Activity 11: Reading Fish Scales

Audience:

Adults and grades 5-12

Time:

30 - 45 minutes

State Essential Learning Requirements

Science: 2.2, 3.2

Math: 5.3

Overview:

Students will practice techniques used in fish management.

Students will read fish scales to determine the age of a salmon.

Students will learn how to predict salmon return numbers based on fish scale research.

Objectives:

- To determine the age of fish by reading fish scales.
- To predict salmon returns based on salmon scale research.

Critical Questions Addressed:

2. Endangered Salmon

3. Salmon Recovery

Background:

Scales on fish grow like a tree ring. With each new growth a ring is added to the scale. With good food supplies the rings grow fast and are wide apart. Fast growth occurs in the warmer seasons when there is more food available. The scales grow slower in the cooler seasons when there is less food available. The dense set of rings on the scales represents the cooler season of slower growth. Each dense set of rings represents a cool season. By counting the dense set of rings you can find out the age of the fish. The attached impressions of scales from several species of salmon are what scientists use to keep a record of the scales they examine.

Materials:

Available in Activity Packet 11

- Fish scale impressions
- Magnifiers
- Diagram showing how to count rings.
- Enlarged scale on sheet to practice aging fish.
- Overheads
- Scientific report on use of scales in salmon management.

Directions: Scale Reading

- Provide students with handouts copied from the materials provided.
- Demonstrate how to determine age of the fish scale using the overhead.
- Give students copies of the sample scales and ask them to determine their age.
- Ask students to view a salmon scale impression with a magnifier – draw a scale and age the scale.

Directions: Forecasting

- Follow the instructions provided in the teacher notes to forecast salmon returns.
- Provide students with the "Reading Fish Scales-Forecasting Activity Sheets."
- Ask students to follow instructions and use the math described to predict future salmon returns based on past returns estimated by fish scale research.

Extension:

- Read the scientific report on salmon scales and describe how scientists use salmon scales to age salmon and make decisions on salmon management

Methods of Aging Fish

Methods of Aging Fish . . .

There are different schemes that have been used throughout the years to designate the age of salmonids. We have most commonly been using the European method. This method details what the age of a fish is by counting the number of winters it has survived. The winters are represented on the scale as winter annuli. The method identifies the number of winters a particular salmon has spent in fresh and salt water. The fresh and salt water phases are identified and separated by a period. The number to the left of a period is the amount of winters the fish have spent in fresh water and the number to the right of the period is the number of winters in salt water.

For example: If the age of the fish is 1.2, this means it has survived a total of 3 winters and has spent 1 winter in fresh water and 2 winters in salt water.

There are salmonid species that are known not to spend a winter in fresh water. For instance, Chum, after emerging from the gravel as fry begin migrating to the estuary or ocean. So if a certain run of Chum have survived 3 winters, their age would be denoted as 0.3. This means zero winters in fresh water and 3 winters in the ocean.

So how old is the Fish really . . .

Now we know that scientists like to age a salmon by counting how many winters it has existed, but what does this really mean? Often the salmon is older than the completed winters. In fact, a salmon is usually about a year older than the number of winters actually completed. By counting winters the scientists know for sure the salmon is at least that given age, but often they will go ahead and add another year to give its final age designation. By looking at the scale, scientists can guess how much older it is than the completed winters they have counted.

For example: If a chinook has completed 3 winters, 1 in fresh water and 2 in salt (denoted age, 1.2) they will probably consider the chinook to be 4 years old since it is most likely in its 4th year.

More examples:

Chum: 0.3 (3 winters completed in salt water, approximately 4 years old)

Pink: 0.1 (1 winter completed in salt water, approximately 2 years old)

Coho: 1.2 (1 winter completed in fresh water, 2 completed in salt, approximately 4 years old.)

Reading Fish Scales
Student Activity

Another use for reading scales.....Forecasting

"Forecasting" in fisheries science means to predict how many fish may come back to the rivers in the upcoming year under healthy, normal, environmental conditions. The biologists forecast to help manage the existing harvesting practices. If we can estimate how many salmon will return on an existing run in a particular river system, then we can figure out how much harvest should be allowed. Often times we know that salmon will return back to the river system at different ages. For a specific run or brood year of salmon we are able to deliberate percentages to the ages of returns. For instance, for a specific brood year of chinook in the Green River, we can say that 20% of the predicted total return for that brood year will return as 3-year olds, and that 70% of the predicted total return will come back as 4-year olds. The reason only 70% return as 4-year olds and not 80% is due to the mortalities that will occur by spending an additional year in the ocean, and not returning the river system sooner. So, if we know that 20 percent of chinook salmon return to streams as three year old fish, and 70 percent return as four year old fish, then we can estimate how many fish will return as four year olds if we know how many three year old fish we returned. If the Green River has a total return of 2,000 three year old fish in 1996, then we know that in 1997 we should be able to expect 7,000 four year olds (remember minus the 10% due to the mortalities in the additional year). This is because 2,000 is 20% of the total expected return, so therefore, 7,000 would equal 70% of the total expected return.

chinook spawned 1994 brood year > 2,000 returned as 3-year olds in > **(- 10%)** > 7,000 returned as 4-year olds in > 9,000, total return for the 1994 brood year

due to addt'l yr

1996 | this is supposed to be 20 % of the return for brood year 1993

1997 | this is supposed to be 70% of the return for the the brood year 1993

Reading Fish Scales
Student Activity

Forecasting Populations of Salmon Runs

Student Assignment

Name _____ Date _____ Teacher _____

Directions:

Read the information sheet on forecasting then complete the following chart.

