

Skein 9

Adult Salmon

Overview:

This skein gives students the opportunity to:

- **P / I** Identify where salmon smolt come from and how they live in an estuary
- **P / I** Test how salt water affects cells
- **I** Discuss how salt water and fresh water mix in an estuary
- **I** Play a simulation game representing salmon predators

Big Ideas:

- Adult salmon travel long distances to the ocean. They migrate through the ocean and return to their natal rivers. People fish for salmon in different ways and for different reasons [sport, personal, commercial, subsistence (AS 16.05.940)].

Vocabulary:

adult, ocean, school, natal stream, scent, salinity, magnetic direction, thermal, navigation, principles, by-catch, dichotomous key

BACKGROUND INFORMATION

THE ADULT SALMON

After gaining weight in the estuary and adapting to the salt water, salmon travel along the coastline and then to the open ocean. Here they gain the full size, shape and color of one of the species of mature salmon: coho, sockeye, pink, chum, and chinook. Because scientists cannot easily observe salmon in the ocean, knowledge of this part of the salmon's life cycle is limited. Scientists do know that most salmon spend the first part of their life in coastal waters, then migrate farther out to sea. Each species of Pacific salmon has a characteristic migration route and spends a different length of time in the ocean before returning home.

Young salmon can travel up to 20 km (approximately 12 miles) a day, while mature salmon can travel as much as 50 km (approximately 30 miles) a day. Salmon usually travel north in summer, as far as Northwest Alaska, and south in winter, possibly following ocean temperature changes while searching for food.

While at sea, salmon feed on a variety of smaller fish and plankton, often following schools of herring or krill. They can gain many kilograms, with mature adults reaching weights ranging from a few kilograms to 20 kilograms (approximately 40 pounds) or more, depending on the species. Salmon are also prey for larger salmon species, seals, orcas, and other fish, such as sharks and cod.

Alaska divides the allotment of salmon catch between sport/personal use fisheries, commercial fisheries and subsistence use after estimating how many salmon must return to their natal streams and lakes to conserve the species.

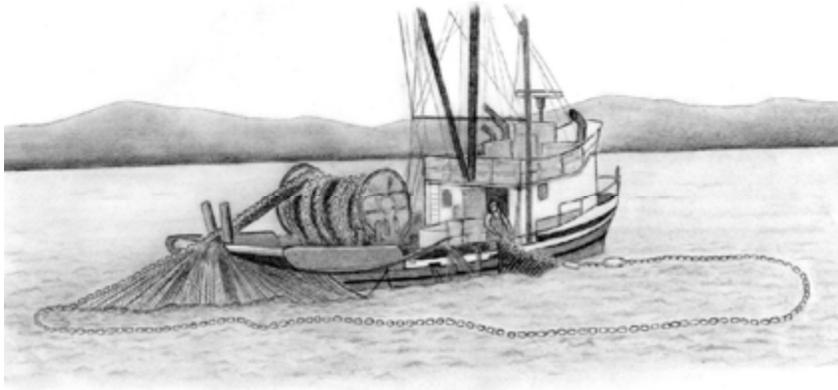
The largest number of adult salmon are probably taken by human fishers. People catch salmon mainly in coastal waters as large schools return from their ocean travels, although some are also caught in rivers and huge ocean drift nets. Commercial fishers use three main kinds of gear to catch salmon:

- gill nets: nets that hang like a curtain from the water's surface and entangle salmon by their gills;
- purse seine nets: nets that fishers first drag to form a circle around a school of fish, then pull in the bottom to form an enclosure from which fish cannot escape; and
- troll lines: long steel fishing lines, each with several lures and hooks to catch salmon by the mouth.

After spending from one to seven years at sea, depending on the species, salmon return to their natal stream or lake to spawn a new generation. No one knows how, but mature salmon form large schools and find their way to the mouth of their home stream. Scientists think salmon use ocean currents, the earth's magnetic field, and even the North Star to find their way back. When they get near their natal river, the scent of its water helps them identify the right river. The salmon congregate at the mouth of their natal river before starting the difficult journey upstream.

Adult Salmon

Handout 9.1



Salmon swim to the ocean to grow into adults. Some live in the ocean for only one year. Others live in the ocean for many years.

Salmon find many smaller fish to eat in the ocean. They grow very large.

