Grade Level:
4th Grade

Time:
85 Minutes

Season:
All

Objectives:
Students will be able to...

- Identify internal and external salmon anatomy
- Recall the function of anatomical features that are unique to fish.

Key Concepts:
- Salmon have anatomical features that are similar to humans while other features are unique to fish

Salmon Anatomy : Dissection

Lesson 1 of 2

Background & Summary

Many of the schools involved in our Salmon in the Classroom program have been able to expand their studies in many ways. One activity that has been well received by teachers and students is the salmon dissection activity. This is a lesson in comparative physiology and anatomy.

Take time to consider the physical arrangement of the room. Keep in mind that some children may find this activity somewhat stressful, so try to make everyone comfortable with participating in the activity. Arrange the room in a way that allows students to move in and out according to their curiosity and comfort level.

Be sure to be in a well-ventilated room and if possible, open the windows. The smell can be overpowering to some, so it's also important to provide everyone with a space where they can step outside the classroom or building to get some fresh air.

Safety is a top priority. Given the sharp tools required for this lesson, it's not recommended to attempt the dissection activity with less than a 1:4 volunteer to student ratio. The students should be split into groups of no more than four and a single salmon should be shared by no more than two students. Further, in addition to volunteers, it's helpful to have one to three "floaters" moving between groups in addition to the lead instructor.

During the dissection, it may be inappropriate to pass the parts around from student to student. Imagine what might occur if the part doesn't make it all the way, and it ends up in someone's pocket! Instead, it may be better to get a volunteer to help ensure that parts stay with the fish. This method could also be a relief for those kids who want to participate, but don't wish to get too close to the action.

Establish ground rules with your class before passing out the salmon. Suggested ground rules are:

- Respect the carcass. The animal was once a living organism, and its carcass is here for learning purposes. Do not use the dissection tools to deface, maim or otherwise disrespect the specimen.

Background & Summary (Continued)

- The tools provided should only be used for their intended use. Scissors should only be used for cutting and forceps should only be used for grabbing or holding parts of the specimen.
- Under no circumstances are any students allowed to use the scalpels or kitchen knives. These are sharp objects that can cause severe injuries and should only be handled by the adult volunteers in the room

This is a hands-on activity and it's guaranteed to get messy. Try to avoid doing the dissections in areas with carpet. It's a lot easier to clean fish guts from a laminate floor than a carpeted one. Make sure there is a sink near with lots of hand soap and paper towels for people to use at the end. Further, students may want to considering bringing a spare shirt in case they get dirty. The fish carcasses should be disposed of in an outdoor dumpster. Ideally you should freeze the fish until garbage day to avoid foul smells and scavengers looking for a seafood dinner. Under no circumstances should any part of the animal be consumed. The salmon may have been chemically anesthetized prior to spawning and consuming them may lead to accidently poisoning.

Procedure

Warm-Up Activity: What is "Anatomy"?

1. Split students of into groups with no more than 4 students per group. Introduce the class to the lesson by asking them to share what they think of when they hear the word "anatomy". Encourage students to use humans as a reference for discussing anatomical features and their respective functions. Facilitate a discussion by having the class use the answers they provide to narrow down a collective definition of the word "anatomy". In the end, the consensus should be that anatomy describes the structure and function of an organism and its parts. (5 minutes)

Human vs Fish Anatomy

Learning objectives:

a. Compare and contrast human and fish anatomy

b. The functional roles of basic internal and external fish anatomy

2. Pass out two "Salmon Anatomy Student Sheets" to each group. Use the prompts below to continue the discussion by having the class compare and contrast human and fish anatomy. The "Salmon Anatomy Cheat Sheet" lists the functions of the anatomical features found on the student sheet and interesting facts about salmon anatomy. (10 minutes)

Procedure (Continued)

-What external features do human and fish have in common? What type of internal features?

-What internal (or external) anatomical features does one possess that the other doesn't?

-What anatomical features are unique to fish that aren't shown on the handout?

Examples:

Scales- Protection from pathogens. Flexible cover to ease movement. Reduced drag.

Slime- Protection from pathogens. Chemical barrier for maintaining osmotic pressure.

Vent- Eliminate waste.

-What features do human and fish have in common that have structural similarities but functional differences?

Examples

Nostrils- Breathing and smelling in humans, smelling in fish

Vent- Eliminate waste in humans, eliminate waste and reproductive function (eggs for females, milt for males) in fish

Salmon Dissection

Learning objectives:

a. Identify salmon anatomy

3. Provide each volunteer with a "Salmon Anatomy Cheat Sheet", a "Salmon Dissection Guide" and a scalpel. Provide each pair of students with a salmon carcass, one pair of scissors and one pair of forceps. Starting with external anatomy, instruct students to work in pairs to find the anatomical structures listed on the "Salmon Anatomy Student Sheet". The brain and otolith should only be removed by volunteers that have prior experience with fish dissections. (1 hour)

Plan Ahead

Have volunteers familiarize themselves with the "Salmon Dissection Guide" in advance. They'll be able to better assist students with identifying and removing parts of the salmon.

Some structures, such as the gill arches, require a little precision to remove and keep them intact enough to show off anatomical features like gill rakers.

4. Conclude the activity by inviting students to share their thoughts and reactions to dissecting a salmon. The prompts below can be used to guide the conversation. (10 minutes)

-What did you enjoy the most? The least?

Procedure (Continued)

-What are some things you observed about salmon anatomy?

-How were you able to determine the sex of your salmon?

-Ask students how many of them were able to find an organ of your choosing. Then ask the students to describe that organ (it's shape, texture, any features).

-Did anyone cut open the stomach to see the contents? What did you find?

Extensions

Additional Activities

Aging Tree and Fish
Students examine a fish scale to determine the age. The instructions for this activity is included in the supplemental materials for this lesson plan.

Gyotaku: Fish Printing
Students make colorful prints of fresh, frozen or rubber fish. The instructions for this activity is included in the supplemental materials for this lesson plan. If you don't have the supplies for this activity, you may be able to borrow the kit from the Columbia River Fish and Wildlife Office.

Dig Deeper

Salmon Identification
A chart to identify salmon by species provided by the Alaska Department of Fish and Game. Included in the supplement materials for this lesson plan

Salmon Dissection Video
A recording of a salmon dissection provided by the South Sound Green program. Link here: https://www.youtube.com/watch?v=i2esFr8drdQ

Vocabulary

Refer to "Salmon Anatomy Student Sheets".

