

Lesson 5: Aquatic Ecosystems (2 Days)

☐ Getting Started

What happens when something in an ecosystem changes?

A small change, like pollution or a new species, can affect food, energy, and the survival of living things. In this lesson, you will explore how organisms are connected in aquatic ecosystems and how changes in resources can impact entire food chains and food webs. You will think like a scientist by asking questions, building models, and explaining how one change can affect an entire system.



Stuff You Need

- *Water: The Story of the Hydrosphere, 2nd Edition* by Lynne Z. Petkovic, M.Ed., J.D.
- glue or gluestick
- goldfish crackers
- scissors
- crayons, colored pencils, or markers
- small clear cups (kit)

Ideas to Think About

- How is energy transferred between organisms within systems and across systems?
- How can human interaction negatively impact Earth's systems?

Things to Know

- The **biosphere** is made up of all the ecosystems found on Earth.
- An **estuary** is a coastal area where freshwater from rivers and streams blends with saltwater from the ocean, creating a partially enclosed water body.
- **Brackish water** is water that is a mixture of freshwater and saltwater, usually found in places like estuaries where rivers meet the ocean.
- Thousands of species of birds, mammals, fish, and other wildlife rely on estuarine habitats for living, feeding, and reproducing.
- **Biodiversity** describes the variety of species found in an aquatic ecosystem.
- The integrity of an ecosystem's biodiversity is used as a measure of its health.
- Aquatic ecosystems depend on water conditions and the interactions of living organisms within them.

☐ **Reading and Questions**

Read Chapter 5 in the book *Water: The Story of the Hydrosphere*. Then, answer the questions.

1. What is biodiversity?

2. How can a decrease in fish populations affect other organisms in an ecosystem?

3. Why are estuaries often called important nursery areas for aquatic life?

Activities☐ **Activity 1: Investigating Aquatic Ecosystems**

Imagine you are a scientist studying a real ecosystem—a place where living (biotic) and nonliving (abiotic) factors interact every day. In aquatic ecosystems, even a small change can have a big impact. What happens if a new species enters the system? What if pollution changes the water? What if an important resource like food or oxygen becomes limited? These changes can affect entire food chains and food webs, and may even reduce **biodiversity**.

In this activity, you will investigate a real-world problem affecting a water ecosystem. As you explore, you will think like a scientist—asking questions, identifying problems, and figuring out how changes in resources can impact living things. Your goal is to develop a question that could help scientists better understand or solve the problem. You may use one of the following examples and links for research or find one of your own:

Option 1: Asian Carp in the Mississippi River**Asian Carp**

www.beyondthepage.com/link/13337/

**Midwest battles to keep invasive Asian carp out of the Great Lakes**

www.beyondthepage.com/link/13338/

Option 2: Zebra Mussels in the Great Lakes**Invasive Zebra Mussels**

www.beyondthepage.com/link/13339/

**"Silent Invaders" Zebra Mussels**

www.beyondthepage.com/link/13340/

Option 3: Oil Spills and Ocean Ecosystems**Oil Spills: The impact on the marine environment**

www.beyondthepage.com/link/13342/

**Impacts of Oil Spills- A Marine Conservation Documentary**

www.beyondthepage.com/link/13341/

To develop a topic other than the ones listed, try calling a local water official and asking questions about challenges with water in your local area involving either abiotic or biotic factors. Remember that the focus of your investigation is to ultimately develop a question that will lead to inquiry and discovering or aiding in the resolution of the problem you discover.

Steps for Investigating and Asking Questions:

1. Use the "Investigating and Asking Questions" activity sheet to write down your thoughts and ideas. There are sections to help you stay organized and jot down notes as you go.
2. Pick Your Body of Water and Location: First, choose the body of water and its specific location that you want to explore. Let's use the Coral Sea in Australia as an example.
3. Find Your Focus: Once you have your body of water, decide what you want to focus on. For example, do you want to explore coral bleaching of the Great Barrier Reef, water temperature changes, or something else like pollution? As you choose your focus, think about what resource might be affected, such as food, oxygen, sunlight, or clean water.
4. Identify Problems: After you pick your focus, think about the problems related to it. For example, if you choose coral bleaching, what causes coral bleaching, and how does it affect the coral and the marine life that depends on it? Also, consider what resource is changing or becoming limited and how that change affects organisms and populations in the ecosystem.
5. Brainstorm Solutions: Next, think of ways to solve the problem. What could help reduce coral bleaching in the Great Barrier Reef? Write down any ideas for solutions, like lowering water temperatures or reducing pollution in nearby waters. Think about how your solution could help restore or protect important resources in the ecosystem.
6. Create Your Inquiry Question:
Now that you have some ideas about the problem and possible solutions, create a question that will guide your investigation. This question should focus on something you can test or explore and should include a resource that affects organisms. For example, "How can reducing water pollution near the Great Barrier Reef help prevent coral bleaching?"
7. Focus on Testing One Thing: When you're creating your question, make sure it focuses on one part of the solution that can be tested. For example, if you want to test ways to reduce coral bleaching, pick one way to test, like reducing pollution or water temperature. Your question could be, "Does reducing nearby water pollution help prevent coral bleaching in the Great Barrier Reef?"
8. Make It Your Own: Look at the examples in the reading, but remember, your question should be unique and based on your own ideas for this activity. Also, look at the example Activity Page about the Great Barrier Reef in Australia.

PICK your body of water and location:	
Body of water: The Great Barrier Reef	Location: Off the northeastern coast of Australia in the Coral Sea

FIND your focus:

Focus: Coral bleaching I want to focus on how coral bleaching affects the reef and marine life. Resource to consider: Sunlight and clean water	
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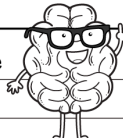
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IDENTIFY problems:

1. Rising ocean temperatures due to climate change are causing coral bleaching. → This reduces the coral's ability to get energy from sunlight. 2. Increased water pollution from agricultural runoff is harming the coral. → This reduces water quality, an important resource. 3. Overfishing near the reef is disrupting the balance of the marine ecosystem. → This affects the availability of food for other organisms.	
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BRAINSTORM solutions:

1. Implement policies to reduce greenhouse gas emissions to slow climate change and protect energy sources for coral. 2. Create regulations to reduce water pollution and improve water quality. 3. Establish fishing restrictions or marine protected areas to help restore food availability and ecosystem balance.	
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CREATE your inquiry question:

1. How does reducing nearby water pollution affect coral bleaching in the Great Barrier Reef? 2. How does ocean temperature affect the coral's ability to get energy from sunlight? 3. How does overfishing affect the availability of food in the reef ecosystem?	
(You only need to write one question. The sample shows you three different possible questions.)	

