vote on the "Best Camouflaged" eelgrass inhabitant. Discuss how camouflage aids in survival.
3. Think of 3 adaptations that help animals avoid being eaten (close up, bury, camouflage, sting, pinch, have spines).
4. Find one fish that swims constantly and one that rests on the bottom. Think of an advantage for each style (keep moving to avoid being eaten, blend in).
5. Choose your favorite animal and make up a name for it.
6. Think of waves pounding on rocks. What are some adaptations to help animals survive this pounding? (hard shell, suction for holding on, ability to hide under rocks and in sand)
7. What bird can probe deep in the mud for its dinner? (shorebird) What enables it to do so? (long bill) What might it feed on? (worms, small clams, snails)
8. Hermit crabs are scavengers, searching out and eating wounded or dead things. They help to "recycle" nutrients in an estuary. Can you find dead things in the tanks?
9. How many different species of seastars can you find? Look for tube feet.
10. What are 3 animals adapted for living in the mud? (shrimps, clams, worms) Give a unique adaptation for each that aids it in living "down under." (see wall model)
11. What makes eelgrass different from seaweed? (reproduces by flowers, has roots not holdfasts, leaves not blades, anchors in mud not onto rocks) Why is eelgrass so important to animals? (food, habitat, source of detritus)



Aquaria Inquiry

12. Why do some raptors (birds of prey) live by estuaries? (abundance of food: shorebirds on mudflats, fishes in water, small rodents in nearby fields)
13. Find out which birds, fishes and mammals live in marshes.
14. How do nutrients from eelgrass get recycled? (bacteria and fungi feed on the dead grass and break it down. These particles are in turn food for plankton and detritivores)
15. How many animals can you find that have hard shells on the outside of their bodies? (snails, clams, barnacles, limpets, shrimps) How does this help them survive? (protection)



by Pam



On Your Own At The Beach

Beach Etiquette

Estuaries are valuable habitats, easily damaged by careless exploring. 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 to it reminds us to step lightly and carefully return rocks to their original position. A toy shovel reminds us to fill in holes. A limpet shell reminds us to leave limpets safely attached to their rocks, and a piece of litter encourages children to pick up garbage. Be sure your students know these rules.

Equipment

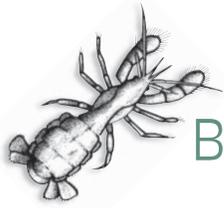
We use shovels, plastic jars, and dissecting trays to help students find animals, focus attention and share their discoveries. (One set of equipment for every 5-8 students is adequate.) This equipment is not necessary, but is helpful. Feel free to use any of the following Scavenger Hunt lists to help your group in their exploration. Students should handle animals as little as possible and return all animals to their appropriate habitats.