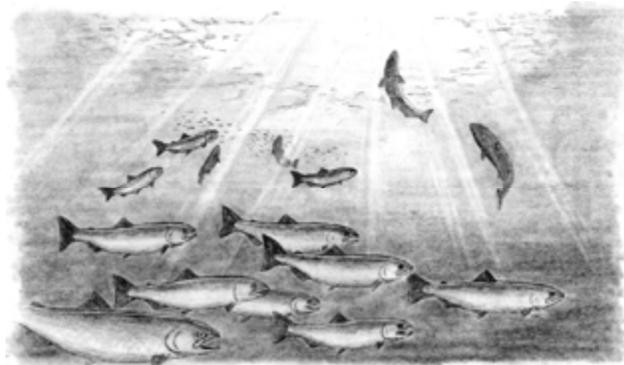
Their bodies become silver and gray. They are hard to see in the ocean.

Seals, whales, and large fish catch salmon and eat them. Human fishers in fishing boats catch many salmon.

Like many birds, salmon can travel a very long way. Often they swim in big groups called schools. But they come back when their travel is finished.

No one knows how salmon find their way home. Scientists think they use all their senses to find the way.

Salmon remember the scent of the water where they were born. The scent of their home river in the ocean tells them they are almost home.



Illustrations: Karen Uldall-Ekman

Adult Salmon

Handout 9.2

After gaining weight in the estuary and adapting to the salt water, salmon travel along the coastline and then to the open ocean. Here they gain the full size, shape, and color of a mature salmon.

Most salmon spend the first part of their life in coastal waters, then migrate further out to sea. Each of the species of Pacific salmon has its own migration route and spends a different length of time in the ocean before returning home.

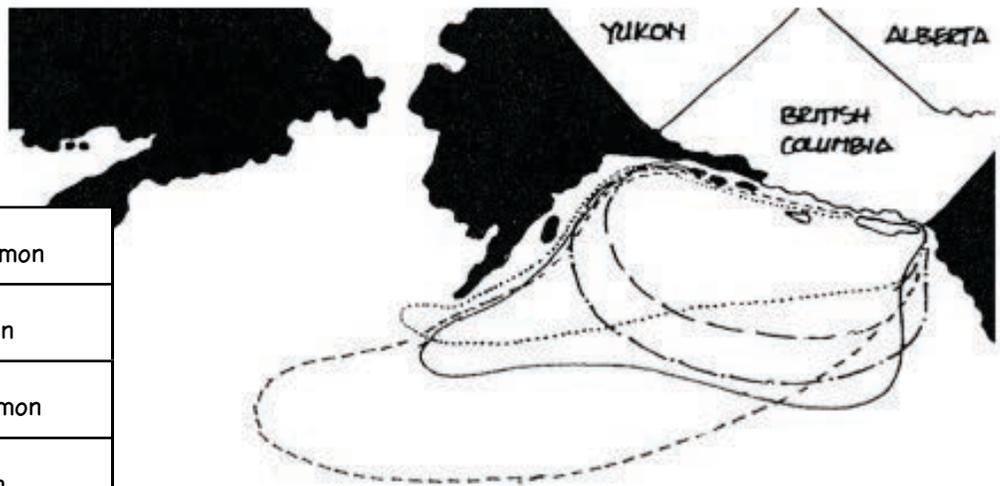
Young salmon can travel up to 20 km (approximately 12 miles) a day, while mature salmon can travel as much as 50 km a day. Salmon usually travel north in summer, often swimming as far as Northwest Alaska, and south in winter.

While at sea, salmon feed on a variety of smaller fish and zooplankton. The salmon can gain many kilograms (kg), with mature

adults reaching a few kilograms to 20 kg (7 to 45 pounds) or more, depending on the species. Salmon are prey for seals and orcas, as well as for fish, such as cod.

The largest number of salmon is probably taken by human fishers. People catch salmon mainly in coastal waters as large schools return from their ocean travels, although some are also caught in rivers and huge ocean drift nets. Millions of salmon are caught each year.

After spending from one to seven years at sea, depending on the species, salmon return to their natal stream or lake. Mature salmon form large schools and find their way to the mouth of their natal stream. They gather at the mouth of their natal river before starting the difficult journey upstream.

