GEMS®

Ocean Sciences Sequence

for Grades 3–5

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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Global Explorations

With two partners:

1. Find the names of the different parts of the ocean on the globe: Pacific, Atlantic, Indian, Arctic
2. Trace a path on the globe with your finger, always staying on land. Trace a path that takes you as far from your starting point as possible.
3. Trace a path on the globe with your finger, always staying on water. Trace a path that takes you as far from your starting point as possible.

Developing New Ideas

- Can you find the exact line where the Pacific Ocean ends and the Atlantic Ocean begins?
- Can you trace a longer path on land or on water?
- What does this tell you?

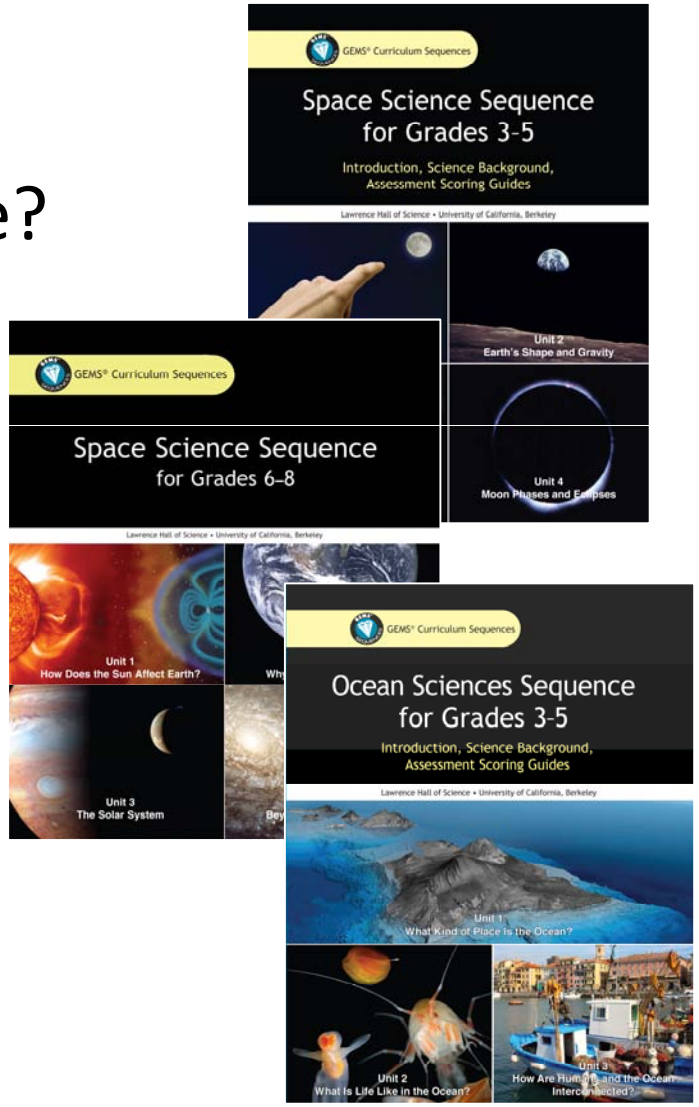
Concept Wall

There is only ONE ocean.

Classroom "Concept Wall" Builds Over Time

GEMS® Curriculum Sequences

- What is a Curriculum Sequence?
  - Focused opportunities to learn essential concepts
  - Coherent instruction
  - Hands-on activities
  - Practical length and number of sessions
  - Flexible format



