CULMINATING LESSON

Matter Cycles and Energy Flow in the Open Ocean

Lesson at a Glance

To refresh the information students learned throughout this unit, the class will participate in a short review game. Students will then demonstrate what they have learned in this unit about the zones of the Open Ocean, the organisms in the Open Ocean, and how matter cycles and energy flows through a matching activity.

Lesson Duration

One 45-minute period

Essential Question(s)

How does matter cycle and energy flow in the Open Ocean?

Key Concepts

- Phytoplankton are the producers of the ocean, capturing sunlight energy and synthesizing simple foods through photosynthesis.
- Phytoplankton are eaten by primary or first level consumers.
- First level consumers are eaten by secondary or second level consumers, which are eaten by tertiary or third level consumers.
- Both producers and consumers are broken down by decomposers.
- Energy flows through the food web from sunlight to phytoplankton and is transferred whenever an animal or plant is eaten. Matter is cycled when organisms die and are broken down by the decomposers into nutrients for the producers.

Instructional Objectives

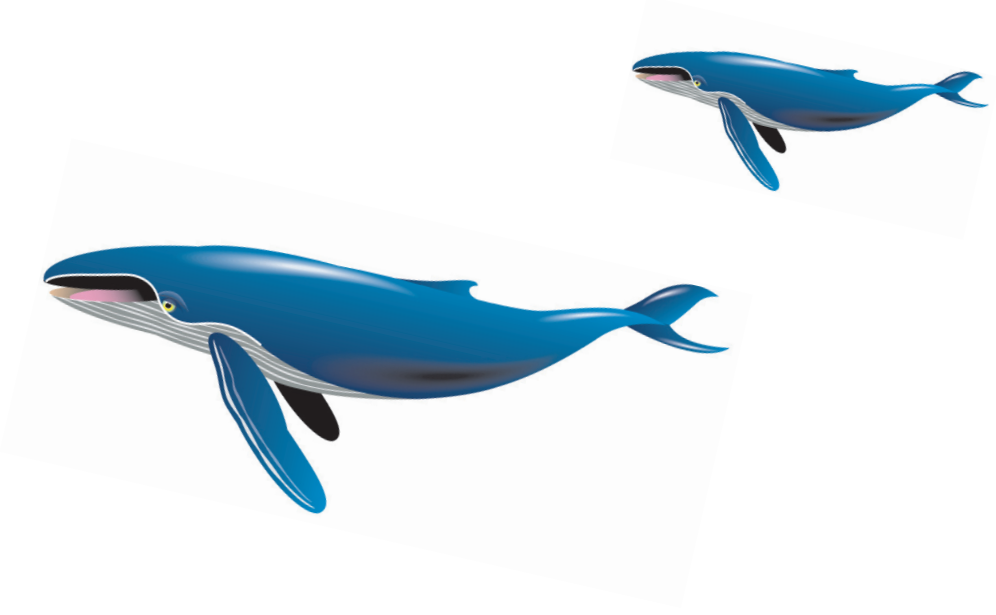
- I can describe how matter cycles and energy flows in the Open Ocean ecosystem.
- I can use a model of the Open Ocean to label the zones, to show where specific organisms live, and how these Open Ocean organisms interact with one another in the food chain (i.e., producer, consumer, and decomposer).

Related HCPSIII Benchmark(s):

Science SC.5.2.1
Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world.

Science SC.5.3.1
Describe the flow of energy among producers, consumers, and decomposers.

Science SC.5.3.2
Describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of cycles of matter.



Assessment Tools

Benchmark Rubric:

Topic		**Unifying Concepts and Themes**	
Benchmark SC.5.2.1		Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Consistently select and use models and simulations to effectively represent and investigate features of objects, events, and processes in the real world	Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world	With assistance, use models or simulations to represent features of objects, events, or processes in the real world	Recognize examples of models or simulations that can be used to represent features of objects, events, or processes

Topic		Cycles of Matter and Energy	
Benchmark SC.5.3.1		Describe the cycle of energy among producers, consumers, and decomposers	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Explain and give detailed examples of the cycle of energy among producers, consumers, and decomposers	Describe the cycle of energy among producers, consumers, and decomposers	Describe a part of the energy cycle with an example (e.g., describe one or two parts of a food chain)	Recognize an example of part of an energy cycle

Topic		Interdependence	
Benchmark SC.5.3.2		Describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycles of matter	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Explain and give examples of how specific relationships among producers, consumers, and decomposers in an ecosystem affect the cycling of matter	Describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycling of matter	Identify a few relationships between producers, consumers, or decomposers in an ecosystem in terms of the cycling of matter	Recall, with assistance, that matter cycles in an ecosystem among producers, consumers, and decomposers

Assessment/Evidence Pieces

Lesson
- Student Worksheet: *Open Ocean Bingo Card*
- Student Worksheet: *Open Ocean Constructed Response Assessment (optional)*