Materials

Included:

10 – Salmon Dissection Guides (for volunteers and instructor)
16– Salmon Anatomy Student Sheets
10 – Salmon Anatomy Cheat Sheets (for volunteers and instructor)
(Optional) Aging Tree and Fish Activity – See Extension Section
(Optional) Gyotaku: Fish Printing Activity – See Extension Section
(Optional) Salmon Identification Chart – See Extension Section

Materials (Continued)

Request to Borrow from Columbia River FWCO:

Note: Requests are pending availability and geographical location

14- Salmon for dissection (or 28 rainbow trout, one for each student since they are smaller than salmon)
14 – Forceps (or 28 if using rainbow trout)
14 – Dissection scissors (or 28 if using rainbow trout)
10 – Scalpels (for volunteers and instructor)

Not Included:

4 to 7 – Kitchen knives (sharp and flexible)
Bib paper or plastic (to cover dissection surface)
Hand soap, water and paper towels (for washing up)
Clorox or disinfecting wipes (for cleaning surfaces)
Plastic bags (for waste)
Plastic spoons (for scooping out the salmon kidney)

Next Generation Science Standards

Life Science

LS1 – From Molecules to Organisms: Structures and Processes

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

Common Core Standards

Reading Standards

4.7: Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

Speaking and Listening Standards

4.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacherled) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

Common Core Standards (Continued)

4.4: Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Acknowledgments

Columbia River Gorge Information and Education, Columbia River Gorge National Fish Hatchery Complex, U.S. Fish and Wildlife Service

Pacific Streamkeepers Federation

Klamath Basin Research & Extension Center, Oregon State University

Salmon Anatomy Student Sheet

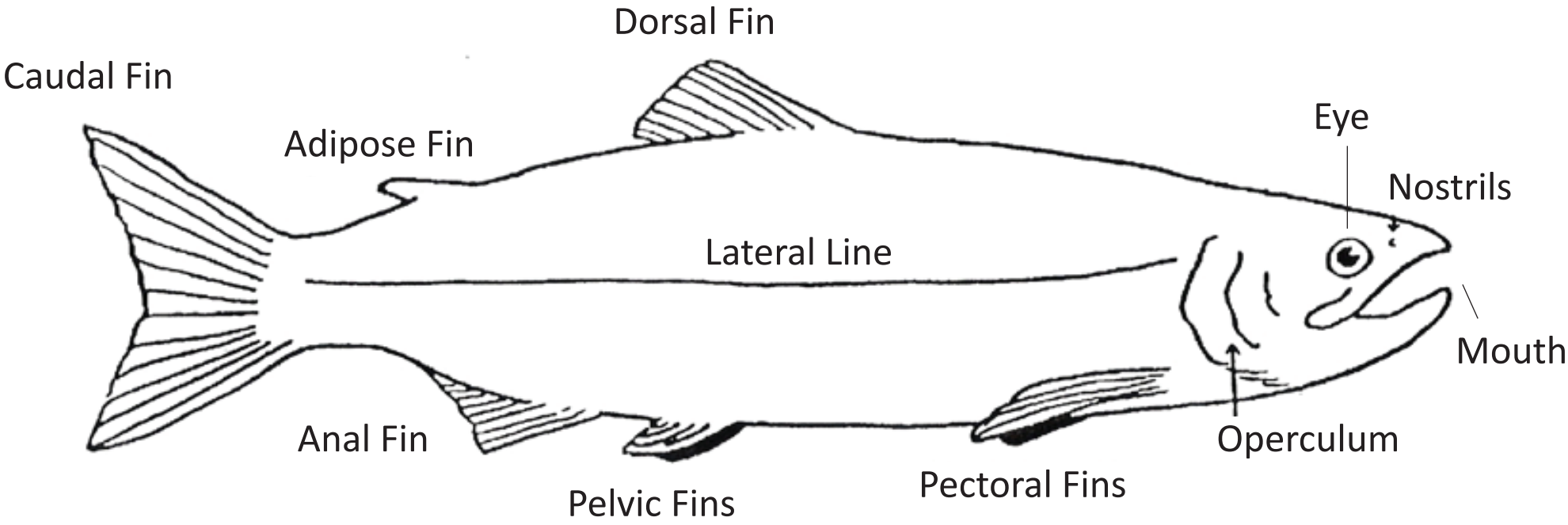
Printing Instructions:

