Lesson2: Loberg Lake Stickleback

Introduction

You have been learning about stickleback fish to help you understand how populations change over time. In this lesson, you will learn about the changes to one specific population of stickleback.

Process and Procedure

1. Write the focus question for the lesson in the box below. Underneath the box, write your best ideas about the question. Leave space to revise your ideas as you learn more.

2. Read and annotate *Loberg Lake: A Fish Story* to learn more about a case where saltwater stickleback were put into a freshwater lake. As you read, stop and discuss the questions in the scenario with your group.

Loberg Lake: A Fish Story

Scenario: Loberg Lake, Alaska

Loberg Lake is a small freshwater lake in Alaska, just north of Anchorage. It covers about 11 acres and contains approximately 62 million gallons of water. For comparison, an Olympic size pool contains about 650,000 gallons of water making it about 100 times smaller than this lake. Loberg is a popular lake for fishing. A population of stickleback fish lived in the lake. Like many freshwater stickleback, the fish had little body armor and short spines. In 1982, the Alaska Department of Fish and Game decided to exterminate all the stickleback fish in the lake using chemicals. They made this decision because they thought removing the stickleback would improve the lake for recreational fishing because there would be more room for trout and salmon.

Stop and Think

Why would removing stickleback fish affect the numbers of trout and salmon and therefore improve the recreational fishing in Loberg Lake?

As scientists surveyed the fish in the lake in the following years, they did not see any sign of stickleback. In 1990, however, scientists did find stickleback in Loberg Lake. Scientists do not know exactly how the fish were reintroduced because Loberg Lake is not connected to the sea. There may have been a temporary connection to ocean waters at some point. The scientists do know from studies that the stickleback found in 1990 were very similar to the ocean, or marine, stickleback in nearby Cook Inlet. These fish had a full set of armor—up to 30 body plates—and long spines. They were very different from the original population of stickleback that were in the lake in 1982. Every year since 1990, the scientists have returned to Loberg Lake to examine the stickleback. They take a sample of the fish in the lake by setting traps and counting the number of fish that are caught overnight. Then they examine each fish. By 2008, most of the fish had little armor and short spines, like the original freshwater population of stickleback.

Stop and Think

Why do you think the scientists have continued to study the fish in the lake each year?

Loberg Lake is a typical freshwater lake in Alaska. The stickleback eat a diet of insects and small shrimp-like organisms. There are no large predator fish of stickleback in the lake. The stickleback predators in the lake environment include small fish, birds, otters, and dragonfly nymphs. Stickleback typically live about two years so the fish that were found in 1990 must have been born around 1988. The stickleback are able to reproduce after the first year. Each female stickleback can lay several hundred eggs at a time.

Loberg Lake: A Fish Story Timeline

3. Draw a timeline below to approximate scale and fill it in to show what happened in Loberg Lake.

4. Between 1990 and 2015, the stickleback fish population in Loberg Lake changed a lot. Use the following table to help you consider how the two scientists you learned about in Lesson 1 would explain the changes. You may need to refer to *Two Views about change in Populations* from lesson 1.

Question	How **Scientist 1** would answer	How **Scientist 2** would answer
1. Did the population of stickleback fish change between 1990 and 2008?	Answer the question by circling: **YES** **NO**	Answer the question by circling: **YES** **NO**
2. Did any individual fish change during its lifetime?	Answer the question by circling: **YES** **NO**	Answer the question by circling: **YES** **NO**
3. Which variation of stickleback would decrease in the presence of dragonfly nymphs?	Answer the question by circling: **LONG SPINE** **SHORT SPINE**	Answer the question by circling: **LONG SPINE** **SHORT SPINE**
4. Which variation of stickleback is favored when there are NO large fish, like trout?	Answer the question by circling: **LONG SPINE** **SHORT SPINE** **NEITHER**	Answer the question by circling: **LONG SPINE** **SHORT SPINE** **NEITHER**
5. How many generations of fish would it likely take for the population to change from mostly full armor, long spine fish to low armor, short spine fish?	**Number of generations** **_____**	**Number of generations** **_____**

5. Which statement below best represents your thinking about the traits that an organism can pass on to its offspring?

   - ❖ All organisms with or without favorable traits will pass on only the favorable traits.
   - ❖ Any organism that survives long enough to reproduce will pass on its traits, both favorable and unfavorable.
   - ❖ Organisms with favorable traits can reproduce and pass on favorable traits to offspring; however, organisms with unfavorable traits cannot reproduce and pass on their unfavorable traits.
   - ❖ Organisms that reproduce will pass on favorable traits they have acquired during their lifetime in order to adapt to their environment.

6. In the next steps, you will learn more about stickleback fish. You will use the information to decide whether scientist 1's ideas or Scientist 2's ideas better explain how populations change. The graph shows the *percent of fish in the sample the scientists took* with complete armor and low armor each year. Taking a sample allows scientists to represent the percentages in the total fish population without catching all the fish.

