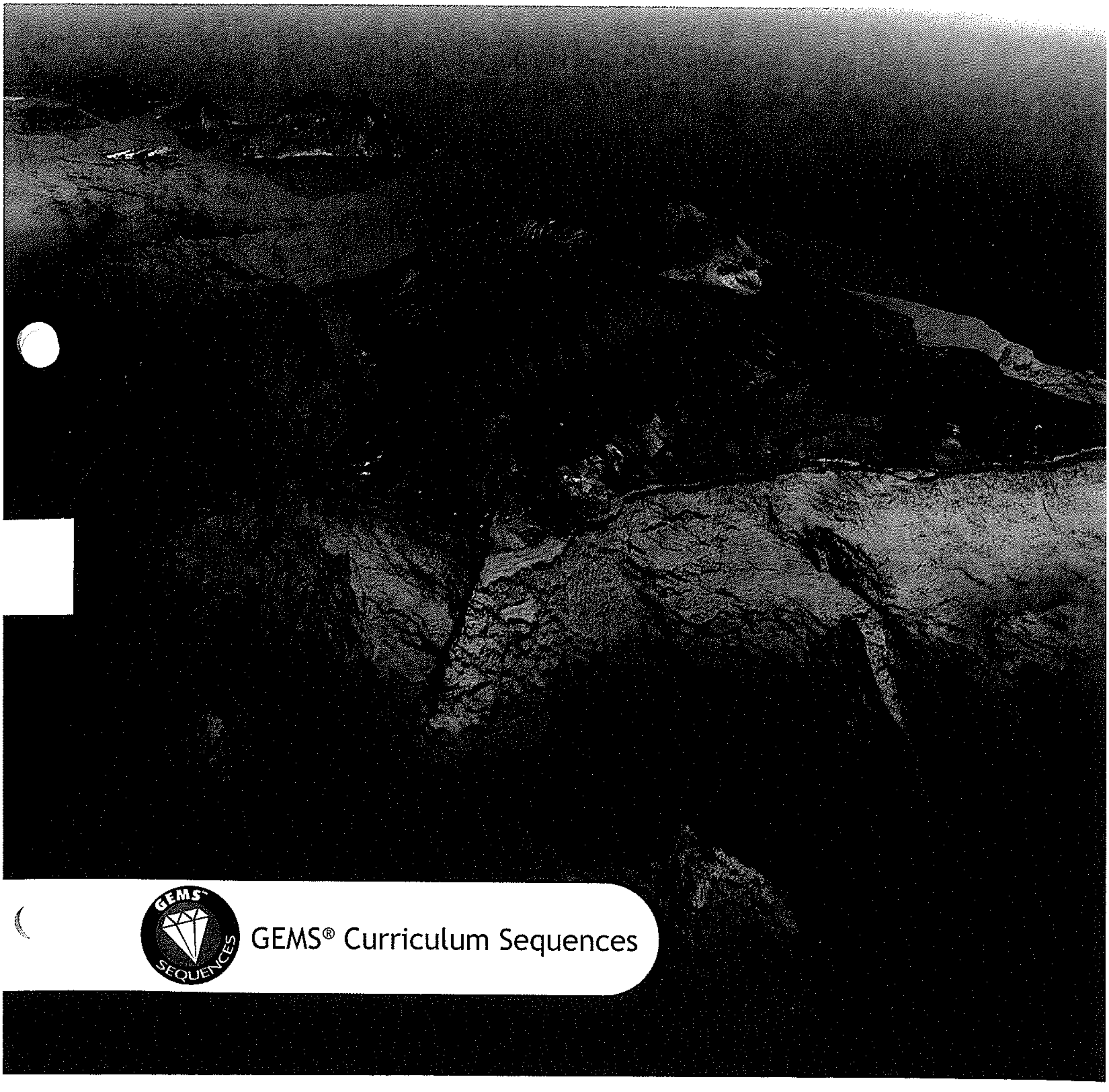
Unit 1
What Kind of Place Is the Ocean?



GEMS® Curriculum Sequences

National Oceanic and Atmospheric Administration
Funding for the GEMS® *Ocean Sciences Sequence* was provided by the NOAA Environmental Literacy Grant Program

Great Explorations in Math and Science (GEMS) is an ongoing curriculum development program and growing professional development network. There are more than 70 teacher's guides and handbooks in the GEMS Series, with materials kits available from Carolina Biological. GEMS is a program of the Lawrence Hall of Science, the public science education center of the University of California at Berkeley.

Marine Activities, Resources & Education (MARE), a program of the Lawrence Hall of Science, is a whole-school interdisciplinary ocean science immersion program. MARE has provided professional development for teachers, curricular materials, and resources for families for 20 years. It is the longest running elementary and middle school marine science program in the country.

Lawrence Hall of Science
University of California, Berkeley, CA 94720-5200.
Director: Elizabeth K. Stage

GEMS Director: Jacqueline Barber
MARE Director: Craig Strang
Project Directors: Catherine Halversen (Co-Director, MARE), Craig Strang, Jacqueline Barber, and Janice McDonnell (Institute of Marine and Coastal Sciences, Rutgers University)
Curriculum Development Team: Catherine Halversen, Kevin Beals, Emily Weiss, Jonathan Curley, Josiah Baker, Craig Strang, Jacqueline Barber; Sarah Pedemonte, Emily Griffen, and Noelle Apostol
Assessment Development: Seth Corrigan, Lauren Brodsky; Lynn Barakos, Kristin Nagy Catz
Science Advisors: Dr. Scott Glenn and Dr. Josh Kohut (Institute of Marine and Coastal Sciences, Rutgers University), Dr. John Manderson (National Marine Fisheries Service), Dr. David Mountain (NOAA/National Marine Fisheries Service [retired]), Dr. Drew Talley (National Estuarine Research Reserve, San Francisco/Elkhorn Slough and University of San Diego), and Dr. Ann Ball (NOAA Coastal Services Center)
Technology Development: Ivar Babb and Michael McKee (National Undersea Research Center, University of Connecticut), Sage Lichtenwalner and Janice McDonnell (Institute of Marine and Coastal Sciences, Rutgers University), Steven Dunphy (Lawrence Hall of Science)
NOAA Program Officer: Sarah Schoedinger
Editors: Lincoln Bergman, Trudihope Schlomowitz
Production Managers: Trudihope Schlomowitz, Steven Dunphy
Internal Design: Chris Patrick Morgan
Illustrations: Lisa Haderlie Baker, Lisa Klofkorn, Chris Patrick Morgan

This curriculum and DVD were prepared by the University of California at Berkeley, under award NA07SEC4690003 from the National Oceanic and Atmospheric Administration (NOAA), U. S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration (NOAA) or the U. S. Department of Commerce.