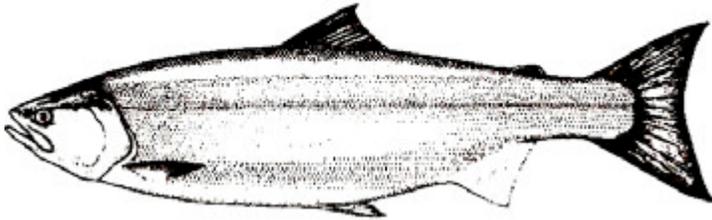


-----	Sockeye Salmon
_____	Chum Salmon
.....	Chinook Salmon
-. - . - . - . - .	Coho Salmon
___ ___ ___	Pink Salmon

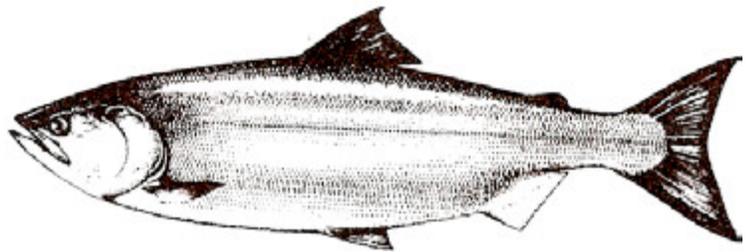
Species of Pacific Salmonids

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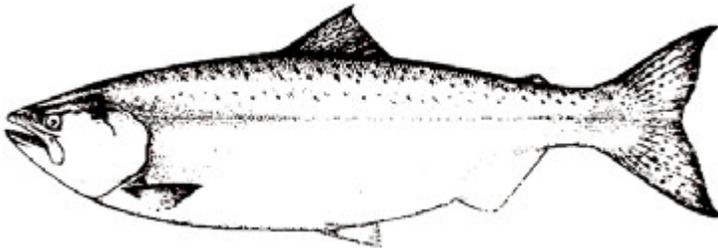
Handout 9.3



A. Sockeye



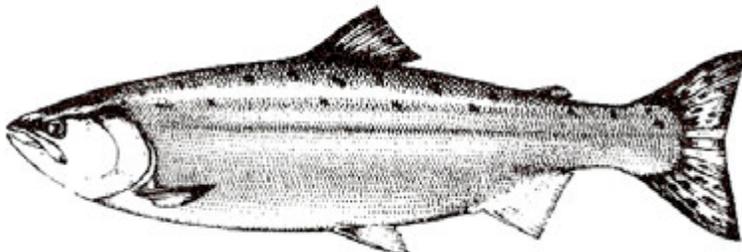
B. Chum



C. Chinook



D. Coho



E. Pink



This activity demonstrates how a scent can be used to identify a location. It leads to a discussion of how salmon identify their natal stream or lake by the scent of the water.

Materials:

For each group of students:

- ⇒ Variety of strongly scented substances that students will recognize (preferably not artificial or allergenic scents)
- ⇒ Opaque containers with perforated lids (e.g., plastic film canister)
- ⇒ Option: Cotton balls
- ⇒ Writing supplies

Time Required:

Two or three lessons

Level of Conceptual Difficulty:

Simple to moderate

PREPARATION

- ☞ Place a variety of strongly scented substances, such as orange, banana, mint, toothpaste, maple syrup and chocolate, in plastic film canisters (or other opaque containers) with holes in the top. (You may prefer to place the scents on cotton balls in the containers. Avoid perfume or artificial scents that might cause allergic reactions.) Test the scents with the students so that they can recognize them prior to taking part in the activity.

INTRODUCTION

- ☞ Make sure your students have read Handout 9.1, "Adult Salmon."
- ☞ Discuss with the class how people find their way on a trip. If necessary, prompt them with questions, such as:
 - How do you know when you are going in the right direction?
By using memories and familiar sights as landmarks.
 - How do you know when to turn?
By using memories and landmarks.
 - How do you know when you have arrived at your destination?
By using memories and landmarks.
 - What do you do if the road is blocked?
Look for another way until you find a familiar landmark.
- ☞ Have students, in pairs, describe to each other or map a trip they know how to take, e.g., from school, swimming pool, or a friend's house to home. Have the pairs list any landmarks or memories that help them find their way and know when they have reached their destination. Model this activity for students, if necessary.
- ☞ Explain that one way salmon find their way home is by the scent of their natal stream. They also use other factors, such ocean current. This activity tests how to use scents to identify a home.

Evidence for Assessment:

Review student discussion and observation pages to ensure that the students recognize that scents can be used to find a home area.

- ☞ Ask the class to name any smells that identify a place they know: a bakery, swimming pool, laundry, garbage, garden, etc.
- ☞ Ask the class to predict whether students could use scents to find a home area of the classroom.

EXPERIMENT

- ☞ Divide the class into groups and assign each group a home smell. Have the groups sniff and describe their scent sample.
- ☞ Place the samples in different parts of the room and have students try to find their home by sniffing each sample to identify their home area.

DISCUSSION

- ☞ With the class, discuss whether or not the test supports the predictions. Have students record their predictions.
- ☞ Option: With older students, reassign the samples, repeat the activity, and compare the time needed to identify different home locations by their scent.
- ☞ Option: Use masking tape to mark a path on the floor representing a river system with tributary streams, and place a different home scent at each stream. Have students follow the river system to their home stream.

