Environmental Science 120 **Name(s):**

Lab – Reading a Salmon Scale

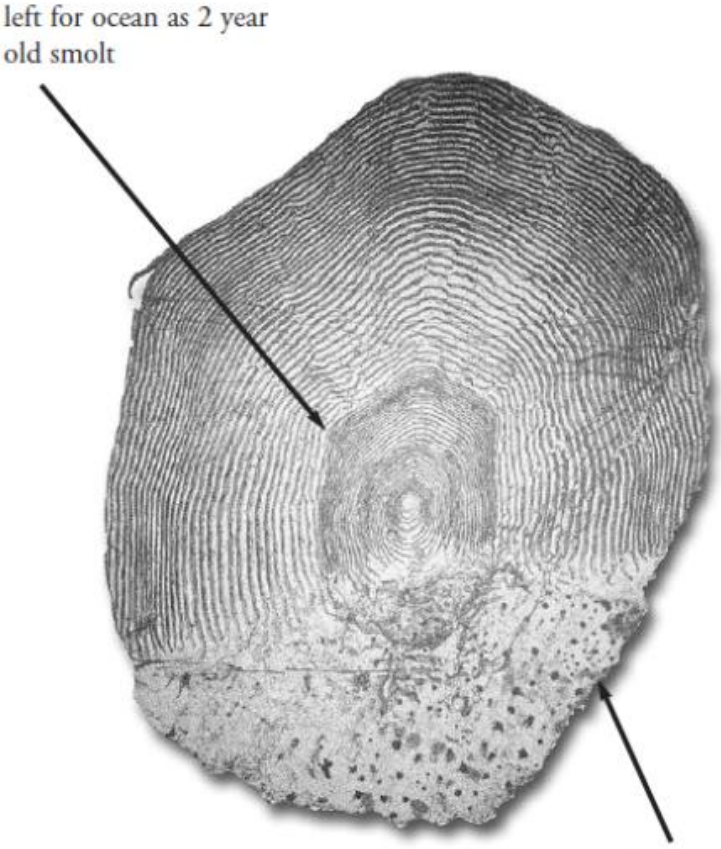
NOTE: See the end of this lab (Appendix D) for general information on the use of a compound microscope.

PART A - Background Information…

READING A SALMON SCALE

Have You Read Any Good Salmon Lately?

The scales of a fish are like a book; they tell a story. Information about how old a fish is, where it has lived, and if it has been eating well can be gathered from its scale.



Does Scale Sampling Harm the Salmon?

An advantage of scale sampling is that scales can be removed without harming the fish. Scale samples are regularly collected from the brood stock of an enhancement project and from fish collected during stream surveys and recreational fishery surveys.

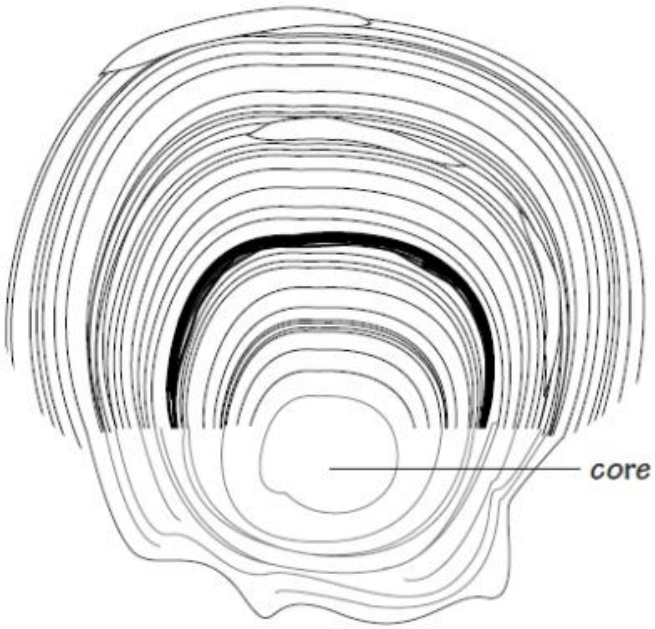
In figure _, the rings that form around the centre or core of each scale represents stages in either fresh or saltwater. The most widespread method of aging salmon parr and adults involves collecting scales. When clean and undamaged, scales show progressive growth rings similar to the rings on a tree. As the salmon grows, new growth rings are laid down in the scale as it gets bigger. The scales with their growth rings can be magnified in order to accurately reveal the life history of an individual salmon.