1. Select option to print on both sides of paper

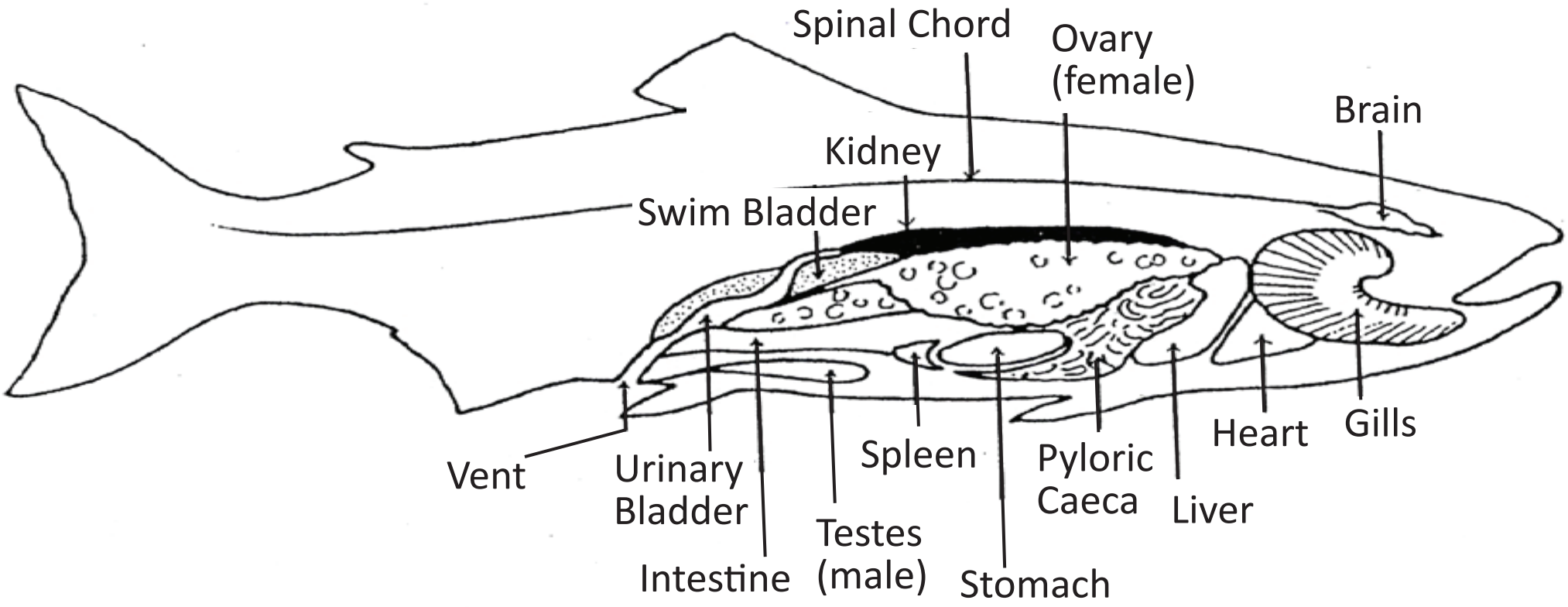
Alternatively,

1. Print page 1
2. Place back in printer tray face-side up
3. Print page 2

Salmon External Anatomy



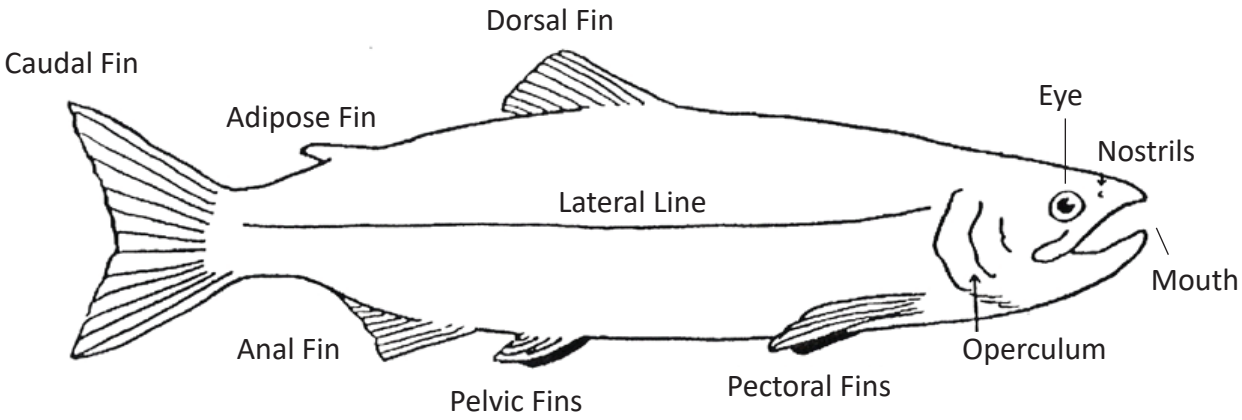
Salmon Internal Anatomy



Salmon Anatomy Cheat Sheet

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation

Salmon External Anatomy



Fish use their **EYES** for sight to navigate their aquatic environment. Fish have very sharp vision under water; some can see five meters or more.

Fish use their **MOUTH** to catch and hold food, and breathe. Water is constantly taken in through the mouth and forced out over the gills.

Salmon have a well developed sense of smell. When it's time to spawn, they use their **NOSTRILS** to navigate their way back to the streams they were born in.

The **OPERCULUM** covers the delicate gill filaments, and together with the mouth force water containing oxygen over the gills.

PELVIC FINS help with stability and slowing the fish down. Fish can also use these fins to move up or down.

Fish don't have ears. Instead they have **LATERAL LINE,** a specialized set of cells, that is used to detected low frequency sound waves in the water.

PECTORAL FINS create lift and helps the fish turn left or right.

The **DORSAL FIN** helps fish make quick turns or stops. It also helps to prevent rolling.

ANAL FINS act to stabilize the fish and help control rolling motion.

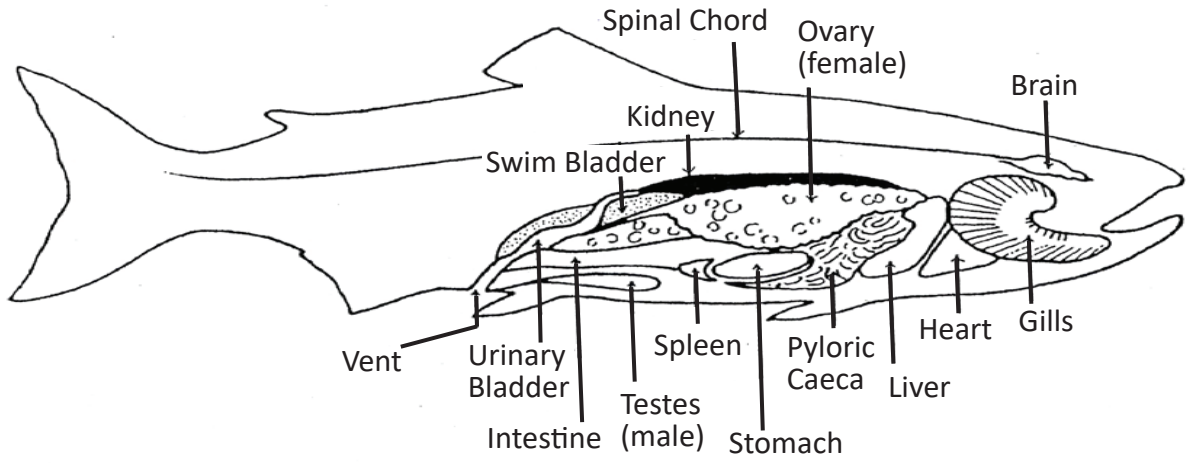
ADIPOSE FIN is a small fleshy fin which serves no known purpose.

The **CAUDAL FIN** acts as a propeller. Combined with very strong body muscles, fish use their caudal fins to create forward motion and speed.

Special thanks to Columbia River Gorge Information and Education Office

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation

Salmon Internal Anatomy



The **SWIM BLADDER** helps the fish stay buoyant. Salmon can adjust the air in their swim bladders to acclimate to changes in water pressure.

