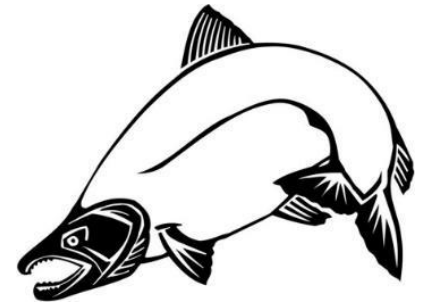

Salmon Dissection

(Indoors)



Purpose:

- Students will dissect (or observe the dissection of) a salmon or trout sample in order to become familiar with internal and external anatomy of salmonid species.

Objectives:

- Students will identify internal and external anatomy of a salmon
- Students will describe the function of each feature or organ

Materials:

Provided:

- Dissection kit (scalpel, tweezers, scissors, ruler, pipette, 6 pins)
- Dissection instructions (following lesson)
- External anatomy transparency and worksheet
- Internal anatomy transparency and worksheet

Not Provided:

- Salmon or trout specimen
- Paper plates
- Newspaper
- Garbage bags

Time Required: 1 -2 hours

Appropriate grades: 4th-8th

NGSS and Common Core Standards:

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

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.

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.



**ENVIRONMENTAL
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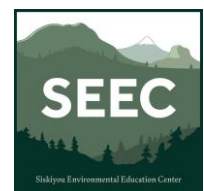


Activity:

Introduction	<p>Preparation:</p> <p><i>Acquiring a salmon specimen:</i> To acquire a salmon or trout for dissection contact Cole M. Rivers Hatchery at (541)878-2235 and include your school name and the number of fish desired. The hatchery has steelhead trout, and Chinook and coho salmon carcasses available depending on the time of year. The hatchery will also provide information on the proper disposal of carcasses.</p> <p><i>Dissection prep:</i> It is advised to perform the dissection outside. Cover a table in plastic garbage bags or newspaper. Label paper plates with each organ-you can place the organ on the plate as you dissect and pass them around to the class. Have a plan to dispose of the salmonid carcass before beginning-DO NOT LEAVE IN TRASH. Follow the hatchery's recommendations for disposal.</p> <p>Activity/Lesson:</p> <p>With younger students the teacher will perform the dissection. For older students give a talk on proper scalpel use and allow students to take turns identifying and removing organs.</p> <ol style="list-style-type: none">1. Before beginning dissection, brainstorm unique characteristic of fish. What makes a fish a fish? Are there any unique anatomy adaptations you think you might find in a salmon or anadromous trout?2. Choose a location where all students can view the dissection clearly and have students gather around it. Project salmon external and internal anatomy diagrams on the board or handout diagrams to students.
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<p>Body</p>	<p>Salmon Dissection Questions</p> <p><i>Dissection instructions can be accessed in the following pages or from the Salmonids in the Classroom Program of Fisheries and Oceans Canada at http://www.pskf.ca/sd/</i></p> <p>Use these questions to help facilitate discussion with your students about the external and internal anatomy of a fish.</p> <p><i>External Anatomy</i></p> <p>1. What is the first thing you notice when you handle a fish? If you had a fish in a big bag and you put your hand in, what would be the first thing you would notice?</p> <p>2. Slime-why is a fish slimy?</p> <ul style="list-style-type: none"> ● to slip away from predators such as bears ● as an anti-abrasive to slip over rocks ● lubricant to enable easy swimming through the water ● protection from fungus, parasites and disease <p>3. Identify the external anatomy.</p> <ul style="list-style-type: none"> ● mouth, eyes, gills, nostrils, vent, lateral line <p>4. Identify both single and paired fins:</p> <ul style="list-style-type: none"> ● Caudal fin, anal fin, pelvic fins, pectoral fins, dorsal fin, adipose fin (unless it is a hatchery fish, in which case the adipose fin may have been clipped to identify it). Clipped hatchery fish will also have a tiny steel pin, or coded-wire tag, about the dimension of a day's growth of a man's whisker, embedded in the nose cartilage. If your specimen is missing the adipose fin, the head should be removed and turned into the nearest Fish and Game office with information on when and where the fish was caught (if available). <p>5. What are the fins for?</p> <ul style="list-style-type: none"> ● Not for swimming, but for steering. The muscles of the entire body of the fish are used for propulsion, and even if the fish had no fins at all it could still make progress through the water; however it would not be able to right itself well. <p>6. How are the fins attached?</p> <ul style="list-style-type: none"> ● To muscle tissue, not to the skeleton. Why is that? <p>7. What are the scales for?</p>
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- As "armor plating". Remove a scale for later observation under a microscope or a hand lens.