☐ Activity 2: A Day in the Life of an Estuary

In this simulation game, you'll explore the incredible biodiversity within estuaries and learn about their role in the larger ecosystem of the hydrosphere. Estuaries are unique environments where freshwater from rivers and streams meets the salty water of the ocean, creating a rich and diverse habitat for many species of plants and animals.

As you participate in the game, you'll manage an estuary represented by a bowl of goldfish crackers. By drawing cards, you'll experience different events and actions that can positively or negatively impact the health of your estuary. Many of these events affect important resources like oxygen, food, clean water, and habitat space. As these resources change, you'll see how they affect the biodiversity (variety of life) and the number of organisms in your estuary. This helps show how ecosystems depend on a balance of both living (biotic) and nonliving (abiotic) factors.

But ecosystems are not only affected by resources—they are also shaped by how organisms depend on each other for energy. In every estuary, organisms are connected through feeding relationships, where energy moves from one organism to another. As you play, you will also observe how changes in one group of organisms can affect others, helping you understand how living things interact within an ecosystem.

You will need to ask a parent or sibling to play the game with you.

After the game, answer the questions on the "A Day in the Life of an Estuary" Activity Page.

Game Directions

1. To set up for play, each player places 10 goldfish crackers into three small labeled cups:

*Cup 1: 6 small fish

*Cup 2: 3 big fish

*Cup 3: 1 predator

Each cup represents a different level in the estuary food chain. Cut out the deck of game cards.

2. The "Fish" banker holds the additional crackers and deck of game cards.
3. Read this passage aloud:

"Estuaries are places where freshwater from rain, creeks, and rivers meets salty ocean water. These areas are rich habitats for many organisms. The shallow water and salt marshes provide food and shelter, making estuaries important nursery areas for young fish, shrimp, and crabs. However, changes in the environment can affect important resources. Pollution can cause algae to grow too much. These algae use up oxygen in the water. Fish need oxygen to survive, and when there is not enough, fish can die in what is called a 'fish kill.'

Organisms in an estuary also depend on each other for food. If one population changes, it can affect many others. Positive actions can also improve the ecosystem. Cleaning up pollution, protecting habitats, and managing fishing can help restore resources and support healthy populations."

4. To play the game, one by one, each player draws a card and completes the action, adding or subtracting fish from the correct cup (small fish, big fish, or predator) as directed.
5. The game continues until all cards have been drawn or one player's "estuary" is depleted of "fish." The player with the most fish at the end "wins."

6. After the game, each player should explain what happened in their estuary.

Take turns answering:

*What happened to your fish population?

*Which events helped your estuary? Which harmed it?

*What resources changed during the game? (oxygen, food, clean water, habitat)

*How did those resource changes affect your fish population?

*Was the change caused by a biotic or abiotic factor?

*How did changes in one type of organism affect other organisms? Explain using feeding relationships (who eats whom).

Day 2

☐ Activity 3: Building and Disrupting a Food Chain

In every aquatic ecosystem, living things are connected in ways you can't always see at first glance. A tiny organism like algae might not seem very important, but it can support an entire chain of life. From small animals to large predators, energy moves through an ecosystem in a connected pathway called a food chain. But what happens when something in that chain changes? In this activity, you will first build a food chain to understand how organisms depend on one another. Then, you'll investigate what happens when part of that system is disrupted and how that change affects the flow of energy and the availability of resources in the ecosystem.

Part 1: Build the Food Chain

Start by cutting out the organism cards on your activity page titled "Building and Disrupting a Food Chain." Take a moment to study each organism. Think about what it eats, or if it makes its own food. Now, instead of placing the organisms in a straight line, glue them into a food pyramid (bottom → top) to show how energy and populations are distributed in the ecosystem. The bottom level should be the largest, and each level above should get smaller. This helps show that there are more producers and fewer organisms at higher levels.

- Producers (like algae) make their own food using sunlight
- Consumers eat other organisms to get energy
- Decomposers break down dead organisms and return nutrients to the environment

Use these questions to help you decide where each organism belongs:

- Which organism makes its own food? (This belongs at the bottom.)
- Which organisms eat that organism?

- Which organisms eat other consumers?
- Where would there be the most organisms? The fewest?

Place the decomposer somewhere that connects to ALL levels of the pyramid. Think about what decomposers act on. Once your pyramid is complete, draw arrows to show how energy flows from one organism to the next.

Part 2: Follow the Energy

Now look closely at your food chain. Energy is moving through this system, from sunlight to producers, and then from organism to organism. As energy moves up the pyramid, less energy is available at each level. This is why there are many producers at the bottom and fewer organisms at the top. But energy is not the only thing moving. Matter, like nutrients, is also being recycled.

Label each organism in your pyramid:

- Producer
- Consumer (primary, secondary, or tertiary)
- Decomposer (Place the decomposer somewhere that connects to all levels of the pyramid. Draw arrows from every organism in the pyramid to the decomposer to show that decomposers break down all living things after they die. Then draw a curved arrow from the decomposer back to the producer and label it "Nutrients returned to environment.")

Now imagine a change in the ecosystem. A local business begins harvesting large numbers of clams. At first, this might not seem like a big deal but clams play an important role in the food chain. Look at your model and predict what would happen if the clam population decreased.

- Predict how each population will change if the clam population decreases
- Draw a green ↑ arrow next to any population you think would increase.
- Draw a red ↓ arrow next to any population you think would decrease.

Take your time here. This is where you start to see how connected everything really is. Remember, ecosystems depend on balance. When one part of a food chain changes—even something small—it can affect the entire system. Now answer the questions on the activity page.

☐ **Activity 4: Connecting Marine and Terrestrial Ecosystems**

In nature, ecosystems are not isolated. Marine and terrestrial ecosystems are connected in ways that may not always be obvious. Scientists call land ecosystems

terrestrial ecosystems. Organisms move between systems, and materials—like nutrients and pollution—can travel through food webs. In this activity, you will build a model of a food web that connects a marine ecosystem and a terrestrial (land) ecosystem. Then, you will investigate how a pollutant moves through this system and affects organisms over time.