During the growth of salmon, ridges (or rings) are formed around the centre of the scale (also known as the focus or nucleus). It has been determined that these rings are found in proportion to the growth of the fish.

It is from these groupings that we can analyze the growth rates and ages of salmon. The wide-spaced rings are summer growth, while narrowly-spaced rings are winter growth. While growth is usually determined by temperature and amount of food intake, these terms indicate increased food and growth in summer periods and a decrease in growth during winter when temperatures are colder and food is less abundant.

PART B – Label the Stages of Growth… [8]

Label the scale using letters A – H with arrows.



The scales of a fish are like a book. They tell a story. They tell how old the fish is, where it has lived and if it has been eating well. Now scales can be used as a source of DNA to find out how closely individual Atlantic salmon are related, and even whether they are from the same stream or not.

Find the core or centre of the scale (it's not in the middle!). This has been labeled on the diagram. The first rings form when the fish is in its early stages. If the water is warm and there's lots of food, the fish will grow well. The rings will be spaced far apart. This is summer growth. Label this section of the scale. **[A]**

Next are some rings that are very close together. These grow during the fish's first winter. The water is cold and there's little food. The fish doesn't grow very much and the rings are close together. This is winter growth. Label this section on the diagram. At this stage, the fish was a year old. **[B]**

The fish then spends another year in freshwater. Can you find the summer and winter growth rings for the second year? Label these sections second summer and second winter. **[C]**

Following the second winter, the fish feeds heavily and then starts its journey to sea. At this stage it is called a smolt. It goes through some major changes and the scales show a dark band. Find the smolt mark and label it. **[D]**

The fish then spends its first summer at sea. There is lots of food and it eats and grows well. The growth rings are far apart. Can you find these? Label their first summer at sea. **[E]**

This is followed by a winter at sea wnen the fish is not eating well and the rings are closer together. Find these rings and label them first winter at sea. **[F]**

The fish then returns to freshwater to spawn. During this time it doesn't feed and the scales develop special marks or scars. They look like blank spots on the scale. Label these spawning scars. **[G]**

The fish spends the winter in freshwater and then returns to sea the next spring. After another summer and winter at sea, it comes back to freshwater to spawn again. Label second summer at sea, second winter at sea, and second spawning scars. **[H]**

PART C – Analyzing Your Scales…

Procedure: Using the two given scales, do each of the following…

1) Measure the diameter of the scale. [2]

[A] diameter = _____ mm [B] = _____ mm

2) Put the scale under the microscope. Draw a sketch of the scale and include the growth rings. [4]

[A] [B]

3. On the above diagrams, label each of following with arrows to indicate the location: [12]

A) core
B) parr summer growth year 1
C) parr winter growth year 1
D) parr summer growth year 2
E) parr winter growth year 2
F) smolt mark
G) sea summer growth year 1
H) sea winter growth year 1
I) grilse freshwater summer growth
J) grilse freshwater winter growth
K) spawning scars
L) sea summer growth year 2 (salmon)
M) sea winter growth year 2 (salmon)
N) salmon freshwater summer growth
O) salmon freshwater winter growth
*** (continue lettering if needed for sea/freshwater summer/winter growth year 3)