The **BRAIN** and **SPINAL CHORD** are part of the central nervous system, which controls functions such as movements, sensations and awareness.

Ammonia is a toxic byproduct of normal respiration in fish and **KIDNEYS** remove that waste from their blood stream. The kidney also plays a vital role in osmoregulation.

OVARIES and **TESTES** are salmon reproductive organs. The ovaries of the female salmon produce eggs, while the testes of male salmon produce milt.

The **VENT** is where fish eliminate waste. Additionally, eggs are laid from there by females and milt is released from there by males.

The **URINARY BLADDER** stores waste fluid. Urine is collected by ducts near the vent.

The **SPLEEN** is responsible for making white blood cells and recycling red blood cells.

The **INTESTINE** extends from the pyloric caeca to the vent. Similar to humans, intestines in fish function to absorb nutrients from food and transport solid waste to the vent.

The **STOMACH** uses digestive enzymes to break down food.

The **LIVER** is essential for digestion and maintaining blood chemicals.

The **HEART** is a muscular organ that circulated blood through the fishes' body.

PYLORIC CAECA in fish absorbs nutrients into the blood.

The **GILLS** absorb oxygen from water and remove carbon dioxide from the blood

Special thanks to Columbia River Gorge Information and Education Office

Salmon Internal Anatomy

Did you know?...

- Salmon have two kidneys. The head kidney functions to replace red blood cells, and the rearward part filters waste out of the blood.
- The memory and smell centers' in a salmon's brain grow rapidly just before it leaves its home stream for the sea. A salmon can detect one drop of water from its home stream mixed up in 250 gallons of sea water.
- The ovaries from a single female salmon can produce anywhere between 1,000 to 17,000 eggs.
- The digestive tract in fish is surprisingly short and simple, compared to humans. This is because fish are cold-blooded, and do not require a large amount of energy to be extracted from their food since they do not heat their body by their metabolism
- Fish have sharp spines that guard the opening of their throat called gill rakers. Gill rakers prevent food from entering the gill passages, and instead guide it into the throat
- Salmon are covered in a layer of mucous that acts to protect the fish from disease organisms and helps it maneuver through the water more easily.

Salmon External Anatomy

Did you know?...

- Fish don't chew their food. Instead, they use their tongue to thrust their food items towards the back of their mouth to swallow them.
- Fish breathe through their gills, not their nostrils.
- Salmon can swivel each eye independently, which allows them to cover a much wider field of vision.
- Fish gills are very thin and filled with blood vessels. Gills are far more efficient at extracting oxygen than human lungs. Fish are able to extract 80% of the oxygen dissolved in water, while human lungs only extract 25% of the oxygen in the air.
- The lateral lines detects vibrations in the water which helps that fish "see" when they can't use their eyes; such as at night or in murky water.
- The caudal fin is used by female salmon to dig the redd where they deposit their eggs.
- Salmon born in hatcheries can sometimes have their adipose fins removed to help distinguish them from wild fish when they return or are caught.

Salmon Dissection Guide

Columbia River FWCO Information and Education, 2022

Salmon Dissection Guide

Anatomy that does not require dissection

Shape

Salmon are streamlined to move easily through water. Water has much more resistance to movement than air does, so it takes more energy to move through water. A streamlined shape saves the fish energy.

Fins

Salmon have eight fins including the tail. They are made up of a fan of bone-like spines with a thin skin stretched between them. The fins are embedded in the salmon's muscle, not linked to other bones, as limbs are in people. This gives them a great deal of flexibility and maneuverability.

Each fin has a different function. The caudal or tail, is the largest and most powerful. It pushes from side to side and moves the fish forward in a wavy path.

The dorsal fin acts like a keel on a ship. It keeps the fish upright, and it also controls the direction the fish moves in.

The anal fin also helps keep the fish stable and upright.

The pectoral and pelvic fins are fused for steering and for balance. They can also move the fish up and down in the water.

The adipose fin has no known function. It is sometimes clipped off in hatchery fish to help identify the fish when they return or are caught.

Slime

Many fish, including salmon, have a layer of slime covering their body. The slime layer helps fish to:

- slip away from predators, such as bears.
- slip over rocks to avoid injuries
- slide easily through water when swimming
- protect them from fungi, parasites, disease, and pollutants in the water

Scales

Most fish, including salmon, have a layer of scales covering their skin. Scales are small, hard plates, like fingernails, that cover the body for protection. The scales overlap to form a flexible armour plating to protect from predators and bruising.

Salmon begin to grow scales at the fry stage.

The way scales are arranged in rows or patterns is different for each species.

Fish have the same number of scales all their lives. As the fish grows, the scales grow. They form lines, like the rings in a tree. Biologists can tell the age of a fish and how many years it spent in fresh and saltwater from the groups of lines on its scales.

If a scale is lost, another scale will grow to replace it, but it will not have the growth lines in the center.

Lateral Line

The lateral line functions somewhat like an ear. It detects vibrations and pressure waves in the water, just as an ear does in air. The lateral line is a series of liquid-filled canals below the skin along the side of the fish. It combines aspects of touch, hearing and seeing. Fish use the lateral line mainly to tell distance and water flow, and to detect disturbances in the water. Some fish can use the lateral line to find their way when it is too dark or muddy to see.

Nostrils

Salmon have nostrils above their mouth, but no nose. Fish do not breath through their nostrils. The nostrils are a small indention that is not connected to the mouth. Fish smell very tiny amounts of chemicals in the water. They use this information to detect harmful pollution and avoid potential threats, if possible. Salmon also use smells to recognize their way home from the ocean.

Mouth

Salmon have teeth that are sharp and needle-like, which they use to grab their prey. Their tongue also has two sharp shafts. Salmon do not chew their food.

Salmon have taste buds inside their mouth, like people do. They probably taste salt, sweet, bitter and acid, but their sense of taste has not been studied in detail.

Operculum (Gill Cover)

The operculum protects the gills. It is a hard outer lining like a flexible plate that the fish opens and closes to let water pass over the gills.