This book is part of the GEMS *Ocean Sciences Sequence for Grades 3–5*.
The sequence is printed in four volumes with the following titles:
Introduction, Science Background, Assessment Scoring Guides: ISBN 978-1-4350-0737-6
Unit 1: What Kind of Place Is the Ocean? ISBN 978-1-4350-0738-3
Unit 2: What Is Life Like in the Ocean? ISBN 978-1-4350-0739-0
Unit 3: How Are Humans and the Ocean Interconnected? ISBN 978-1-4350-0740-6
Complete four-volume set of the GEMS *Ocean Sciences Sequence for Grades 3–5*: ISBN 978-1-4350-0736-9

Published by Carolina Biological Supply Company. 2700 York Road, Burlington, NC 27215.
Call toll free: 1-800-334-5551.
www.carolinacurriculum.com/GEMS/

1 2 3 4 5 6 7 8 9 10 14 13 12 11 10

Making Sense of Ocean Currents

Students spend this session making sense of what they've learned about ocean currents and using evidence from what they've learned to make predictions about water in the ocean. First, the class views a DVD simulation of how currents move in the ocean. Next, students explore surface ocean currents marked on the globes, identifying routes where rubber ducks could travel while floating in ocean currents. The class works together to make a prediction about what might happen to warm freshwater as it moves from the Columbia River to the Pacific. Then, each group of students chooses one of three similar scenarios, and each pair within the groups makes a prediction about what will happen when two different kinds of water meet in the ocean. Students can draw on evidence from the models used in class, the DVD simulation, and the Mystery of Freshwater in the Ocean (from Session 1.3). The two pairs within each group share their predictions with one another and notice differences between their predictions. The key concept for this session is:

- Scientists need to be ready to change their ideas, predictions, and explanations based on new evidence.

Students also learn:

- Currents are forced to turn and flow around continents and around and over features in the ocean.
- Currents can occur at the surface or deep in the ocean.
- Ocean currents flow in predictable ways.
- Different scientists investigating the same question may emphasize different evidence, but they try to use all the evidence available to make predictions and explanations.
- Scientists may disagree with one another, but they do so in a respectful way, using evidence to support their ideas.

Making Sense of Ocean Currents	Estimated Time
Viewing DVD: Ocean Currents Model	10 minutes
Exploring Currents on the Globe	10 minutes
Making Predictions as a Class About Ocean Water	10 minutes
Making Predictions in Pairs About Ocean Water	15 minutes
Sharing Predictions	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

Ocean Literacy Scope and Sequence Correlations for Session 1.4
Principle 1.B.7 Wind- and density-driven currents move ocean water around Earth. (Also Principles 1, 1.B.6, 1.C.5, and 3.A.3)

TEACHER CONSIDERATIONS

WHAT YOU NEED

For the class:

- ❑ overhead projector or computer and LCD projector*
- ❑ DVD player*
- ❑ DVD clip #4: Ocean Currents Model
- ❑ Copymaster Packet
- ❑ transparencies (#1–4 through #1–7)
- ❑ Scientific Language chart (from Session 1.2)*
- ❑ sentence strips
- ❑ marker
- ❑ overhead marker, black*
- ❑ masking tape

For each group of four students:

- ❑ 1 inflated globe (from Session 1.1; keep inflated for Session 1.5)

For each student:

- ❑ Investigation Notebook (pages 2, 7, 9–10, 12; optional: page 11)

*provided by the teacher

GETTING READY

1. **Arrange for the appropriate projector format.** Use a computer with a large-screen monitor, an LCD projector, or an overhead projector to display images to the class.
2. **Prepare DVD viewing setup.** If you don't have a computer on which to play the DVD, bring in a DVD player and monitor. The DVD segments are organized by unit and session. Spend a few minutes familiarizing yourself with how to navigate the DVD.
3. **Add to Scientific Language chart.** Add the following sentence starters to the chart:
   - I agree because....
   - I disagree because....
   - You convinced me because....
   - Could you explain more about why you think...?
4. **Prepare student sheets.** Make about 10 copies of each of the following pages from the Copymaster Packet (These are the same as Transparencies 1–5 through 1–7. See #5 below.):
   - _ Alaska Iceberg Scenario
   - _ Gibraltar Scenario
   - _ Currents by Boston Scenario

   Each group will use two copies of one of the scenarios. Groups that finish early may complete a second scenario.
5. **(Optional) Make transparencies.** If you will be projecting transparencies using an overhead projector rather than projecting from a computer, make transparencies of the following pages from the Copymaster Packet:
   - _ Columbia River Scenario (Transparency 1–4)
   - _ Alaska Iceberg Scenario (Transparency 1–5)
   - _ Gibraltar Scenario (Transparency 1–6)
   - _ Currents by Boston Scenario (Transparency 1–7)
6. **Prepare key concept.** Write out the following key concept for this activity in large, bold letters on sentence strips and underline the word *predictions*:
   - _ Scientists need to be ready to change their ideas, predictions, and explanations based on new evidence.

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?

Science Standards for Session 1.4
Inquiry: make predictions, make explanations from evidence, visualize
Science Concepts: ocean currents, characteristics of ocean water

Viewing DVD: Ocean Currents Model

1. **Introduce DVD model.** Tell students that they will watch a short DVD clip that shows the movement of currents in the ocean. Say that scientists used a lot of evidence from measurements of currents to make this model. The clip was made with computers. It shows things that you wouldn't see observing the real ocean, such as:

   - arrows showing the direction of currents
   - the shape of the bottom of the ocean without the miles of ocean water blocking your view
   - how the features of the ocean floor influence current patterns
   - currents moving *much* faster than they do in the real ocean

2. **Give instructions.** As students watch the DVD, they should try to observe at least two things about currents that the model shows, including:

   - something they already knew about currents
   - something new that they didn't know about currents before watching the DVD

3. **View DVD.** Play DVD clip #4: Ocean Currents Model.

4. **Shared Listening.** Remind students of the Shared Listening routine they did in Session 1.2 and have them form pairs. Have one student in each pair be Partner #1, and the other student be Partner #2.

   a. First question. Ask, **"What are some new things about currents that you learned from the model?" "Did anything surprise you?"** [Currents flow around land. Currents go all over the ocean. Scientists make DVD models of currents.] Have Partner #1s tell their answers to Partner #2s, and have Partner #2s repeat back what they heard. Then, call on a few Partner #2s to share their partners' responses.

   b. Second question. Have partners switch roles to answer the following question. Ask, **"What happened when currents ran into features such as ridges or islands?"** [Sometimes, the currents went around the ocean-floor feature. Sometimes, the current was pushed up over the feature. Sometimes, the feature changed the direction of the current.] After Partner #2s have shared their responses, call on a few Partner #1s to share with the class.