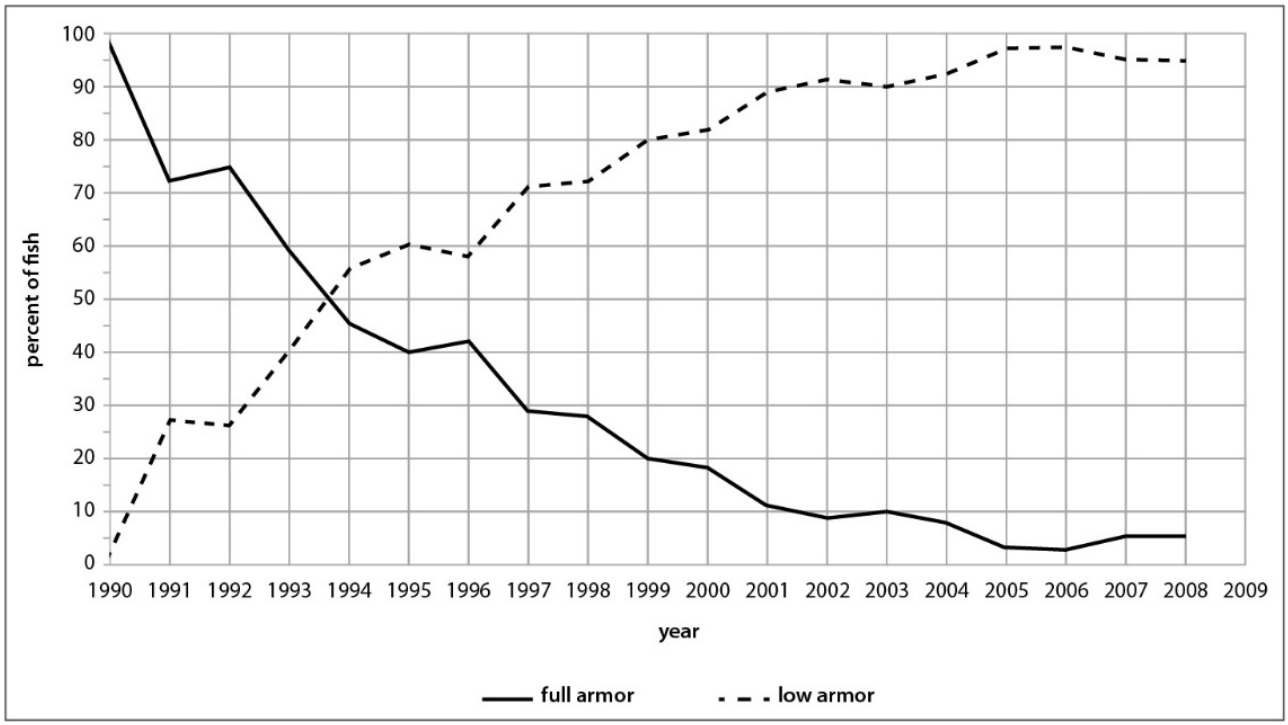
Use Identify and Interpret (I^2) by following the steps below to analyze the graph.

a. Draw arrows to places on the graph that show changes, trends, or differences.

b. For each arrow, write the words "What I see" or "WIS". Then write a short statement to describe the change, trend, or difference that you noticed.

c. Under each "What I see" statement, write the words "What it means" or "WIM". Write a comment for each statement to explain what the change, trend, or difference means for the fish population.

Percent of Fish in Population Sample with Full and Low Body Armor



Stickleback Fish at Three Time Points during Adult Life

7. Examine the following sets of pictures. Each picture represents the same fish at several points in its adult life. These fish are form Loberg Lake where there were larger fish predators present.

12 Months

18 Months

photos by Kasie Barnes

24 Months

a. Look closely at the dorsal (back) side of each fish to locate its dorsal spines. The arrow on the top picture of each fish points to the location of dorsal spines. Based on the four sets of pictures, what do you observe about the dorsal fin of each fish (did each fish gain spines, lose spines, or stay the same)? Why did you choose the answer you did?

b. Based on your answer to 5a, do you think fish can make the conscious decision to lose, gain, or keep spines and armor and then do so based on the decision? Why or why not?

c. If a fish loses its spines because of a fight with another stickleback, can it pass on “spinelessness” to its offspring?

d. What additional data would help support your ideas better?

8. Refer back to the table you completed for the two scientists' ideas in step 4. Based on the new data you have about stickleback from steps 6 and 7, determine if you can add any information to your answers. Add new ideas to your table in a different color.

9. Also in your table, circle any questions where the two scientists' ideas are different from each other. For each question you circle, list the question number and evidence you have related to the question in the space below. Then write whether the evidence supports the ideas of Scientist 1 or Scientist 2.

10. Now, refer back to your cause and effect organizer in Lesson 1, step 9 and decide which cause is supported by evidence. Record your response below.

Summarize and Synthesize Ideas

11. Based on what you know now, answer the focus question that you wrote on the first page of Lesson 2. Revise your ideas in a different-colored pen or pencil. If your ideas have changed a lot, you may also draw a line under your initial answer and write a new answer in a different color.

12. Scientist 1 is Jean Baptiste de Lamarck. His ideas of how populations change are called acquired characteristics. Scientist 2 is Charles Darwin. His ideas are called natural selection. Which scientist's ideas seem to be more like how the stickleback fish population changed over time? How did data help you determine whether Lamarck's ideas or Darwin's ideas are more likely to be true? Go back to your *Two Views about Change in Populations* reading and label each column with the appropriate Scientist's name.