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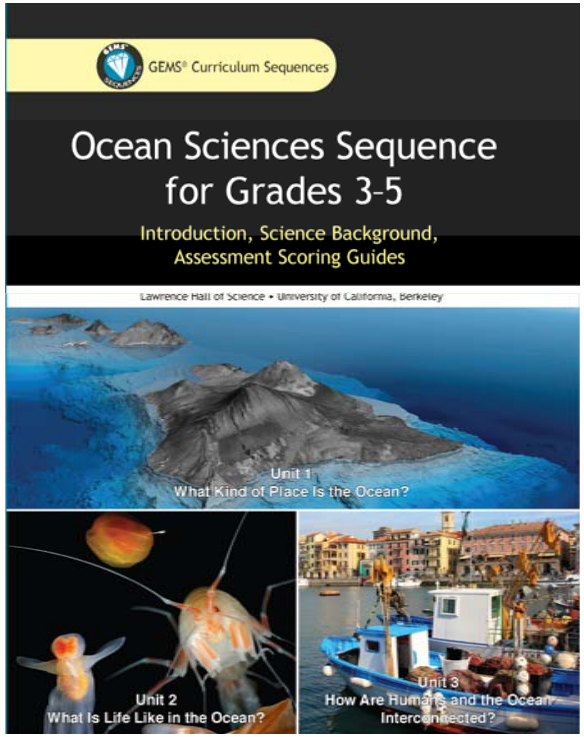
GEMS® Ocean Science Sequences



Unit 1: What Kind of Place Is the Ocean?
8 sessions

Unit 2: What Is Life Like in the Ocean?
11 Sessions

Unit 3: How Are Humans and the Ocean Interconnected?
6 sessions

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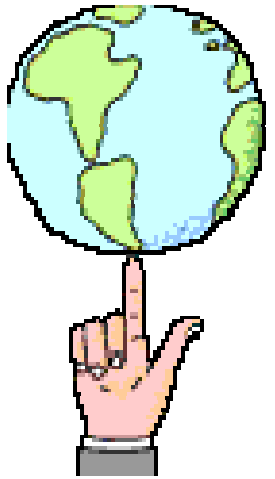
Globe Toss

With two partners:

1. Toss the globe around. Each time someone catches the globe, record if the tip of his/her right index finger is on land or water.
2. Complete a tally of the number of times for each:
   - Finger on land
   - Finger on water



Developing New Ideas

- How much of Earth is covered by water?
- Was this a fair test?
- What does this tell you?

Concept Wall

There is only ONE ocean.

Scientists use models to help understand and explain how things work

Most of the Earth (~71%) is covered by ocean.

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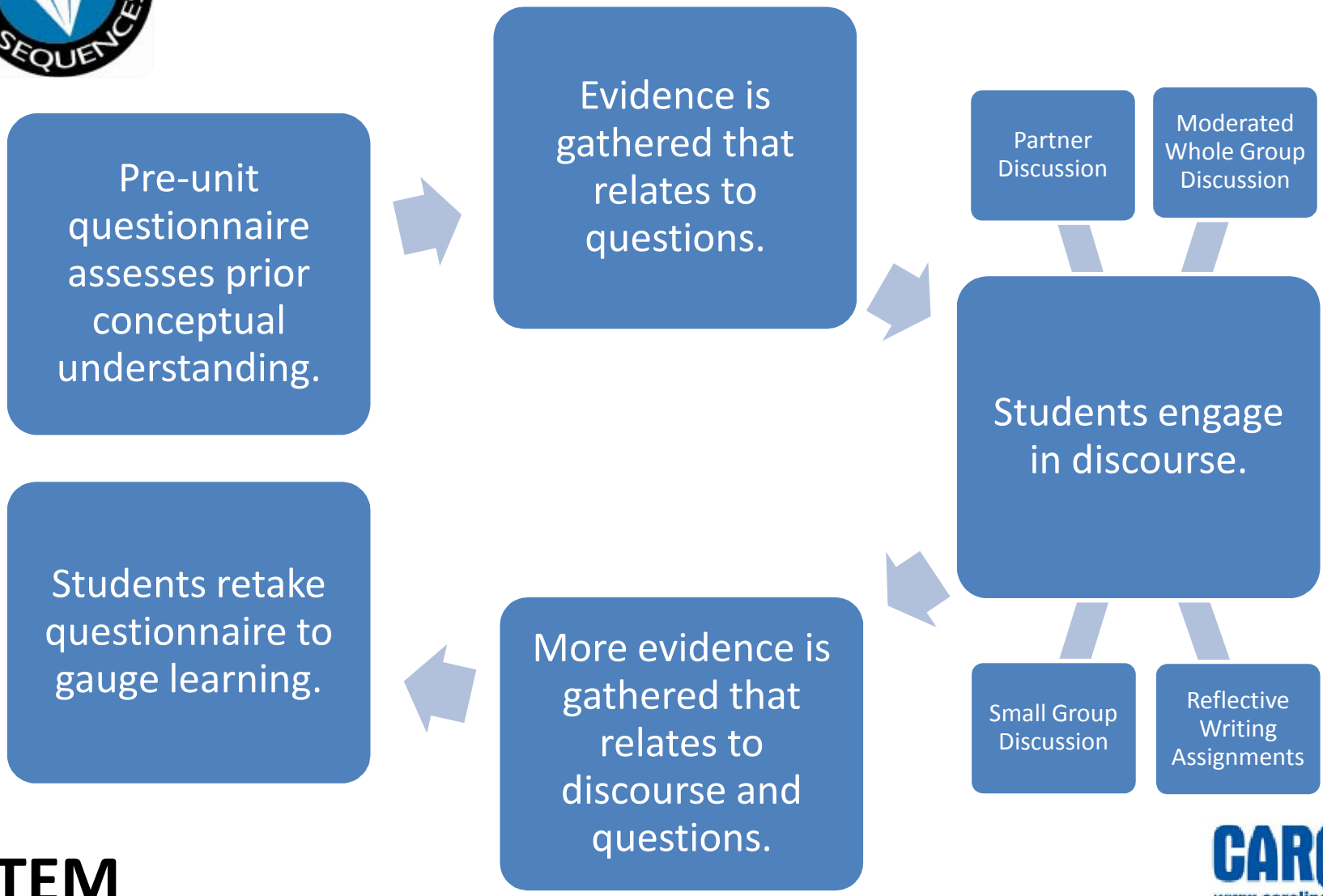
Structure of the Units



