Estuary Food Web

Grades: 3-7

Subject, Science, Language Arts

Time required: 1 class

Key Concepts:

River and estuary habitat is important for fish, wildlife, and people.

Objectives:

Students will:

-Recognise that estuary food chains are the transfer of food energy from plants through to a top consumer.

- Give examples of a food chain from the estuary and a food web from the estuary.

SQUAMISH RIVERS & ESTUARY

Key Words:

Community, herbivore, carnivore, adaptation, ecosystem, food chain, food web, detritus

Skills:

Classification, discussion, writing Interpreting, analyzing

Background:

An ecosystem is an interacting and interrelated community of living and nonliving, physical and chemical things between which energy and materials are exchanged. A community includes a group of plants and animals that occur in a given habitat. An ecosystem can be as large as the ocean or forest or as small as an aquarium filled with plants, fish, bacteria, fungus, and invertebrates.

Food chains are the transfer of food energy from plants through a series of organisms to a top consumer. This is achieved by a series of eating and being eaten. For example, one link in the food chain might be a plant-eating animal (herbivore) being eaten by a meat-eating animal (carnivore).

Materials:

- Estuary Food Chain story
- Estuarine Food Web student handout
- List of Squamish Estuary plants and animals
- String (optional)

Estuary Food Web

Background Continued
An example of an estuarine food chain is as follows:

Sun
↓
Marsh Plant
↓
Protozoa
↓
Amphipod
↓
Stickleback
↓
Great Blue Heron.

In the above food chain, the amphipod does not eat the marsh plant. This is an important aspect of the food chain, since only a few estuarine animals directly eat the vast amount of living plant material in the estuary. The few herbivores in the estuary are mainly water birds (such as geese and ducks) which feed on bulrushes and marsh plant seeds).

All the dead plant material accumulating at the end of the growing season forms an important base of the estuarine food chain call detritus. Detritus consists of dead plants combined with a rich assortment of microscopic fungi, bacteria, protozoa, and other micro-organisms. Small invertebrates such as worms, snails, and crustaceans (e.g. amphipods) thrive on this detritus.

The millions of small invertebrates fed by detritus are eaten by fish, birds, and amphibians. Small fish and amphibians are in turn eaten by larger fish, birds, and mammals. Much of the estuary's food chain is therefore supported by the rich organic detritus of the marshes, shallow slough, and tidal channels.

In reality, the estuary consists of an interconnection of different food chains. This pattern is called a food web. The food web pattern recognizes that each species can get its food from one or more of its fellow inhabitants in the estuary community.

Procedure:

1. Brainstorm with students what plants or animals might be found in the estuary and list them on the blackboard. Have students classify them as either herbivores or carnivores (some animals eat both plants and animals– they are called omnivores).
2. Introduce the concept of food chains and have students design a food chain from the Estuary Food Chain Story. Have students connect each link with an arrow which points from what is being eaten to what is doing the eating.
3. Discuss with students some other possible food chains using the list of plants and animals from the list generated by students and the supplied plant and animal list of the Squamish Estuary (optional).
4. Ask students whether or not they think some of these chains could be interconnected? Discuss.
5. Have students complete the simplified estuarine food web activity sheet.
6. (optional) Make a food web with a ball of sting: have one student become a part of the estuary food web and hold onto one end of a ball of string. That student will pass the ball to another student who eats or is eaten by that organism. The ball continues to be passed onto the next plant

Estuary Food Web

or animal until all relationships have been discovered. The end result will be a large web of plants and animals of the estuary. Ask students what they think would happen if some of the plants or animals were not available (killed by pollution for example)?

Extensions:

1. Students can research a plant or animal from the estuary food web and make a poster showing how that plant or animal fits into the estuary food web.

Evaluation:

1. Have students:
    a. Define food chains and food webs and give an example of an estuary food chain.
    b. Draw an estuary food web such as on the student worksheet.

Community Connections:

1. The estuary was a rich source of traditional food for the Squamish First Nation. The estuary was a place that they visited often for the abundance of resources that could be found there. Ask students to use the list of plants and animals to research which are important traditional foods for the Squamish people.

Resource:

This activity has been adapted from "Estuary Food Chain" and "Estuarine Food Web" from Discover your estuary (1992) as well as "Wildlife Tree Food Web" from Wildlife Trees in B.C. (1994).

Taking It Home:

Go on a family field trip to the Estuary. Visit the site of the new totem pole in the Skwelwil'em Wildlife Management Area at the estuary and make a list of the wildlife and plants that you can see.