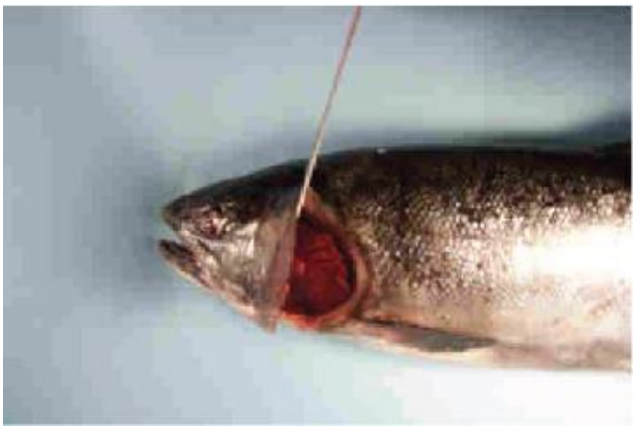
Anatomy that requires dissection

Gills

Fish breath by gulping water through their mouth, then close their mouth and throat. The water is forced though the opening in the back of their throat that is lined with gills.

Gills are very thin, they look like fine, branched structures, like a Christmas tree. This gives the greatest possible surface area to absorb oxygen from the water.

Gills are red because they are filled with blood. Oxygen in the water passes into the blood and is carried through their body. Gills are more efficient than lungs at extracting oxygen.



1. Remove the gills on one side of the salmon. Cut through the bone at the top where the gills are joined to the head.

2. Cut through the bone at the bottom where the gills are joined to the head.

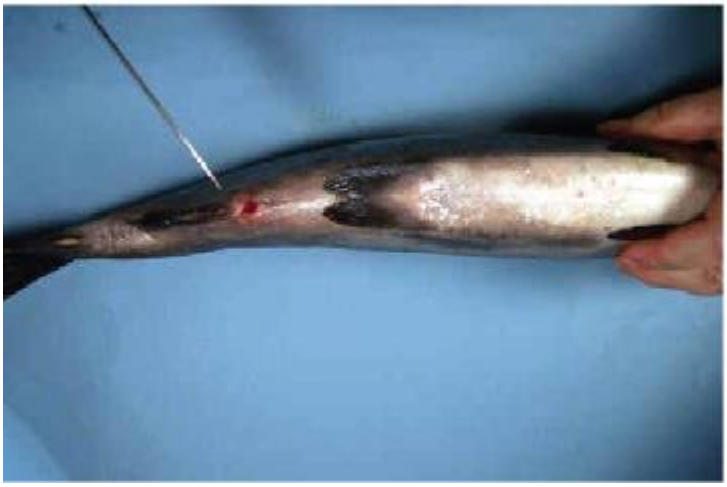
3. Lift the back edge (farthest from the mouth) of the gills and cut away from the skin.

4. Each pair of gills has 4 arches, each with a row of gill rakers. These rakes prevent food from entering the gill and instead guide it into the throat

The Vent

The vent opening on the underside of the salmon. Eggs are laid from here by females.

Milt is released from here by males. As well, both males and females eliminate waste from the vent.

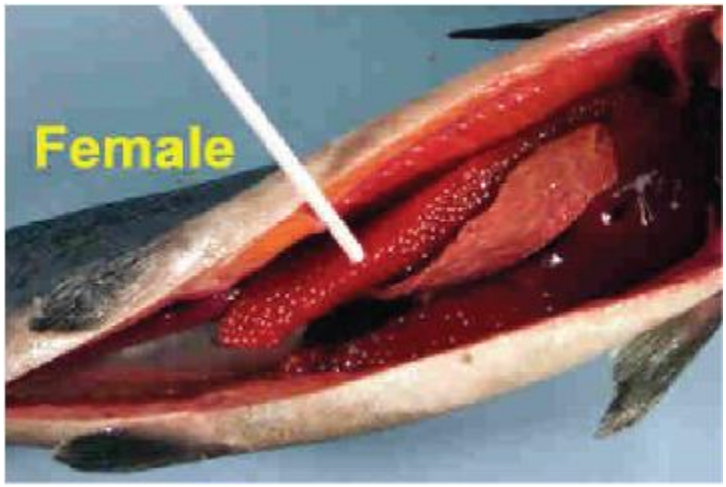


5. Cut the fish open beginning at the vent. Do not cut too deeply or the internal organs will be damaged.

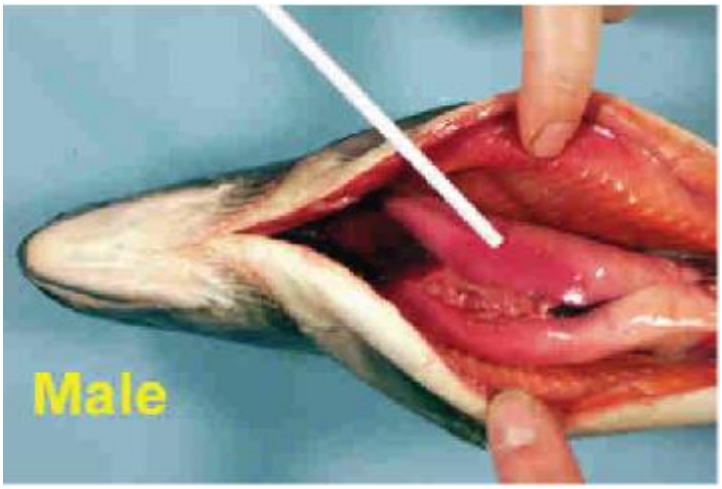
6. Open the fish from the vent to the throat.

Reproductive Organs

If the fish is female there are two sacs of eggs each held with a membrane. When the female is ready to spawn the eggs come loose inside her body and are laid from the vent.



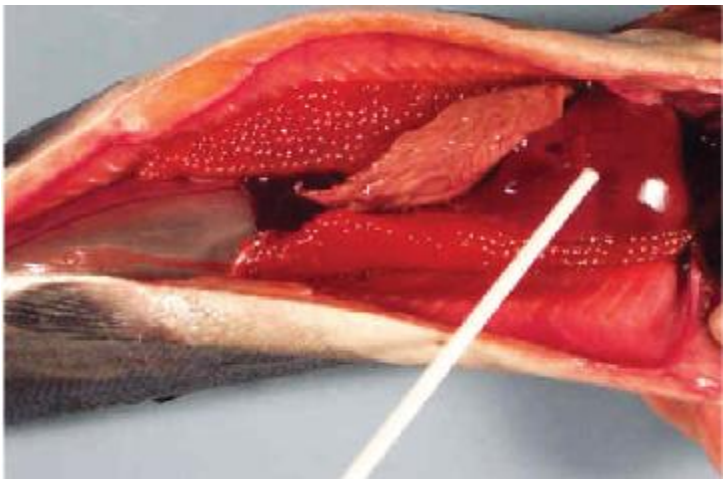
If the fish is male there are two sacs or testes, that produce milt when ready to spawn. The milt becomes liquid containing sperm and is squeezed out the vent opening to fertilize the eggs. The milt sacs are usually firm and white if the male has not spawned.