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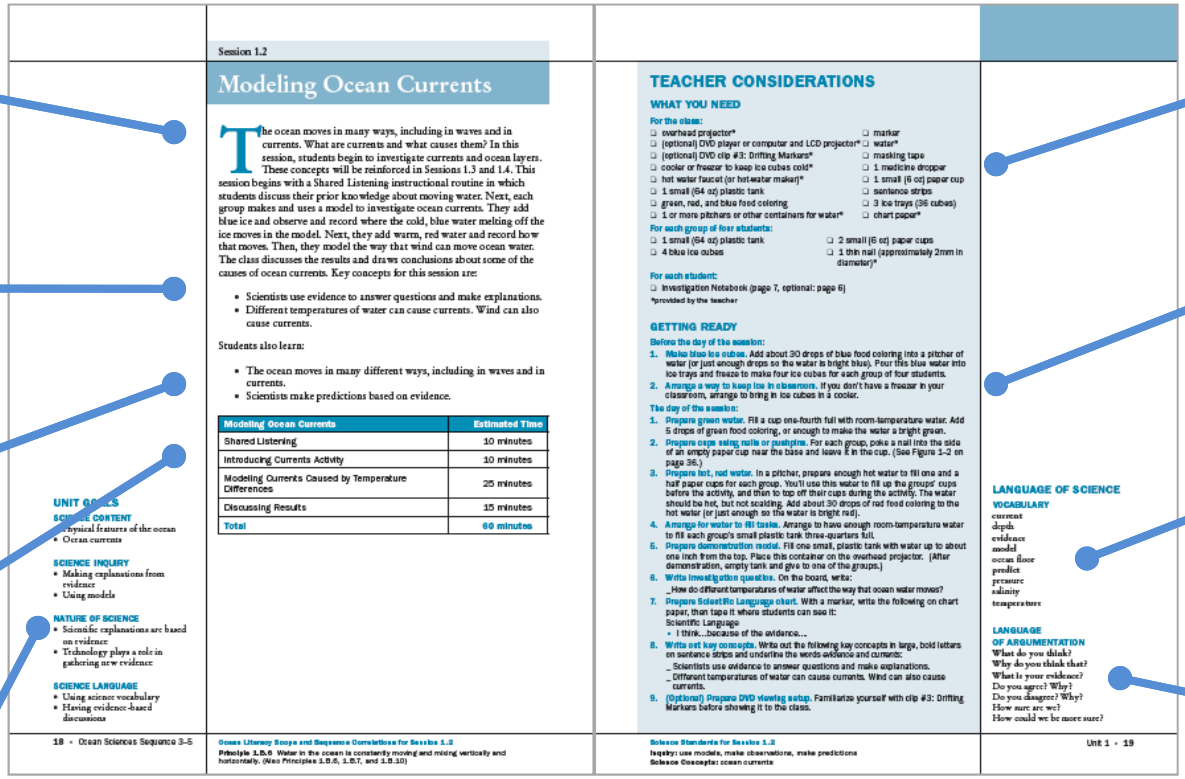
Structure of the Guide



