

LESSON 1

ANATOMY OF AN ANCIENT FISH

Activity 3: Aging Sturgeon

Students create a distribution plot using provided data related to sturgeon length and age. Students then examine images of pectoral fins of sturgeon to learn about one way scientists age sturgeon. Students are exposed to the challenges of following a scientific protocol, the variability in data collected and recorded when different individuals observe the same item, and the difficulty of even maintaining internal consistency from one observation to the next. Finally, students graph their sturgeon length and estimated age data and compare the resulting graph to the original length and age graph generated in step one of the activity.

Activity Preparation

Pre-Reading

In "Saving Our Sturgeon," have students read Chapter 4: Sturgeon by the Numbers p. 38-44.

Prior Knowledge

Basic understanding that scientists use methods or protocols (including the use of calibrated measuring devices) when collecting data so that meaningful comparisons between samples can be made.

Key Vocabulary

Annuli: annual marks (rings) found in different structures of many fish species, including sturgeon.

Box and whisker plots: plots that are specifically designed to visually represent the distribution of numerical data. They display a "five-number summary": minimum, first quartile (Q1), median, third quartile (Q3), and maximum.

Circuli: concentric, continuous lines on fish scales and various bones.

Cross-section: a surface exposed by making a straight cut through something, especially at right angles to its axis.

Distribution plot: a graphical representation of how data points are spread across a range of values.

Focus: the point on a fish scale where growth begins.

Operculum: a flap covering the gills, consisting of four bones.

Pectoral fin: each of a pair of fins situated on either side just behind a fish's head, helping to control the direction of movement during locomotion.

Objectives

After participating in this activity, students can:

Create a distribution plot using multiple pairs of sturgeon length and age data points.

Take and then defend a position related to how reliable they feel examining pectoral fins is as a technique for aging sturgeon, and what might be done to enhance reliability.

Create a line graph that plots the length and age of a sturgeon using multiple calculated data points generated from observation of pectoral fin annuli and circuli.

Next Generation Science Standards

Covered

MS-LS1-5

Wisconsin Academic Standards

Assessed

Math

M.6.NS.C.6 c, M.8.SP.A.1

Covered

Science

SCI.LS1.B.m, SCI.LS2.A.m.

Great Lakes Literacy Principles

Principle 5

The Great Lakes support a broad diversity of life and ecosystems.

Whiskers: lines extending from the ends of the box in a box and whisker plot. They typically extend to the minimum and maximum values within the data set that are not considered outliers.

X-axis: the horizontal line on a graph.

Y-axis: the vertical line on a graph.

Files Needed

- Aging Sturgeon (handout and answer key)

Materials Needed

- Graphing supplies, including Google Sheets or Microsoft Excel, graph paper, or whiteboard
- For a closer look:
 - 1:1 device
 - Fish Base website <https://fishage.org>

Activity Steps

Total estimated activity time – 90 minutes

In activity two of lesson 1, the students investigated the relationships between length, girth, and weight of sturgeon. In this activity they will investigate another relationship—this time between length and age. To explore length and age, students will 1) create a distribution plot; 2) try their hand at pectoral fin aging; 3) create a line graph.

Pass out the “Aging Sturgeon” handout.

Step One – Distribution Plot – 30 minutes

Using the top row of data on the “Lake Sturgeon Measurements” chart on the “Aging Sturgeon” handout, demonstrate for the students the technique of creating a distribution plot by using the length (20 inches), mean age (3.5), minimum age (3), and maximum age (4) data.

Have students use the remaining length, mean age, minimum age, and maximum age data provided within the table to complete the distribution plot.

When the students are finished, ask them whether they think knowing the length of a sturgeon is an accurate measure of the sturgeon’s age. Have students defend their response. The length of a sturgeon can give an approximation of a sturgeon’s age, but scientists also use other techniques. Inform students that scientists use information from the pectoral fin. Then ask students to recall where the pectoral fin is located (on the side of a fish just past the operculum).

Step Two – Pectoral Fin Aging – 30 minutes

The purpose of this portion of the activity is not mastery of estimating age via counting annuli and circuli accurately, but rather to expose students to the challenges of following a scientific protocol, the variability in data collected and recorded when different individuals observe the same item, and the difficulty of even maintaining internal consistency from one observation to the next. In other words, it is anticipated that for each row of the data table, students will have very different results from one another based on how they interpret the annuli and circuli patterns of each pectoral fin image.

Step Three – Creating a Line Graph – 30 minutes

Students create a graph with length on the X-axis and their estimated sturgeon ages as generated in part 2 of the activity on the Y-axis. When finished, ask students to compare their age estimation data and graph to another student's age estimation data and graph. Which rows in their table are different from rows in their partner's table? Which rows in their table are similar? Why might this be so?

Have students create a second line graph on the same piece of paper that plots length on the X-axis and actual sturgeon ages as provided in the pectoral fin age answer key of the activity on the Y-axis. Have students explain what might have caused any differences between their original pectoral fin age estimate graph and the second graph based on the pectoral fin answer key data.

Once again, ask students: How reliable do they feel examining the length of a sturgeon is as a technique for aging sturgeon?

Ask students to compare their age pectoral fin age estimation graph to the graph they created in step 1 that used Michigan Department of Natural Resources data. Are the graphs similar to each other? Have students explain any similarities and differences.

** To further explore lake sturgeon data, visit the Michigan Dept. of Natural Resources website:

https://www.michigan.gov/dnr/-/media/Project/Websites/dnr/Documents/Fisheries/Research/StClair_weight_estimation.pdf