4. Determine the age of the fish [1SW – grilse; 2SW – salmon; 3SW – salmon; 4SW – salmon] [2]

[A] Age = _____ [B] Age = _____

Appendix D Use of the Microscope

The Compound Microscope

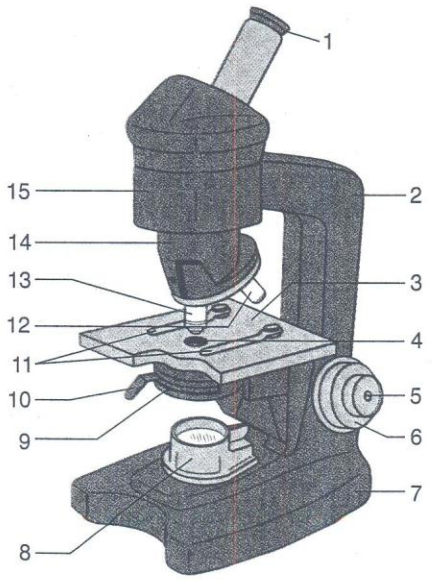
The microscope used in most biology classes, the compound microscope, contains a combination of lenses. The eyepiece lens is located in the top portion of the microscope. This lens usually has a magnification of 10×. Other lenses, called objective lenses, are at the bottom of the body tube on the revolving nosepiece. By rotating the nosepiece, you can select the objective through which you will view your specimen.

The shortest objective is a low-power magnifier, usually 10×. The longer ones are of high power, usually up to 40× or 43×. The magnification is marked on the objective. To determine the total magnification, multiply the magnifying power of the eyepiece by the magnifying power of the objective. For example, with a 10× eyepiece and a 40× objective, the total magnification is 10 × 40 = 400×.

Learning the name, function, and location of each of the microscope's parts is necessary for proper use. Use the following procedures when working with the microscope.

1. Carry the microscope by placing one hand beneath the base and grasping the arm of the microscope with the other hand.
2. Gently place the microscope on the lab table with the arm facing you. The microscope's base should be resting evenly on the table, approximately 10 cm from the table's edge.
3. Raise the body tube by turning the coarse adjustment knob until the objective lens is about 2 cm above the opening of the stage.
4. Rotate the nosepiece so that the low-power objective (10×) is directly in line with the body tube. A click indicates that the lens is in line with the opening of the stage.
5. Look through the eyepiece and switch on the lamp or adjust the mirror so that a circle of light can be seen. This is the field of view. Moving the lever of the diaphragm permits a greater or smaller amount of light to come through the opening of the stage.
6. Place a prepared slide on the stage so that the specimen is over the center of the opening. Use the stage clips to hold the slide in place.
7. Look at the microscope from the side. Carefully turn the coarse adjustment knob to lower the body tube until the low-power objective almost touches the slide or until the body tube can no longer be moved. Do not allow the objective to touch the slide.