Part 1: Build the Food Web Model

Cut out the organism cards from your activity page, titled "Marine and Terrestrial Ecosystems." Using the table as a guide, arrange and glue the organisms into a food web inside the large box on page 2. Use the example in Chapter 5 of *Water: The Story of the Hydrosphere* to help you. Arrange the organisms across the page to create a food web, not a straight line. Some organisms may connect to more than one other organism.

Marine and Terrestrial Organisms		
<u>Niche</u>	<u>Marine Organisms</u>	<u>Terrestrial Organisms</u>
producer	algae	grass/shrubs
primary consumer	clams	squirrels/rabbits
secondary consumer	sunfish	hawks
tertiary consumer	largemouth bass	fox/bears
decomposer	bacteria	fungi

Draw arrows to show energy flow from one organism to another. Many organisms will have more than one arrow, showing multiple feeding relationships. Use the following arrow key throughout the activity:

- Black solid arrows = energy flow through the food web
- Black dashed arrows = nutrients moving to decomposers and back to producers
- Blue arrow = connection between marine and terrestrial ecosystems
- Red arrows or red tracing line = movement of pollution through the food web

Part 2: Show Connection between Ecosystems

Now look at your model. Marine and terrestrial ecosystems are connected because some organisms move between them.

- Identify the organism that connects the two ecosystems.
- Color or circle that organism.
- Draw a blue arrow showing how energy can move from the marine ecosystem to the terrestrial ecosystem.
- Label the arrow: "Ecosystems connect here."

Think about:

- Which organism moves between the two ecosystems?
- How does energy flow from one ecosystem to the other?

Part 3: Trace the Movement of Pollution

A pollutant enters the marine ecosystem. Use a colored pencil to TRACE the path of the toxin through your food web:

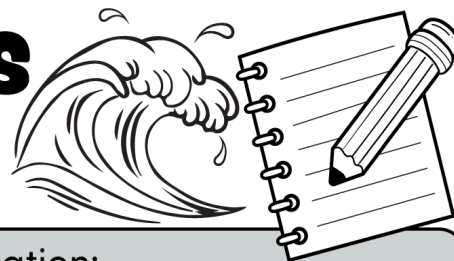
- Draw a large red arrow pointing to the organism where the pollutant enters the system (algae).
- Label the arrow "Pollution."
- Using a red pencil, trace the path of the pollutant through the food web.
- Show how the pollutant moves from organism to organism.
- Continue tracing until the pollutant reaches the terrestrial ecosystem.

Remember, ecosystems are connected systems. Changes in one part, like pollution, can move through food webs, affect resources, and impact organisms far beyond where the change began. Now, answer the questions on the activity page.

Wrapping Up

In this lesson, you explored how organisms in aquatic ecosystems are connected through food chains and food webs. You saw how energy flows, how matter cycles, and how changes in resources like food or oxygen can affect entire ecosystems. You also discovered that even small changes, like pollution or removing one species, can have big effects across a system. Next up, you'll zoom out even further to explore the water cycle and see how water moves through Earth's systems, connecting everything together.

Investigating Notes and Questions



PICK your body of water and location:

Body of water:

Location:



FIND your focus:

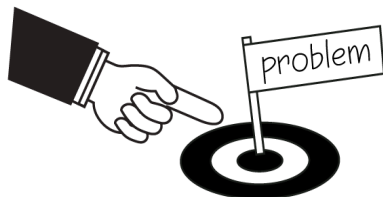
- What is your focus?
- Is this a **biotic** or **abiotic** factor?
- What resource might be affected? (food, oxygen, space, sunlight, clean water)





IDENTIFY problems:

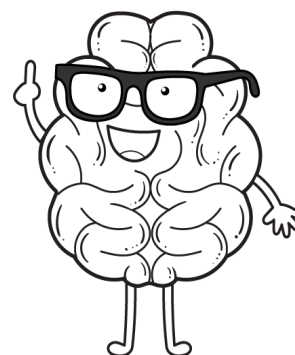
- What problem is happening in this ecosystem?
- Which organisms are affected?
- What resource is changing or becoming limited?
- How does this change affect the organisms or their population?





BRAINSTORM solutions:

- What are possible solutions?
- How might your solution help restore or protect resources?

**CREATE** your inquiry question:

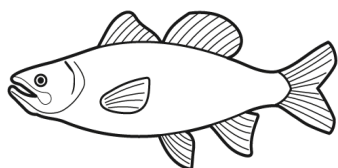
- Focus on one part of the problem
- Include a resource in your question
- Think about how the resource affects organisms



(You only need to write one question. The sample shows you three different possible questions.)

A Day in the Life of an Estuary Playing Cards

Bluefish closes in on a school of smaller fish.



Remove 3 small fish.

Mr. Farmer sprayed for insects near the waterway. Runoff kills fish.



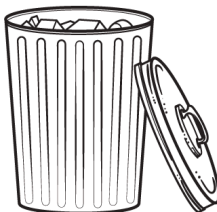
Remove 2 small fish and 1 big fish

Legal protection for your fish species.



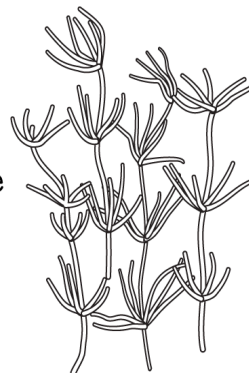
Add 3 big fish and 2 small fish

Volunteers clean up the estuary.



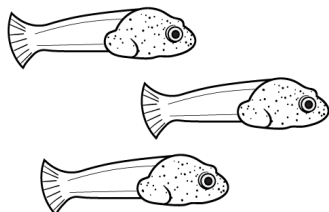
No fish lost (water quality improves)

Fertilizer runoff causes extra algae growth. Oxygen decreases.



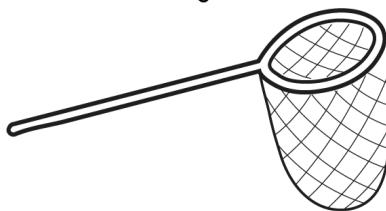
Remove 2 small fish

The nursery loses 3 fry (baby fish).