SUMMATION

- ☞ With the class, compare a salmon's sense of smell with a human's sense of smell.
Salmon can smell under water, while people cannot. Salmon remember smells longer than people do. A salmon's sense of smell is more acute than a human's.

Navigating Without Landmark

Materials:

- ⇒ One copy of Handout 9.4, "Salmon Navigation," for each student
- ⇒ Writing supplies

Time Required:

Approximately 60 minutes in two periods

Level of Conceptual Difficulty:

Moderate to advanced

Evidence for Assessment:

Monitor the class discussion of navigation using the senses and how salmon navigate, and review their imaginary instructions for a salmon to ensure the students can describe how salmon navigate the ocean and return to their natal river.

INTRODUCTION

- ☞ Make sure your students have read Handout 9.2, "Adult Salmon," and Handout 9.3, "Species of Pacific Salmonids."
- ☞ Discuss with the class how students find their way from one place to another without using a map. If necessary, prompt them with questions, such as:
 - How do you find your way home after school?
By following a familiar route.
 - How do you know you are going in the right direction?
By heading toward familiar landmarks, such as intersections, buildings, signs, etc.
 - How do you know when to turn?
Watch for familiar landmarks, etc.
 - How do you know when you are there?
By recognizing the destination.
 - Do you rely on any senses besides your vision?
Humans rely mainly on vision.
 - How is this different from finding your way to a new place, like a new shop?
In traveling somewhere new, you need a map or familiar landmark to which to relate.

DISCUSSION

- ☞ Explain that salmon navigate through the ocean, without maps or familiar routes, by using all their senses. This activity demonstrates how to use a variety of senses to find an unfamiliar destination.
- ☞ Have the class suggest ways to navigate through an unfamiliar neighborhood without using a map, using their senses of vision, hearing, smell and touch. If necessary, prompt them with questions, such as:
 - What kinds of things could you watch for?
Vegetation, buildings, roads, sun and stars, etc.
 - What kinds of things could you smell?
A bakery, a garbage container, a candy shop, a flower bed, etc.
 - What kinds of things could you listen for?
A playground, a radio, a speaker system, a dog, etc.
 - What kinds of things could you feel?
Carpet on the floor, grass, gravel, a hill, a rough wall, etc.

- ☞ Option: Have groups of students navigate blindfolded, if it can be done safely in the school.

ACTIVITY

- ☞ Note: It is strongly suggested that you try this activity in a nearby natural environment if time permits.
- ☞ Have students write instructions for getting from one place to another in the school without naming the destination, and without using a map or names of rooms, teachers, etc. Have students use each of their senses (except taste) at least once in their instructions. (For example, go down the hall toward the clock until you smell something cooking.) Have other students attempt to follow the instructions and discuss their success with the class. If necessary, prompt them with questions, such as:
 - Who was able to follow the instructions to the destination?
 - Which directions were easy to follow? Which were difficult?
 - Which of your senses were easiest to use?
 - What was difficult about writing clear instructions?

RESEARCH/DISCUSSION

- ☞ Have students, in groups, read Handout 9.4, "Salmon Navigation," and help each other clarify any parts they do not understand. Discuss with the class various hypotheses in the handout on how salmon navigate through the ocean. If necessary, prompt them with questions, such as:
 - Which salmon senses are most like human ones?
Smell, touch (temperature).
 - Which salmon landmarks are like those humans use?
Sun, stars, scents.
 - Would other human senses help salmon find their way in the ocean?
Not much since visibility is limited and sounds do not seem very distinct.
 - If salmon could draw a map, what would they put on it?

Salmon Navigation

Handout 9.4

Sockeye and chum salmon travel as far as the Aleutian Islands, Northwest Alaska, and the middle of the Pacific Ocean.

Salmon from different lakes and rivers mingle together in the ocean. They follow schools of plankton and smaller fish, such as herring. Although they follow a general pattern, their position can vary greatly from one year to the next.

Migrating salmon seem to know where their natal stream is and how to return to it. When they are mature, all those that hatched at the same time in one stream or lake return together to the mouth of their natal river. Then they begin their journey back upstream.

No one knows how salmon navigate through the ocean and find their way back. Scientists believe that salmon use a variety of ways to tell where they are and where they are going.

Possible navigational aids for salmon

Possibly salmon use different senses at different times, or rely on all of them together.