Cleanup

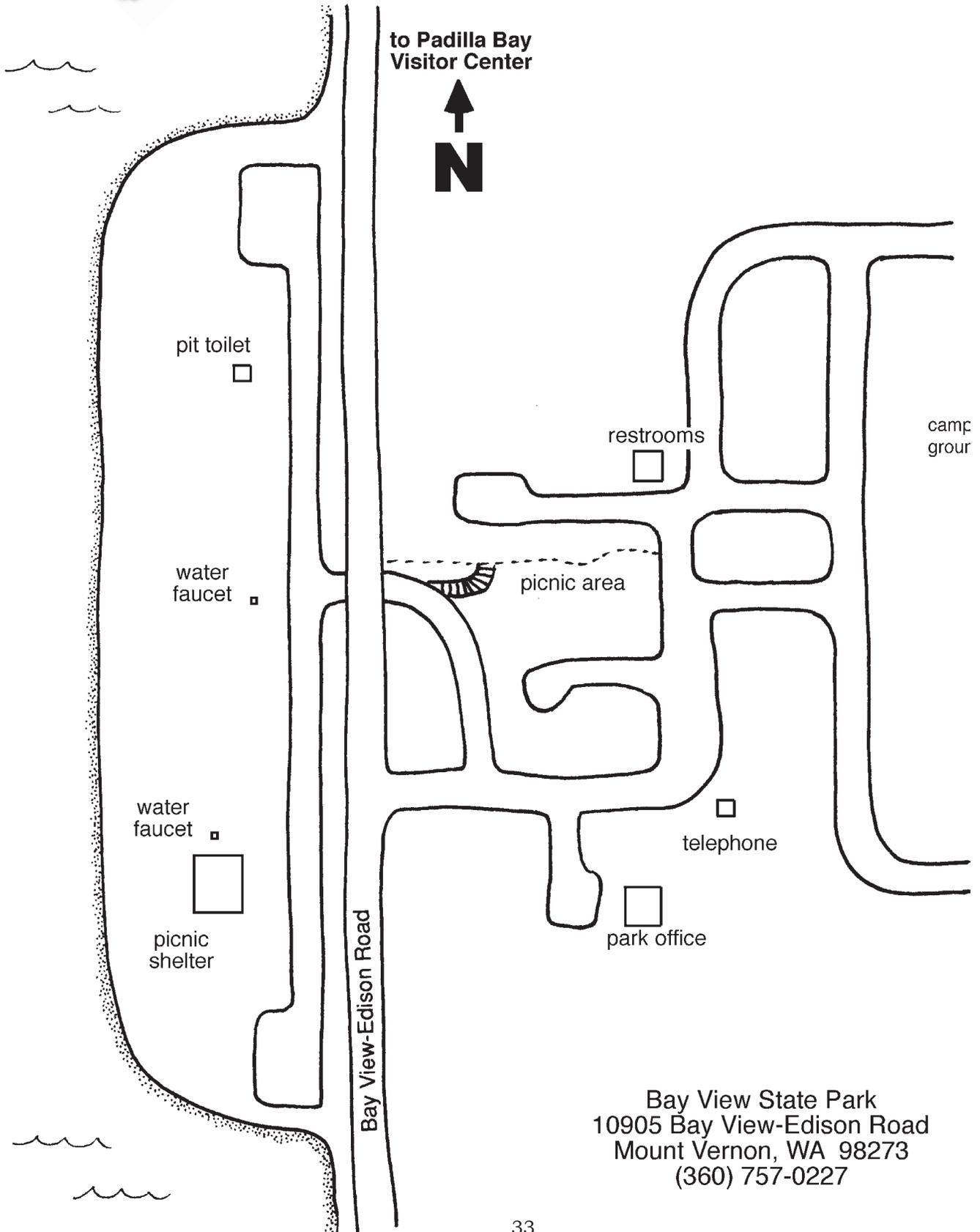
High tide cleanup is as simple as wiping off loose sand and perhaps changing wet shoes. Low tide in Padilla Bay means mud. Setting clear expectations is important. Each teacher has his or her own "tolerance level" for how much mess is allowed. Be sure your students know what you expect. You should expect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



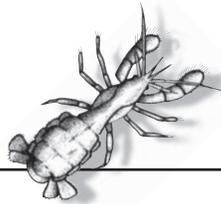
Several dishpans of water and a hose help reduce congestion and clogging mud at the faucet. Please wash up at the faucet at the beach, not in the rest rooms. Check for litter before you leave. Your help in keeping the picnic area and rest rooms clean will insure that we continue to have access to this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



Bay View State Park



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



Padilla Bay's Scavenger Hunt



Clamshells: 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 _____

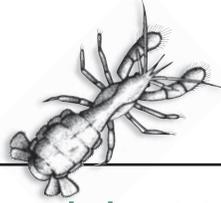
2 kinds of crabs:

3 unique smells:

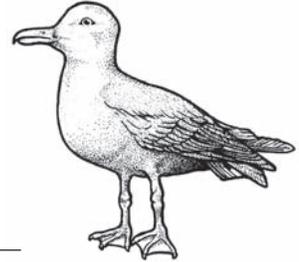
2 different mud dwellers:

Signs of human influence: garbage

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



Low Tide Hunt



__ 2 bivalves (with hinged shells) _____

__ 4 birds _____



__ 2 gastropods (snail and slug family) _____

__ 2 different kinds of eelgrass _____

__ a red algae

__ a green algae



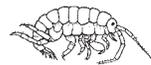
__ a brown algae

__ 2 animal tracks _____



__ 3 mud dwellers _____

__ a detritivore (eats detritus)



__ 2 kinds of crabs _____

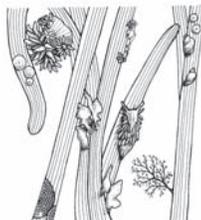
__ a crab molt (a shed shell)



__ 2 unique smells _____

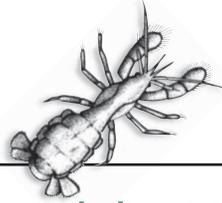
__ 2 epiphytes (living on a plant) _____