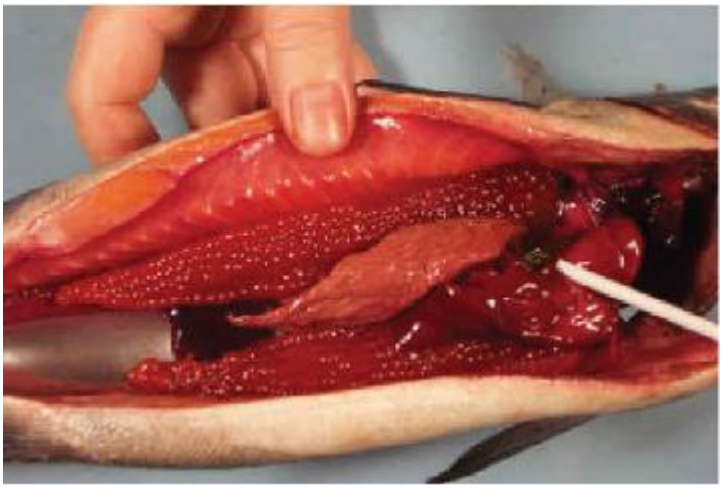
7. Remove the eggs or milt by gently pulling the sacs away from the body.

Liver and Gall Bladder

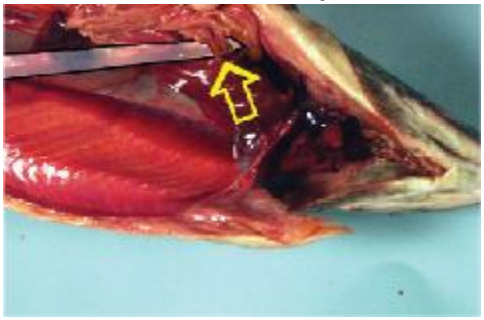
The liver is the largest organ in the fish's body. It is part of the digestive system. As in humans, it is essential for maintaining the proper level of blood chemicals and sugars.



Turn the liver over to view the gall bladder. The gall bladder contains green bile which is used to help digest fats.



8. Remove the liver and gall bladder by gently cutting any small membranes that join it to the digestive system.



9. Pull away from the stomach and remove.

Liver with empty gall bladder.

Digestive System (stomach, pyloric caeca and spleen)

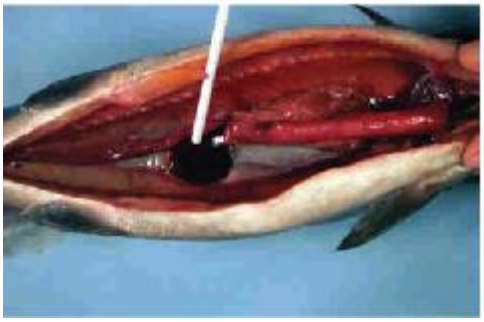
Observe the digestive system (stomach, pyloric caeca and spleen) by gently opening the body cavity.

The digestive system is shorter and simpler than in mammals. Because fish are cold-blooded they do not use as much energy to keep warm and do not need as much energy from their food so they expel it more quickly.

The stomach breaks down food with digestive juices.

The pyloric caeca absorbs nutrients into the blood. It is similar to the small intestine in people.

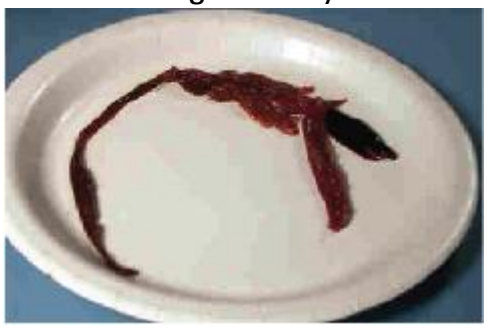
The spleen is a storehouse of blood for emergencies and recycles worn-out red blood cells.



10. Remove the stomach by cutting it away at the throat and gently pulling.

11. Remove the complete digestive system and intestines, which end at the vent.

12. Most food is absorbed in the intestine, the tube-like section at the end of the digestive system.



The Heart

The heart pumps blood through the body. It is very close to the gills where fresh oxygen enters the blood.

Heart showing ventral aorta leading to gills.

Swim Bladder

The swim bladder fills up with air to provide buoyancy, allowing fish to float in water

13. Remove the swim bladder by gently scraping it away from the sides of the body with the flat side of the knife.

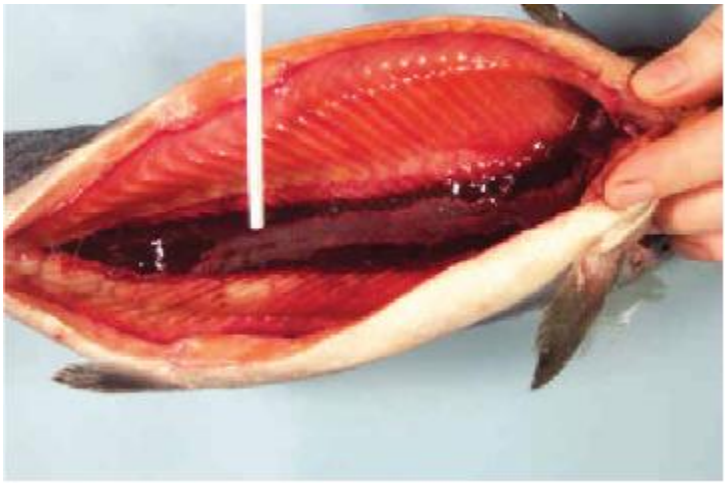
14. At the vent end of the fish, reach one finger under the swim bladder and pull it away.

15. Continue pulling up to the throat where a gentle tug will release it.

Kidney

Salmon have two kidneys joined together. The front kidney produces red blood cells and the back kidney cleans the blood. Urine is collected by ducts near the vent.

