Lesson 5: Explaining Changes in the Loberg Lake Stickleback Population

Introduction

Over the past several lessons, you have looked at observations and data that will help you answer the question: "What caused the population of stickleback in Loberg Lake, Alaska, to change over time?" In this lesson, you will construct a scientific explanation that answers this question.

Process and Procedure

1. Write the focus questions for the lesson in the box below. Write your best ideas about the questions under the box.

2. Read the following information about how to write a scientific explanation. As you read, underline key ideas. Make notes in the margins about ideas and questions that you have about how you will write your scientific explanation.

Scientific Explanations

What Is a Scientific Explanation?

Scientists work to explain the natural world. Their explanations begin with a question they have or a problem they are trying to solve. Scientists collect and analyze data to see if the data will help them answer the question or solve the problem. The data that help answer the question and solve the problem become the evidence that they will use in their scientific explanations. In their scientific explanations, they use evidence and reasoning about what they are investigating in order to support their claims. Their claims are the answer to the question they are investigating or the problem they are trying to solve. Your explanations in science should include evidence, reasoning, and claims. As part of becoming proficient in science, you will learn to support your claims with evidence. This evidence may be from data that you have collected or that someone else has collected. You may also use evidence from reports and summaries from scientists or even from other students. This evidence will provide you with what you need to support your claims in science.

When you write a scientific explanation, you will use reasoning. Reasoning links your evidence to your claim. This makes your explanation stronger and more convincing. Your reasoning should be logical and explain why the data you are using are evidence that supports your claim. As you learn more about a science concept, you will want to use scientific principles in your reasoning. These scientific principles are the accepted understandings in science that you will learn about in your science classes. When you use scientific principles to support your explanation, you will add to the logical connections you make. This creates a stronger scientific explanation.

The Explanation Tool (figure 1) provides you with a way to organize the important parts of a scientific explanation—your claim, evidence, and reasoning. This organization will help other people make sense of your work. Notice that the Explanation Tool in figure 1 has five basic parts.

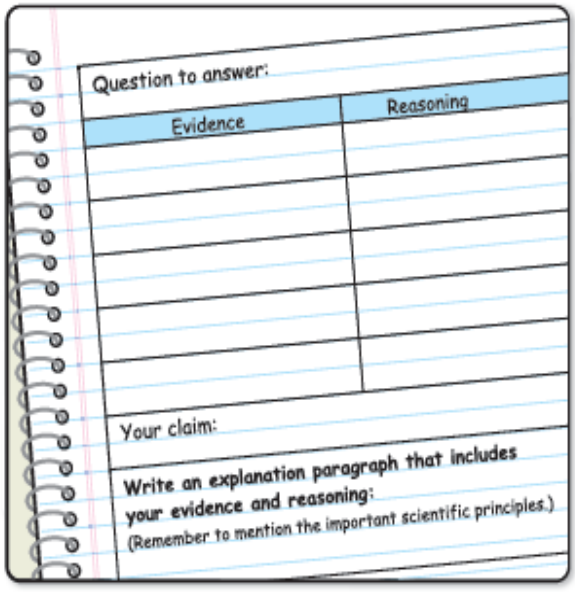

Figure 1: Explanation template. This explanation template can help you write a scientific explanation from a claim, evidence, and reasoning.

3. Follow your teacher's instructions to read about the parts of a scientific explanation. As you read and discuss your part, underline or make notes in the margin so you can share these ideas with your group.

Parts of a Scientific Explanation

1) The first part of the Explanation Tool is **the question that you are trying to answer or the problem you want to solve**. Doing science involves answering questions about the world around you. Testable questions in science are those that you can answer by investigations. The questions that you ask help you decide what data you will collect.

Stop and Think

What is the question you will answer in your scientific explanation?

2) **The evidence that you gather.** This part of the template includes the data you have collected that will help you answer the question. You may collect a lot of data in an investigation. But some of that data will not help you answer your question. Data become evidence when they help answer your question. Do not list individual data points but, rather, choose the data that will count as evidence. Then write a summary of your evidence. This evidence may come from a number of sources, like your investigation, observations you make, or investigations that others have done.

3) **The relevant science ideas and concepts.** In this part, add science ideas that justify why each piece of evidence helps support your answer to the question. This is your reasoning: a justification that logically links the answer to your question to the evidence. These statements show why the data count as evidence to help you answer the question. When you can, base your reasoning on appropriate science ideas.