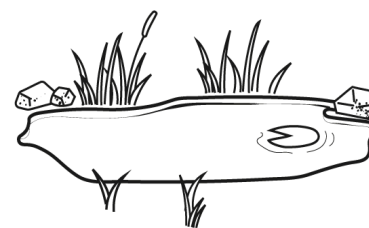
Remove 3 small fish

3 fish are caught in a gill net.



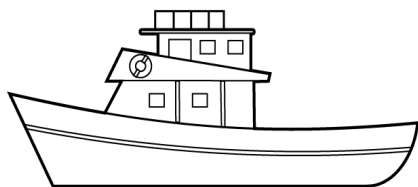
Remove 2 big fish and 1 small fish

Salt marsh area is set aside as a nature reserve.



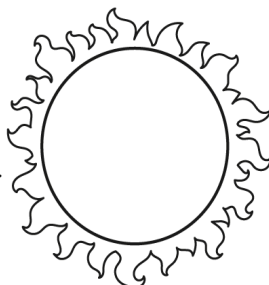
Add 3 small fish and 1 big fish

New marina brings more boats to the estuary.



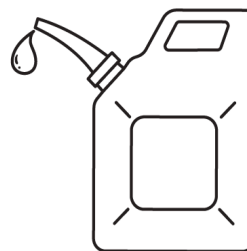
Remove 2 big fish and 1 small fish

Great weather improves habitat conditions.



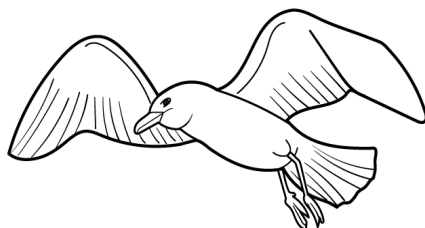
Add 2 small fish.

A boater spills oil into the water.



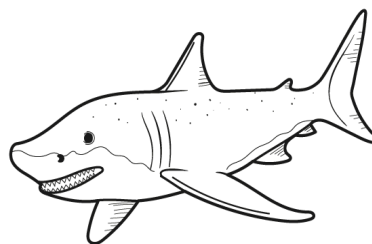
Remove 2 small fish and 1 big fish

A seagull flies over and catches a fish.



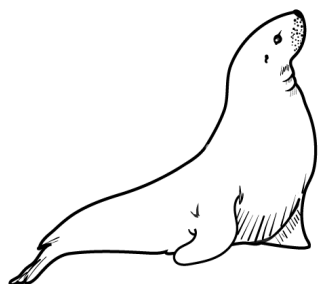
Remove 1 big fish.

A shark hunts in the estuary.



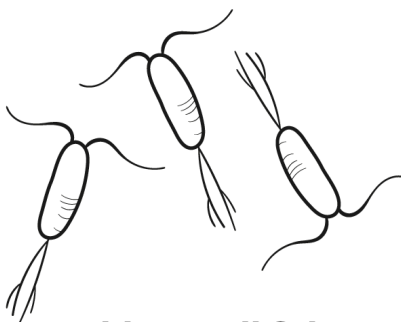
Remove 3 big fish.

Seals feed in the estuary.



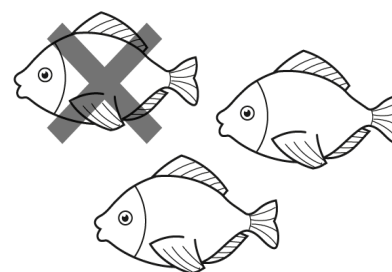
Remove 2 big fish.

Plankton levels increase.



Add 3 small fish

Small fish population drops.



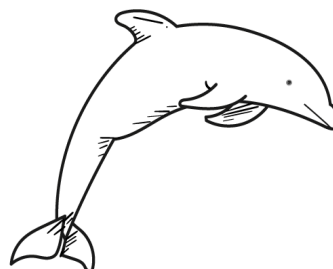
Remove 1 big fish.

Too many predators in the estuary.

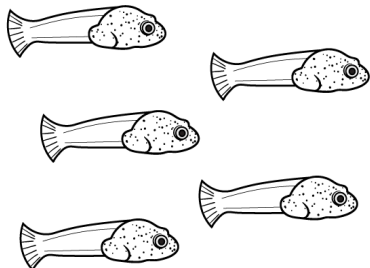
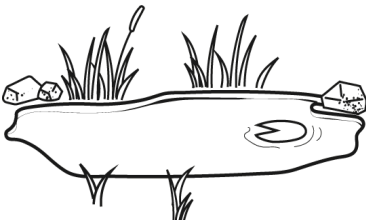
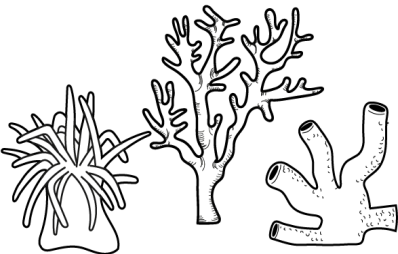
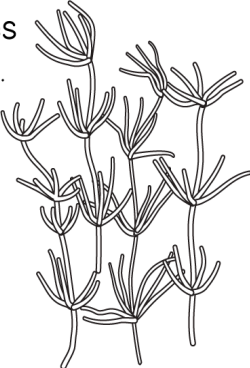
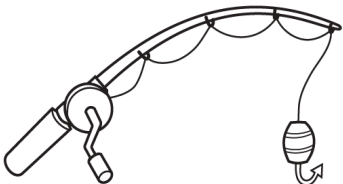
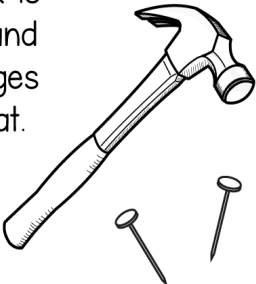