Session 1.2

Modeling Ocean Currents

The ocean moves in many ways, including in waves and in currents. What are currents and what causes them? In this session, students begin to investigate currents and ocean layers. These concepts will be reinforced in Sessions 1.3 and 1.4. This session begins with a Shared Listening instructional routine in which students discuss their prior knowledge about moving water. Next, each group makes and uses a model to investigate ocean currents. They add blue ice and observe and record where the cold, blue water melting off the ice moves in the model. Next, they add warm, red water and record how that moves. Then, they model the way that wind can move ocean water. The class discusses the results and draws conclusions about some of the causes of ocean currents. Key concepts for this session are:

- Scientists use evidence to answer questions and make explanations.
- Different temperatures of water can cause currents. Wind can also cause currents.

Students also learn:

- The ocean moves in many different ways, including in waves and in currents.
- Scientists make predictions based on evidence.

Modeling Ocean Currents	Estimated Time
Shared Listening	10 minutes
Introducing Currents Activity	10 minutes
Modeling Currents Caused by Temperature Differences	25 minutes
Discussing Results	15 minutes
Total	60 minutes

UNIT GOALS

SCIENCE CONTENT
- Physical features of the ocean
- Ocean currents

SCIENCE INQUIRY
- Making explanations from evidence
- Using models

NATURE OF SCIENCE
- Scientific explanations are based on evidence
- Technology plays a role in gathering new evidence

SCIENCE LANGUAGE
- Using science vocabulary
- Having evidence-based discussions

18 • Ocean Sciences Sequence 3-5

Ocean Literacy Scope and Sequence Correlations for Session 1.2
Principle 1.5.6 Water in the ocean is constantly moving and mixing vertically and horizontally. (Also Principles 1.5.5, 1.5.7, and 1.5.10)

TEACHER CONSIDERATIONS

WHAT YOU NEED

For the class:
- ☐ overhead projector*
- ☐ (optional) DVD player or computer and LCD projector*
- ☐ (optional) DVD clip #3: Drifting Markers*
- ☐ cooler or freezer to keep ice cubes cold*
- ☐ hot water faucet (or hot-water maker)*
- ☐ 1 small (64 oz) plastic tank
- ☐ green, red, and blue food coloring
- ☐ 1 or more pitchers or other containers for water*
- ☐ marker
- ☐ water*
- ☐ masking tape
- ☐ 1 medicine dropper
- ☐ 1 small (6 oz) paper cup
- ☐ sentence strips
- ☐ 3 ice trays (36 cubes)
- ☐ chart paper*

For each group of four students:
- ☐ 1 small (64 oz) plastic tank
- ☐ 4 blue ice cubes
- ☐ 2 small (6 oz) paper cups
- ☐ 1 thin nail (approximately 2mm in diameter)*

For each student:
- ☐ Investigation Notebook (page 7, optional: page 6)

*provided by the teacher

GETTING READY

Before the day of the session:
1. **Make blue ice cubes.** Add about 30 drops of blue food coloring into a pitcher of water (or just enough drops so the water is bright blue). Pour this blue water into ice trays and freeze to make four ice cubes for each group of four students.
2. **Arrange a way to keep ice in classroom.** If you don't have a freezer in your classroom, arrange to bring in ice cubes in a cooler.