Exploring Currents on the Globe

1. **Introduce currents on globe.** Tell students that scientists have gathered evidence to map many currents in the ocean, including the largest currents. Hold up a globe and point out the blue and red arrows showing currents. Explain that these are the directions in which water flows on the surface of the ocean. The red arrows show warm currents, and the blue arrows show cold currents.

TEACHER CONSIDERATIONS

DAILY WRITTEN REFLECTION

Why do scientists use models to learn about the ocean? This prompt, on page 11 of the Investigation Notebook, invites students to summarize some of what they've learned about models. Students might point out that models make something big and complicated (such as the ocean) easier to study and understand. They may point out that using a model allows scientists to focus on just one aspect of the ocean (such as layers in the water). Encourage students to refer to the models they've used: the globe, the currents model, and the layers model.

SCIENCE NOTES

About the Ocean Currents Model. The Ocean Currents Model animation on the DVD shows a portion of the ocean's currents that are driven by differences in water temperature and salinity (thermohaline circulation). The clip focuses on the North Atlantic and the areas around Greenland, Iceland, and the North Sea. This is one of the major regions where surface water becomes cold enough and salty enough to sink to the ocean depths. This sinking of dense water forces the deeper water to move horizontally until it hits features on the ocean floor and is forced to rise back toward the surface and close the current loop. The surface ocean current brings water to this region from the South Atlantic via the Gulf Stream, and the water returns to the South Atlantic via the North Atlantic Deep Water current. The depths of the different parts of the ocean are highly exaggerated to better illustrate the differences between the surface flows and deep-water flows. The speed of the current is also exaggerated. The flows shown in this model are based on recent theories that have not been conclusively tested.

INSTRUCTIONAL ROUTINE

Shared Listening. This is the second time that students have used this routine, so they may remember the procedure. However, they might still need quite a bit of guidance. Using the Shared Listening routine here allows all students to discuss what they observed in the DVD currents model. The routine is especially helpful for English language learners because it provides them with an opportunity to rehearse language and to learn from their partner's language use. It also gives students a chance to check their understanding with their partners.

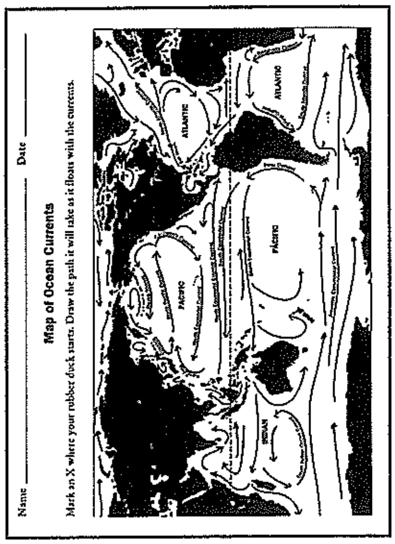
LANGUAGE OF SCIENCE

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?



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.

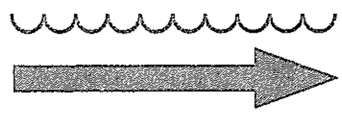
TEACHER CONSIDERATIONS

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
a huge amount of water moving in one direction

Drawing



Currents

ocean
moving
temperature
layers

Related words

corrientes (Spanish)

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

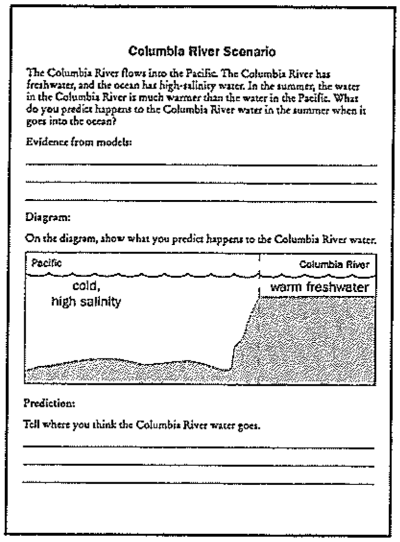
Alternatively, you can use any of the following more narrative-type prompts:

- 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?



Columbia River Scenario

The Columbia River flows into the Pacific. The Columbia River has freshwater, and the ocean has high-salinity water. In the summer, the water in the Columbia River is much warmer than the water in the Pacific. What do you predict happens to the Columbia River water in the summer when it goes into the ocean?

Evidence from models:

Diagram:

On the diagram, show what you predict happens to the Columbia River water.

Prediction:

Tell where you think the Columbia River water goes.

Transparency 1–4

6. **Students trace other paths on globe.** Pass out a globe to each group of students. Have each group member choose one challenge from the list on the board and trace it on the globe, showing it to the other members of her group. More than one student in a group can choose the same challenge.

7. **Summarize.** Conclude by emphasizing that there are predictable currents in the ocean, and that these currents move water, heat, and even animals around Earth's one, connected ocean. Have groups set the globes aside.

Making Predictions as a Class About Ocean Water

1. **Pose question.** Have students locate the Columbia River on the Map of Ocean Currents. Project Transparency 1–4, Columbia River Scenario, and read the top section aloud: **"The Columbia River flows into the Pacific. The Columbia River has freshwater, and the ocean has high-salinity water. In the summer, the water in the Columbia River is much warmer than the water in the Pacific. What do you predict happens to the Columbia River water in the summer when it goes into the ocean?"**

2. **Groups discuss evidence from models.** Tell students that evidence from models the class has used can help them answer this question. Ask, **"Will the river water form a layer, or will it mix completely with the Pacific water?" "Will it go above, below, or in the middle?"** Have pairs or groups discuss evidence from the models and what they think will happen to the river water. Encourage students to refer to pages 7 and 9–10 in their Investigation Notebooks to find evidence.

3. **Share and record evidence.** Call on students to share their ideas and to explain evidence that supports their ideas. When a student refers to evidence from a model, list this evidence on the transparency in the spaces labeled "Evidence from Models." [Warm water formed a current in models; warm water went on top of colder water in models; high-salinity water went below freshwater in model.] The whole class does not have to agree on one prediction.