- **Scents in the water.** Scientists know that salmon use their sense of smell to recognize their natal river and to find their natal stream or lake when they travel upstream. They may use similar scents to tell where they are in the ocean.
- **Water pressure and salinity.** The amount of salt in the ocean varies slightly in different places, and pressure can vary, too. Salmon are very sensitive to these changes and may use them to tell one place from another.
- **Magnetic direction.** Salmon seem to be sensitive to the earth's magnetic poles. They may use the poles to help in getting their direction.
- **The sun and the North Star.** Salmon seem to have more trouble finding their way on overcast days. Some scientists think this is because they use the North Star or the sun to navigate.

ADULT SALMON WRAP-UP

REVIEW

- ☞ Materials: chart paper and markers.
- ☞ Have students draw and label or list the benefits and dangers in a salmon's ocean environment.
Lots of small fish to eat, clean water, many predators, fishers, etc.
- ☞ Explain that adult salmon grow large in this environment, then find their way back to their natal stream or lake.

EVIDENCE FOR UNIT ASSESSMENT

- ☞ Have students make stick puppets of an adult fish and use them to explain, in a play, how an adult salmon swims through the ocean and then finds its way home.
- ☞ Have students make a web or write a sentence listing ways in which an adult salmon is different from a salmon smolt.
- ☞ Have students complete a stem sentence, such as, "I used to think... about adult salmon, but now I know that...", or, "One thing I learned about adult salmon is that...".
- ☞ Have students add their materials to their salmon science notebook and write a sentence explaining what they learned.

LANGUAGE AND ARTS INTEGRATION

- ☞ If there are fishers in your community, invite one to tell the class how they catch and process fish.
- ☞ If there is a fish cannery, native fishery, or fish market in your area, arrange a tour to show students how fish get from the fishers to the home.
- ☞ Make canned salmon sandwiches, arrange a salmon barbecue for the class, or discuss how students enjoy eating salmon.
- ☞ Have students compare the migration of salmon with the annual migration of birds. If there is a migratory bird flyway in your area, arrange a field trip when the birds are migrating.
- ☞ Make fish prints by painting colors on a whole fish and gently pressing a page of paper against the paint.
- ☞ Make mobiles of salmon to represent a school of fish.

HOME CONNECTIONS

- ☞ Have students describe the fishing activity to an adult and explain how a larger number of fishers increases the catch.

ADULT SALMON

WRAP-UP

EXTENSION ACTIVITIES

- ☞ Have students glue the illustrations of Pacific salmon species to cards and challenge each other to recognize them by playing a game of Snap with the cards.
- ☞ Have students describe their own experiences in the sport, commercial or native fishery, or recount stories or “tall tales” they have heard from other fishers.
- ☞ Have students prepare a variety of salmon recipes and hold a class party in which they describe their favorite way to eat salmon.
- ☞ Have students arrange a field trip to a nearby salmon or trout fishing stream or commercial fishing operation, or have someone from the industry come to the class to talk about their work.
- ☞ Have students visit a cultural center, or Native fishing site to discuss traditional and modern methods of salmon harvesting and the role of salmon in the culture of Natives.
- ☞ Have students describe what a fisheries conservation officer does to manage the population and catch of Pacific salmon.
- ☞ Have students present information on the 1985 fisheries treaty between the United States and Canada or treaties with other countries and report to the class on the main issues.
- ☞ Have students research methods of aquaculture and identify the pros and cons of each.
- ☞ Have students research the effect of introducing non-native species into an environment. Have them evaluate the potential effect of introducing Atlantic salmon into Pacific waters.
- ☞ Have students research the extent of ocean pollution or climate change.
- ☞ Have students write imaginary instructions for a salmon to return from the Aleutian Islands to a local river mouth, using only senses that a salmon could detect.

SUGGESTIONS FOR ASSESSMENT

- ☞ Have students label a black outline drawing of an adult salmon.
- ☞ Have students describe at least three ways by which salmon are thought to navigate through the ocean and back to their natal stream or lake.
- ☞ Have students write quiz questions about adult salmon on one side of an index card and answers on the other. Have them quiz each other by asking the questions or by using a Jeopardy-style format (i.e., giving the answers and asking for a question).

- ☞ Monitor student discussions of the class' habitat mural and Life Cycle poster to ensure that the students can identify the needs of adult salmon, as well as their habitat and threats to it.
- ☞ Have students add their notes, experiment observations, and other materials to a salmon science notebook.

HOME AND COMMUNITY CONNECTIONS

- ☞ Have students ask an adult to take them fishing, and discuss how to catch fish responsibly.
- ☞ Suggest that the class implement a project encouraging sport fishers to follow fishing regulations and to explain why it is important to do so.