References:

Kistritz, R.U. 1992. *Discover Your Estuary: Understanding and Exploring the Aquatic Environment of the Fraser River Estuary.* Environment Canada

Tobe, Edith. 1993. Squamish: *Walk on the Wild-Side*. Squamish River Watershed Society, Squamish, BC

Glossary:

Carnivore: An animal that feeds chiefly on other animals. Carnivores include predators such as lions and alligators, and scavengers such as hyenas and vultures. In a food chain, carnivores are either secondary or tertiary consumers.

Community: A group of organisms or populations living and interacting with one another in a particular environment. The organisms in a community affect each other's abundance, distribution, and evolutionary adaptation. Depending on how broadly one views the interaction between organisms, a community can be small and local, as in a pond or tree, or regional or global, as in a biome.

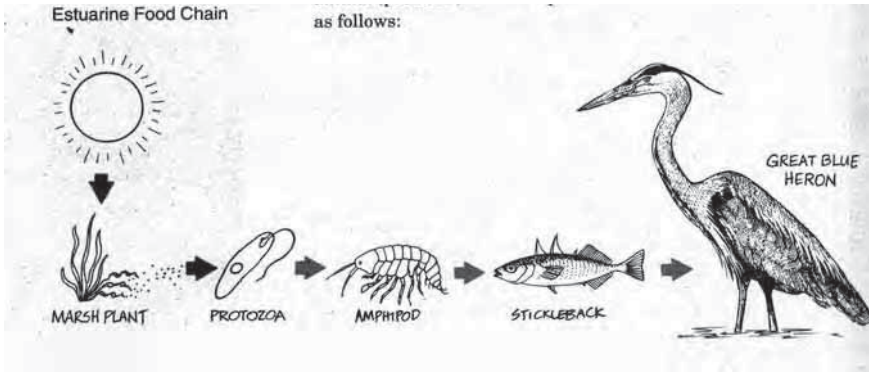
Detritus: Matter produced by the decay or disintegration of an organic substance such as a plant or animal.

Ecosystem: A community of organisms together with their physical environment, viewed as a system of interacting and interdependent relationships and including such processes as the flow of energy through trophic levels and the cycling of chemical elements and compounds through living and nonliving components of the system.

Food Chain: a series of organisms interrelated in their feeding habits, the smallest being fed upon by a larger one, which in turn feeds a still larger one, etc.

Food Web: a community of organisms where there are several inter-related food chains

Herbivore: An animal that feeds mainly or only on plants. In a food chain, herbivores are primary consumers



Source:
Discover Your Estuary (1992)

Source: A Walk through the Estuary.
No date

List of Names of some Common Plants and Animals

Plants

Water Plants

Bog Rosemary *Andromeda polifolia*
Bullrush *Scirpus americanus*
Cat Tail *Typha latifolia*
Eelgrass *Zostera marina*
Lyngbye's Sedge *Carex lyngbyei*
Sundew *Drosera rotundifolia*

Shrubs and Flowers

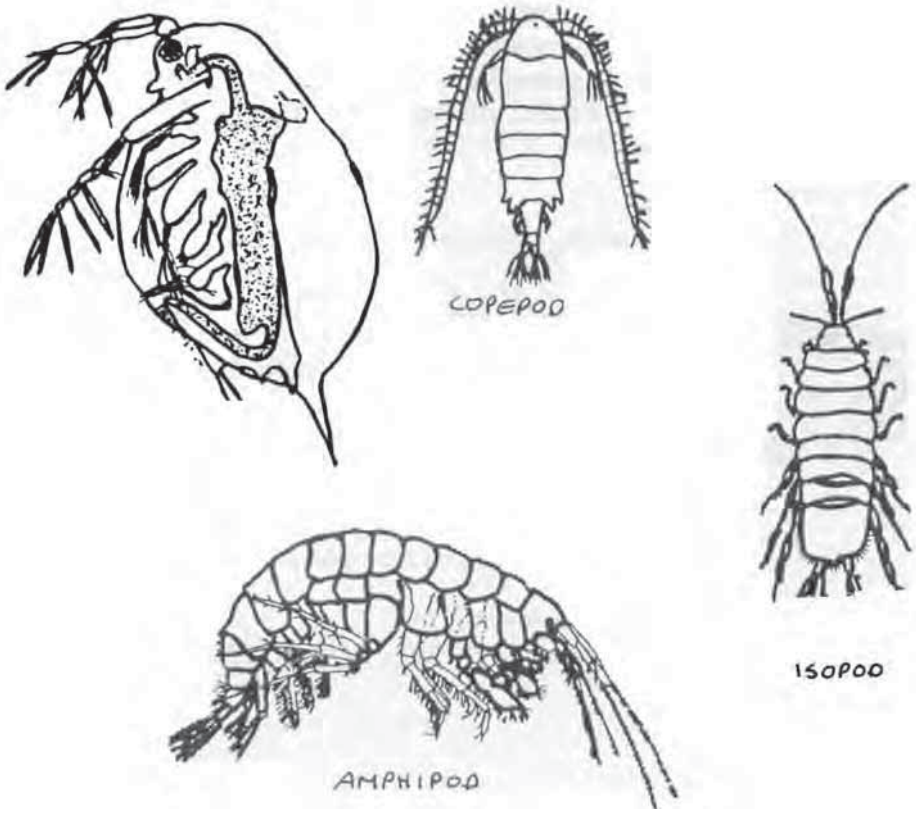
Cloudberry *Rubus chamaemorus*
Labrador tea *Ledum palustre groenlandicum*
Perennial Clover *Trifolium wormskjoldii*
Red Fescue *Festuca rubra*
Salmonberry *Rubus spectabilis*
Sheep Sorrel *Rumex acetosella*
Silverweed *Potentilla pacifica*