4. **Draw a prediction for how deep the water will go.** Let the class know that it's okay for them to have different ideas about what will happen to the water. Point out the diagram on the transparency and be sure students understand that it is a cross-section of the ocean—it shows ocean water from the surface to deep down. On the diagram, draw a representation of one or two student ideas about what will happen.

TEACHER CONSIDERATIONS

INSTRUCTIONAL RATIONALE

Importance of Making These Predictions. The predictions that pairs make in this session give students the opportunity to apply what they've learned about layers of ocean water to real ocean contexts. This activity is also an important chance for students to practice using evidence to answer a question. They should be reflecting on what they observed in earlier activities, using key science words, and trying to convince one another by using evidence. This process is much more important than the answers that students arrive at. In reality, these scenarios are quite complicated and involve many more factors than those that students have learned about. Another benefit of these scenarios is that they reinforce the idea that ocean water is different in different places.

Why Make Predictions as a Class? Starting by making predictions as a class will model for students what you expect them to do when they work in pairs. Emphasize that groups are backing up their ideas with evidence, and that the evidence is drawn from a few different sources. The whole class might come to agreement about one prediction. However, this is unnecessary because the focus of this activity is on understanding the evidence gathered from the model. Scientists often disagree at this early stage of an investigation.

SCIENCE NOTES

About Columbia River Scenario. The Columbia River empties into the Pacific at the border between Oregon and Washington. Water from the Columbia is freshwater. In the summer, water from the Columbia is warmer (almost 70°F) than water in the Pacific (about 50°F). In the winter, the river is colder (about 40°F) than the ocean (still about 50°F). Students should conclude that in the summer, the Columbia River water will form a layer on top of the ocean water.

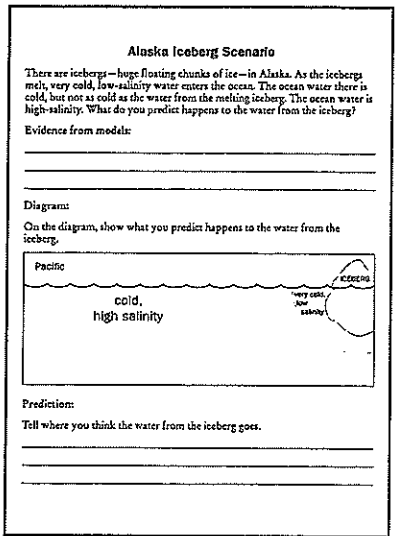
LANGUAGE OF SCIENCE

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?


Alaska Iceberg Scenario

There are icebergs—huge floating chunks of ice—in Alaska. As the icebergs melt, very cold, low-salinity water enters the ocean. The ocean water there is cold, but not as cold as the water from the melting iceberg. The ocean water is high-salinity. What do you predict happens to the water from the iceberg?

Evidence from models:

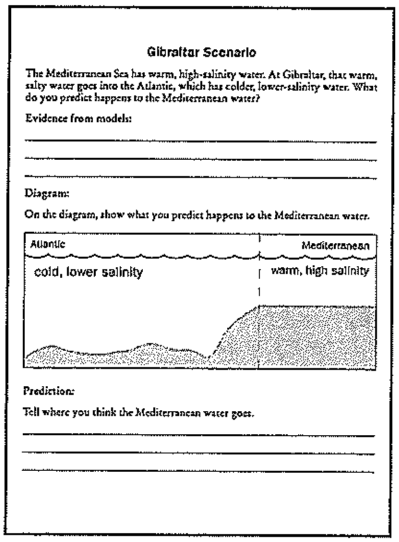
Diagram:

On the diagram, show what you predict happens to the water from the iceberg.

Prediction:

Tell where you think the water from the iceberg goes.

Transparency 1–5 and Student Sheet


Gibraltar Scenario

The Mediterranean Sea has warm, high-salinity water. At Gibraltar, that warm, salty water goes into the Atlantic, which has colder, lower-salinity water. What do you predict happens to the Mediterranean water?

Evidence from models:

Diagram:

On the diagram, show what you predict happens to the Mediterranean water.

Prediction:

Tell where you think the Mediterranean water goes.

Transparency 1–6 and Student Sheet

5. **Write a prediction about where the water will go.** Help the class agree on how to write one prediction for where the river water will go. In the space provided on the transparency, write a sentence about this. For example: "The Columbia River water will form a layer on top of the Pacific water, and it will flow away from the coast."

Making Predictions in Pairs About Ocean Water

1. **Introduce activity.** Tell students that they will now work with a partner to make a similar prediction about a different scenario.

2. **Discuss sources of evidence.** Explain that students will be able to list evidence from the currents model they made with their group, the layers model the class made, and the Mystery of Freshwater in the Ocean. They might also be able to use evidence from the DVD model of ocean currents.

3. **Introduce the scenarios.** Tell students that they can choose from three different scenarios. Each group of four students will need to quickly agree on which scenario to choose. They will then work in pairs within their groups to make their predictions.

   a. **Water from an iceberg in Alaska.** Project Transparency 1–5, Alaska Iceberg Scenario, and read aloud the question. Point out that the Map of Ocean Currents in their notebooks has Alaska marked on it to help students understand where this is in the world.
   b. **Water from the Mediterranean Sea.** Project Transparency 1–6, Gibraltar Scenario, and read the question aloud. The Map of Ocean Currents also has Gibraltar marked on it.
   c. **Water in currents by Boston.** Project Transparency 1–7, Currents by Boston Scenario, and read aloud the question. The Map of Ocean Currents also has Boston marked on it.

4. **Each group chooses a scenario.** Pass each group two copies of the student sheet for the scenario they choose (one copy for each pair).

5. **Each pair makes a prediction.** Give pairs about 7–8 minutes to make their predictions, reminding them to:

   - list their evidence from models
   - draw on the diagram to show their prediction of what will happen to the water
   - write their prediction about where the water will go

   Circulate and assist as necessary.

TEACHER CONSIDERATIONS

INSTRUCTIONAL SUGGESTIONS

Discussion-Leading Tip. As students share ideas and evidence, there is a balance to be struck between encouraging them to speak like scientists and validating their own styles of speech and conversation. On the one hand, teaching students to use the language of science is an important learning goal and will help students succeed academically. To this end, you should encourage them to cite their evidence and to use unit vocabulary and sentence starters from the Scientific Language chart. On the other hand, many students' cultures have specific ways of speaking and conversing that may appear quite different from scientific talk. Research shows the importance of students' feeling that their cultures and ways of speaking are valued in the classroom. As you encourage students to discuss like scientists, also try to leave room for students to draw upon their own cultural ways of speaking.