The day of the session:
1. **Prepare green water.** Fill a cup one-fourth full with room-temperature water. Add 5 drops of green food coloring, or enough to make the water a bright green.
2. **Prepare cups using nails or pushpins.** For each group, poke a nail into the side of an empty paper cup near the base and leave it in the cup. (See Figure 1-2 on page 36.)
3. **Prepare hot, red water.** In a pitcher, prepare enough hot water to fill one and a half paper cups for each group. You'll use this water to fill up the groups' cups before the activity, and then to top off their cups during the activity. The water should be hot, but not scalding. Add about 30 drops of red food coloring to the hot water (or just enough so the water is bright red).
4. **Arrange for water to fill tanks.** Arrange to have enough room-temperature water to fill each group's small plastic tank three-quarters full.
5. **Prepare demonstration model.** Fill one small, plastic tank with water up to about one inch from the top. Place this container on the overhead projector. (After demonstration, empty tank and give to one of the groups.)
6. **Write investigation question.** On the board, write:
   _How do different temperatures of water affect the way that ocean water moves?
7. **Prepare Scientific Language chart.** With a marker, write the following on chart paper, then tape it where students can see it:
   Scientific Language
   • I think...because of the evidence...
8. **Write out key concepts.** Write out the following key concepts in large, bold letters on sentence strips and underline the words evidence and currents:
   _ Scientists use evidence to answer questions and make explanations.
   _ Different temperatures of water can cause currents. Wind can also cause currents.
9. **(Optional) Prepare DVD viewing setup.** Familiarize yourself with clip #3: Drifting Markers before showing it to the class.

Science Standards for Session 1.2
Inquiry: use models, make observations, make predictions
Science Concepts: ocean currents

LANGUAGE OF SCIENCE

VOCABULARY
current
depth
evidence
model
ocean floor
predict
pressure
salinity
temperature

LANGUAGE OF ARGUMENTATION
What do you think?
Why do you think that?
What is your evidence?
Do you agree? Why?
Do you disagree? Why?
How sure are we?
How could we be more sure?

Unit 1 • 19

Session Overview

Key Concepts

Other Concepts

Time Frame

Unit Learning Goals

Materials Needed for the Session

Preparation

Unit Vocabulary

Discussion Prompts

Ocean Literacy Correlations

Science Standards

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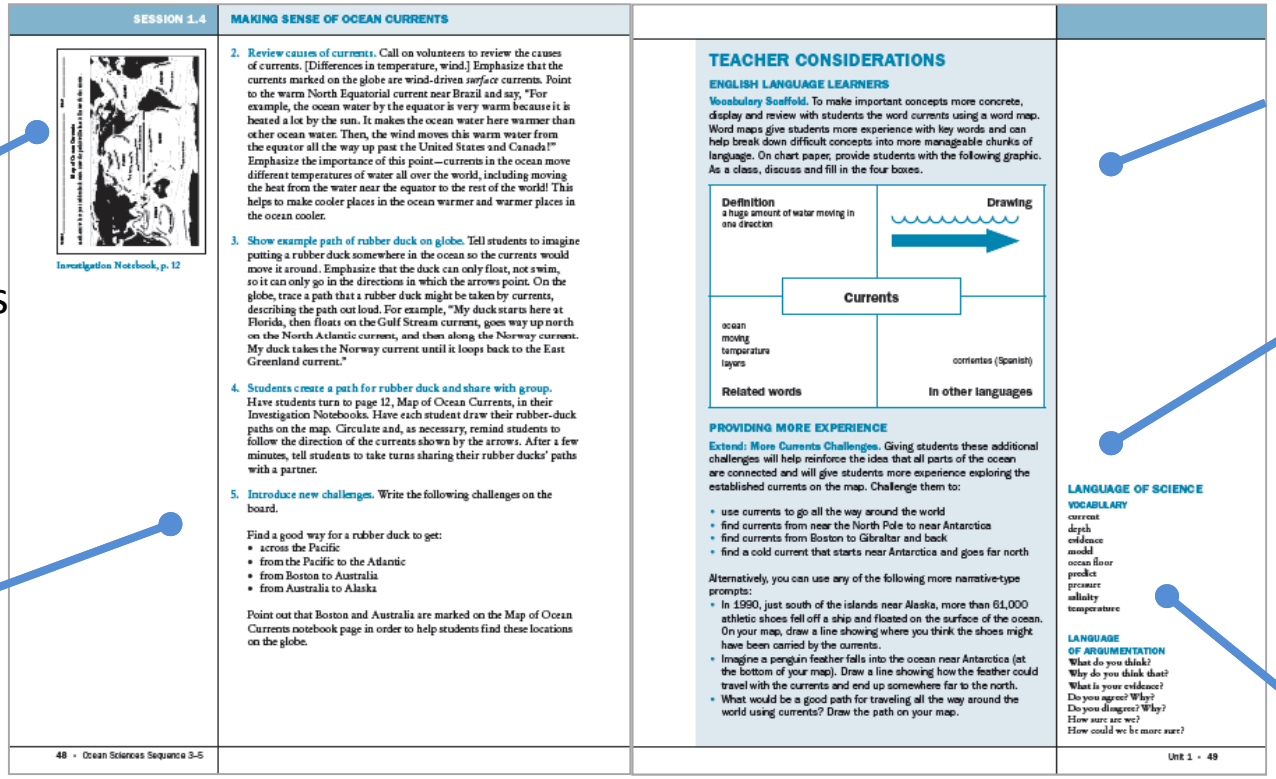
Structure of the Guide