Materials Needed

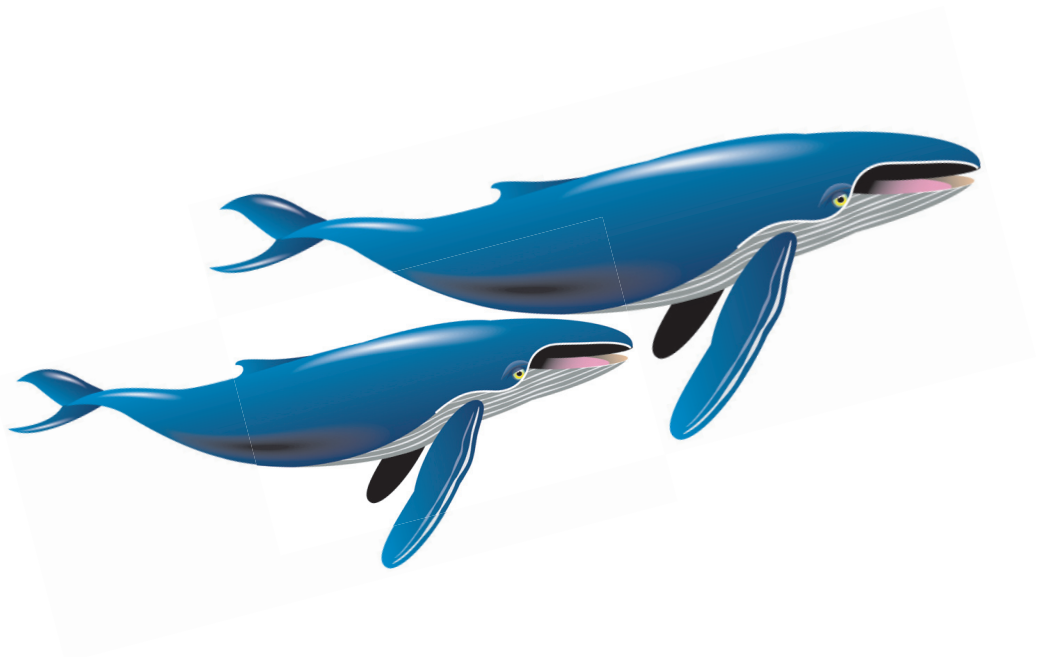
Teacher	Class	Group	Student
• None	• None	• None	• Student Worksheet: *Open Ocean Bingo Description Cards* • Student Worksheet: *Open Ocean Bingo Card* • Scissors • Glue

Instructional Resources

Student Worksheet: *Open Ocean Bingo Description Cards*
Student Worksheet: *Open Ocean Bingo Card*
Student Worksheet: *Open Ocean Constructed Response Assessment*
Supplemental Resource: *Life in the Open Ocean Interactive Game (CD-ROM)*

Student Vocabulary Words

benthic zone: bottom portion of ocean, also called seafloor, or sometimes seabed.
bony fishes: fishes that have jaws and skeletons made of bones; most have scales and swim bladders.
cartilaginous fishes: fishes, such as sharks and rays, which have skeletons made of cartilage, not bone.
cephalopods: biological classification meaning "head-foot." Includes octopus, squid and chambered nautilus.
cetaceans: whales (baleen and toothed-sperm whales, dolphins, and orcas), porpoises, dolphins.
continental terms: pelagic zone consisting of neritic (over continental shelf) plus oceanic zone (Open Ocean water column beyond continental shelf).
crustaceans: includes bottom-dwelling crabs and lobsters as well as mid-water column shrimp.
inshore: less than 100 meters (328 ft.) off the coast; in Hawai'i, sometimes called nearshore or coastal waters.
open ocean: more than 300 meters (984 ft.) off the coast; in Hawai'i, sometimes called pelagic.
pollution: contamination of soil, water, or the atmosphere by the introduction of harmful substances.



Lesson Plans

Lesson Preparation

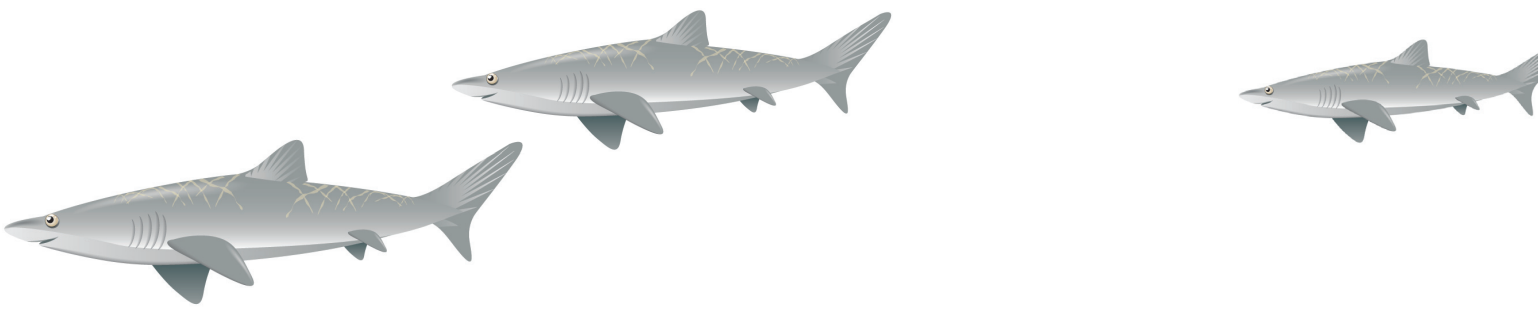
- Review the key concepts of each lesson to prepare for review with students, including:
  1) Food chains and food webs with producers, consumers, and decomposers.
  2) Flow of energy in the Open Ocean with producers, consumers, and decomposers.
  3) Cycles of matter in the Open Ocean.
- Preview and make copies of Student Worksheets *Open Ocean Bingo Description Cards* and *Open Ocean Bingo Card*, one per student.