The kidney is also critical in the smolting process (going from fresh to salt water) in a process called osmoregulation.



16. Remove the kidney by cutting along each side.

17. Use a spoon to lift it out.

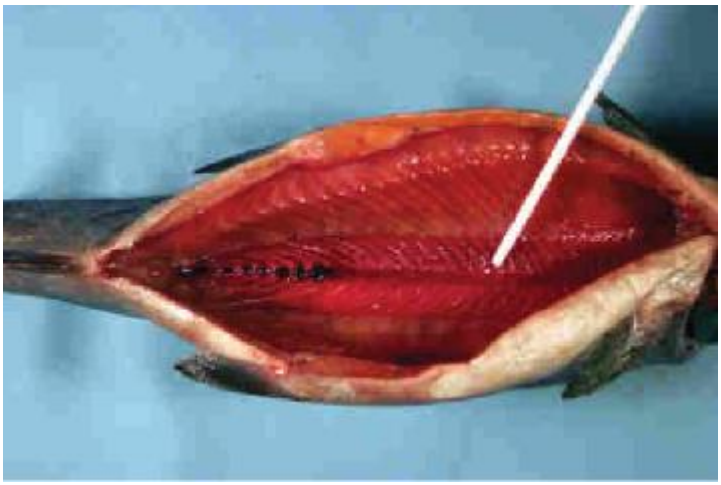
18. Kidney

Skeletal System

Fish have a flexible backbone, as do mammals. The backbone is a series of interlocked disks. Salmon can move from side to side, but can only bend up and down a small amount.

The backbone protects the spinal cord that runs through the body to the brain.

The ribs are lightweight, curved bones that give the fish its shape. The ribs protect the salmon's internal organs



19. Remove a rib by cutting on each side and pulling it up toward the backbone.

20. Cut to disconnect it.

You may also cut off the tail to show the spine. Membranes carry messages via nerves from the lateral line to the spine.

Eyes

Salmon have two eyes, but unlike people, salmon do not have binocular vision, which would give them depth perception. However, they swivel each eye independently forward and backward to cover a much wider field of vision than people have. Fish have very sharp vision under water. Some can see five meters or more.

21. Remove one eye by reaching under the gill with a finger and pushing hard to loosen the muscles in the socket behind the eye.

22. When it is pushed out of the socket, remove your finger.

23. From the outside, gently pull up on the eye with one hand as you cut it away from the head.

Brain

Like all chordates, salmon have a brain at the end of their spinal cord where the nervous system transmits the information they receive about their environment.

24. Begin by cutting through the salmon's head behind the gill covers.

25. Hold the head by the nose and place the back of the head on a cutting surface.

26. Remove a very thin slice (1/3 cm) from the top of the head. Thin slices will prevent damage to the soft brain tissue.

27. Remove a second 1/3 cm slice. The opening to the brain is surrounded by cartilage.

28. Remove a third 1/3 cm slice. There are three pea-shaped sections.

29. Use the tip of the knife to gently probe and scrape out the brain. Tilt the head up side down and continue to scrape until removed.

The salmon brain. The forebrain controls the salmon's sense of smell. The midbrain controls vision, learning and responses to stimuli. The hindbrain coordinates movement, muscles and balance.

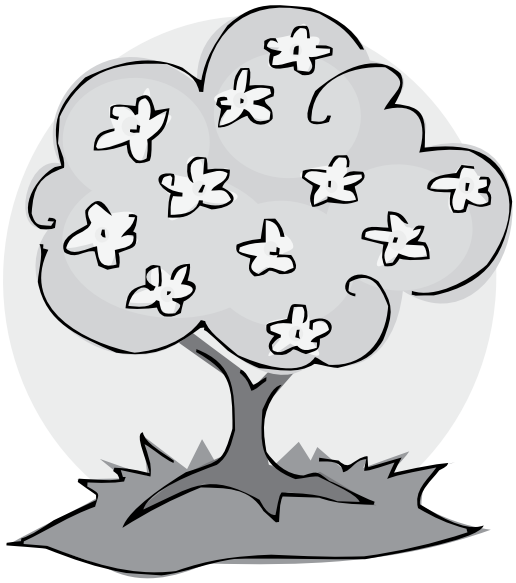
Salmon rely on their senses and an inborn knowledge called instinct to help them survive.

Aging Tree and Fish Activity

Aging Trees and Fish – An Activity

Key Concepts:

FOR YOUNGER STUDENTS and OLDER STUDENTS
• By examining a drawing of a salmon scale, students will be able to determine their age.



Objectives:

1. Students will learn about tree growth patterns.
2. Students will be able to age a tree by counting its growth rings.
3. Students will relate growth information to the aging of fish through their scales.

Materials:

• Tree cross-sections (if available)
• Enlarged fish scale drawing
• Copy master (following page)

Background:

Cross-sections of tree trunks reveal the different layers of a tree. Each ring in the trunk of a tree represents one year of tree growth; they are called annual rings. Each year the cambium (cambium is the area just under the bark) forms a layer of light-colored cells in summer. You can 'read' the age of a tree by counting the rings in a cross-section of the trunk. The annual rings in a tree cross-section vary depending on the weather and growing conditions.

Method for Aging Trees:

1. Explain how tree rings are made and what constitutes one ring. Pass out tree "cookies" from the kit to students. Have them decide how old the tree was when it was cut.

2. Each group finds the rings that correspond to the years their classmates were born. Use pins to mark the ring(s), first placing a paper "flag" on the pin to label the date.

3. Use pins to mark other significant dates. For example, how large was the tree when:
   a. Students were in the first grade?
   b. The school was built?
   c. Washington or Oregon became a state?

4. Examine the cross-section for differences in growing conditions during the years the trees lived.

Method for Aging Fish:

This is where we relate tree rings to the aging of fish through their scales.

1. Split the class into groups of two. (If you have a small class the students could work individually).

2. Give each group one scale to work with, can be xeroxed from the following page. They may need a magnifying glass to see the details of the rings. A photocopy of the scales could be used so the students can write directly on the scale.

3. Students should look for the heavy or dark rings in-between the lighter rings. The heavy lines are called annual rings (the mark of 1 year of life). Just like the cross-section of a tree trunk, the oval scales of the salmon show annually growth rings. Annual rings can be used to learn the age of a tree or fish. During the summer or other times when growing conditions are good, the fish grows quickly and the rings are far apart. In winter when living conditions are not as good, the fish grows slowly so the rings are close together.