Remove 2 small fish

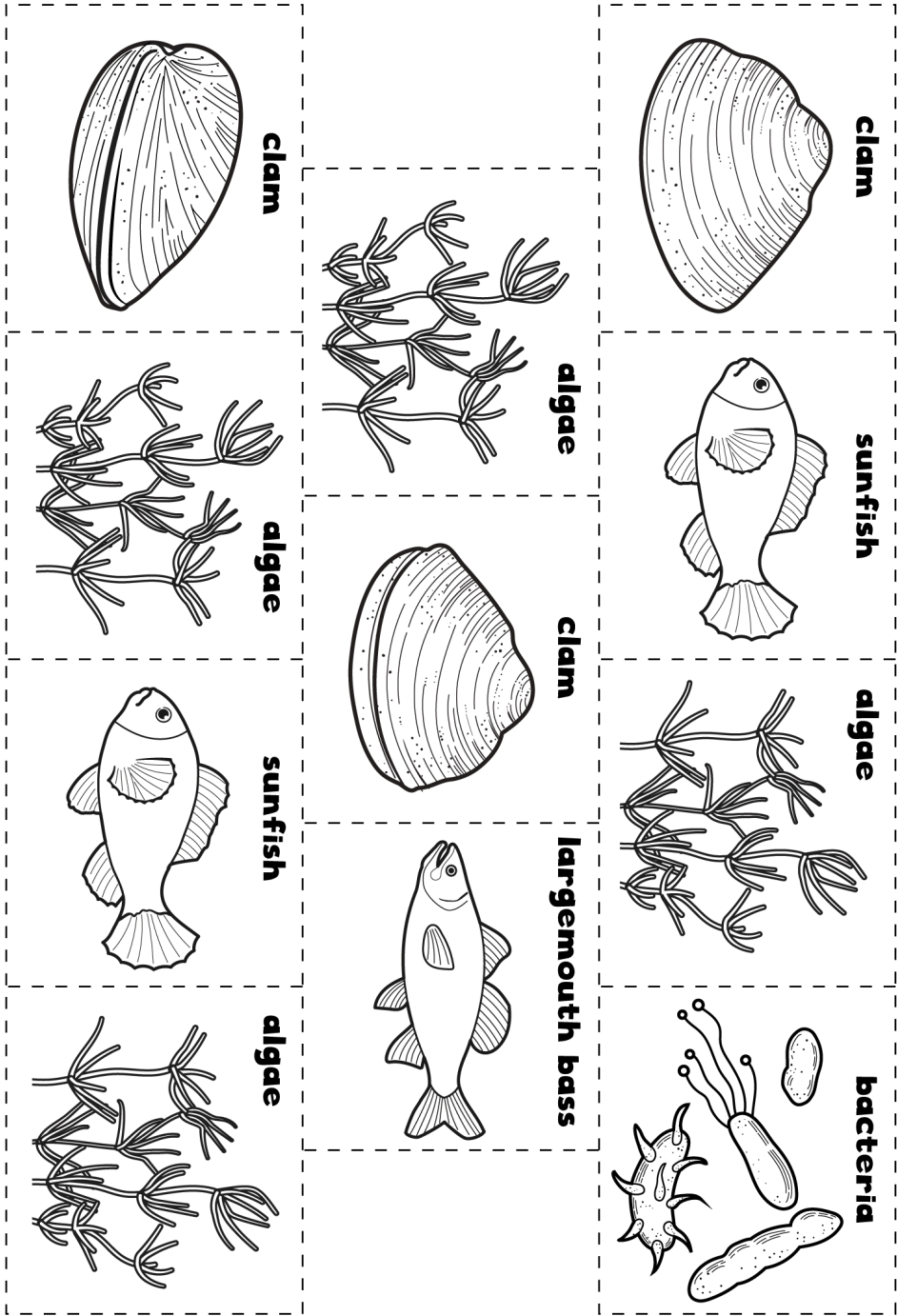
Predators leave the area.



Add 1 big fish

New fry hatch.  Add 5 small fish.	Salt marsh left undisturbed.  Add 4 small fish	Artificial reef installed.  Add 2 small fish and 2 big fish
Fishing is prohibited in the area.  Add 2 big fish and 1 small fish	Something mysterious in the water kills fish.  Remove 4 small fish and 2 big fish	
Big algae bloom causes oxygen loss.  Remove 6 small fish, 3 big fish, and 1 predator	A family goes fishing and catches fish.  Remove 4 big fish	A dock is built and damages habitat.  Remove 2 small fish
A fish eats plastic and dies.  Remove 1 big fish	A fish eats a rubber worm and dies.  Remove 1 big fish	

Building and Disrupting a Food Chain



Food Pyramid

Directions: Glue the organisms from page 1 into a food pyramid. The bottom level should be the largest, and each level above should get smaller.



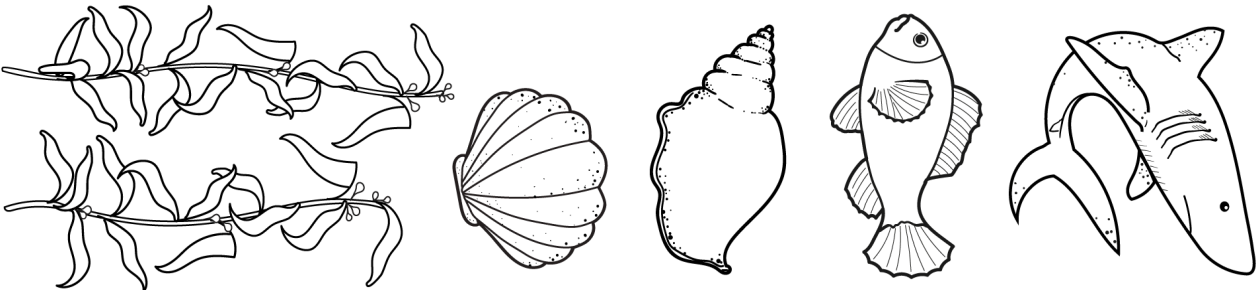
Questions:

1. What happens to the algae population if clams decrease? Why? _____

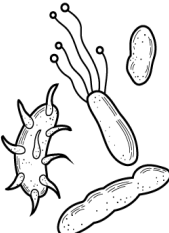
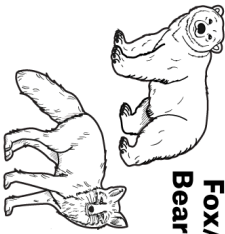
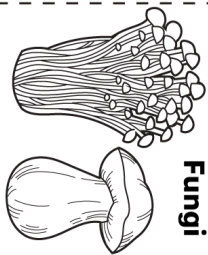
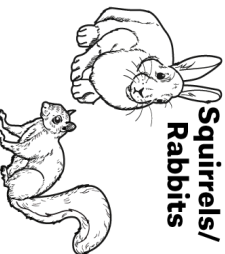
2. How does this change affect the other organisms in the food chain? _____

