

Connect to the Ocean: A Program About Ocean Habitats
Presented by the Sciencenter in Ithaca, NY

Program Overview

Connect to the Ocean introduces students to the ocean and marine science. The program is designed for classes or home-school groups of up to 24 students in grades K-5. Each program runs approximately 45 minutes, and is held in the Sciencenter amphitheater and touch tank area on the museum floor.

Students begin in the amphitheater by sharing previous knowledge about the ocean, and discussing the importance of the ocean. This introduction provides context for the hands-on experience of interacting with ocean animals at the touch tank and using companion exhibits related to the ocean. (*For background information and ocean basics, see page 3.*)

Although there are a number of learning objectives, students may not grasp them all during the program. Post-program activities will reinforce their learning and help broaden their understanding.

Learning Objectives:

Students will be able to:

- Explain that the ocean is the dominant physical feature on Earth, covering approximately 70% of the planet's surface.
- Describe how the ocean makes it possible for humans to live on earth, by creating an environment in which we can survive.
- Describe how human activities affect the ocean and the living things that depend on ocean habitats.
- Explain that everyone relies on the ocean to survive, and everyone is responsible for caring for the ocean.
- Explain that the ocean supports a great diversity of ecosystems and life forms.

Students will practice the following process skills:

- Scientific observation and description
- Reasoning and drawing conclusions.

New York State Math, Science and Technology Curriculum Standards:

Standard 1—Analysis, Inquiry and Design

Scientific Inquiry

1. The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing creative process.
2. Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.

Standard 4—Science

The Physical Setting

2. Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.
4. Energy exists in many forms, and when these forms change energy is conserved.

5. Energy and matter interact through forces that result in changes in motion.

The Living Environment

1. Living things are both similar to and different from each other and nonliving things.
2. Individual organisms and species change over time.
4. The continuity of life is sustained through reproduction and development.
5. Organisms maintain a dynamic equilibrium that sustains life.
6. Plants and animals depend on each other and their physical environment.
7. Human decisions and activities have a profound impact on the physical and living environment.

Standard 6—Interconnectedness: Common Themes

Systems Thinking

1. Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

Equilibrium and Stability

4. Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium).

Background Information

(Source: *Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences*, Centers for Ocean Science Education Excellence (COSEE), www.cosee.net.)

The ocean is the dominant physical feature on planet Earth, covering approximately 70% of the planet's surface. There is only one ocean on earth, but it has many basins: the Pacific, Atlantic, Indian, and Arctic. Ocean basins have features such as islands, trenches, ridges, and valleys. Earth's highest peaks, deepest valleys and flattest vast plains are all in the ocean!

The ocean provides diverse habitats from the surface all the way to the floor. Ocean habitats vary according to a number of factors, including water salinity, temperature, oxygen, pH level, nutrients, pressure, substrate, and circulation.

Ocean life ranges in size from the smallest virus to the largest animal that lives on Earth, the blue whale. There is greater diversity of major groups of organisms in the ocean than on land.

The ocean makes our planet habitable for humans. The ocean controls weather and climate by dominating the Earth's energy, water, and carbon systems. It supplies nearly all the Earth's oxygen (through photosynthesis activities by ocean organisms) and freshwater (most rain comes from water that evaporated from the ocean). The ocean moderates the Earth's climate and influences our weather.

Humans affect the ocean in a variety of ways. Human development and activity leads to pollution, and to physical changes to the ocean shoreline and inland waterways that lead to the ocean. Humans also affect the plant and animal population of the sea through fishing, hunting, and collecting.

Although the ocean is large, it is finite and resources are limited. Everyone is responsible for caring for the ocean. Even people who live inland have a role, because all major watersheds on Earth drain to the ocean, carrying nutrients, salts, sediments and pollutants.

Resources

Websites

The Monterey Bay Aquarium website has lots of great resources related to ocean habitats and animals. Educators have access to learning activities and teaching units, a web-based video library, an ocean animal field guide, and cool animal facts:

www.mbayaq.org

National Geographic websites include education resources related to marine biology, ocean exploration, and geography.

www.nationalgeographic.com/education
www.ngedsnet.org

The National Oceanic & Atmospheric Administration website provides curricula and teacher resources for grades 6-12 on topics related to weather, climate change, oceans and coasts, and satellites and space. Provides good background for teachers of all grades:

www.education.noaa.gov
www.oceanexplorer.noaa.gov/edu

The following sites provide education resources, including sample classroom activities, lesson plans and book reviews.

www.projectwet.org
www.sea.edu/academics/k12.asp
www.vims.edu/bridge

Books

Bill Nye the Science Guy's Big Blue Ocean. Hyperion Books for Children, 1999.