I. Unit Assessment

A. Briefly review with students the following information:
  1) Food chains and food webs with producers, consumers, and decomposers.
  2) Flow of energy in the Open Ocean with producers, consumers, and decomposers.
  3) Cycles of matter in the Open Ocean.

B. Distribute the Student Worksheets, *Open Ocean Bingo Description Cards* and *Open Ocean Bingo Card*, one per student. Have students cut out the description cards. Explain to students that their task is to match the description cards to the photos on the *Open Ocean Bingo Card*. The students may glue or tape the descriptors to the photos on their Bingo Card. NOTE: Make sure that they only glue or tape along the top portion of each card so that, once fastened down, they can lift it up like a flap. This will allow them to check their responses with the picture underneath it. Explain to "win" this Bingo game, they must achieve "blackout," which means they must match ALL of the descriptions with the correct picture. Students are to do this individually and this can serve as assessment evidence.

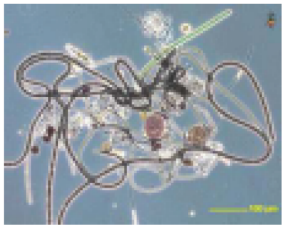
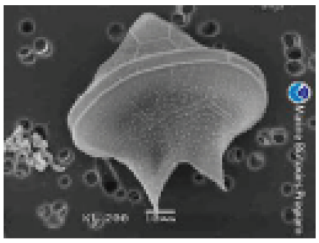
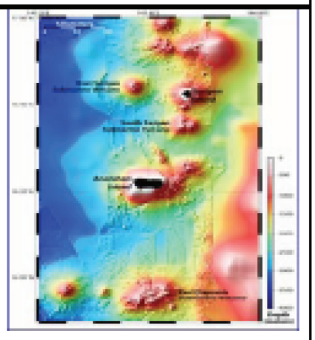
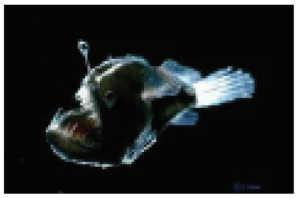
C. *Open Ocean Constructed Response Assessment* (optional): Have students complete this assessment if more summative assessment is needed.



Culminating Lesson Open Ocean Bingo Description Cards

I am an apex predator. I live in the photic zone. I eat everything, including sharks.	I am a primary consumer. My groups consists of organisms, such as larvae, copepods, and krill.	I live in the benthopelagic zone. I have bioluminescent organs as an adaption to living in this environment.	I make marine snow. I also live everywhere in the Open Ocean. I am a decomposer.
I am actually bits of dead animals and plants, as well as sediment. I am produced in the photic zone of the ocean.	I am the highest producing zone in the Open Ocean. My zone extends as far as sunlight can reach.	I live in the photic zone. I am the primary producer of the ocean. You will find blue-green algae and diatoms amongst me.	I tell you how deep the ocean is and what it looks like at the ocean bottom. I am made through sonar.
I am 90% of the Open Ocean. I house creatures that have had to adapt to my unique environment.	I am delicious! My bullet shape allows me to cover vast expanses of ocean. I am a tertiary consumer.	I am a secondary consumer. I live in the photic zone.	I live in the bathypelagic zone. I have a lure as an adaptation.
I enable marine snow to return to the photic zone, which serves as food for the primary consumer.	I am a tertiary consumer. I live in the photic zone. The open ocean is the perfect environment for me because of my size.	I am big and look scary, but really I am a secondary consumer.	I am the source of all energy in the Open Ocean. I am the “food” for the producers.

Culminating Lesson Open Ocean Bingo Card

 Galapagos Shark	 Zooplankton	 Lanternfish	 **Bacteria**
 Marine Snow	**Photic Zone**	 Phytoplankton	 Bathymetry
Aphotic Zone	 Tuna	 Kelp and Sardines	 Anglerfish
Upwelling	 Humpback Whales	 Whale Shark	 Sunlight

CULMINATING LESSON

Name: _____ Date: _____

Open Ocean Constructed Response Assessment

1. **What are the two main ocean zones found in the Open Ocean? Describe them.**

2. **Draw an Open Ocean food web in the box below.**

3. **Explain how energy flows in an Open Ocean ecosystem.**

4. **What are decomposers and how do they enable matter to cycle in an Open Ocean ecosystem?**