

The Tale of a Scale

Grade Level: Middle School

Subject Area: Life Science, Environmental Science

Duration: 45 minutes

Next Generation Science Standards:

- MS-LS1-5 – Construct a scientific explanation based on evidence for how environmental...factors influence the growth of organisms.
 - Practices of science
 - Asking questions
 - Planning and carrying out investigations
 - Analyzing and interpreting data
 - Constructing explanations
 - Crosscutting Concepts
 - Cause and effect

Common Core State Standards – ELA/Literacy

- SL.6-8.1 - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade appropriate topics, texts, and issues, building on others' ideas and expressing their own clearly.

Environmental Literacy

- 1.A.4 – Design and conduct research
- 1.A.5 – Use data and references to interpret findings to form conclusions

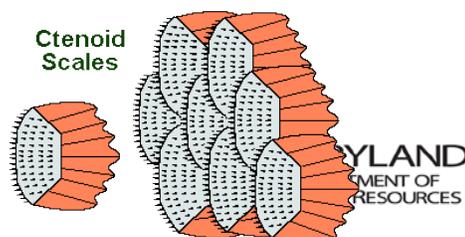
Objectives:

- Students will understand one method used by fisheries scientists to determine the age of a fish.
- Students will understand why it is important for scientists to know the age of fish when attempting to manage a population
- Students will understand the impact of the environment on the growth rate of fish.

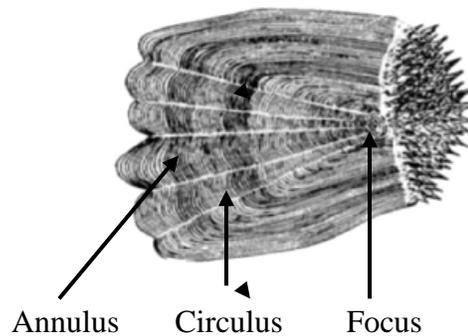
Teacher Background:

In some ways, fish scales are like tree rings - as a fish grows, its scales grow too. The rate at which the fish and their scales grow depends on a number of factors – water temperature, available food and external stressors such as decreased oxygen or increased sedimentation.

There are several types of fish scales. Bluegills have **ctenoid** (“teen-oid”) scales, which means that the scales have small sharp spines on the exposed edge. This gives bluegills a somewhat rough texture. Scientists believe that ctenoid scales may help make the fish more hydrodynamic by reducing drag.



When a fish is hatched, it is covered with tiny scales. The center of an older fish's scale, called the **focus**, represents the scale of the newly hatched fish. As the fish grows, the scales develop circular growth rings around the focus. Each growth ring is called a **circulus** (plural: **circuli**). Like a tree, the fish grows faster during the summer when the temperature is warmer and there is more food available, and the circuli are spaced farther apart. During the winter, growth slows down and the circuli are very close together. When the circuli are close together, they form a dark ring called an **annulus** (plural: **annuli**). Each annulus represents a year's growth; this is easy to remember since the word annulus has the same Latin root as "annual". By counting the annuli, it is possible to estimate the fish's age.



Another way of determining a fish's age is by counting the rings on an **otolith** or ear bone. This method is often more accurate than counting the annuli on a scale, but it requires killing the fish. Scale sampling, on the other hand, is non-lethal and causes no harm to the fish.

Scientists use information about the age of fish to determine growth rates, maturity, and survival rates. It can also be used to determine the strength of a year-class of a population – for example, the number of a given species of fish that hatched in 2009. In the northern hemisphere, biologists assign January 1 as the birthday of all fish, so a fish hatched in the summer of 2009 would be considered a one-year-old on January 1, 2010.

Materials:

- Microscope – dissecting or low-power scope will do
- Microscope slides and cover slips- one for each student
- Corn syrup or glycerin
- Fish scales
 - The best option is to buy a fish and let the students remove the scales themselves; this way they can compare their results for accuracy.
 - The other option is to get scales from a seafood store or the seafood section of the grocery store – anywhere that fish are cleaned.

- Forceps – if students are going to remove scales from a fish
- Student worksheet

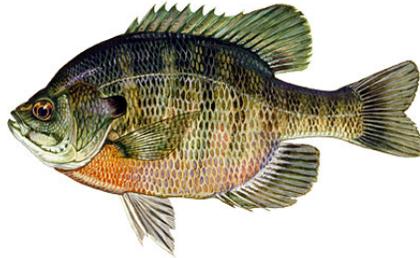
Activity:

