

How Old Is That Fish?

Created By: Creek Connections Staff, 2002.

Grade Level: Intermediate to Advanced

Duration: 45min. - 1hr.

Setting: Classroom or Laboratory

Summary: Students analyze fish scales to determine the age of several fish. Additionally, influences on growth will be discussed

Objectives: Students should become familiar with conventional methods for determining the age of fish.

Vocabulary: Bioindicator, Scales, Placoid, Ganoid, Ctenoid, Cycloid, Annuli, Circuli,

Related Module Resources:

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Materials (Included in Module):

- Slides of scales
- Worksheets

Additional Materials (NOT Included in Module):

- Microscopes and/or overhead projector

ACADEMIC STANDARDS: ENVIRONMENT & ECOLOGY

7th Grade

4.3C Explain biological diversity

- Explain the complex, interactive relationships among members of an ecosystem

4.6A Explain the flows of energy and matter from organism to organism within an ecosystem

- Describe and explain the adaptations of plants and animals to their environment

10th Grade

4.7B Explain how structure, function, and behavior of plants and animals affect their ability to survive

- Describe an organism's adaptations for survival in its habitat

12th Grade

4.6A Analyze the interdependence of an ecosystem

- Analyze the relationship among components of an ecosystem

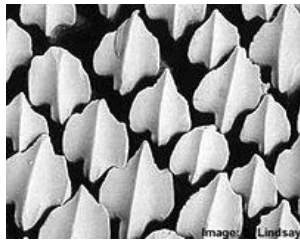
BACKGROUND:

Fish play vital roles in the aquatic community by serving as both predators and prey. Fish also are the subject of many stocking programs that aim to reintroduce and/or rejuvenate fish populations. Additionally, fish serve as **bioindicators**, meaning that by knowing a fish's pollution tolerances we can evaluate the health of a waterway based on the species present. Another method of using fish to determine the health of waterways is to track fish growth and compare that to fishes in other bodies of water.

There are several ways that we can age fish. These methods include cross-sectional analysis of fin rays, otoliths (ear bone), bones, and through the examination of scales. The focus of this activity will be on the use of scales as a means for determining age. Fish wear the story of their life on the outside, in their scales. **Scales** are the overlapping series of hard plates that cover a fish's body. Scales serve to protect the body from the outside dangers such as predators and infection.

Not all fish share the same kind of scales. There are four main types of scales: placoid, ganoid, ctenoid, and cycloid. **Placoid** scales form from a rectangular base that exist under the skin, spines project from this base

to the surface and point posteriorly. Sharks, skates, and rays are common species that have placoid scales, consequently their skin is rough to the touch. Because these scales do not grow, new rows of scales must be added as the fish grows. **Ganoid** scales have a rhombus shape and are connected by peg and socket joints. Gar, bowfin, paddlefish, and sturgeon exhibit this scale pattern. The majority of *Teleost*, or bony fishes, are covered by **ctenoid** or **cycloid** scales. These overlapping scales allow greater maneuverability because the scales can slide over one another as the fish bends. The difference in the two kinds of scales is that ctenoid scales have a spiny or comb-like posterior margin. While cycloid scales have a smooth posterior margin.

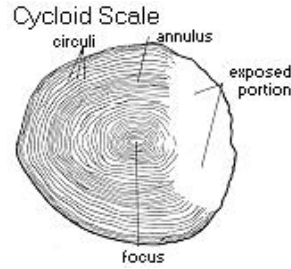
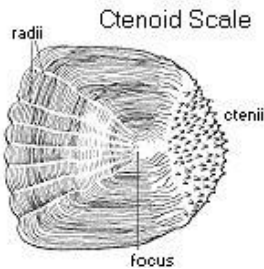


Placoid Scales



Ganoid Scales

Photographs courtesy of <http://www.amonline.net.au/fishes/students/scales/index.htm>



Diagrams courtesy of <http://pc65.frontier.osrhe.edu/hs/science/bfish2.htm>

Ctenoid and cycloid scales, grow proportionally to the fish. Evidence of this growth can be seen in the **circuli**, or concentric lines laid down on a scale. The spacing between circuli are an indication of the environmental conditions present in the waterway. Large gaps in circuli indicate favorable environmental conditions and a plentiful food supply. During periods of environmental stress or decreased metabolism, fish growth will be slow and the circuli will be very close together. These lines are often so close that they appear as a heavy line on the scale. These heavy lines are called **annuli** and generally occur during the winter months. These lines resemble the growth rings on trees that indicate periods of growth and rest.

By counting the number of annuli on a scale, the age of the fish can be determined. However, the distinction between annuli may become blurred due to the partial re-absorption of the outer edge of scales. This re-absorption can occur during periods of scarce food availability when the fish uses the scale as a means of nourishment.

Additional factors that will affect one's ability to determine age include the size of the fish and whether the scale is original or a replacement. Several scales should be taken from each fish to compare age estimates, because scales that are lost will be replaced with new scales that lack the original growth rings.

OVERVIEW: This is a lab activity that focuses on using fish scales to determine fish age. The students will compare scales from several fish of various species and size to determine age and growth rates.

PROCEDURE:

Teacher Preparation:

1. Teachers should have microscopes available for the students to use. An overhead projector may be substituted and used to project the image on a large screen.

Student Experiment or Activity:

1. Students should record the number of the slide they are using, and should record the information on the slide (Fish species, length, and location of catch).
2. Have students examine the scales under a microscope.
3. Students should sketch an image of what they see under the microscope, making special note of rings that are close together or are overlapping.
4. Once all students have made a sketch of their scale, they should count the number of annuli (heavy/overlapping rings) and note the age of the fish.
5. After all the necessary information about a scale is recorded students should exchange slides and repeat steps 1-4 with the new slide. This process should be repeated for at least 3 different slides.
6. Talk about the difference in growth between species. For example, if a bass and a minnow are the same age the bass will be much larger.

DISCUSSION:

What factors will cause a fish to grow slower? *Decrease in food supply, decrease in metabolic rate that results from cooling water temperatures, stress from pollution, stress from spawning.*

What factors will cause a fish to grow faster? *Ideal water temperatures, lack of competition, and an abundant food supply.*

Why would scientists be concerned with the age of fish? *Often times when a body of water is thought to be polluted, scientists will collect scales from fish and compare their age to their size. They can compare the results to known growth rates of fish from healthy bodies of water and determine if a fish's growth is being hindered by environmental conditions.*

EVALUATION:

- What are **circuli**? (*concentric growth lines laid down on a scale*)
- What are **annuli**? (*heavy lines that occur as a result of some form of stress*)
- Name some factors that influence fish growth? (*refer to discussion*)
- Explain a **bioindicator**. (*refer to the background*)
- Explain the differences between the four types of scales. (*refer to the background*)

EXTENSIONS AND MODIFICATIONS:

- Teacher could catch or buy a fish from the grocery store and have the students practice collecting scales and mounting them on slides
- Have students research their favorite fish and gather information on its size, longevity, life cycle, and distribution. The students can then present their findings to the class
- Have students graph length to age ratios for several fish then compare growth.

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):



DATA SHEET : HOW OLD IS THAT FISH?

Name _____ Date _____

Slide Number _____ Species Name _____

Length _____ Location of Catch _____

Sketch of the scale

Name _____ Date _____

Slide Number _____ Species Name _____

Length _____ Location of Catch _____

Sketch of the scale

Name _____ Date _____

Slide Number _____ Species Name _____

Length _____ Location of Catch _____

Sketch of the scale