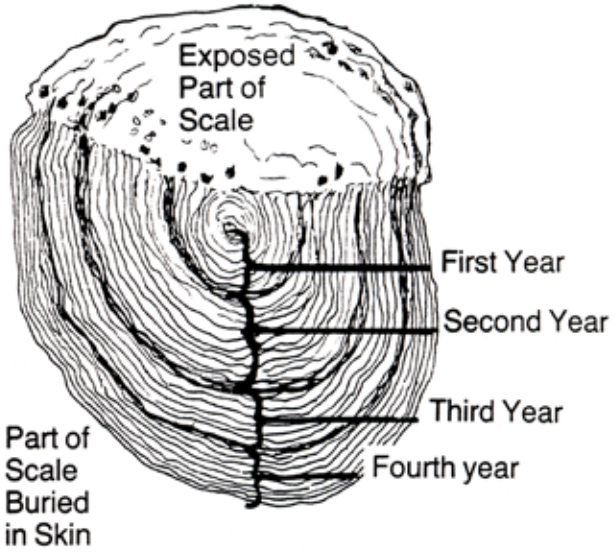
4. Ask students to tell about their fish. How old is it? Did this fish have a lot of space between the annual rings or very little? What des that mean? Which part of the scales shows where it was attached to the fish? What part was exposed?

5. Students could create their own scale, drawing the light and dark lines indicating differing growth patterns. Have them explain the reasoning behind what they created addressing some of the same questions in #4 above.

Evaluation:
Students observe the cross-section of a tree and list events which might cause differences in the width of tree rings. They describe how each event might influence the size of the ring.

How is a Salmon Like a Tree?

Cross Section of Tree



Salmon Scale

Just like the cross section of a tree trunk, the oval scales of the salmon show annual growth rings. Annual rings can be used to learn the age of a tree or fish. During the summer or other times when growing conditions are good, the fish grows quickly and the rings are far apart. In winter when living conditions are not as good, the fish grows slowly so the rings are close together. How old is the fish below?

Gyotaku-Fish Printing Activity

Gyotaku – Fish Printing! – An Activity

Key Concepts:

Fish are fun to catch. Fish are good to eat. Fish are fun to print.....Waaaaaait a minute! Print a fish? That's right - you can actually make colorful prints of the fish you catch! And now that the fish are biting, it's a great time to try your hand at fish printing. This process allows you to record your catch in an artistic way. You can make a print with most any fish, but those with larger scales and bodies such as salmon, carp, bass, bluegill, rock fish or flounder, will give the best results.

Objectives:

1. Students will be able to classify animals as fish or non-fish.
2. Students will name the external features of a fish.
3. Students will describe functions and adaptations of the external features of a fish.

Materials:

- Fresh, frozen or rubber fish
- Newspaper
- Modeling clay, straight pins
- ½" stuff bristle brush, small paint brush
- Water based ink (linoleum block ink is best; liquid tempera paint also can be used)
- Rice paper, newsprint or other moisture-tolerant paper (since rice paper is expensive, you might prefer to start with newsprint. After you gain experience you might want to try making a print on a tee-shirt.)

Background:

The art of fish printing is called gyotaku (pronounced ghio-ta'-koo) has been used in Japan for more than a century to record catches of sport fish. The Japanese technique is also used by scientists.

Methods:

1. Use soap and water to clean the outside of the fish as completely as possible. The cleaner the fish, the better the print. Dry the fish well.

2. Place the fish on a table covered with newspapers. Spread the fins out over some clay and pin them in this position. Allow the fish to dry further.

3. Brush a thin, even coat of ink or paint over the body and fins. Leave the eye blank.

4. Carefully place a piece of rice paper or newsprint over the inked fish. Use your fingers to *gently* press the paper over the surface of the fish. Be careful not to change the position of the paper or a double impression will result. Also, do not press too hard, or it will all blur together. *You will get better detail if you press lightly!*

5. Remove the paper from the fish quickly, lifting up one end and peeling it off. Often the second or third print from one inking or painting comes out the best.

6. Use a small brush to paint the eye on the finished print.

Salmon Identification Chart

Pacific Salmon Marine Phase Identification

Please note, when salmon enter fresh water they undergo significant physical changes including changes in coloration. This chart is intended to help anglers identify salmon by species. However, it is the angler's responsibility to be able to positively identify the species at any point in its life cycle.

Chinook (king) Salmon

- Spots on back and both lobes of the tail
- Black mouth with a black gumline

Coho (silver) Salmon

- Spots on back and upper lobe of the tail
- Black mouth with a white gumline

Sockeye (red) Salmon

- No distinct spots on back or tail
- White mouth with a white gumline
- Large, bright gold eye

Pink (humpy) Salmon

- Large, oval spots on back and both lobes of tail
- White mouth with a black gumline

Chum (dog) Salmon

- No spots; calico bands on body (often faint in saltwater)
- White mouth with a white gumline

Photographs courtesy of Washington Department of Fish and Wildlife.

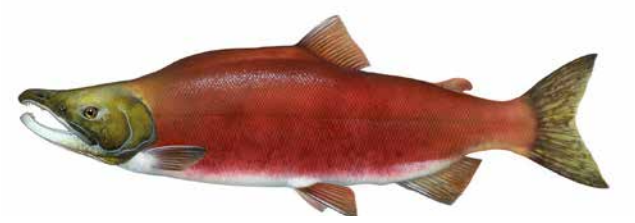
Chinook (king) Salmon

- Spawning adults turn maroon or olive brown
- Spots on body and both lobes of the tail remain

Coho (silver) Salmon

- Males develop pronounced "kype" (hooked-nose)
- Spots on back and upper lobe of the tail remain
- Male and female turn dark maroon and have dark backs

Sockeye (red) Salmon



- Spawning adults develop dull-green heads
- Males develop hump on back
- Both female and male turn red

Pink (humpy) Salmon

- Spawners turn dull gray on their backs and upper sides
- Lower sides appear cream color or white
- Large, oval spots on back and both lobes of tail remain

Chum (dog) Salmon

- Spawners develop pronounced, vertical calico bands on sides
- Males exhibit large, canine-like teeth

Illustrations courtesy of US Fish and Wildlife Service.