3. What resource is changing in this ecosystem? (food, energy, nutrients, etc.) _____

4. How does this change affect the flow of energy through the ecosystem? _____



Marine and Terrestrial Ecosystems

 Bacteria	 Sunfish	 Largemouth Bass
 Fox/ Bears	 Algae	 Grass/Shrubs
 Hawks	 Clams	 Fungi
		 Squirrels/ Rabbits

Food Web

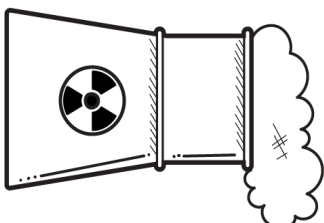
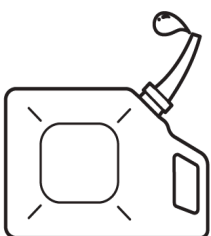
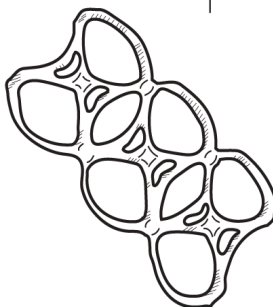
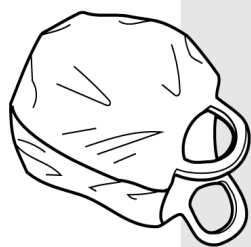
Questions:

1. At what level do the two ecosystems become linked? _____

2. What would the long-term effects of pollution be on the two ecosystems? _____

3. Make a claim about what happens in the ecosystem and support it with evidence from your model.

- What resource is affected (food, energy, etc.)
- How the pollutant moves through organisms
- How populations may increase or decrease over time



Lesson 5: Aquatic Ecosystems (2 Days)

Getting Started

✿ Ideas to Think About

- How is energy transferred between organisms within systems and across systems?
- How can human interaction negatively impact Earth's systems?

📖 Things to Know

- The **biosphere** is made up of all the ecosystems found on Earth.
- An **estuary** is a coastal area where freshwater from rivers and streams blends with saltwater from the ocean, creating a partially enclosed water body.
- **Brackish water** is water that is a mixture of freshwater and saltwater, usually found in places like estuaries where rivers meet the ocean.
- Thousands of species of birds, mammals, fish, and other wildlife rely on estuarine habitats for living, feeding, and reproducing.
- **Biodiversity** describes the variety of species found in an aquatic ecosystem.
- The integrity of an ecosystem's biodiversity is used as a measure of its health.
- Aquatic ecosystems depend on water conditions and the interactions of living organisms within them.

Reading and Questions

1. What is biodiversity?

Biodiversity is the variety of species found in an aquatic ecosystem. Ecosystems with high biodiversity tend to be more stable because many different species interact in different ways.

2. How can a decrease in fish populations affect other organisms in an ecosystem?

Ecosystems are interconnected. If fish populations decrease, predators that depend on those fish for food may struggle to survive. This can create a ripple effect that affects many parts of the ecosystem.

3. Why are estuaries often called important nursery areas for aquatic life?

Estuaries provide shelter, food, and protection for many young organisms. Because they are productive environments where freshwater and saltwater mix, species such as salmon, shrimp, and blue crabs often begin their lives there before moving to other ecosystems as adults.

🎯 Skills

- Analyze and interpret data to provide evidence for how resource availability affects organisms and populations in aquatic ecosystems. (MS-LS2-1) (S)
- Develop and use models (food chains, food webs, and food pyramids) to describe the flow of energy and cycling of matter in ecosystems. (MS-LS2-3) (S)
- Construct an explanation based on evidence for how changes in resources like food, oxygen, and clean water impact ecosystem stability and biodiversity. (MS-LS2-1) (S)
- Construct an explanation based on evidence for how changes in environmental conditions and interactions among organisms (such as feeding relationships) affect populations in an estuary ecosystem. (MS-LS2-2) (S)

- Develop and use models to show how disruptions (such as pollution or removal of a species) affect energy flow and matter cycling in ecosystems. (Science & Engineering Practice) (S)
- Analyze and interpret patterns in food chains and food webs to predict how changes in one population affect others. (Science & Engineering Practice) (S)
- Construct an argument supported by evidence to explain how changes to biotic or abiotic factors impact populations in ecosystems. (MS-LS2-4) (S)
- Describe how terrestrial and aquatic food webs are interconnected. (S)
- Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (S)
- Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (S)
- Analyze evidence to explain observations, make inferences and predictions, and develop the relationship between evidence and explanation. (S)
- Identify and create questions and hypotheses that can be answered through scientific investigations. (S)
- Observe, collect, organize, and analyze data. (S)
- Use oral and written language to communicate findings. (S)
- Use technologies and information systems to research, disseminate findings to others, gather, visualize, and analyze data. (S)

Introducing the Lesson

In this lesson, your child explores how aquatic ecosystems function and how living and nonliving factors interact. She investigates how changes in important resources like food, oxygen, and clean water can affect organisms and populations. Through hands-on activities and modeling, she builds an understanding of how energy flows, matter cycles, and how changes in one part of an ecosystem can impact the entire system.

Activities

Activity 1: Investigating Aquatic Ecosystems

Here, your child will focus on understanding how to investigate a real-world problem in an aquatic ecosystem and develop a meaningful scientific question. They will use provided resources to explore how changes in an ecosystem—especially changes in important resources like food, oxygen, sunlight, or clean water—affect living organisms. There is always the possibility that your child may go further than necessary with the investigation process. Be sure that they stay focused on developing an inquiry question that will guide an investigation. Good inquiry questions have the following characteristics:

- Your child poses a question or claim that can be tested.
- The question is based on important scientific background knowledge.
- The inquiry leads to an investigation that allows data collection.
- Your child identifies a variable that can be changed or tested.
- The question considers how a resource affects organisms or populations in an ecosystem.

Your child will be focused on developing a question at this point, so the goal is to create a question that focuses on a specific issue related to how ecosystems change. Encourage them to think about how a change

in a resource might impact living things. For the sake of time, be sure to stop at the question development stage.