Trees

Black Cottonwood *Populus trichocarpa*
Broadleaf Maple *Acer macrophyllum*
Common Oak *Quercus robur*
Douglas Fir *Pseudotsuga menziesii*
Douglas Maple *Acer glabrum*
Pacific Dogwood *Cornus nuttalii*
Pacific Willow *Salix lasiandra*
Red Alder *Alnus rubra*
Sitka Spruce *Picea sitchensis*
Vine Maple *Acer circinatum*
Yellow Cedar *Chamaecyparis nootkatensis*

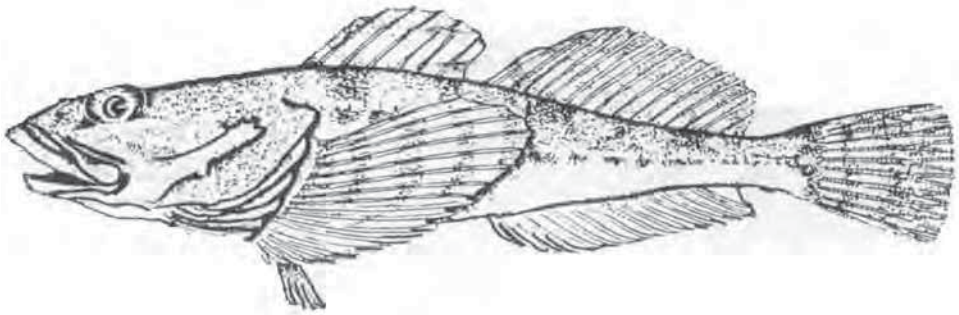
Marine Invertebrates
Amphipod *Orchestia traskiana*
Dungeness crab *Cancer magister*
clam
mussel
shrimp

Insects
Anise swallowtail Papilio zelicaon
Red admiral Vanessa atalanta
Dragonflies; Western Flying Adder *Cordulegaster dorsalis*



Fish

Chinook Salmon *Oncorhynchus tshawytscha*
Chum Salmon *Oncorhynchus keta*
Coastal Cut-Throat Trout *Salmo clarki*
Coho Salmon *Oncorhynchus kisutch*
Dolly Varden Char *Salvelinus malma*
Eulachon *Thaleichthys pasificus*
Herring *Clupea harengus pallasi*
Pink Salmon *Oncorhynchus gorbuscha*
Sand Lance *Ammodytes hexapterus*
Shiny Perch *Cymatogaster aggregata*
Sockeye Salmon *Oncorhynchus nerka*
Spiny Dogfish *Squalus acanthias*
Staghorn Sculpin *Leptocottus armatus*
Starry Flunder *Platyichthys stellatus*
Steelhead Trout *Salmo gairdneri*
Surf Smelt *Hypomesus pretiosus*
Threespine Stickleback *Gasterosteus aggregata*



STAGHORN SCULPIN

Birds

Birds of Prey (Raptors)
Bald Eagle *Haliaeetus leucocephalus*
Great Horned Owl *Bubo virginianus*
Marsh Hawk *Circus cyaneus*
Peregrine Falcon *Falco peregrinus*

Heron
Great Blue Heron *Ardea herodias*

Hummingbird
Rufous Hummingbird *Selasphorus rufus*

Perching Birds
American Goldfinch *Carduelis tristis*
Red-winged Blackbird *Agelaius phoeniceus*
Song Sparrow *Melospiza melodia*
Yellow Warbler *Dendroica petechia*

Pipit
Water Pipit *Anthus spinoletta*

Sea Birds
Black Oyster Catcher *Haematopus bachmani*
Brandt Cormorant *Phalacrocorax penicillatus*
Pigeon Guillemot *Cepphus columba*