Notebook pages, student sheets, and transparencies

Step-by-step instructions with suggested language



SESSION 1.4 MAKING SENSE OF OCEAN CURRENTS

Investigation Notebook, p. 12

2. **Review causes of currents.** Call on volunteers to review the causes of currents. [Differences in temperature, wind.] Emphasize that the currents marked on the globe are wind-driven *surface* currents. Point to the warm North Equatorial current near Brazil and say, "For example, the ocean water by the equator is very warm because it is heated a lot by the sun. It makes the ocean water here warmer than other ocean water. Then, the wind moves this warm water from the equator all the way up past the United States and Canada!" Emphasize the importance of this point—currents in the ocean move different temperatures of water all over the world, including moving the heat from the water near the equator to the rest of the world! This helps to make cooler places in the ocean warmer and warmer places in the ocean cooler.

3. **Show example path of rubber duck on globe.** Tell students to imagine putting a rubber duck somewhere in the ocean so the currents would move it around. Emphasize that the duck can only float, not swim, so it can only go in the directions in which the arrows point. On the globe, trace a path that a rubber duck might be taken by currents, describing the path out loud. For example, "My duck starts here at Florida, then floats on the Gulf Stream current, goes way up north on the North Atlantic current, and then along the Norway current. My duck takes the Norway current until it loops back to the East Greenland current."

4. **Students create a path for rubber duck and share with group.** Have students turn to page 12, Map of Ocean Currents, in their Investigation Notebooks. Have each student draw their rubber-duck paths on the map. Circulate and, as necessary, remind students to follow the direction of the currents shown by the arrows. After a few minutes, tell students to take turns sharing their rubber ducks' paths with a partner.

5. **Introduce new challenges.** Write the following challenges on the board.

Find a good way for a rubber duck to get:
- across the Pacific
- from the Pacific to the Atlantic
- from Boston to Australia
- from Australia to Alaska

Point out that Boston and Australia are marked on the Map of Ocean Currents notebook page in order to help students find these locations on the globe.

48 • Ocean Sciences Sequence 3–5

TEACHER CONSIDERATIONS

ENGLISH LANGUAGE LEARNERS

Vocabulary Scaffold. To make important concepts more concrete, display and review with students the word *currents* using a word map. Word maps give students more experience with key words and can help break down difficult concepts into more manageable chunks of language. On chart paper, provide students with the following graphic. As a class, discuss and fill in the four boxes.