__ 1 filter feeder



__ a sponge

__ garbage

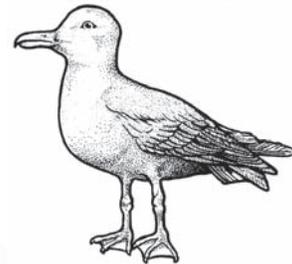


High Tide Hunt

__ 2 different bivalves (hinged shells)



__ 4 different birds



__ 2 different gastropod shells (snails, limpets)

__ 2 different eelgrass species

__ eelgrass with epiphytic algae



__ eelgrass with Spirorbis (snail worm) casings



__ eelgrass with bryozoan colonies

__ a red algae



__ a green algae



__ a brown algae

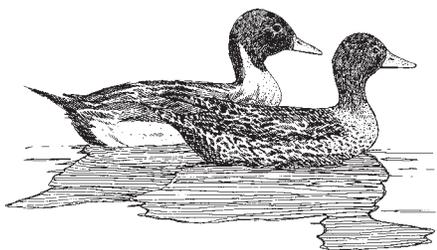
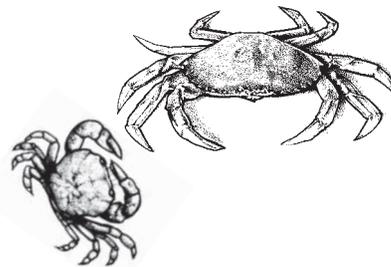


__ an amphipod

__ a crab molt (empty shell)

__ 2 unique smells

__ 4 Signs of human influence





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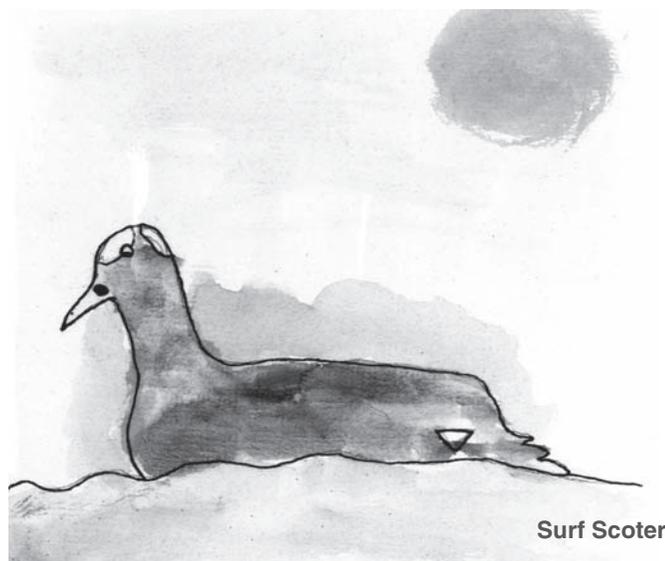
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Surf Scoter



Critter Creations

Research and create an estuary animal or plant.

Ask each student to choose one animal or plant from the list below. Using resources from the library have students research:

- what their organism looks like
- where it lives
- how it fits into the food web.

Using modeling clay, instant paper maché or home-made clay, have them shape their animal/plant, let it dry, and paint it. Follow-up activities may include written and oral presentations, or a class project building an estuary diorama.

Invertebrates

jellyfish
anemone
ribbon worm
lugworm
sand worm
barnacle
amphipod
eelgrass isopod
mud shrimp
hermit crab
Dungeness crab
shore crab
sponge
limpet
mud snail
bubble shell
bent-nosed clam
little neck clam
mud clam
mussel
oyster
sea star

Fishes

herring
salmon
surf smelt
bay pipefish
three-spine stickleback
shiner perch
sculpin
flounder
gunnel

Birds

common loon
great blue heron
black brant
mallard
sandpiper
dunlin
peregrine falcon
bald eagle
gull
bufflehead

Plants

eelgrass
algae
phytoplankton
salt grass
pickleweed

Mammals

river otter
harbor seal
muskrat



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 . . .

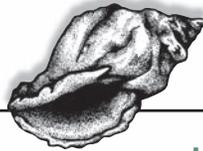


Afternoon In An Estuary

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 . . .