Shore Birds
Killdeer *Charadrius vociferus*
Least Sandpiper *Caldris minutilla*

Swallows
Barn Swallow *Hirundo rustica*

Thrush
Varied Thrush *Ixoreus naevius*

Water Birds
Barrow's Goldeneye *Bucephala islandica*
Bufflehead *Bucephala albeola*
Canada Goose *Branta canadensis*
Common Loon *Gavia immer*
Common Merganser *Mergus merganser*
Common Murre *Uria aalge*
Glaucus-winged Gull *Larus glaucescens*
Horned Grebe *Podiceps auritus*
Mallard *Anas platyrhynchos*
Pintail Duck *Anas acuta*
Trumpeter Swan *Olor buccinator*
Western Grebe *Aechmorphorus occidentalis*
White-winged Scoter *Melanitta deglandi*
Wood Duck *Aix sponsa*

Woodpeckers
Red-Shafted Flicker *Colaptes auratus*
Pileated Woodpecker *Dryocopus pileatus*

Wren
Long-billed Marsh Wren *Telmatodytes palustris*

Source: Squamish: a walk on the wild-side. 1993

Estuary Food Chain

Name: _____

Make a food chain using the **underlined words** from this story:

The **sun** shone down on the Squamish Estuary on a sunny morning in May. A cat tail plant grew tall throughout the summer and fall using the sun's energy. When winter came, parts of the cat tail plant died, falling into the estuary waters. These dead plant leaves drifted down to the bottom of the estuary and became part of estuary **detritus**. A **clam** which lived in the tidal mudflats of the estuary busily filtered the small detritus as its food. The clam grew and was eaten by a **seagull** that was looking for food for its hungry **chick**. Soon a **Bald Eagle** searching for food came down and flew off with the chick.

Source:
Discover Your Estuary (1992)

Estuary Food Web

Use these words and clues to fill in the estuary food web!

Words:

Clam Heron Mayfly

Humans Plants Snake

Flounder Detritus Vole Beaver

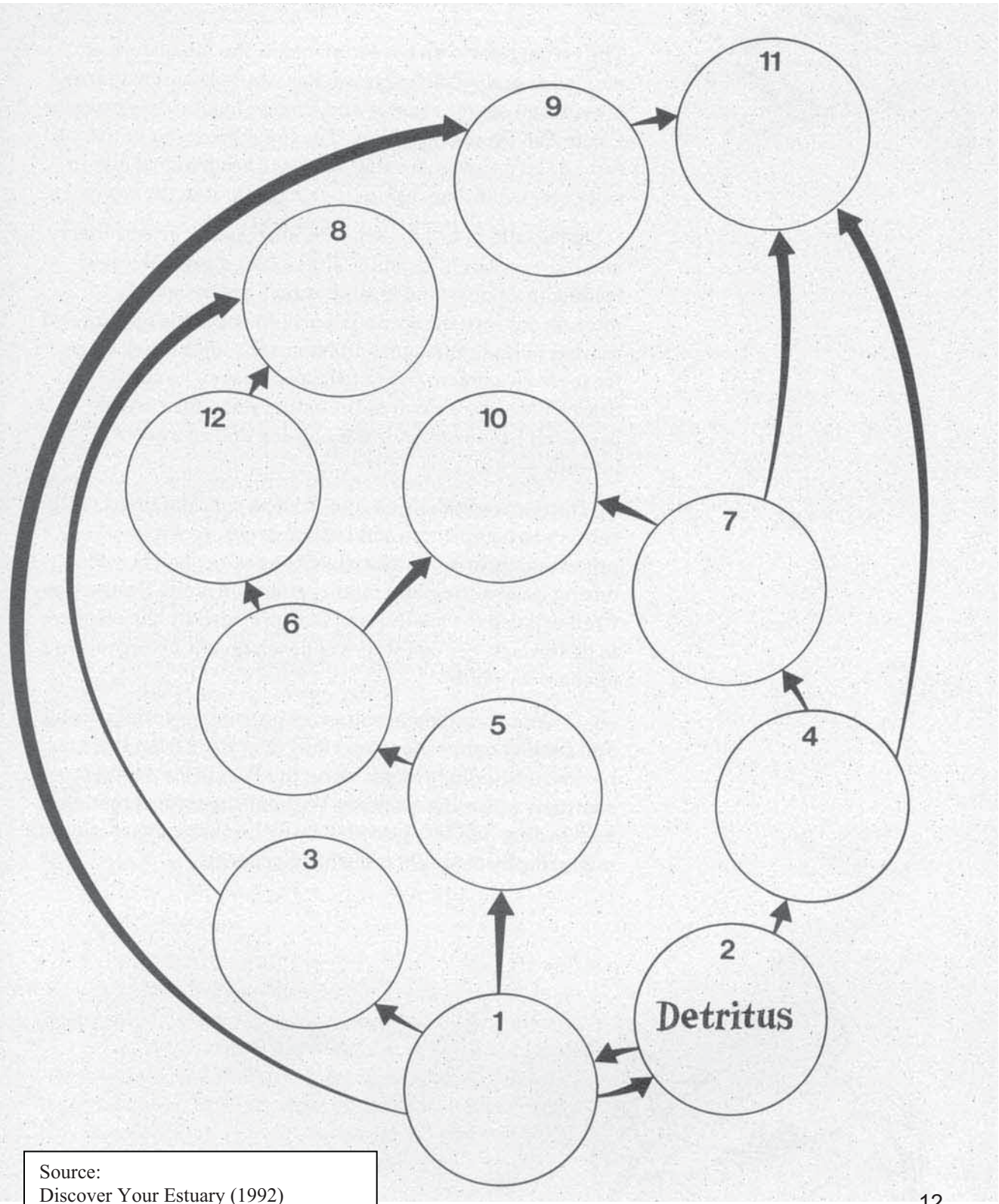
Clues:

1. These organisms use energy from the sun to make food.
2. This is dead plant material enriched with bacteria and fungi. It returns plant nutrients back to the marsh.
3. This small rodent eats mainly plants and sometimes insects.
4. These shelled animals live in the mud and sand and filter small particles of organic matter.
5. The larva of this flying insect feeds on organic matter.
6. This amphibian eats any small moving invertebrate.
7. This flat-looking animal lives underwater and feeds on small bottom-dwelling invertebrates.
8. This animal hunts at night for snakes and voles.
9. This small mammal was hunted in the past for its fur and it eats mainly plants.
10. This long-legged animal can be seen patiently standing in shallow water for a fish or frog to eat.
11. If it wants to, this creature can find and eat almost anything in the estuary. Nothing in the estuary can kill and eat this animal.
12. This reptile slithers around to hunt for frogs.

Source:
Discover Your Estuary (1992)

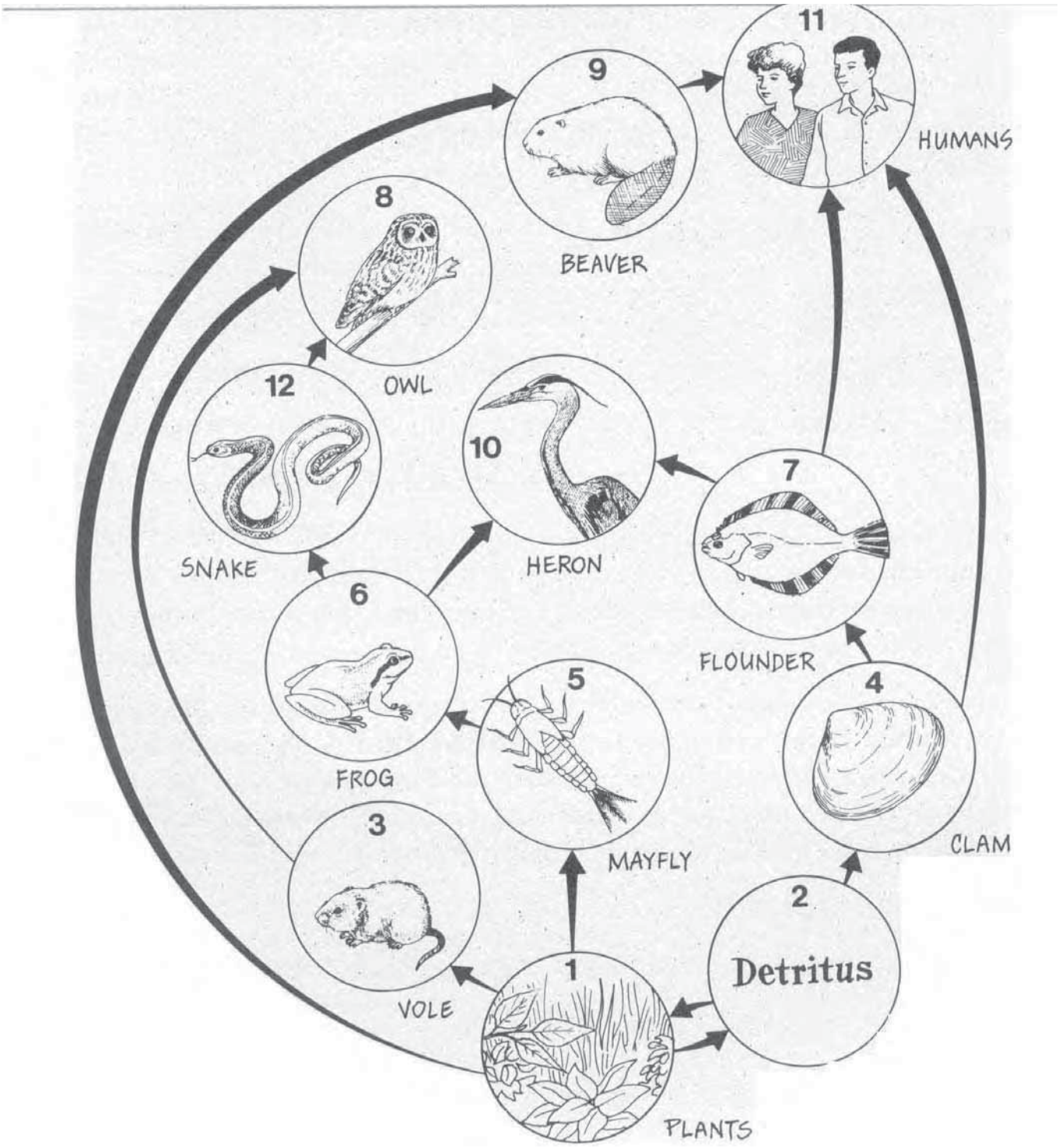
Estuary Food Web

Name: _____



Source:
Discover Your Estuary (1992)

Estuary Food Web Key



Source:
Discover Your Estuary (1992)

Taking It Home…

Sights and Sounds of the Squamish Estuary

Name: _____

On your family visit to the estuary, can you find out:

Is the tide moving in or out? How can you tell?
Which way is the wind blowing?
What tiny creatures can you find in the mud?
Are there any small fish in the estuary channels?
What types of human activities can you see or hear? (be sure to look far and wide).

Make a sketch of your observations:

Did You Know??

The Squamish River Estuary is a rich and diverse community which, like a good painting, unfolds into worlds full of fascinating detail. From the influx of tidal waters over the mud flats to the many visiting flocks of water birds, there is never a shortage of finding something new at this wonderful but fragile environment. The estuary is home to many different plants, animals and human activities. Tidal channels, mud flats, marshes, meadows and forests are all part of the estuary. There are over 200 types of birds that visit the estuary – some will visit in the spring and fall migrations while other stay all year around or just during the winter months. The estuary changes daily and seasonally – use all your senses to find out more about the estuary.

Name: _____

Taking It Home…

Plants and Animals of the Squamish Estuary

Name or draw three plants or animals that live in the Squamish Estuary and explain why they are important.

Did You Know??

Herring is a very important fish for the Squamish First Nation people who live near the estuary. In the past, large "runs" of herring came nearby the beach and people would catch and dry them for eating. Now herring habitat is limited but some people are re-planting the eelgrass beds where herring spawn and grow. One day, it is hoped that large herring populations will be found in the estuary once again.