SCIENCE NOTES

About Alaska Iceberg Scenario. As icebergs (and glaciers) near Alaska melt, very cold freshwater enters the slightly warmer high-salinity water of the Pacific. Students should conclude that the cold freshwater will likely form a separate layer from the rest of the ocean water. They may disagree about whether the iceberg water will go below the surface ocean water because of temperature or on top of the water because of salinity.

About Gibraltar Scenario. The Mediterranean is located in a warm area and is relatively shallow compared with other parts of the ocean. (Its average depth is about 1,500 meters, while the average depth of the Atlantic is about 3,300 meters.) These factors mean that the temperature of the water in the Mediterranean is warmer than water in nearby parts of the Atlantic. The warm Mediterranean water evaporates relatively quickly, and there is little precipitation in the area, so the water has high salinity. The warm, high-salinity water from the Mediterranean joins the colder, lower-salinity water of the Atlantic near Gibraltar. This Mediterranean water remains as a distinct layer below the surface in the Atlantic, thousands of miles away from Gibraltar.

About Currents by Boston Scenario. The cold Labrador current moves south along the coast of the northeastern United States. The warm Gulf Stream current moves in the opposite direction. Students should conclude that when these currents meet, the warm water is likely to form a layer above the cold water.

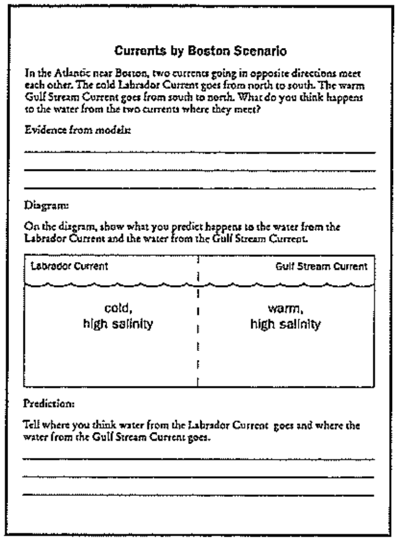
LANGUAGE OF SCIENCE

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?



Currents by Boston Scenario

In the Atlantic near Boston, two currents going in opposite directions meet each other. The cold Labrador Current goes from north to south. The warm Gulf Stream Current goes from south to north. What do you think happens to the water from the two currents where they meet?

Evidence from models:

Diagram:

On the diagram, show what you predict happens to the water from the Labrador Current and the water from the Gulf Stream Current.

Prediction:

Tell where you think water from the Labrador Current goes and where the water from the Gulf Stream Current goes.

Transparency 1–7 and Student Sheet

Sharing Predictions

1. **Discuss sharing predictions.** Get students' attention and tell them that the two pairs in each group will now share their predictions with each other. Say, **"Sharing ideas helps scientists think about more evidence. Additional evidence might make them change their ideas or might give them more reason to be confident in the ideas they had."**

2. **Add key concept.** Hold up the key concept, read it aloud, then post it on the concept wall.

> KEY CONCEPT
>
> **Scientists need to be ready to change their ideas, predictions, and explanations based on new evidence.**

Point out the important science word *predictions* that you underlined.

3. **Present scientific language.** Point out the Scientific Language chart you prepared before class and say that these are sentence starters that can help students speak like scientists as they respond to one another's ideas. Call on volunteers to read each sentence starter aloud.

> **Scientific Language**
>
> I think...because of the evidence....
> I agree because....
> I disagree because....
> You convinced me because....
> Could you explain more about why you think...?

4. **Give instructions.** Each pair will take a turn presenting their prediction to the other pair in their group. Students should listen carefully for differences between their predictions. Say, **"If you make different predictions, discuss why."** After each pair shares, students should use sentence starters from the Scientific Language chart to comment on one another's predictions.

5. **Pairs share and discuss predictions.** Give students 7–8 minutes to share and discuss their predictions in their groups. Circulate and encourage use of evidence. Ask, **"Did you use different evidence?" "What was it?" "If you made similar predictions, what are some differences in the evidence you used?"**

TEACHER CONSIDERATIONS

ASSESSMENT

Critical Juncture: Predictions About Ocean Water. Monitoring students' recorded predictions can help you assess their understanding of layers in ocean water. It can also allow you to assess their ability to use evidence. Check that students' predictions demonstrate an understanding that ocean water moves in predictable currents, and that differences in temperature or salinity can cause those currents. Notice whether students predict that the ocean water will form distinct layers rather than immediately mixing homogeneously. To assess students' use of evidence, check whether the evidence cited is relevant to their predictions.

PROVIDING MORE EXPERIENCE

Reinforce: Currents and Layers. For students still having trouble with ideas about ocean currents and/or layers in ocean water, a review may be helpful. Meet with these students and make a three-column chart with the headings "What We Did," "What We Observed," and "What We Learned." Have students help you complete the chart. In the first column, list activities the class has done related to currents and layers (e.g., put cold, blue water into room-temperature water); in the second column, list what students observed (e.g., blue water moved down and across bottom of container); in the last column, list the important idea related to this activity (e.g., different temperatures of water make currents).

Reinforce: Evidence. For students struggling to use evidence, ask them to imagine that they have no idea what month it is. Have them look around the room and out the windows for evidence that would help them figure out what month it is. Lead a discussion, helping students identify as many pieces of evidence as they can (calendars, seasonal decorations, weather, vegetation outside, etc.).

Extend: Early Finishers. If a pair finishes early, first have them consider if there is any additional evidence—from a class model, from the DVD, from *Mystery of Freshwater in the Ocean*—that they can add to their prediction. After that, early finishers can begin working on one of the other two scenarios.

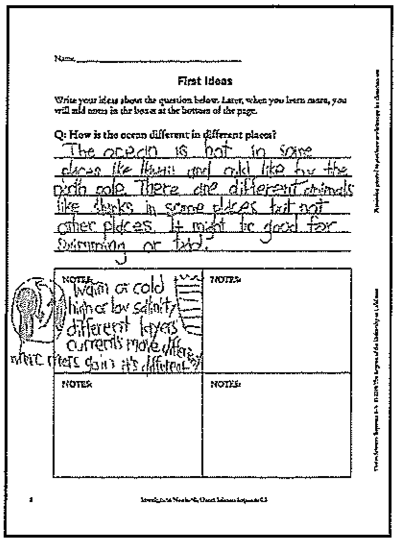
LANGUAGE OF SCIENCE

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?


Name

First Ideas

Write your ideas about the question below. Later, when you learn more, you will add notes in the boxes at the bottom of the page.