4) **Your claim or claims.** Your claim is the response to the question you are trying to answer. You will state your claim in one or two sentences. Your claim should make a statement that answers the question or addresses the original problem. This may be in the form of a statement of a trend, a behavior, or a generality that your evidence supports.

5) **Your scientific explanation.** This is the most important work you will do—creating your scientific explanation. As you get better at writing scientific explanations, you may complete only this part of the template. The other parts of the tool are to help you with this final step. Your explanation will likely be a short paragraph. There are two goals to writing a strong scientific explanation. The first goal is to write a logical explanation that includes a claim that is supported with your evidence and reasoning. Connect each piece of evidence and reasoning to your claim. The second goal is to use appropriate scientific principles in your reasoning when you can. In using a scientific principle, you show how the evidence supports your claim.

Stop and Think

How will you explain your part of the Explanation Tool to the rest of your group?

4. Working as a group, use the Explanation Tool template on the next page to write a scientific explanation that answers the question.

1) Begin by writing the question.
2) Then add evidence from the data and observations you examined in previous lessons.
3) Then add the science ideas. These science ideas will help you justify why your evidence supports your claim.
4) Write your claim in complete sentences.
5) Write your explanation.

Make sure that each member of the group has a complete explanation and is ready to share.

Explanation Tool

Question	
Evidence from data and observations (e.g., patterns or trends specific to your investigation)	**Science ideas and concepts (e.g., patterns or trends that are generalizable across many situations; may include science vocabulary).**
Claim (Your claim should answer the question.)	
Scientific Explanation (Be sure to Include the claim, evidence, and reasoning in your explanation. Reasoning includes science concepts and linking words used to connect your ideas in the paragraph.)	

5. Scientists consult with other scientists to get feedback on their explanations. They use this feedback to revise their explanations to make sure they have strong evidence, science ideas, and reasoning. Like scientists, you will get feedback on your explanations. To do this, follow the steps below.

   Work with a partner from a different group to complete the steps in the chart. One of you will be Student A and the other will be Student B. *Contribute* your explanation to a discussion with your partner. Then switch roles and complete the steps again.

	Student A	Student B
Contribute	■ This is a *partner* step. ■ **Contribute** your ideas to a discussion with your partner by doing the following: • If you used words to record your ideas, read the sentences aloud, word for word. Do not add any additional explanation. • If you used sketches to record your ideas, explain the sketches carefully, including the labels. ■ Answer any questions your partner might have. ■ Watch your partner for signs of confusion. ■ Take turns so that each partner has an opportunity to contribute.	■ This is a *partner* step. ■ Listen quietly as your partner reads or explains his or her work. ■ Ask any questions that would help you understand your partner's work. ■ Think about the feedback you could give your partner. If you are having trouble thinking of feedback, ask yourself the following questions: • "Was everything correct?" • "Was everything clear in the answer?" • "Would an example help?"

   Next, *consult* with your partner to get feedback on your explanation. Follow the steps in the chart below. After Student A has consulted Student B, switch roles and repeat the consult steps.

	Student A	Student B
Consult	■ This is a *partner* step. ■ **Consult** your partner to get feedback on your answer. ■ Listen to the feedback from your partner. ■ Ask questions that would help you understand your partner's feedback. ■ Carefully consider the feedback that your partner gives. ■ Take turns so that each partner has an opportunity to receive feedback.	■ This is a *partner* step. ■ Offer advice to your partner to help improve his or her work. ■ Answer any questions your partner might have.

   Return to your group to *revise* your explanation. Share the feedback from your partner with your group. After all members of your group have shared their feedback, revise your group's explanation following the steps in the chart below.

Revise	■ **Revise** your work based on any problems you discovered on your own during the contribute and consult steps. ■ Decide which advice is useful and would improve your answer. Include any ideas that your partner had that you thought were good. ■ Use a different-colored pen or pencil for your revisions. ■ For any feedback that did not lead to a revision, describe why you chose not to make any changes.

Summarize and Link

6. Look back at the focus questions for the lesson. Your scientific explanation answered the first question about a specific population, the stickleback fish in Loberg Lake. Think about how your explanation could help you predict future changes to the stickleback. In the space below write your best ideas about what will happen to the stickleback population of Loberg Lake in another 25 years. Be prepared to share your ideas with the class.