Riparian Field Trip

Grades: 2-7

Subject, Science, Language Arts

Time required:50 minutes & prep time

Key Concepts:
Fish and wildlife need a healthy habitat.
Everyday actions make a difference in watershed & estuary health.

Objectives:
Students will describe riparian areas and their importance for healthy watersheds.

Key Words:
Riparian areas, plants, watershed,

Skills:
Gathering information, analysis, classifying, describing

Background:

The word riparian refers to land next to a body of water such as land adjacent to streams, rivers, floodplains, lakes, wetlands, and coastal shorelines.

Riparian areas provide a number of ecological functions that are a crucial component of watershed health. Riparian areas provide a transition area between wet habitat and drier upland habitat. Many species of wildlife use riparian areas to live, find food and water, reproduce, and establish viable populations. Riparian areas also function as a flow pathway for energy, materials, and animals. Water and sediment flow through the area into streams and rivers. Wildlife use the thick vegetation for cover from predators while

Materials

- Hula hoops
- Pencils and crayons, clipboards
- Mural paper
- Field guides (optional)

Riparian Field Trip

Background continued:
moving from one area to another. Healthy riparian areas benefit both stream habitat and the surrounding land uses.

Healthy riparian areas mean:

- reduced watershed asphalt areas (impervious surfaces) to control flooding and increase groundwater infiltration;
- increased distance from urban land use to stream habitat;
- prevention of soil erosion from steep slopes;
- protection of stream banks;
- increased sediment and pollutant removal;
- lower stream water temperatures essential for fish habitat;
- increased food, cover, and steam habitat for wildlife;
- wetland protection;
- wildlife corridors for wildlife to move from one area to another.

Identifying riparian areas often involves observing the plants that live there. Riparian plants enjoy having what is sometimes called “wet feet.” That is to say that they like moist soils and have the ability to handle intermittent high water. Native plants or species of plants that naturally exist in riparian areas can be easily identified using field guides. Some riparian areas also have introduced or non-native plants. Non-native plants can have an undesirable effect on some native species by out competing them for essential nutrients. Purple loosestrife is one non-native riparian plant that is devastating areas throughout the province. Introduction of non-native species can displace native plants and lead to a decrease in biodiversity.