Here are some examples of good inquiry questions:

- How does a decrease in food supply affect fish populations in a lake?
- Does water pollution reduce the oxygen available to aquatic organisms?
- How does a change in sunlight affect plant growth in an aquatic ecosystem?

A sample activity sheet with possible answers about a problem with the Great Barrier Reef has been provided as reference.

Activity 2: A Day in the Life of an Estuary

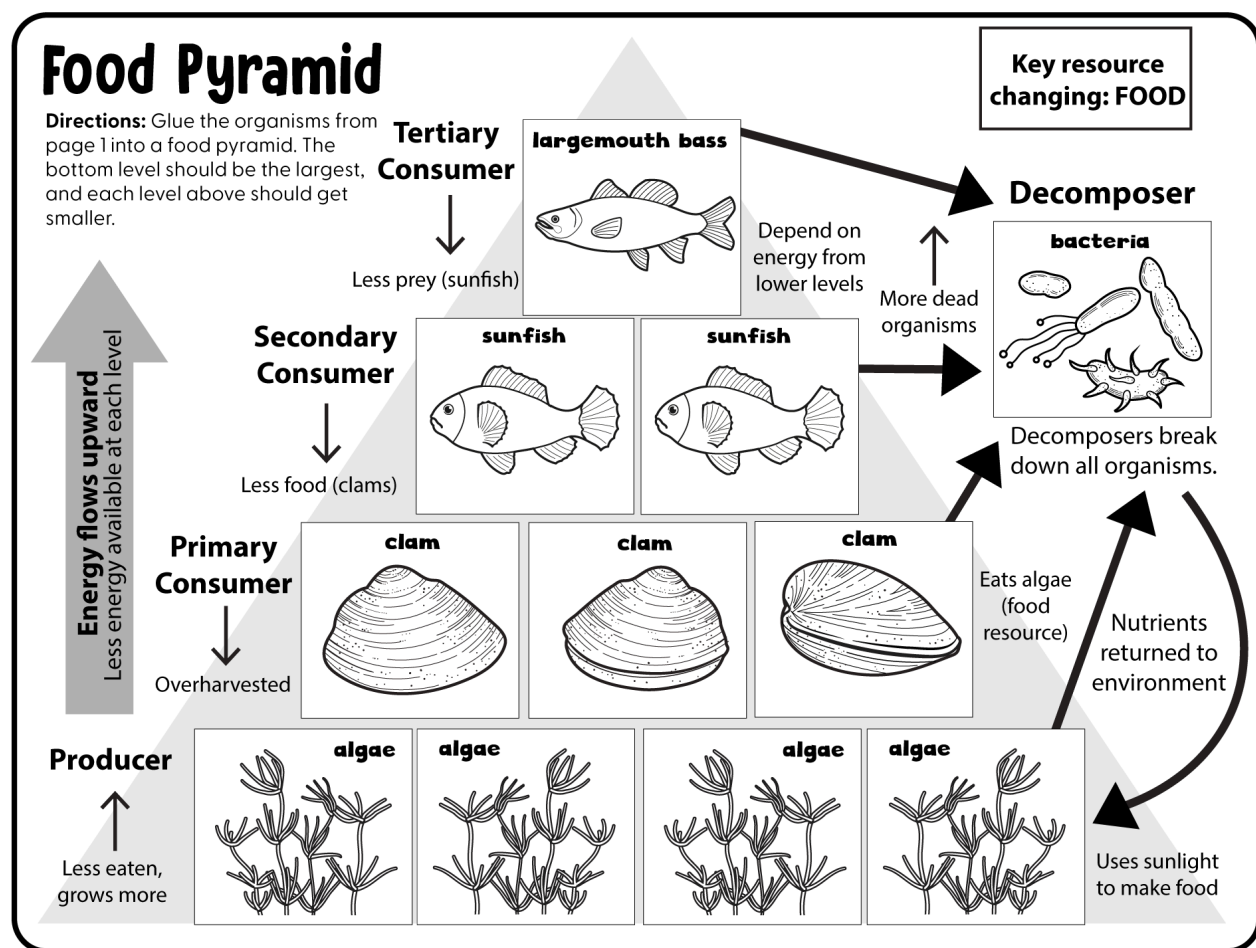
In this activity, your child plays a game to model an estuary ecosystem. As she plays, she observed how changes in resources like oxygen, food, clean water, and habitat affected fish populations. She also explores how organisms depend on one another for energy through feeding relationships. Encourage her to explain what happened using cause-and-effect reasoning, including how both environmental changes and interactions between organisms impacted the ecosystem.

Day 2

Activity 3: Building and Disrupting a Food Chain

In this activity, your child builds and analyzes a food chain to understand how organisms in an ecosystem depend on one another. She explores how energy flows from producers to consumers and how matter cycles through decomposers. Then, she investigates what happens when part of the food chain is disrupted, focusing on how changes in resources like food affect populations. Through this process, she practices explaining cause-and-effect relationships within an ecosystem.

Answer Key:



If clam populations decrease due to overharvesting:

- Algae: Green ↑ (increase) because fewer clams are eating the algae.
- Clams: Red ↓ (decrease) because they are being harvested.
- Sunfish: Red ↓ (decrease) because there are fewer clams available as food.
- Largemouth bass: Red ↓ (decrease) because there are fewer sunfish available as prey.
- Decomposers: Answers may vary. Your child may predict a temporary increase because more dead organisms may become available. Others may predict little change because decomposers break down organisms from all levels of the ecosystem.