Parts of the Microscope and Their Function

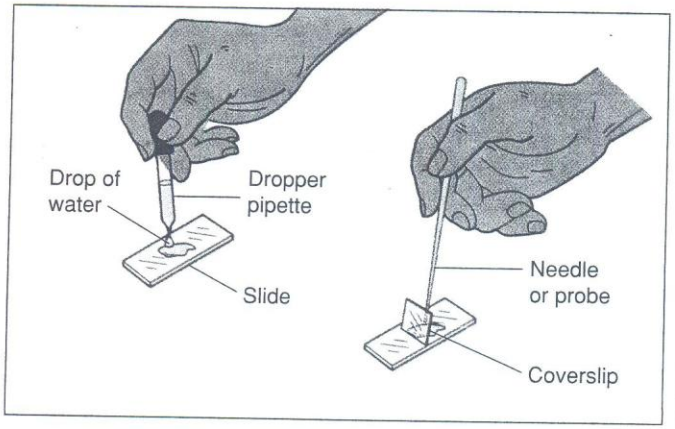


1. **Eyepiece** Contains a magnifying lens
2. **Arm** Supports the body tube
3. **Stage** Supports the slide being observed
4. **Opening of the stage** Permits light to pass up to the eyepiece
5. **Fine adjustment knob** Moves the body tube slightly to sharpen the image
6. **Coarse adjustment knob** Moves the body tube to focus the image
7. **Base** Supports the microscope
8. **Illuminator** Produces light or reflects light up toward the eyepiece
9. **Diaphragm** Regulates the amount of light passing up toward the eyepiece
10. **Diaphragm lever** Opens and closes the diaphragm
11. **Stage clips** Hold the slide in place
12. **Low-power objective** Provides a magnification of 10× and is the shortest objective
13. **High-power objective** Provides a magnification of 40× and is the longest objective
14. **Nosepiece** Holds the objectives and can be rotated to change the magnification
15. **Body tube** Maintains the proper distance between the eyepiece and the objectives

8. Look through the eyepiece and observe the specimen. If the field of view is out of focus, use the coarse adjustment knob to raise the body tube while looking through the eyepiece. **CAUTION:** *To prevent damage to the slide and the objective, do not lower the body tube using the coarse adjustment while looking through the eyepiece.* Focus the image as best you can with the coarse adjustment knob. Then, use the fine adjustment knob to focus the image more sharply. Keep both eyes open when viewing a specimen. This helps prevent eyestrain.
9. Adjust the lever of the diaphragm to allow the right amount of light to enter.
10. To change the magnification, rotate the nosepiece until the desired objective is in line with the body tube and clicks into place.
11. Look through the eyepiece and use the fine adjustment knob to bring the image into focus.
12. After every use, remove the slide. Return the low-power objective into place in line with the body tube. Clean the stage of the microscope and the lenses with lens paper. Do not use other types of paper to clean the lenses; they may scratch the lenses.

Preparing a Wet-Mount Slide

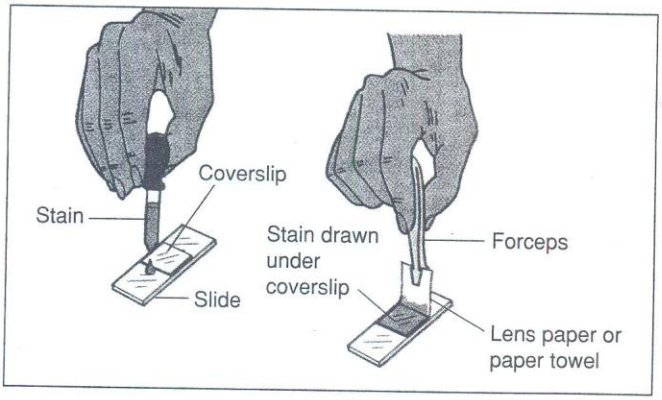
1. Obtain a clean microscope slide and a coverslip. A coverslip is very thin, permitting the objective lens to be lowered very close to the specimen.
2. Place the specimen in the middle of the microscope slide. The specimen must be thin enough for light to pass through it.



3. Using a dropper pipette, place a drop of water on the specimen.
4. Lower one edge of the coverslip so that it touches the side of the drop of water at about a 45° angle. The water will spread evenly along the edge of the coverslip. Using a dissecting needle or probe, slowly lower the coverslip over the specimen and water as shown in the drawing. Try not to trap any air bubbles under the coverslip. If air bubbles are present, gently tap the surface of the coverslip over the air bubble with a pencil eraser.
5. Remove any excess water at the edge of the coverslip with a paper towel. If the specimen begins to dry out, add a drop of water at the edge of the coverslip.

Staining Techniques

1. Obtain a clean microscope slide and coverslip.
2. Place the specimen in the middle of the microscope slide.
3. Using a dropper pipette, place a drop of water on the specimen. Place the coverslip so that its edge touches the drop of water at a 45° angle. After the water spreads along the edge of the coverslip, use a dissecting needle or probe to lower the coverslip over the specimen.



4. Add a drop of stain at the edge of the coverslip. Using forceps, touch a small piece of lens paper or paper towel to the opposite edge of the coverslip, as shown in the drawing. The paper causes the stain to be drawn under the coverslip and to stain the cells in the specimen.