Q: How is the ocean different in different places?

The ocean is hot in some places like Hawaii and cold like by the north pole. There are different animals like sharks in some places but not other places. It might be good for swimming or bad.

NOTES: warm or cold / high or low salinity / different layers / currents move differently / where it's going it's different

NOTES:

NOTES:

NOTES:

Investigation Notebook, p. 2
with sample student work

6. **Introduce adding to First Ideas.** Have students turn back to page 2, First Ideas, in their Investigation Notebooks where they wrote in Session 1.1. Review the question, point out the spaces for adding notes below, and say, **"Today you'll add notes about new ideas you've learned about how the ocean is different in different places."** Add that students don't need to write in complete sentences, and they can make small scientific drawings if it will help them remember an idea.

   a. **Review key words.** Point out the following underlined words in key concepts on the concept wall and encourage students to use some or all of these words in their notes: *evidence*, *currents*, *temperature*, and *salinity*. Encourage students to note examples or evidence from this or earlier sessions.

   b. **Add to First Ideas.** Give students the rest of the class time to add notes to their First Ideas notebook pages.

TEACHER CONSIDERATIONS

INSTRUCTIONAL RATIONALE

Importance of Sharing Predictions. Having pairs share their predictions is a key element of this session. Sharing predictions allows students to speak like scientists—presenting evidence, agreeing and disagreeing respectfully, using science vocabulary, and asking questions about predictions. Don't be surprised if this is somewhat difficult for your students. There will be more opportunities in this unit and in the rest of *Ocean Sciences Sequence for Grades 3–5* for students to develop the skills needed to share predictions and explanations and to disagree respectfully and productively.

INSTRUCTIONAL ROUTINES

Adding to First Ideas. This is the first time that students revisit their First Ideas writing from Session 1.1. Students will record additional notes in Sessions 1.5 and 1.7, then they will write a new paragraph of their revised ideas in Session 1.8. In this session, students will likely add notes about ocean currents, different layers of ocean water, and/or ways that ocean water is different (such as temperature or salinity).

PROVIDING MORE EXPERIENCE

Prepare: Discuss in Pairs Before Writing. Your students may need more preparation before they are ready to add notes to their First Ideas pages. Before writing notes, have them discuss in pairs what they've learned about how the ocean is different in different places. You could have each partner take two turns answering this question, and you could assign a specific word to use in each turn, such as *currents, evidence, layers, salinity, or temperature.*

Extend: Reflection Prompts. The prompts below can be used for partner discussions after the session, for a large-group discussion, or as writing prompts.

- We have used four models of ocean water—the globe, the currents model, the layers model, the DVD model. Why was it useful to use many different models?
- Do you think ocean water moves differently in the summer than in the winter? What makes you think that?
- How do you think that features on the ocean floor influence 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?

Columbia River Scenario

The Columbia River flows into the Pacific. The Columbia River has freshwater, and the ocean has high-salinity water. In the summer, the water in the Columbia River is much warmer than the water in the Pacific. What do you predict happens to the Columbia River water in the summer when it goes into the ocean?

Evidence from models:

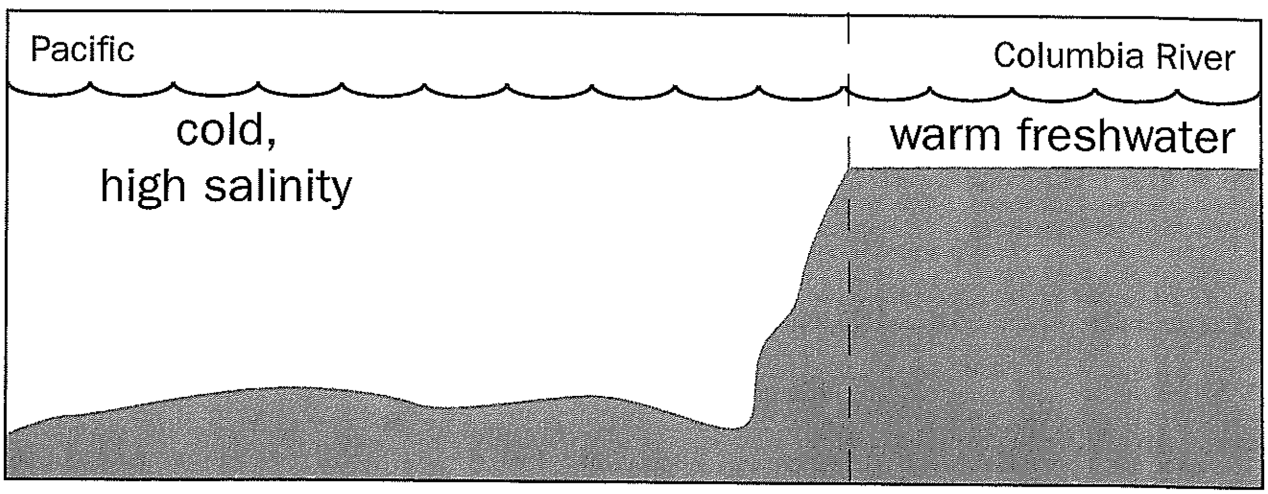
____

____

____

Diagram:

On the diagram, show what you predict happens to the Columbia River water.



Prediction:

Tell where you think the Columbia River water goes.

____

____

____

Alaska Iceberg Scenario

There are icebergs—huge floating chunks of ice—in Alaska. As the icebergs melt, very cold, low-salinity water enters the ocean. The ocean water there is cold, but not as cold as the water from the melting iceberg. The ocean water is high-salinity. What do you predict happens to the water from the iceberg?