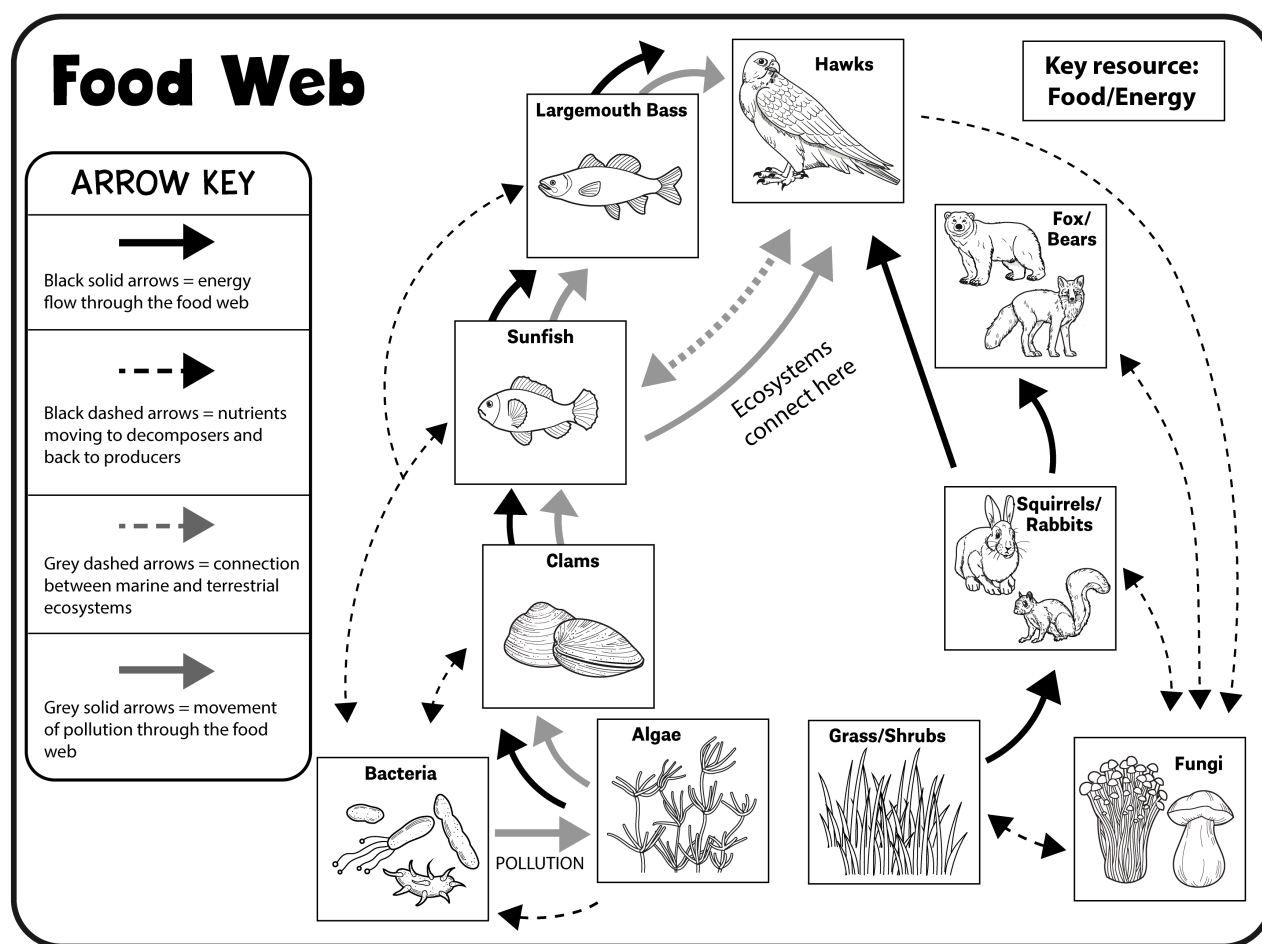
1. The algae population increases because there are fewer clams to eat the algae. Without enough primary consumers, the algae is not controlled and grows more quickly.
2. With fewer clams, organisms that eat clams (like sunfish) will have less food and may decrease. This can cause a chain reaction where higher-level consumers (like largemouth bass) also decrease because their food source is reduced.
3. The main resource changing is food. Clams are an important food source, and their decrease affects how much food is available for other organisms. Nutrients and oxygen may also be affected if algae grows too much.
4. Energy flow is disrupted because less energy is passed from clams to higher-level consumers. More energy stays at the producer level (algae), and less energy moves up the food chain, causing populations at higher levels to decrease.

Activity 4: Connecting Marine and Terrestrial Ecosystems

In this activity, your child builds a food web that connects marine and terrestrial ecosystems to show how organisms depend on one another. She models how energy flows and matter cycles through the system, then traces how a pollutant moves through the food web from water to land. As she analyzes the model, she explains how changes in resources like food affect organisms and how populations may increase or decrease over time.

Answer Key:

Answers will vary. The layout of the food web may differ, but the arrows should accurately represent energy flow, nutrient cycling, pollution movement, and the connection between the marine and terrestrial ecosystems. Accept any scientifically accurate arrangement.



1. The two ecosystems connect when a land animal eats an organism from the water. For example, a hawk eats a fish (sunfish), linking the marine and terrestrial ecosystems.
2. Pollution can spread through the food web and harm many organisms. As it moves from one organism to another, it can make animals sick or cause them to die. Over time, this can lead to fewer organisms, less biodiversity, and an unhealthy ecosystem.
3. Pollution enters the water and is taken in by producers like algae. When clams eat the algae, they also take in the pollution. Then fish eat the clams, and animals like hawks eat the fish. This spreads the pollution through both ecosystems. The main resource affected is food, because the pollution moves through the food web. As organisms become sick or die, fewer are available to pass energy along. This disrupts the flow of energy and causes populations to decrease over time.

Wrapping Up

In this lesson, your child explored how organisms in aquatic ecosystems are connected through food chains and food webs. She examined how energy flows, how matter cycles, and how changes in resources like food or oxygen can affect entire ecosystems. She also learned that even small changes, such as pollution or the removal of a species, can have widespread effects across a system. Next, she will build on this understanding by exploring the water cycle and how water moves through and connects Earth's systems.

Questions to Discuss

- What is the difference between a food chain and a food web? (Answer: A food chain shows a single pathway of energy flow from one organism to another, while a food web shows many connected pathways and relationships between organisms in an ecosystem.)
- If a new predator were added to an aquatic ecosystem, what might happen to the balance of that ecosystem? Explain your reasoning. (Answer: A new predator could reduce the population of the organisms it eats, which could cause those organisms' food sources to increase. This can create a chain reaction throughout the food web, changing population sizes and disrupting the balance of the ecosystem.)

Things to Review

- Review that ecosystems are connected systems. Organisms depend on one another through food chains and food webs, and a change in one part can affect the entire system.
- Review that resources control populations. Changes in resources such as food, oxygen, and clean water can cause populations to increase or decrease and disrupt the flow of energy through an ecosystem.