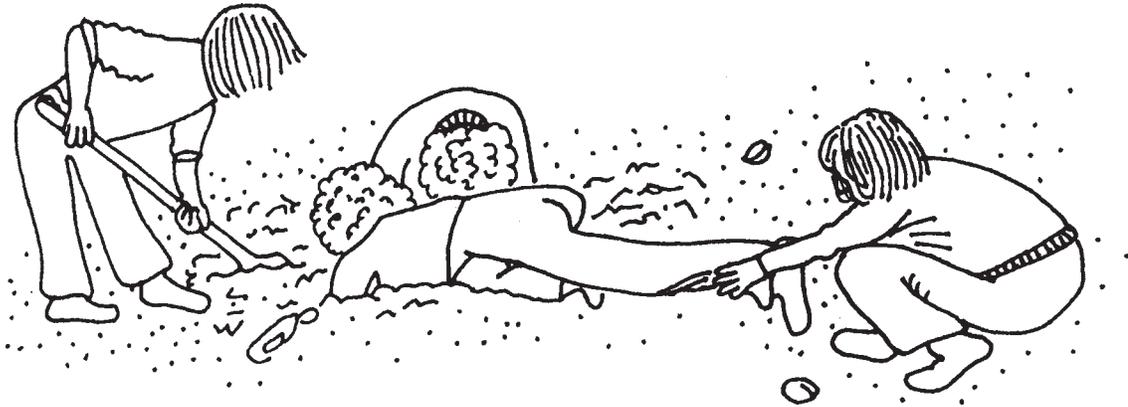
Adapted from “Clean Water, Streams, and Fish”,
Washington State Office of Environmental Education





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.



Thanks to the Poulsbo Marine Science Center



Estuary Stories

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

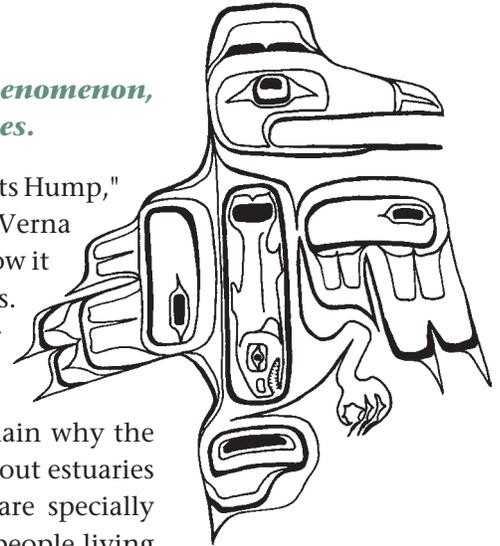
Rudyard Kipling's *Just So Stories* ("How the Camel got its Hump," etc.) and *Why Mosquitoes Buzz in People's Ears*, by Verna Aardema, are familiar examples of stories that tell "how it came to be." Choose a story to read aloud to your class. Collections from other cultures are good sources for such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





The Salmon Gazette

Create a student newspaper with a salmon theme.

Creating a newspaper is a great interdisciplinary tool for in-depth exploration of a topic. Students draw from their studies as well as from their lives and local environments to gather information, compiling it into a creative product to share.

Salmon are very much "in the news" these days. Their dwindling populations, their dependence on many different habitats throughout their life cycle, and their strong place in Northwest culture, all make salmon an excellent topic for study.

Study the local newspaper with the group. You might also arrange to take a trip to a newspaper office or invite a news media representative to speak to your students. This will allow them to see how complex the news-gathering process is. If your school has its own newspaper, consult with the staff for resources and advice, or invite the staff to work with you to produce your "Gazette".

Organize students into four or more news departments. Ask each department to discuss types of stories and headlines they can write. Examples of departments and sample topics are listed on the following page. Illustrations or photographs should accompany the stories.

Plan to distribute the newspaper locally in school and perhaps also in the community. Contact the local newspaper to see if the editor will print one or two of the better stories.

Finally, review the newspaper with the students. Question them about salmon issues. What have they learned about publishing a newspaper? What was the biggest problem they encountered and how did they solve that problem?



Adapted from *Wetlands Conservation and Use*
U.S. Fish & Wildlife Service.



The Salmon Gazette

Departments

Local, Regional,
and National News

Editorials

Sports &
Recreation

Community Events

Art & Culture

Food

Advertisements

Travel & Leisure

Weather

Sample Topics

- logging, farming, and development in the watershed that might affect salmon
- related science news; research findings
- health of local salmon stocks

- opinions about actions to help salmon
- letters to the editor

- salmon runs, good observation spots
- fishing regulations and hot spots

- watershed cleanups
- stream restoration activities
- local meetings

- illustrations, poems or cartoons about salmon
- interview a local wildlife or fish printing artist
- native designs with a salmon image
- storytelling

- salmon and seafood recipes
- interviews with restaurants that serve salmon

- ads for salmon-related businesses, e.g. smoked salmon, sporting goods stores
- help wanted ads for related jobs

- estuaries to visit around the state, country or world

- el niño
- floods
- drought



Salt Water - Fresh Water

Investigate the properties of salt and fresh water.

