ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine
DEPARTMENT OF EDUCATION, INNOVATION & TECHNOLOGY
CENTER FOR EDUCATIONAL OUTREACH

Day 11: Can Changes in a Food Chain Affect an Ecosystem?

Mini-lesson	Children receive support as needed to combine information into synthesis statements.
Inquiry Circles	Inquiry teams will work together to write a synthesis statement for each of their inquiry questions.
Guided Science Investigation	Children learn how changes in a food chain such as overpopulation or elimination of organisms can impact ecosystems.

Literacy Strategy: synthesizing information	**Reading TEKS** ELA.3.6H	**CCSS** W.3.2, SL.3.2
Science Concept: Food chains transfer energy between organisms, from producers to consumers. An imbalance or disruption in a food chain can occur when one component changes, impacting the entire ecosystem.	**Science TEKS** **2018–19:** 3.9B **2024–25:** 3.12B	**NGSS** LS2-D, 3-LS4-3
Science and Literacy Connection: As strategic readers, we synthesize information from many sources in order to create our own, new information. During an investigation, we must analyze information from multiple sources to produce evidence that supports our claims and explains our work.		

Mini-Lesson (15 minutes)

OVERVIEW

This is day two of the three days dedicated to synthesis. In the previous class, the teacher modeled how to write a synthesis statement using the class Inquiry Chart about pond ecosystems; the teacher also supported inquiry circle teams as they created a synthesis statement for one of their inquiry questions.

Today teams create a synthesis statement for each remaining inquiry question by combining (synthesizing) the findings in each column of the Inquiry Chart. Some teams may have finished their Inquiry Chart yesterday and will be writing their first synthesis statement today. Other teams may have written their first synthesis statement yesterday and are ready to continue writing synthesis statements for their

remaining inquiry questions. Use this time to support teams as needed. You may need to model writing a synthesis statement again (using the same materials from yesterday) for teams who are just starting to synthesize.

The class Inquiry Chart should be posted for learners to reference as they write their own synthesis statements.

Science Inquiry Circles (30 minutes)

OVERVIEW

Today inquiry teams will continue writing synthesis statements for each of their inquiry questions.

MATERIALS

Each team member needs:

- science notebook
- pencil

Each team needs:

- team Inquiry Chart
- exploratory texts/media (see the "Ecosystem Resources" spreadsheet for ideas)

Teacher needs:

- class Inquiry Chart (pond ecosystem)

PROCEDURE

Each italicized statement below contains suggested wording the teacher may use for the lesson; additional teacher actions and considerations are in parentheses.

Before Inquiry Circles

1. *It is time to get into our inquiry circle teams. You will be with the same inquiry team as yesterday.*
2. *With all the questions answered on the inquiry charts, today teams will work together to write a synthesis statement about each one of your inquiry questions. You will follow the same process as we did yesterday when writing one synthesis statement for one inquiry question.*
3. *Choose one inquiry question at a time and write a synthesis statement as a team*. (You might also give teams the option to divide up the inquiry questions and have each team member write one synthesis statement. Facilitate in a way that works best for your learners.)

During Inquiry Circles (20 minutes)

1. *As you work to write your synthesis statements, remember the statement we wrote yesterday using one of the questions from the inquiry chart.* (Refer to the written statement.)
2. *Write your synthesis statements in your science notebooks.*
3. *Do not forget to use the anchor charts to help guide your thinking.* (Refer to the posted anchor charts.)
4. *I will help guide the inquiry circles, but I expect you to work as a team to solve your problems together.* (While teams are working, walk around the room to facilitate as needed.)

After Inquiry Circles (10 minutes)

1. *As we conclude our inquiry circles for today, each team will have a chance to share what they accomplished. The Lab Director will lead the discussion about today's results Was the team able to synthesize the questions on their inquiry chart? What problems did the team encounter? How did the team resolve those problems?*
2. *The Data Scientists will now share with the entire class one of their team's synthesis statements.* (Try to encourage teams to share how they developed their synthesis statement. If you saw a great example in action, encourage that team to share with the entire class.)

Guided Science Investigation (30–45 minutes)

OVERVIEW

Learners view a slideshow to discover how changes in a food chain such as overpopulation or elimination of organisms can impact ecosystems.

GUIDING QUESTIONS

What happens when a producer or a consumer is added or missing from a food chain? How does a change in a food chain affect an ecosystem?

BACKGROUND INFORMATION FOR THE TEACHER

Scientists study how living and nonliving things interact in many different environments. Those environments support ecosystems unique to their surroundings and made up of food chains and food webs that provide the energy transfer necessary for the survival of life. Understanding how organisms interact and compete within an ecosystem deepens our understanding about their ecological importance in maintaining balance in the environment.

However, there are many factors that can upset the balance of an ecosystem. Some of them are natural, others are the result of natural disasters or human impact. On the most basic level, a change in a food chain can set off a series of impacts on an entire ecosystem.

When a pond is first formed it begins with mostly water and little life. As nutrients begin to enter the system, plant and animal life begins to grow and food chains develop. When organisms die, they decay and, through decomposition, release nutrients back into the pond to keep the life cycle going. The enrichment of a pond through nutrients is called eutrophication. Over decades, a pond or lake may fill up with materials, creating a wetland and, eventually, land.

Natural nutrients needed for a healthy aquatic ecosystem include carbon, oxygen, nitrogen, and phosphorous. However, animals, agriculture, and urban areas can speed up the process of eutrophication by adding excessive nutrients to the pond or lake. Too many nutrients can cause algal blooms (rapid population growth) and plant growth that directly impact food chains. Algal blooms can deplete other resources in an aquatic ecosystem. In addition, when the algae finally die, decomposers that feed on the dead algae use so much oxygen that low oxygen levels threaten fish and other members of the ecosystem.

