



Oceans: *Discussion Guide*

Overview

The Earth's oceans cover 361,000,000 square miles and reach thousands of miles deep – a vastness like no other on the planet. Take a journey to explore the ocean's underwater life, its geography, and its movement due to currents, tides, and waves. Learn how scientists delve into the depths of the ocean to study sea life, both present and past. Consider why the oceans are becoming polluted and how to help conserve this vital natural resource. Through this journey, students will gain a new understanding and appreciation of the world's oceans.

Classroom Activities

1. Show the video segment "Introduction to Oceans" from *Earth Science: Oceans*.

- **K-W-L Chart:** Ask students what they already know and what they would like to know about the ocean and exploring oceans. Have them create three-column charts listing What I **K**now, What I **W**ant to Know, and What I **L**earned. Encourage them to fill in the third column as they learn new information.
- **Map:** On a map of the world, have students label the five subdivisions of the world ocean: Pacific, Atlantic, Indian, Arctic, and Antarctic. Also ask them to color-code the oceans to show where they think the waters are warmest. Then have them guess the answers to these questions:
 - How deep is the deepest point of the ocean? (The Mariana Trench in the Pacific Ocean is 10,924 meters deep. This is deeper than Mt. Everest is high!)
 - How much area do the world's oceans cover? (about 361,000,000 square miles)
 - Where are the oceans warmest? (at the equator)
 - How much bigger than the United States is the Pacific Ocean? (15 times bigger)
- **Demonstration:** Show students how much of the Earth's waters are saltwater oceans vs. freshwater by filling a glass bottle 97 percent full of colored water. Then add 3 percent oil to float on top, representing freshwater.

- **Glossary:** Have students create a glossary of ocean terms, starting with these: *submersible*, *bathysphere*, *bioluminescent*, *filter feeding*, and *oceanography*. Encourage them to add to their glossaries throughout their study of oceans.
- **Research:** Ask students why they think the ocean floor is largely unexplored. Discuss the problems of exploring the ocean (*e.g.*, *deep-water pressure*) and the types of technology that assist with ocean exploration. Have students research various means of ocean exploration, such as submersibles, drones, satellites, sonar, seismic readings, robots, and bathyspheres.
- **Timeline:** Invite students to make timelines showing the history of ocean exploration. You may wish to have students consult the National Oceanic and Atmospheric Administration’s Web site at <http://oceanexplorer.noaa.gov/> for famous U.S. explorations.
- **Diagramming:** Explore the topography of the ocean. Point out that through ocean exploration scientists have discovered underwater mountain ranges, ridges, and trenches. Have students diagram these features along with the continental shelf that extends along each continent before it slopes down to the ocean basin. You may choose to refer students to the University of Delaware Web site at: www.ocean.udel.edu/deepsea/level-1/geology/geology.html that describes seafloor geologic features, including the Mid-Ocean Ridge and hydrothermal vents.
- **Discussion:** Ask students to consider why the ocean changes over time. Challenge them to consider the effects of the following on the ocean: movement of continents, tectonic plates, glaciers, and global warming.

2. Show the video segment “Understanding Behaviors and Characteristics of Ocean Animals: Dolphins and The Giant Squid” from *Understanding: Oceans*. (Access to *unitedstreaming* is required.)

- **Discussion:** After viewing the video, discuss these questions: Why do scientists know little about life at the bottom of the ocean? How do ocean animals adapt to life in the deep? What did you learn about dolphins and the giant squid?
- **Nonfiction Reading:** Read aloud descriptions of sea life from Thor Heyerdahl’s *Kon-Tiki* or Rachel Carson’s *The Sea Around Us*. Discuss which sea creatures students find most intriguing and why.
- **Image Identification:** Using the *unitedstreaming* Image Gallery, have students identify photographs of whales, sharks, crustaceans, corals, fish, sponges, bivalves, sea stars, jellyfish, dolphins, squids, and other sea life. In addition, point out that aquatic plants exist under the ocean, and show some examples.

- **Research:** Have each student choose an ocean organism to research. Assign the students to report on the characteristics of the life form and how it has adapted to its ocean environment.
- **News Writing:** Inform students that early single-cell life forms originated in the ocean and that fossils allow scientists to discover extinct sea organisms from which today's marine life evolved. Have students imagine the discovery of a new sea organism and write a news story announcing it.
- **Observation:** Provide microscopes or magnifying glasses and sea water for students to examine. Discuss the tiny creatures in the ocean, such as plankton, that provide food for larger sea life, as well as the single-cell organisms from which more complex organisms evolved.
- **Mural Making:** Invite students to contribute a drawing of an aquatic plant or animal to a classroom mural depicting ocean life forms. Point out that the ocean is the world's largest ecosystem.