DK Publishing has several illustrated reference books, including: *Coral Reef*, 2005; *Ocean*, 1995; *Oceans Atlas* (Anita Ganeri) 1994; and *Seashore* (Miranda Macquitty), 2004.

The Magic School Bus series (Scholastic Press) includes several relevant adventures (all by Joanna Cole): *The Magic School Bus at the Waterworks*, 1998; *The Magic School Bus on the Ocean Floor*, 1994; and *The Magic School Bus Takes a Dive: A Book About Coral Reefs*, 1998.

VanCleave, Janice. *Oceans for Every Kid.* John Wiley & Sons, 1996.

DVDs

BBC/Discovery Channel. *The Blue Planet: Seas of Life.* 2001.

Series of four DVDs includes Ocean World/Frozen Seas, Open Ocean/The Deep, Seasonal Seas/Coral Seas, and Tidal Seas/Coasts.

IMAX. *Coral Reef Adventure.* 2003.

Classroom Activities

KWL Chart

A great way to build excitement for your Connect to the Ocean program at the Sciencenter is to create a “KWL” chart with your students. This activity is effective as a whole-class discussion, or as an individual assignment.

The Ocean

K: What I know	W: What I want to know	L: What I learned

Before your field trip, fill in the “K” and “W” columns. After the field trip, fill in the “L” column. You may want to review the program objectives (included in this packet), so that you can help students remember the most important things that they learned. A reproducible KWL chart is available to download.

Map Puzzles

Practice map skills by making puzzles made from world maps and satellite images.

Materials

- Maps and satellite images of the Earth, glued onto stiff paper. Sources include:
 - NASA’s Visible Earth website at <http://visibleearth.nasa.gov> provides free downloads of satellite images of the Earth.
 - The National Geographic online store at <http://shop.nationalgeographic.com> offers a variety of world maps for sale.
- Stiff paper such as poster board or cardboard
- Glue
- Scissors
- Envelopes

Procedure

1. Divide students into small groups, and give each group a map (already glued onto stiff paper).
2. Have each group cut the map into puzzle pieces. Before the students begin cutting, you may want to decide on a general size and/or shape for the puzzle pieces.
3. Have each group place the pieces into an envelope, and label the envelope.
4. Have the groups exchange puzzles and reassemble them.
5. Challenge students to find and list specific physical features in the puzzle images, such as ocean basins. Consider questions regarding the proportion of land to ocean covering or population density patterns.

Adapted from a Sea Education Association lesson plan “Map Puzzles” (based on an idea by Nancy Cande and compiled and edited by Pat Harcourt & Teri Stanley).

Bottling the Water Planet

Create a model of the distribution of water on earth. Teach others by placing the model in the classroom or another school or community location.

Materials

- Seven two-liter bottles
- Blue food coloring
- Labels for bottles
- Graduated cylinders (or kitchen measuring cups with metric units)
- Calibrated droppers for 1 ml (or a medicine dropper marked in ml)

Procedure

1. Color about 2 liters (2000 ml) of water blue, using food coloring
2. Label the bottles according to the chart below
3. Fill each bottle with the appropriate volumes, according to the chart. (Younger students can be given the volume of water to put in each bottle. Older students can be given the percentage of water and asked to calculate the volume.)

<i>Type of Water (Labels for bottles)</i>	<i>Percentage of Earth's Water Supply</i>	<i>Volume of Water to Add to Bottle</i>
All the Earth's Water	100%	2000 ml
All the Earth's Salt Water (In the Ocean)	97.2%	1944 ml
All the Earth's Fresh Water	2.8%	56 ml
Fresh Water in Ice Caps and Glaciers	2.3%	46 ml
Fresh Water Underground	0.4%	8 ml
Fresh Water in Lakes and Rivers	0.05%	1 ml
Water in the Soil and Air	0.01%	0.2 ml

Extension

Have students relate this display to the water cycle. How does water change state and move from place to place through the cycle of evaporation, condensation, and precipitation? (See the Water Cycle activity below.)