MATERIALS

Each team member needs:

- science notebook
- pencil
- pond ecosystem drawing from Day 9

Each team needs:

- access to the "Pond Ecosystems" ppt

Teacher needs:

- "Pond Ecosystems" ppt
- projector/computer

SAFETY

Remind learners to follow safety rules for making observations on their sample.

DAILY OBSERVATIONS

Observations can be made any time of the day as long as they are done daily. Observations should take 5–10 minutes, depending on the data each team is collecting.

PROCEDURE

Engage

1. **Project title slide 1 of the PowerPoint**. *Today we're going to take a different look at the dynamics of a pond ecosystem.*
2. *We'll consider what happens when changes occur to that food chain. Remember,* ***we are only looking at one simple food chain*** *to illustrate the interactions between the organisms in a pond.*

Explore

1. **Project slide 2**. Ask for volunteers to explain the food chain they see. Answers may vary but should describe the producers, consumers, and the sequence of who eats whom.
2. *What do you think the light green color near the surface of the water is?* (It is algae.) Remind learners that algae are so small that we only know they are present by the color of the water.
3. Explain that, overall, this appears to be a healthy ecosystem, with a good balance of organisms. In the next slides, they will see changes and will need to look closely to consider what is happening.
4. **Project slide 3**. *Who can describe what is happening here? Can you explain the changes? (*More heron, less fish, more tadpoles.) Listen to their responses, prompting as needed. (They should explain that with more heron, the population of fish goes down because the more heron eat more fish. Because there are fewer fish now, there will be more tadpoles. More tadpoles will eat more algae.)
5. **Project slide 4.** *What changes do you see now?* (No heron, lots of fish, few tadpoles, more plants, more algae.) Accept responses. Listen for their explanations to be more specific and to offer more complex explanations with fewer prompts from the teacher.
6. Are learners making connections, such as "there are more fish eating the tadpoles, so there are fewer tadpoles" and "there are more fish because there are no heron to eat them"? *The fish population grows if there is nothing to eat them. However, since there are more fish, there are fewer tadpoles. What happens when the fish run out of tadpoles to eat?* (Some fish may die.)

7. *Did you notice there is more of the green color near the surface of the water now? Why is that?* (There is more algae.) *Why do you suppose there is more algae?* Accept responses. Then explain that organisms can add nutrients to the water through their waste and as they rot or decay, making plants and algae grow. *Nutrients are nourishments and substances found in food that help organisms survive and grow. We add nutrients like fertilizers to our lawns and plants at home for the same reason—to make them grow!* (**Note:** a discussion of the exact nature of nutrients is not grade appropriate; however, a basic understanding of their role in ecosystem success is.)
8. **Project slide #5**. *What has happened in the pond?* Accept responses. **Note:** This slide may be harder for learners to analyze on their own, but it opens up the conversation for a beginning understanding of the complexity of the interactions between organisms in an ecosystem. Prompt the discussion through the possible scenarios depicted here:
    - *Why did the fish die?* (Because they had no food—they had used up their supply of tadpoles.) *What happens to the fish when they die?* (They begin to decay, and the action of decomposers releases nutrients into the water).
    - *Also, there has been an algal bloom—too much algae growing faster in the water—perhaps because of too many nutrients released from the air and water; too much algae uses up the oxygen that fish and other organisms need.*
    - *Some plants and algae die. As bacteria breaks down the dead organisms, they use up the oxygen in the water and any remaining organisms eventually die.*

Explain

1. Explain that a *dead zone* occurs when there is low or no oxygen left in an aquatic system. There are many things that cause the dead zones, but too many nutrients are the main cause.
2. Tell learners that besides the natural causes you have described, human activity and other sources such as fertilizers, exhaust from automobiles, wastewater, and animal waste, can make these changes occur faster by putting excessive nutrients into the water.

Elaborate

1. Remind learners that they have been looking at only one of the food chains that make up a pond ecosystem. In real life, there are many food chains that are connected in the same pond, making food webs that they will learn more about in later studies.
2. Ask them to think about the ecosystems they have been researching and learning about. How many different food chains have they discovered in the same ecosystem? Do the consumers in the food chains eat more than one thing?
3. Ask them to write 1–2 sentences in their science notebooks about how changes in the food chains might affect an ecosystem.

Evaluate

1. Did learners give a reasonable written explanation about how changes in a food chain might affect an ecosystem?
2. Did they use science language in their responses?
3. Were any connections made between the pond food chain activity and the ecosystem food chains they are researching?

Science Language

- **Nutrients** are nourishments and substances found in food that help organisms survive and grow.
- **Decay** is the process of rotting or **decomposition** that breaks down material when an organism dies.
- **Bacteria** are organisms so small they can only be seen through a microscope. Some are decomposers that break down dead organisms.

Expanded Standards

Reading TEKS

ELA.3.6H: Listening, speaking, reading, writing, and thinking using multiple texts. The student uses metacognitive skills to both develop and deepen comprehension of increasingly complex texts. The student is expected to: (H) synthesize information to create new understanding.

CCSS

W.3.2: write informative/explanatory texts to examine a topic and convey ideas and information clearly. **SL.3.2:** determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

NGSS

LS2.D: Disciplinary Core Ideas: Being part of a team helps animals obtain food, defend themselves, and cope with changes. Teams may serve different functions and vary dramatically in size. **3-LS4-3:** Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

Science TEKS

2018–19: 3.9B: identify and describe the flow of energy in a food chain and predict how changes in a food chain affect the ecosystem such as removal of frogs from a pond or bees from a field.

2024–25: 3.12B: identify and describe the flow of energy in a food chain and predict how changes in a food chain such as removal of frogs from a pond or bees from a field affect the ecosystem.