3. Show the video segment "Earth: The Water Planet" from *Unsafe Waters*. (Access to *unitedstreaming* is required.)

- **Experiment:** Ask: "Where does ocean water come from?" Have students diagram the water cycle, showing evaporation of water from the ocean into the atmosphere, where it condenses into rain and again becomes part of the ocean. Conduct this experiment to demonstrate the water cycle:
 - a) Cover a cup of warm water with plastic wrap held tightly by a rubber band.
 - b) Observe the steam rising and droplets of water forming on the plastic.
 - c) Place an ice cube on top of the plastic.
 - d) Notice the condensed water falling back into the cup.
- **Diagramming:** Ask students to consider how the ocean originated. Have them diagram the video's explanation about volcanic eruptions.
- **Outlining:** Have students outline these causes of currents:
 - Wind
 - Earth's rotation
 - Gravity
 - Temperature differences
- **Discussion:** Ask students: "What are the effects of currents? How do currents help to balance ocean water? How do they affect climates?" Make sure they understand that currents move heat from the equator to other parts of the ocean and that they circulate nutrients and affect climate, too.
- **Mapping:** Have students trace the Gulf Stream on a map, explaining that it is the best-known surface current and that it brings warmer weather to coastal areas. You may wish to have students investigate other lesser-known ocean

currents.

- **Demonstration:** Have students blow on a pan of water and discuss what happens. Discuss how this demonstration simulates the way wind on the ocean creates waves. Note that *waves*, *currents*, and *tides* are forces in the ocean. Show students a tide table identifying low and high tides, and explain that the moon's gravity pulls on ocean waters to create tides. For a Web site that lists tide predictions, see <http://tbone.biol.sc.edu/tide>.
- **Simulation:** Float plastic toys in a pool and have students observe their movement. To simulate temperature differences in the ocean that cause deep-water tides, add boiling-hot water to the pool. Again have students observe the movement of the toys. Ask them to make a hypothesis based on their observations.
- **Experiment:** Have students conduct an experiment with sea water, allowing it to evaporate and observing the residue. Note the salinity of ocean water.

4. Show the video clip "Ocean Pollution" from *Science Investigations Life Science: Investigating Ecosystems and Biomes*. (Access to *unitedstreaming* is required.)

- **Pre-Video Activity:** Have students consider what inspires them about oceans and what emotions they feel when looking at the ocean. Show works of art that reveal how artists have been inspired by the ocean. Introduce the video by explaining that pollution poses a threat to the world's oceans.
- **Brainstorming:** Have students make lists of all the resources the ocean provides (*e.g., fish, food, minerals, undersea oil, transportation, oxygen*). Discuss the value and importance of the oceans.
- **Discussion:** Display a news article about the oil spill from the Exxon Valdez. Ask: What kinds of damage results from oil spills? How can oil spills be prevented? What are other types of pollution? (*factory waste, trash, toxic chemicals, pesticide runoff, acid rain, etc.*)
- **Simulation:** Simulate an oil spill by placing on its side a bottle of colored water with oil on top; discuss how aquatic life would be affected by an oil spill. Add detergent to simulate the contaminants that industrial detergents add to oceans, and shake the bottle; ask what happens to the oil and how this mixture would affect aquatic life.
- **Experiments:** Have students conduct experiments to test the effect of water pollutants on sea life. For example, they might observe the effect of phosphates from detergents on water plants.
- **Checklist:** In small groups, have students draw up checklists of what they can do to prevent pollution. Then have groups compare ideas and create a master

checklist.

- **Poster Making:** Invite students to teach members of their school and community about conservation by creating posters about preventing pollution.
- **Research:** Have students research endangered species of the ocean and discuss why these plants and animals are endangered. Reasons might include over fishing, pollution, and invasive species. Students may find information about endangered whales, dolphins, sea turtles, sharks, and sturgeons on Web sites of the World Wildlife Fund, United Nations, and WildAid.

Academic Standards

National Science Education Standards

www.nap.edu/html/nses

This discussion guide addresses the following national standards:

- Abilities necessary to do scientific inquiry
- Understanding of motions and forces
- Understanding of structure and function in living systems
- Understanding of populations and ecosystems

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/compendium/browse.asp>.

This discussion guide addresses the following national standards:

- Science
 - Earth and Space Sciences: Understands atmospheric processes and the water cycle
- Language Arts
 - Writing: Uses the general skills and strategies of the writing process; Gathers and uses information for research purposes
 - Reading: Uses reading skills and strategies to understand and interpret a variety of informational texts
 - Listening and Speaking: Uses listening and speaking strategies for different purposes
 - Viewing: Uses viewing skills and strategies to understand and interpret visual media
- History
 - Historical Understanding: Understands and knows how to analyze chronological relationships and patterns



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