- Engage
 - Ask several students when their birthdays are; do any students in the class happen to have the same birthday?
 - Explain that in the case of fish, all fish are considered to have a “birthday” on January 1st, so a fish hatched last summer is considered to be a year old on January 1st of this year.
 - Point out that if peoples’ birthdays were calculated like fish, a baby born in January 2013 and a baby born in December 2013 would all be considered the same age, even though the baby born in January is actually almost a year older than the baby born in December.
 - Ask the students, “So you know when a fish’s “birthday” is, but how do you know how old it is?” How do biologists know how old a fish is?
 - Ask students if they know how biologists tell the age of a tree. (Most students are familiar with tree rings)
 - Explain that many fish scales have rings similar to tree rings; biologists can often tell the age of a fish by counting the rings on a scale.
 - Have students watch <https://www.youtube.com/watch?v=aCy6W0Ob1KM>
- Explore
 - If using a whole fish, have students use the forceps to carefully remove a scale from the fish. The best place is under the pectoral fin because these scales are the least likely to be damaged or worn. However, it is interesting to compare scales taken from various places on the body.
 - Have the students follow the directions on the worksheet to prepare the slide and count the annuli.
- Explain
 - If all the scales were from the same fish, how old do they think the fish was?
 - If there is disagreement, what might be the cause of the differences? *Difficulty counting annuli, the area from which the scale was taken, damaged scale, replacement for a lost scale*
 - Tell the students that it is all right to disagree; biologists often disagree when aging fish.
 - If the scales were not from the same fish:
 - How old was their fish?
 - How hard was it to count the annuli?
 - Were some of the circuli narrower than others? What does this mean? *Narrow circuli indicate slower growth rate that particular summer.*
 - What might have caused this? *Poor water quality (water temperature too warm or cool, low dissolved oxygen), lack of food,*

too many predators affected feeding ability, too much turbidity affected ability to find food, etc.

- Were any of these factors caused by humans? How?
- Why might biologists want to know the age of a fish? *It is important information to have in order to make management decisions. They might need to know growth rates, how old a fish needs to be in order to spawn, how many fish there are of a given age in a population, etc.*
- Food for thought - Would this method of aging fish work on tropical fish? Why or why not? *It would not work because in the tropics there is no cold season so growth rate would not slow down every year and no annuli would form.*
- Extend:
 - Have students do the “Fish Scale Tale” Activity (Created by the Florida Fish and Wildlife Conservation Commission)
 - Materials:
 - Paper
 - Pencils, markers or crayons
 - Activity
 - On a blank sheet of paper, have students draw a tiny circle in the middle of the paper and label it “Birth”.
 - Then have them draw the same number of rings around the birth year and their age.
 - Tell them to think carefully about each year; make special (extra-good) year wide rings and other years thinner.
 - Have students label special years in their lives – birth of a sibling, special vacation, good grades in school, making the team, etc.
 - When students have completed their “Fish Scale Tale”, have them share with the group.

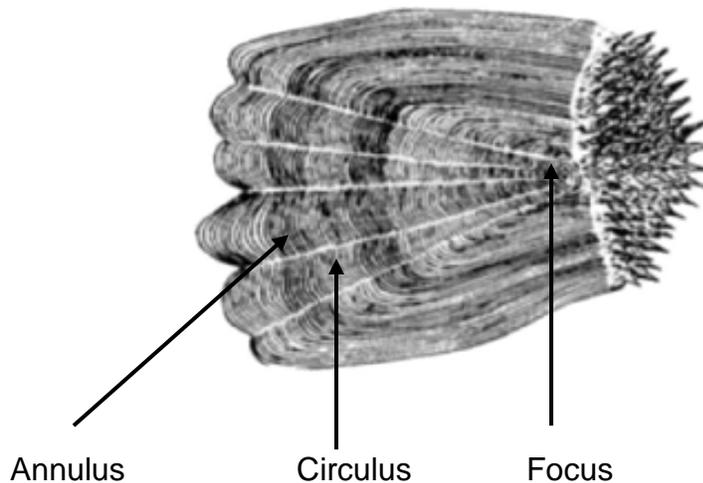
A Tale of a Scale – Student Worksheet



Background:

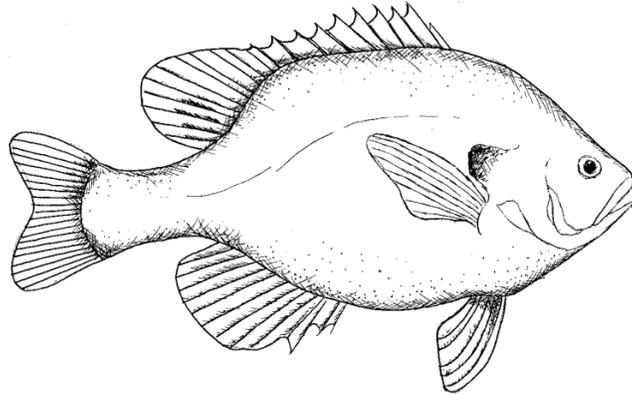
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What to Do:

- You will need a microscope slide, a drop of corn syrup or glycerin, and a cover slip.
- If your teacher has provided a whole fish, you will need to remove a scale.
 - Use the forceps to lift a scale from anywhere on the body of the fish and pull it out. Work carefully so you do not damage the scale.
 - On the drawing below, make an X to indicate the place on the fish's body where you took the scale.



- If you are not taking scales from a whole fish, get a scale from your teacher.
- Put the scale on the center of the slide. Put a drop of corn syrup or glycerin on the scale and put the cover slip on top. Press down **gently** to remove any air bubbles.
- Look at the scale under the microscope. Make a drawing in the space below of what you see. Be sure to indicate the annuli (dark rings).

- Count the annuli. How old do you think your fish was? _____