Procedure:

1. Before heading out into the field, brainstorm with students what they know about streams and the plants and animals that live nearby them. List the types of plants and animals that you might expect to find or find evidence of at your field site. For younger students, introduce the different shapes of leaves that might be found in riparian areas.
2. Introduce the concept of riparian area- it is the area next to a water body such as a lake or stream; explain that riparian areas are important to the health of a watershed, including stream and river habitats.
3. At your field site, place students in small groups at intervals in the riparian area with hula hoops as their survey placement. Give each hula hoop site a survey number.
4. Have students list or draw plants and evidence of wildlife and any other interesting features. Be sure that students note their survey site number on their data sheet.
5. Back in the classroom, recreate your riparian area. On a large sheet of butcher paper, draw an area to represent the riparian zone, including the hula hoop survey sites. Have students draw what they found at their survey site on the mural. Ask students to tell about the plants and animals they have found all along the line.
6. Compare the plants and animals found closest to the stream and furthest from the stream. Is there a difference? Now look for signs of a change of plant communities. For example, is there an area where there was a change from low under-story (shrubs) to forest (trees)?

Riparian Field Trip

7. Ask students how animals might use riparian areas for food or shelter. Why would these areas be important to fish that live in the nearby stream?

Extensions:

1. Ask students to what they think might happen if::
   - A shopping mall was built in the riparian zone that we visited?
   - A park was created in that same area?

Evaluation:

1. Describe the ways in which animals might use the riparian area for food or shelter.
2. Describe the ways riparian plants and animals are connected to other watershed species or habitats. For example, aquatic species, land species, birds, or humans.

Community Connections:

1. Invite a member of a local naturalist group to assist students identifying plants when doing the field study.

Resource:

This activity has been adapted from "Riparian Field Trip" from Wild BC.

Taking It Home:

Have students colour in the fish colouring sheet: adding both stream and riparian habitat.

References:

1. Fisheries and Oceans Canada. No Date. Lost Streams of the Lower Fraser River. (Poster with text). Fisheries and Oceans Canada, Habitat Management, Vancouver, B.C.
2. Zandbergen, Paul, K.J. Hall, S.J. Brown, R. Bestbier, and H.S. Schreier. 2000. *Urban Watershed Management: An interactive graduate level course for distributed learning. CD-ROM by the* Institute for Resources and Environment. University of British Columbia, Vancouver, B.C.

Taking it Home:

EVERYBODY NEEDS A HOME:

HELP KEEP OUR STREAMS CLEAN AND SAFE FOR FISH!

This salmon was coloured by:

_____

Oh, the Cedar Tree

Grades: K-7

Subject, Science, Language Arts, Fine Arts

Time required: 1 class & prep time

Key Concepts:
River and estuary habitat is important for fish, wildlife, and people.
Objectives:
Students will:

-

- *Appreciate the importance and uses of western red cedar in First Nations culture.*

SQUAMISH RIVERS &ESTUARY

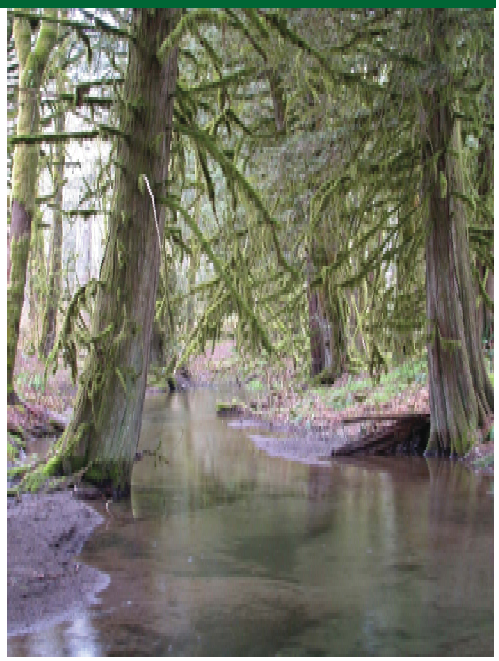
Skills:
Interpreting, analyzing, application of knowledge, presenting

Background:

Of all the plants used as materials by the Coastal First Nation peoples, the red cedar was used often and for multiple uses. Sometimes called, "the tree of life," this versatile tree has wood that is light, strong, and is rot resistant.

For example, it was used to make dugout canoes, paddles, house posts and planks, fishing weirs and equipment, storage and cooking boxes and other household items. The bark, boughs and roots also had many uses. Boughs could be used as bedding, and Squamish Nation people sunk them into Howe Sound near the mouth of the Squamish River to catch herring spawn. The most valuable part of the bark was the fibrous inner bark. This was split into strips and made into mats, capes and other clothing, blankets, and baskets – to name a few uses.