Evidence from models:

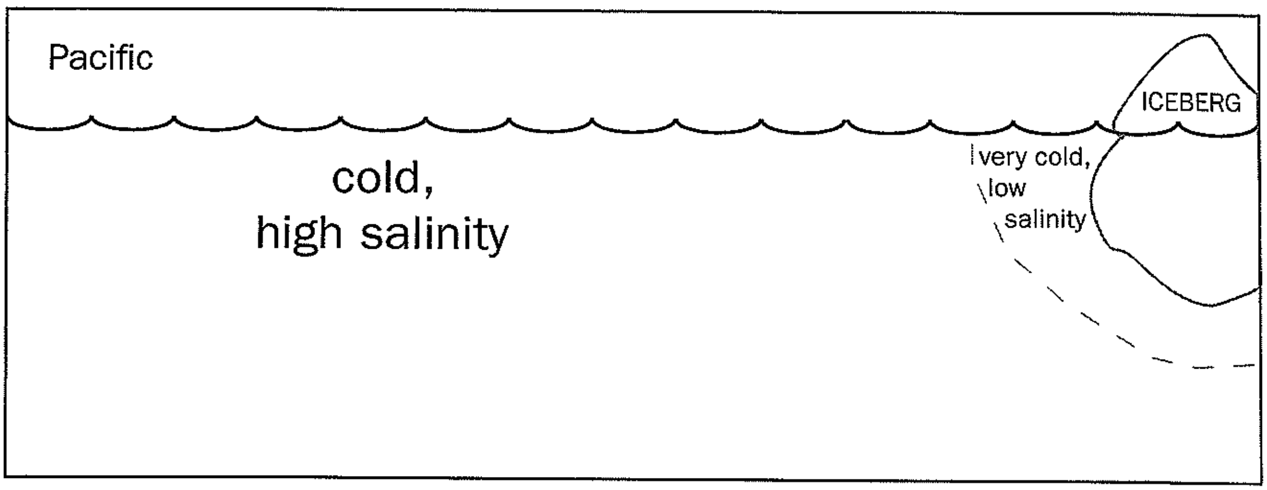
____

____

____

Diagram:

On the diagram, show what you predict happens to the water from the iceberg.



Prediction:

Tell where you think the water from the iceberg goes.

____

____

____

Gibraltar Scenario

The Mediterranean Sea has warm, high-salinity water. At Gibraltar, that warm, salty water goes into the Atlantic, which has colder, lower-salinity water. What do you predict happens to the Mediterranean water?

Evidence from models:

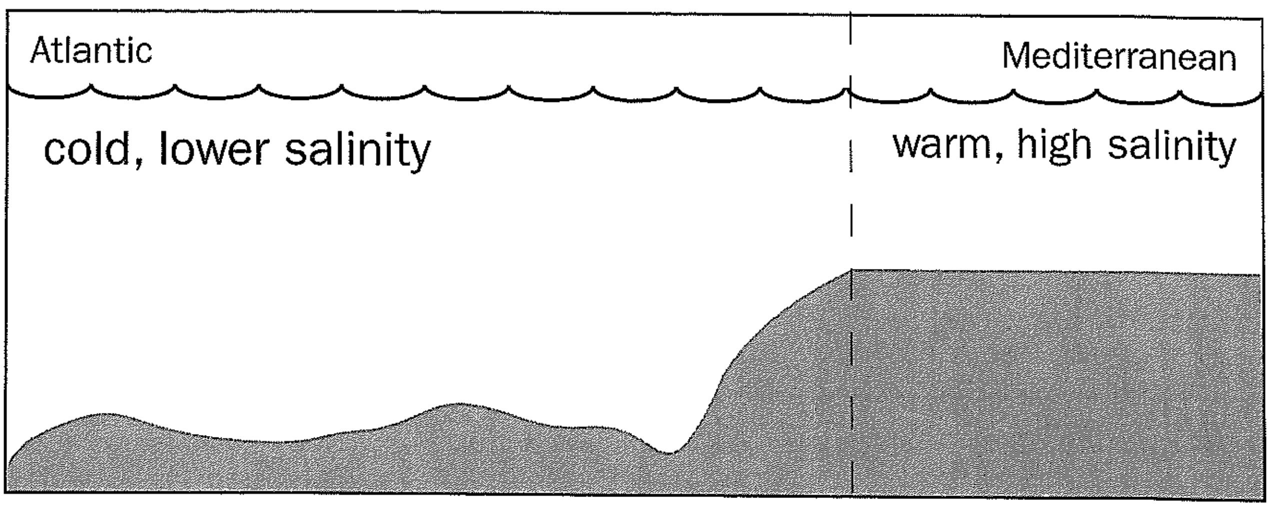
____

____

____

Diagram:

On the diagram, show what you predict happens to the Mediterranean water.



Prediction:

Tell where you think the Mediterranean water goes.

____

____

____

Currents by Boston Scenario

In the Atlantic near Boston, two currents going in opposite directions meet each other. The cold Labrador Current goes from north to south. The warm Gulf Stream Current goes from south to north. What do you think happens to the water from the two currents where they meet?

Evidence from models:

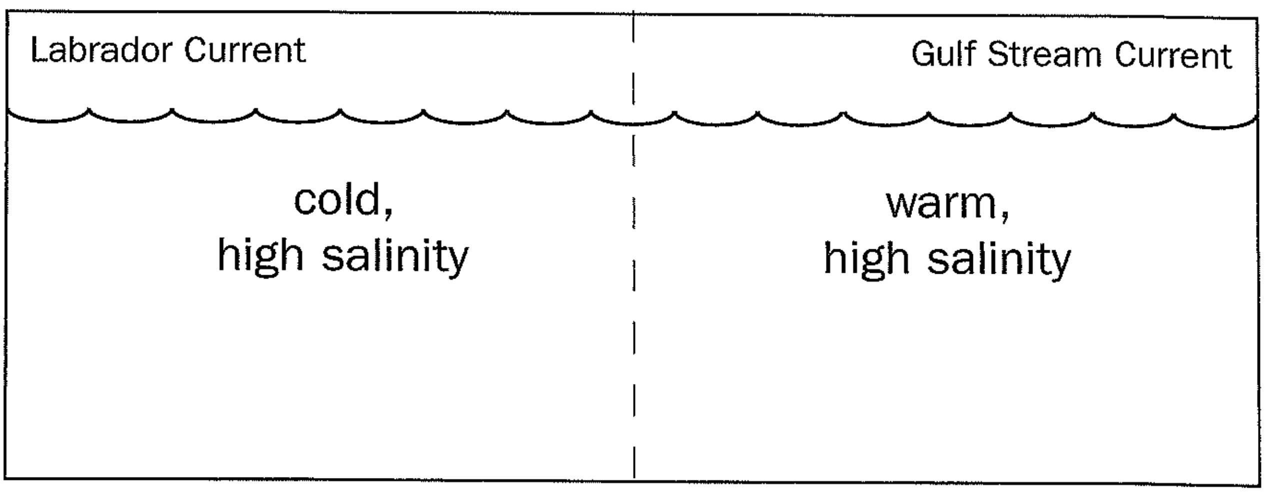
____

____

____

Diagram:

On the diagram, show what you predict happens to the water from the Labrador Current and the water from the Gulf Stream Current.



Prediction:

Tell where you think water from the Labrador Current goes and where the water from the Gulf Stream Current goes.