You can use real samples from the sound and a nearby stream or river, or make samples in your classroom.

Salinity

Ocean water is about 35 parts per thousand salt. That's about one teaspoon in a cup of water. Boil salt water and fresh water and weigh the residue remaining.

Density

Use a hydrometer (available at aquarium stores) to measure water density. What happens to the hydrometer as salinity increases?

Salinity

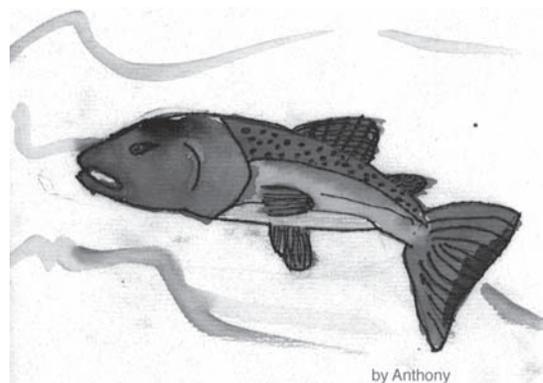
Salt water is denser than fresh water. Use food coloring to show what happens when you slowly pour one into the other. Place an egg in a container of fresh water. Guess how much salt you need to add to make the egg float and then test your guess. Ask your students if they would expect to find higher salinity at the surface or the bottom of an estuary?

Osmosis

Soak 4 eggs in vinegar overnight to remove the shells. Being careful not to break the membranes, place one egg in salt water and one in fresh or distilled water. (The others are extras in case of accidents.) Observe the changes over the course of a day. Ask students to guess why. Osmosis is the movement of a substance across a membrane from an area of higher concentration to an area of lower concentration.

Adaptations

Talk about animals and salinity. List plants and animals that are found in fresh water and those found in salt water. Make a Venn Diagram to show which occur in both. What problems do these organisms face? Check library resources to find out how salmon cope with the change from fresh to salt water.





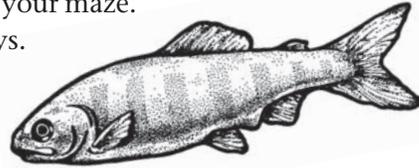
Salmon Maze

Make your own salmon maze.

Life is not easy for a young salmon. Young salmon traveling down river must pass all sorts of hazards. Out of 2,500 coho salmon eggs, only 6 fish will ever make it to the ocean!

Use ideas from the list of places and hazards below to make your own maze. Start with young salmon in their redd (gravel nest) and end with the ocean. Put hazards at dead ends in your maze.

Put good conditions along correct pathways.



Stream

Ocean

Estuary

River

Delayed by slow flow in reservoir

Eaten by gull after it goes over a dam spillway

Killed in power turbine of dam

Trapped in an irrigation ditch

Swim into oil poured down a storm drain

Gills choked with mud and silt from construction site

Eaten by raccoon

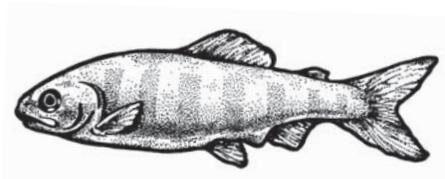
Low oxygen in warm water because of no shade trees

Clean river water

Shrubs and trees growing along stream

Woody debris on stream bed

Healthy eelgrass meadow to hide in



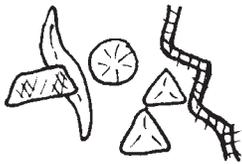
Now copy your maze and share with friends!



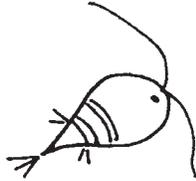
Food Chain Game

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



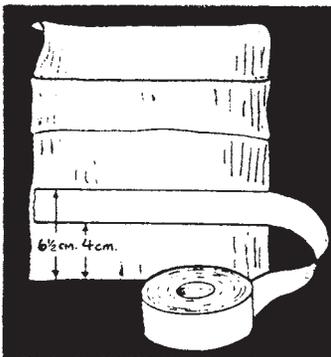
sculpins



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.