The western red cedar (*Thuja plicata*) tree is the B.C. provincial tree and can grow up to 45 m tall and 1.8 m in diameter. It grows best in moist soils and is a common forest tree in the Squamish watershed. The bark has a distinctive "stringy" look and the bark can be pulled off in long strips. Branches are long, irregular and have frond-like shape with a yellowish green colour.



Materials:

- Student Worksheet
- Cardboard strips
- Scissors
- Paint or markers

Oh, the Cedar Tree

Background Continued

In traditional First Nations cultures, working with cedar wood was generally considered the work of men while working with the inner cedar bark, the work of women. Both required a thorough knowledge of the tree and used technologies and skills to sustain both the tree and the native culture. In general, the gathering of bark took place in the spring or summer when the sap was running. Initially, a straight, young tree with few branches was chosen. Then, a cut was made on the side of the tree with the fewest branches and the bark was pried loose. The end was then taken hold of and pulled away from the tree with a twisting motion – gently pulling a strip off the tree. The strips were then folded into a bundle with the sap side on the inside for ease of transport back to the village. Care was taken not to remove too much bark so that the tree would continue to live.

Weaving was one of many ways the cedar bark was used – with the weaving of baskets and mats one of the most useful and creative skills. Bark was usually dyed either shredded or in strands. To make a red dye, the inner bark of the red alder was made into a paste, placed on the bark and then left to dry in the sun. After the dye had taken, the paste was rubbed off. For black, the bark was buried in black swampy mud for a few days and then washed off and dried. In all homes, woven baskets and mats were a vital part of the household for storage, transportation of goods, cooking, and were generally used to make life a bit more comfortable.

Note:
The Origin of the Red Cedar
"There was a real good man who was always helping others. Whenever they needed, he gave: when they wanted, he gave them food and clothing. When the great Spirit saw this, he said, 'that man has done his work; when he dies and where he is buried, a cedar tree will grow and be useful to the people – the roots for baskets, the bark for clothing, the wood for shelter."

As told by Bertha Peters to Wally Henry in *Cedar* (1984) by Hilary Stewart

Procedure:

1. Read the Bill Reid poem, *Oh, the Cedar Tree* or the *Origin of the Red Cedar* to students and ask students to list the ways the cedar was used traditionally in First Nations culture. The poem lists; planks, houses, boats, boxes, cooking pots, mats, and clothing. What else do they think may be made of cedar in the past and today?
2. Explain that cedar bark was used to make many items – one of which was a simple mat that was used for kneeling (in a canoe or on land).
3. Explain the process for harvesting cedar bark (see background material) and that in this case, cardboard strips will be used instead of bark – as cedar bark must be carefully harvested to avoid damaging the tree.
4. Using corrugated cardboard strips, give each student four strips to weave in an over and under pattern. These strips may be painted prior – using traditional red and black colours. See note for hints on traditional weaving methods.
5. Finish up mats with a simple "sandwich and sew" border (see notes) and varnish the mat if time allows.

Oh, the Cedar Tree

Weaving Notes:
One of the simplest weaving techniques is to use a simple plait of multiple strands in an over and under technique – much like a lattice on a pie crust! To start, place the desired number of one colour of strips in a row on a flat surface and form a cross with strips of the other colour, starting in the centre. Then weave the strips so that each strip goes over one strip and under the next, making sure that the strips are tightly woven together. To finish up, trim all edges so that they are even, peel the cardboard back approximately 5-10 cm to separate, then cut off the under flap and fold over and tuck into the back side of the mat. This then can be bound by a blanket stitch or glued if desired.

Extensions

1. Go outside and find a cedar tree and have students do a bark rubbing. Ask students to image peeling bark off of this tree – how would they accomplish this?

Evaluation:

1. Have students:

- Name at least four traditional uses of the red cedar tree;
- Describe or draw the red cedar tree.

Community Connections:

1. Contact: the Squamish Nation for a workshop or classroom activity on traditional uses of cedar.

References:

Lyons, CP; Bill Merilees. 1995. *Trees, Shrubs and Flowers to Know in British Columbia and Washington.* Lone Pine Press. Vancouver, BC

Pollock, Polly. 1994. *Start a craft: Basket-making* Chartwell Books.

Stewart, Hilary. 1982. *Indian Fishing – early methods on the Northwest Coast.* Douglas and McIntyre

Stewart, Hilary. 1984. *Cedar – tree of life to the Northwest Coast Indians.* Douglas and McIntyre, Vancouver, BC.

Taking it Home:

1. Hand out the image of the cedar tree and ask students and their families to find the hidden images. Back in class, discuss what they found and how these items might have been used in the past, what might their uses be today? (Hint: there are at least nine images!)

Taking it Home:

Name: _____

Find and colour the hidden images of the traditional ways the red cedar was used by coastal First Nations.