8. Did the fish always have as many scales? Are there more now than when it was little?

- Fish have the same number of scales all their lives. The fish stacks up "plates" in order to grow the scale. This can be seen under magnification as rings. It is similar to a tree ring, with the difference being that the rings develop as food is available, and the groups of rings coincide with the seasons. An experienced biologist can determine the age of a fish by looking at the rings. Can you?

9. What do you think happens when a scale is shed?

- Scales are regenerated to fit into the missing space, and so these scales will have a clear center, since it does not have the "plates" of previous growth stacked above.

10. Do all fish have the same scale arrangement?

- No, the arrangement and placement of rows or scales is different for different types of fish.

11. What is the lateral line for?

- It emits low level vibrations, somewhat like sonar. It functions something like an organ of touch, something like an organ of hearing, and something like an organ of seeing. It helps fish find their way when they cannot see, such as at night, or when the water is muddy.

12. How does a fish breathe? Ask for a volunteer to demonstrate.

- The gulping action demonstrates how water is drawn in through the open mouth, the mouth and the throat closes, and the water is forced out past the gills. Gills extract oxygen from the water. Cold water, if saturated with oxygen and holding as much as it can, may have 13 parts of oxygen for every million parts of water.
- To demonstrate what 13 ppm is, imagine that you have a million marbles, of which 13 are white oxygen marbles, and the rest are plain water marbles. If you were to drop one marble per second into your pocket, how long would it take you to reach a million? 12 days! Imagine how large your pocket must be.
- At the end of 12 days of marble dropping, you would then drop in the 13 oxygen marbles: that shows how efficient gills must be, and how sensitive they are to material in the water. In fact some pollutants cause problems at levels of parts per billion. Using the same analogy, it would take 38 years of



marble dropping to get a billion! Fish, and all living things must live within an environment, which is why it must be clean!

13. Remove both sets of gills.

- Cut out the gills at their apex near the throat, then pare away up toward the spine on both sides. Take care not to cut along the belly but rather up toward the spine. Cut only as far as is necessary, as once the gills are freed near the throat they can be pulled out with the fingers.

14. What do the gills look like? How are they used?

- The gills have an extensive blood supply, accounting for their color. The laminae, or branches of the gills, perform the same function as the small sacs or alveoli within your lungs, in that they act to transfer the carbon dioxide from the body of the fish and absorb the oxygen from the water. The laminae are only two cells thick, with maximum surface area to permit the most efficient transmission of gases. Under a lens, the laminae look like a Christmas tree.

15. Look for the gill rakers. (The sharp spines that guard the opening of the throat)

- The gill rakers prevent food from entering the gill passages, and instead guide it into the throat.

Internal Anatomy

1. When cutting open the fish, what do you expect to see?

- Place the fish on its side, belly away from you, on newspaper. If right-handed, hold the tail firmly with the left hand. It may help to use paper towels to improve the grip. Insert the tip of the knife into the vent and cut forward only as far as the pectoral fins, passing between the pelvic fins. A safe cut is away from your body with a truly sharp knife. A knife that is thin and flexible is best.

2. What is the first thing that you will see?

- If the fish is a mature female, a large portion of the body cavity is filled with eggs. If the fish is ripe and ready to spawn, the eggs will be loose within the body cavity; more likely the eggs are contained within a membrane. Pull out one of the roe sacs by hand and observe the blood vessels contained within the membrane. What are these for?
- A mature has 2,000-3,500 eggs. The egg provides one half of the genetic information needed in order for fertilization to occur.



3. Why are so many eggs needed?

- On the average, and in rough proportions, salmon lay about 2,500 eggs. Of these, only 15 percent live to hatch, leaving 375. Of those remaining, only 30 last the first year. Of those, only 4 make it to adult, and only 2 live long enough to spawn. What about the rest? If the fish is a male, a white bladder of milt will be easily observed. The milt provides the other half of the genetic information needed.

4. Looking into the body cavity, you will see a large dark red organ. What is this organ; the largest within a fish's (or a person's) body? Remove it with your fingers.

- The liver stores, synthesizes and secretes the essential nutrients that were contained in the food. It plays a part of maintaining the proper levels of blood chemicals and sugars. The gall bladder, which is attached to the liver, contains green bile which in part is used to help digest fats.

5. Remove the stomach and upper gut. Use your fingers.

- It is attached at the throat and, which you cut when you remove the gills, and attached again at the vent. It will come away with the "spaghetti" of the pyloric caeca and the dark spleen attached. It will strip out to the vent.
- The pyloric caeca act like a small intestine, in that they exude the digestive juices needed to break down the food, and absorb the components into the blood stream which passes it on to the liver.
- The spleen acts as a storehouse of blood, to be used if there is an emergency, and to recycle worn-out blood cells.