Remember, the three year old fish from 1996 and the four year old fish from 1997 were spawned in 1993. In 1996 there were 10,000 fish from the brood year 1993 in the ocean; 20 percent of those fish or 2,000, returned to the streams to spawn. The other 80 percent or 8,000, stayed in the ocean for another year. Of the expected total return, 10 percent of those fish died, so therefore 7,000 returned as four year old fish in 1997.

Using the percentages (20%,80%) (Remember to subtract the additional 10% that will die from the 80% that are remaining in the ocean for an additional year) for fish return above, fill in the missing information for the letters **A-F.** (Hint for A: We know that 250 chinook as 3-year olds in 1991, solve for A.) (Hint for F: WE know that the total return for Chinook was 1,000 for the brood year of 1994P, solve for F.)

Year Returned	3-yr Olds	4-yr Olds	Total Returnees
1992	1,500	**A**	1,500 + **A**
1993	400	**B**	400 +B
1994	1,200	**C**	1,200+ **C**

Year Returned	3-yr olds	4-yr Olds	Total Returnees
1995	100	**D**	100 + **D**
1996	2,000	**E**	2,000 + **E**
1997	**F**	**7,000**	7,000 + **F**

After you fill in the missing information, create a bar graph representing the returning chinook for each year.

Reading Fish Scales
Student Activity

Chinook Returns

Between 1992 - 1997

Number of Chinook

Year Returned

Legend:

Reading Fish Scales
Teacher Notes

Forecasting Populations of Salmon Runs — Teachers

Name_____ Date_____ Teacher_____

Summary:

Students will read the summary on forecasting and will complete forecasting chart

Objective:

Students will learn how scientists forecast the populations of certain Salmon runs from a particular brood year or parent spawners. They will also learn the effects that cause salmon returns to vary. .

Vocabulary:

spawning, brood year, forecasting

Background:

It is important for scientists to forecast returning salmon populations so they can plan how to protect Washington's endangered and threatened fish. We can learn how healthy returning populations are by counting how many salmon return the year before the majority are supposed to actually return. In other words, the 20% that return as 3 year olds help us to determine how many 4 year olds (the majority) will return. With the ability to estimate how many fish will return, we can then determine what kind of limits need to be placed on harvesting.

Instructor's Answer Sheet

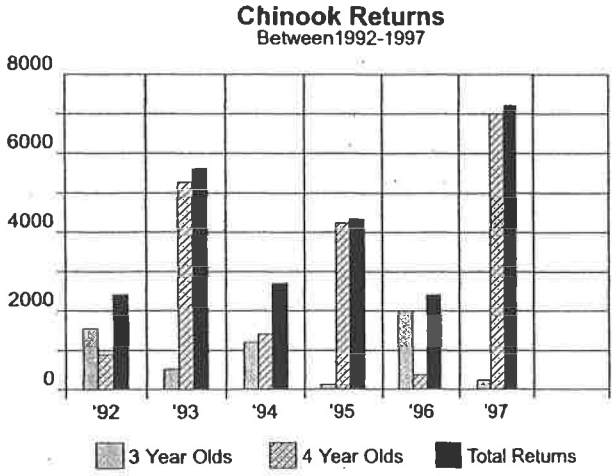
Remember, the three year old fish from 1996 and the four year old fish from 1997 were spawned in 1993. In 1996 there were 10,000 fish from the brood year 1993 in the ocean; 20 percent of those fish or 2,000, returned to the streams to spawn. The other 80 percent or 8,000, stayed in the ocean for another year. Of the expected total return, 10 percent of those fish died, so therefore 7,000 returned as four year old fish in 1997.

Using the percentages (20%,80%) (Remember to subtract the additional 10% that will die from the 80% that are remaining in the ocean for an additional year) for the fish return above and fill in the missing information for the letters **A-F.** (Hint for A: We know that 250 chinook as 3-year olds in 1991, solve for A.) (Hint for F: We know that the total return for Chinook was 1,000 for the brood year of 1994, solve for F.)

Year Returned	3-yr olds	4-yr olds	Total Returnees
1992	1,500	A=875	1,500 + A=2,375
1993	400	B=5,250	400+ B=5,650
1994	1,200	C=1,400	1,200+ C=2,600

Year Returned	3-yr olds	4-yr olds	Total Returnees
1995	100	D=4,200	100 + D=4,300
1996	2,000	E=350	2,000 + E=2,350
1997	F=200	7,000	7,000 + F=7,200

After you fill in the missing information, create a bar graph representing the returning chinook for each year. Show both the amount of returning salmon and the percentage.



Teacher:

Use the graph to discuss how the following factors and human effects can create habitat destruction, thus causing fluctuations in the salmon runs.

El Nino: Water temperature increases, killing off food supply

Scouring winter floods: Kills eggs

Summer low flows: Inhibit migration, raises water temperature

Sedimentation: Smothers eggs, covering spawning habitat

Low stream complexity: Channels flood flows

Poor water quality: Kills fish, low oxygen content, raises water temperature, toxins

Blockages: Closed off spawning and rearing grounds, kill migrating fish