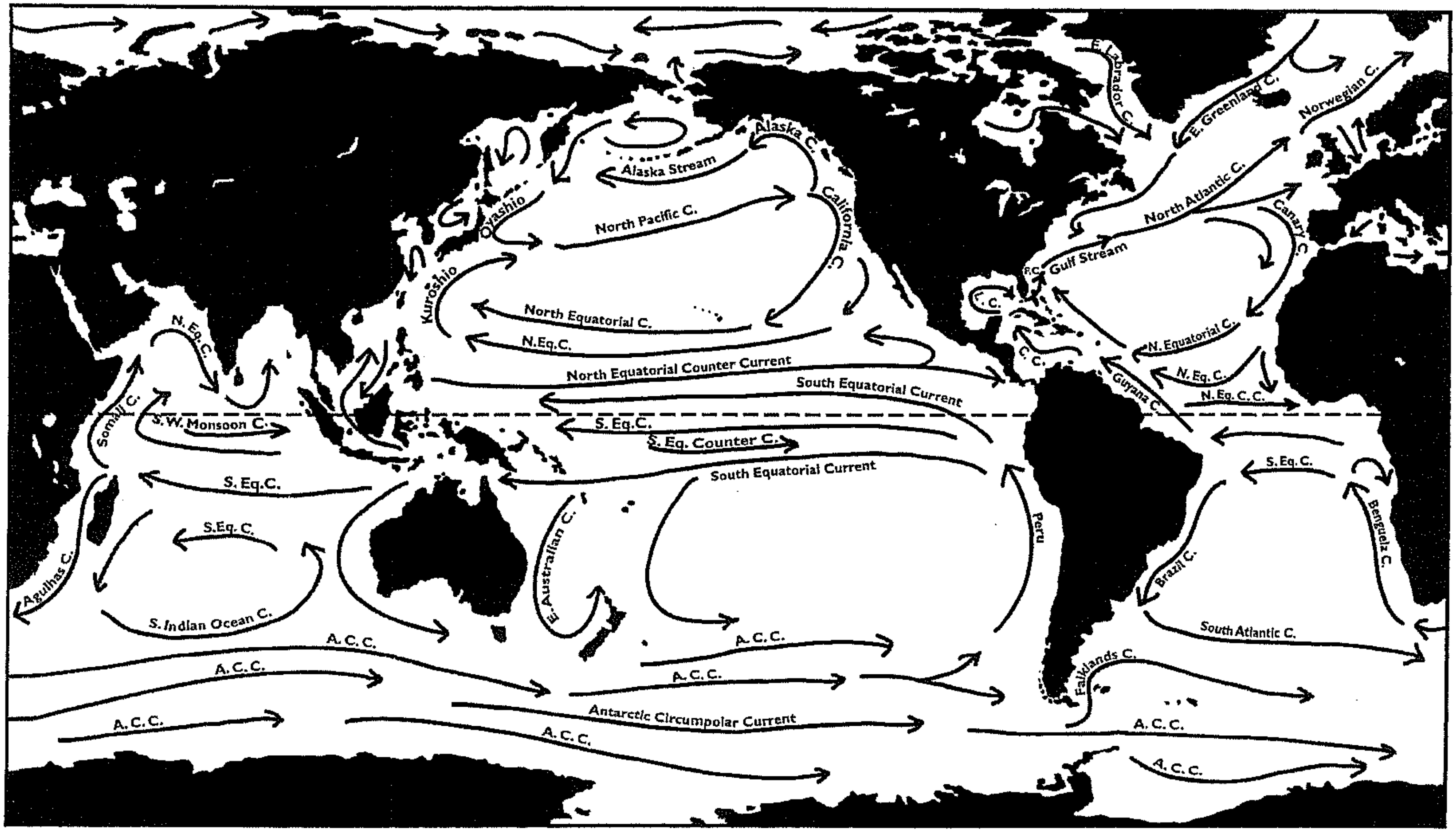
____

____

____

Map of Ocean Currents

Mark an X where your rubber ducky starts. Draw the path it will take floating with currents.



Currents by Boston Scenario

In the Atlantic near Boston, two currents going in opposite directions meet each other. The cold Labrador Current goes from north to south. The warm Gulf Stream Current goes from south to north. What do you think happens to the water from the two currents where they meet?

Evidence from models:

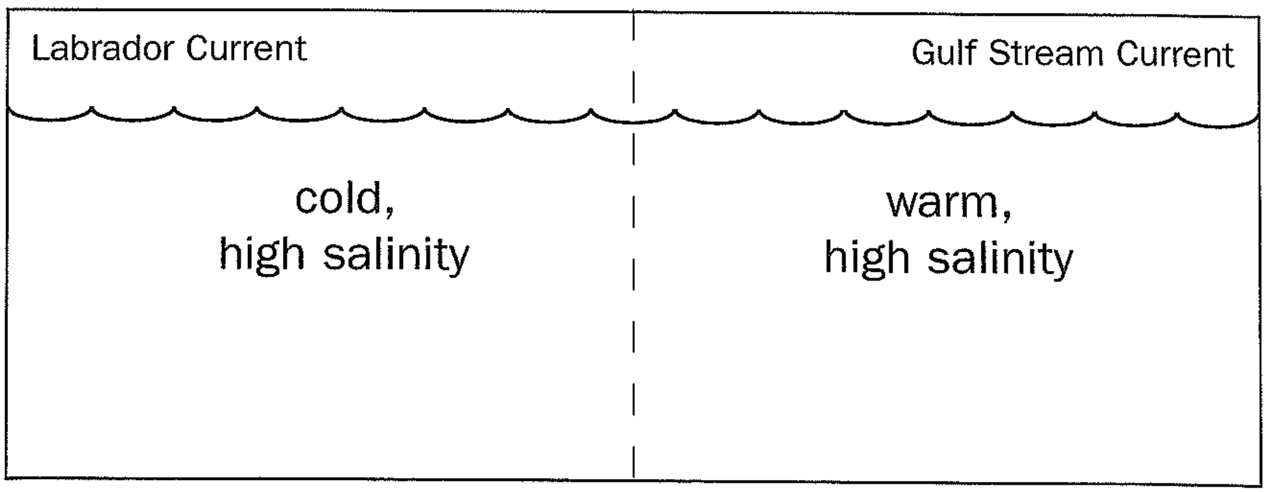
____

____

____

Diagram:

On the diagram, show what you predict happens to the water from the Labrador Current and the water from the Gulf Stream Current.



Prediction:

Tell where you think water from the Labrador Current goes and where the water from the Gulf Stream Current goes.

____

____

____