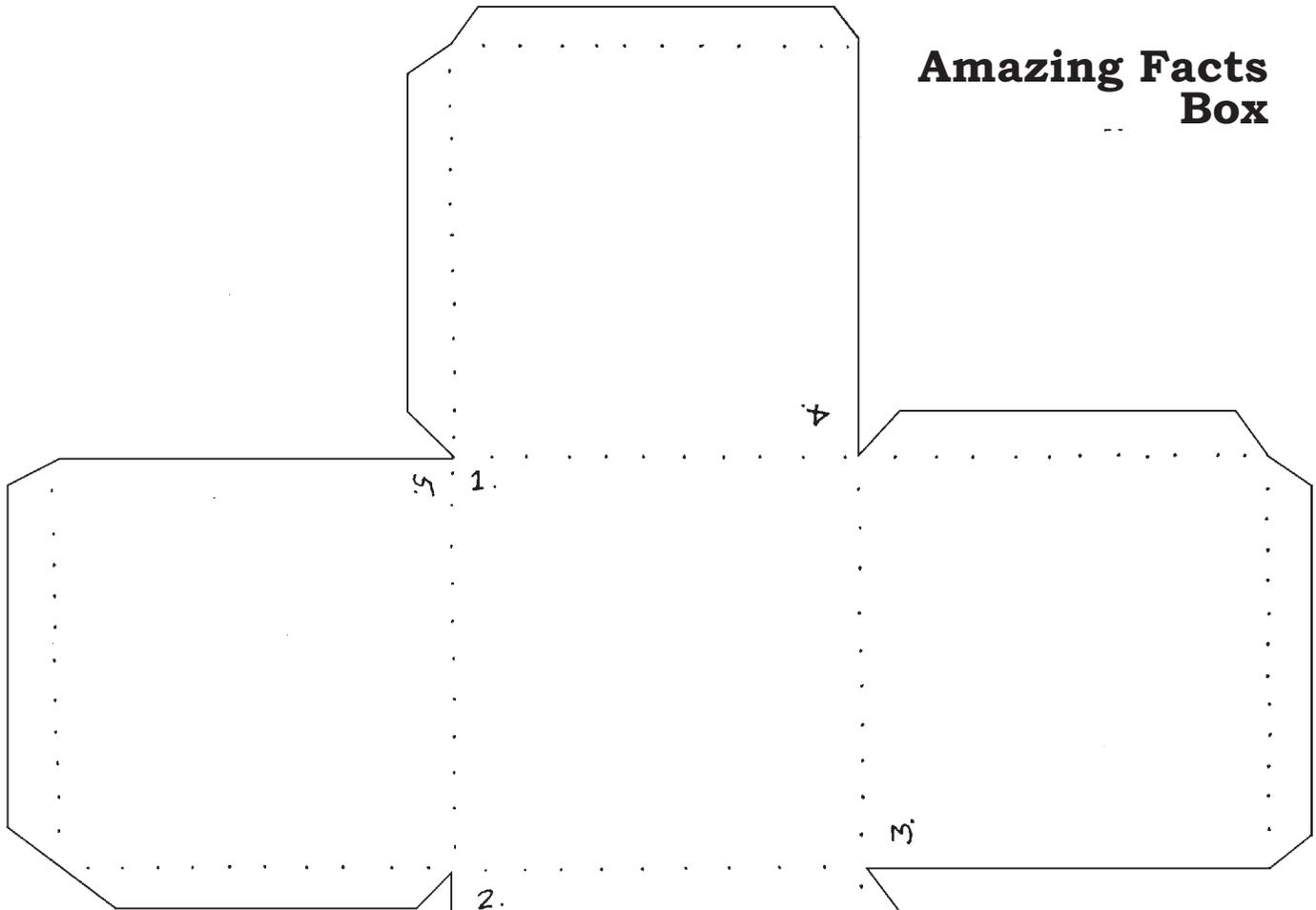
Food Chain Game

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?!

Amazing Facts Box



How to do it:

1. Write or draw questions, riddles, & puzzles about estuaries, plants & animals in each of the 5 boxes.
2. Write the answers in the answer box.
3. Cut on the solid line.
4. Fold on the dotted lines.
5. Tape together your Amazing Facts Box.

Now try it on your friends!

ANSWERS

- 1.
- 2.
- 3.
- 4.
- 5.