Definition	Drawing
a huge amount of water moving in one direction	
Currents	
ocean moving temperature layers	corrientes (Spanish)
Related words	**In other languages**

PROVIDING MORE EXPERIENCE

Extend: More Currents Challenges. Giving students these additional challenges will help reinforce the idea that all parts of the ocean are connected and will give students more experience exploring the established currents on the map. Challenge them to:

- use currents to go all the way around the world
- find currents from near the North Pole to near Antarctica
- find currents from Boston to Gibraltar and back
- find a cold current that starts near Antarctica and goes far north

Alternatively, you can use any of the following more narrative-type prompts:

- In 1990, just south of the islands near Alaska, more than 61,000 athletic shoes fell off a ship and floated on the surface of the ocean. On your map, draw a line showing where you think the shoes might have been carried by the currents.
- Imagine a penguin feather falls into the ocean near Antarctica (at the bottom of your map). Draw a line showing how the feather could travel with the currents and end up somewhere far to the north.
- What would be a good path for traveling all the way around the world using currents? Draw the path on your map.

LANGUAGE OF SCIENCE

VOCABULARY

current
depth
evidence
model
ocean floor
predict
pressure
salinity
temperature

LANGUAGE OF ARGUMENTATION

What do you think?
Why do you think that?
What is your evidence?
Do you agree? Why?
Do you disagree? Why?
How sure are we?
How could we be more sure?

Unit 1 • 49

Support for ELL and differentiation

Optional additional activities

Bolded content related to session

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Overview of Curriculum

Unit 1

- Physical Features of the Ocean
- Ocean Currents

Unit 2

- Habitats
- Adaptations
- Food Webs

Unit 3

- Human Impact on the Ocean
- Protecting Ocean Resources

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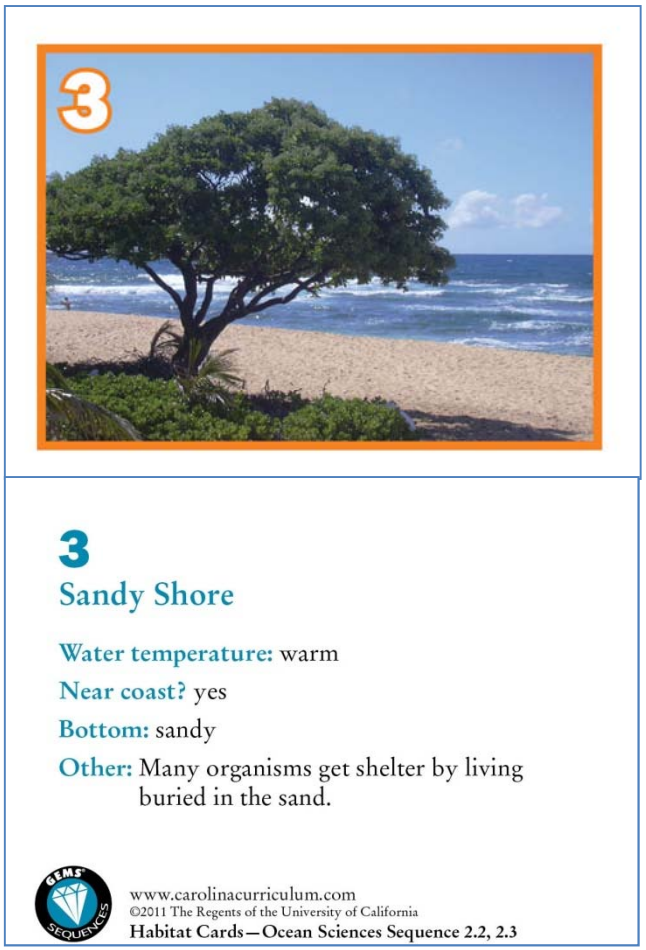
Comparing Habitats

With your partners, sort the habitat cards by one of the following:

- Warm, medium, or cold
- Close to land or far from land
- Murky, greenish water, or clear water