6. If the fish has been taken from a river, it is unlikely that there is any food anywhere in the digestive system. Salmon do not eat once they enter freshwater, and it may be as much as 16 weeks from the time that they take their last meal in the ocean and the time that they spawn and die.

- The digestive tract is surprisingly short and simple, and does not have the extensive intestine that mammals have. 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.

7. We have not seen the heart yet-is it where you thought? Carefully continue to belly cut forward to the throat, but only deep enough to cut through the skin. Find the heart and remove it. What does it look like?

- The heart is located where the gill covers begin to come together high up in the throat, and it may be removed with the fingers. It is triangular in shape, and consists of 4 chambers, as does your heart. The white tube is the venal



aorta, and it leads the short distance to the gills. Why is it located so close to the gills?

8. Remove the swim bladder that is attached to the esophagus by stripping it out from the front with your fingers. Would anyone care to demonstrate how the swim bladder can be inflated?

- Most fish are able to adjust the amount of air in their swim bladder so that they are able to stabilize their movement within the pressures of the water. Notice that the swim bladder is just below the spine, which is just below the center line, or the center of balance of a fish. This is why fish float upside down when they die.
- When a fish, such as a salmon, is deep in the ocean, it adjusts the amount of air in its swim bladder so that it can hover comfortably without sinking or rising in the water. If it wants to come up to the surface, it must release some of this air, something like a burp, in order to hover at the higher depth. Some bottom fish, such as a rockfish, are unable to adjust their swim bladders by burping, and this is why when a bottom fish is caught and brought to the surface its stomach protrudes into its mouth: the swim bladder has expanded due to decreased pressure and is forcing the internal organs out through their throat.

9. The dark red line along the backbone is the kidney. Where are your kidneys, and what are they for?

- The forward part of the fish kidney functions to replace red blood cells, and the rearward part filters waste out of the blood. The kidney can be removed by slicing through the membrane along each side, and then scraping with the spoon.



Closure	<p>V. Assessment: Discuss with the class after dissection is complete</p> <p style="text-align: center;">How does a fish compare to a human?</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Fish</th> <th style="width: 50%; text-align: center;">Human</th> </tr> </thead> <tbody> <tr> <td colspan="2" style="text-align: center;">Respiratory System</td> </tr> <tr> <td style="padding: 5px;">Water enters the mouth. It is forced between the gills. Thin membranes absorb the oxygen from the water and carbon dioxide is released.</td> <td style="padding: 5px;">Air enters the nose. The respiratory system includes the larynx, trachea and lungs. This system provides oxygen for the body cells and removes the waste products (carbon dioxide).</td> </tr> <tr> <td colspan="2" style="text-align: center;">Circulatory System</td> </tr> <tr> <td style="padding: 5px;">The circulatory system carries blood throughout the body. Arteries carry blood to the heart. The heart is like a pump. Veins carry blood away from the heart.</td> <td style="padding: 5px;">The human circulatory system includes the heart, veins, arteries and capillaries. The blood carries oxygen plus nutrients to the cells and removes waste products. The heart is like a pump which circulates blood throughout the body.</td> </tr> <tr> <td colspan="2" style="text-align: center;">Reproductive System</td> </tr> </tbody> </table>	Fish	Human	Respiratory System		Water enters the mouth. It is forced between the gills. Thin membranes absorb the oxygen from the water and carbon dioxide is released.	Air enters the nose. The respiratory system includes the larynx, trachea and lungs. This system provides oxygen for the body cells and removes the waste products (carbon dioxide).	Circulatory System		The circulatory system carries blood throughout the body. Arteries carry blood to the heart. The heart is like a pump. Veins carry blood away from the heart.	The human circulatory system includes the heart, veins, arteries and capillaries. The blood carries oxygen plus nutrients to the cells and removes waste products. The heart is like a pump which circulates blood throughout the body.	Reproductive System	
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	<p>Female salmonids deposit between 500 - 10,000 eggs in redds and the male fertilizes them with milt. The eggs incubate for about one to four months and hatch as alevins.</p>	<p>The ovaries of the female produce eggs cells. The testis of the male produces sperm cells. The two cells unite and the embryo develops in the uterus of the female.</p>
<p>Nervous System</p>		
<p>The brain and spinal cord of all vertebrates are similar in structure and function. The central nervous system controls all conscious body functions. It includes the brain, spinal cord and peripheral nerves..</p>		
<p>Digestive System</p>		
<p>The alimentary or digestive canals are similar. They prepare food for use, absorb nutrients and eliminate waste.</p>		

Additional Resources:

<http://www.portlandfreeschool.org/dissect-a-salmon.html>

This site provides a salmon dissection game along with many videos about salmon.