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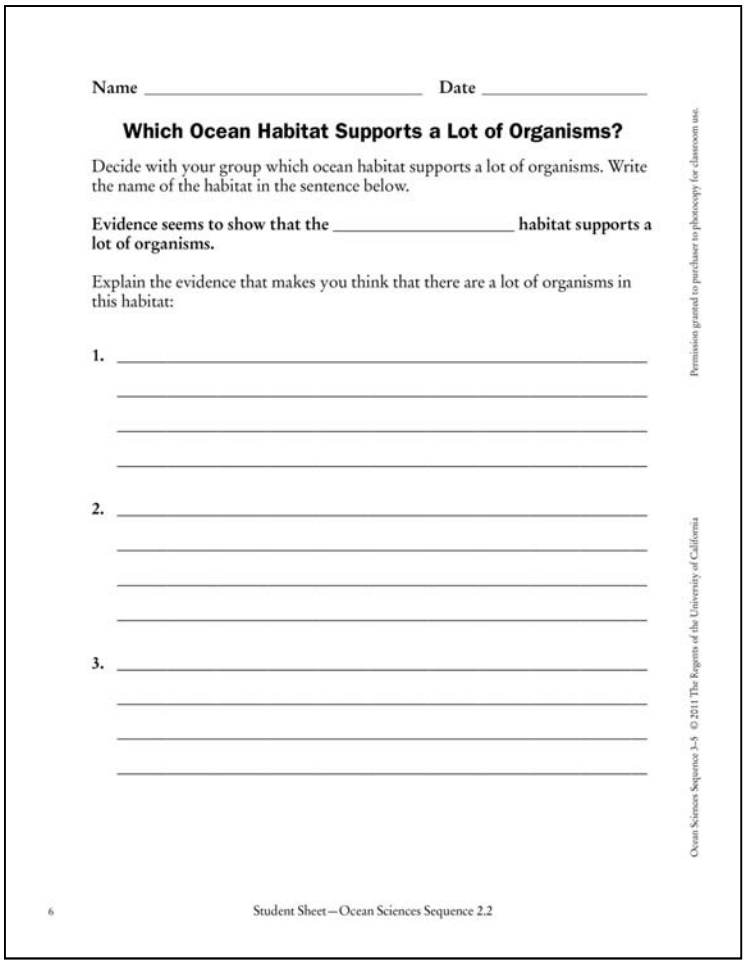
Comparing Habitats

- Choose one habitat you believe lots of organisms will live in.
- Complete the sheet for that habitat.
- Use scientific language such as:
  - I think … because …
  - It's possible that …
  - Some evidence seems to show …



Name _____ Date _____

Which Ocean Habitat Supports a Lot of Organisms?

Decide with your group which ocean habitat supports a lot of organisms. Write the name of the habitat in the sentence below.

Evidence seems to show that the _____ habitat supports a lot of organisms.

Explain the evidence that makes you think that there are a lot of organisms in this habitat:

1. _____
2. _____
3. _____

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Developing New Ideas

- How were the habitats alike and different?
- Do different organisms live in different habitats?
- What does this tell you?

Concept Wall

There is only ONE ocean.

Scientists use models to help understand and explain how things work.

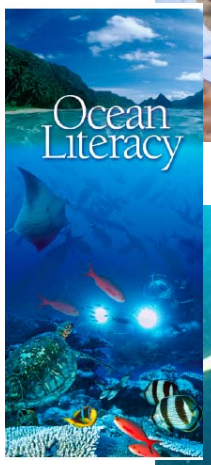
Most of the Earth (~71%) is covered by ocean.

Ocean habitats are different from one another in many ways.

Some ocean habitats support more organisms that other ocean habitats.

How Was Essential Content for Sequence Determined?

- **Standards**
  - Ocean Literacy Scope & Sequence (www.oceanliteracy.net)
  - NSES, AAA Benchmarks, State Standards
  - Secondary standards analyses (TERC Study)
- **Scientists**
  - What's right on? What's wrong? What's missing?
  - What's too important to leave out?
- **Educators**
  - Developmental concerns
  - Commonly misunderstood ideas
  - Well covered in other materials
  - Lends itself to teaching about human impact



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Ocean Sciences Sequence Grades 3-5 Kit

- Teacher's Guide
- Bonus DVD
- Hands-on materials
- Designed for classes of up to 32 students

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Other GEMS® Sequences

- Space Science for Grades 3-5
- Space Science for Grades 6-8

- Coming in 2012:
  Ocean Sciences for Grades 6-8

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The Ocean

Without it … did you know that the surface of our planet would be too hot during the day and too cold at night for most organisms to exist?

Visit the Carolina booth to explore the unit in more detail

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