Adapted from a Sea Education Association lesson plan "Waters of the Earth" (compiled and edited by Pat Harcourt & Teri Stanley), and from the Project Wild Aquatic lesson plan "How Wet Is Our Planet" (Council for Environmental Education).

Ocean Habitat Mural

Research the plants and animals that live in a specific ocean habitat, then make a mural representing that habitat to brighten your classroom or school hallway!

Materials

- Books or internet resources about a variety of ocean habitats, and the plants and animals that live in them. Sources include:
 - Monterey Bay Aquarium website: <http://www.mbayaq.org>. The website has many great resources for teachers and students, including printable posters and keys for six ocean habitats, a printable field guide of animals that live in many ocean habitats, and coloring pages for different habitats and animals.
 - Public and school libraries will have a variety of general reference works appropriate for this activity. Your reference librarian can help you locate them.
- Construction paper
- Scissors
- Markers, crayons, or colored pencils
- Glue or tape for creating reef plants and animals
- Stapler or tape for mounting the mural on a bulletin board or wall

Procedure

Note: This activity can be introduced to the whole class at once, but you may want students to work on the projects in groups of 3-4 so that it is easier for them to share the resources.

1. Choose one or more ocean habitats to illustrate in the mural. Some options include: sandy beach, rocky shore, coral reef, or deep sea.
2. Use colored paper to cover a bulletin board, wall, or poster board.
3. Show students pictures illustrating the habitat, and talk about the variety of animals and plants that live in it.
4. Let students pick a plant or animal to create, to put on the board. They can cut them out of construction paper, or draw them on regular paper.
5. Optional: Have students research a “fun fact” about their plant or animal, and write it on their creation.
6. Have students attach their creation to the mural. Give them a chance to share their work with others.

Adapted from a Sea Education Association lesson plan “Specialized for the Sea” (plan by Karen Dresden, compiled and edited by Pat Harcourt & Teri Stanley).

Hide & Seek

Create imaginary creatures that blend in with a specific classroom “habitat,” to demonstrate how adaptations like camouflage help ocean creatures survive.

Materials

- Fish or other shape template that students can use as the basis for their imaginary animal. (You can also provide blank paper and let students design their own shape.)

- Source: Monterey Bay Aquarium website: <http://www.mbayaq.org>. The website has many great resources for teachers and students, including a “Hide a Ray” activity sheet that you can use for this activity.
- Scissors
- Markers, crayons, or colored pencils

Procedure

1. Ask students to pick a “habitat,” or hiding place, in the classroom and design an imaginary animal that is camouflaged to hide in it. Explain that when they are done, students will hide their animals for the other students to find. Animals must be hidden in plain sight, not inside, under, or above things that make them impossible to spot.
2. Pass out the templates (or blank paper), and have the students color and cut out their animals. Students may want to move around the room to observe their “habitat” more closely.
3. Have half the students cover their eyes, while the others place the “animals” in their “habitats” for the others to find. You can let the class look until all the animals are found, or offer prizes for animals that remain “hidden” after a few minutes of searching.
4. Switch groups and let the other half of the students hide their animals.

Explanation

Plants and animals have different adaptations that help them to survive in their habitat. Animals with effective camouflage are less likely to be spotted by a predator and more likely to survive.

Adapted from a Monterey Bay Aquarium activity “Hide a Ray”, and a Sea Education Association lesson plan “How to Hide in the Ocean” (based on an idea by Sherill Caruana, compiled and edited by Pat Harcourt & Teri Stanley).

The Water Cycle

Demonstrate the water cycle process of evaporation, condensation, and precipitation then construct and observe a water cycle model over time.

Materials

Teacher Demonstration

- Hot plate
- Cooking pot
- Frying pan
- Oven mitt
- Water
- Ice

Student Project

- Large plastic storage tub (clear-sided is best)
- Sand, dirt, and rocks
- Patch of grass (with roots still in soil)

- Water
- Small cup
- Plastic wrap
- Packing tape or large rubber band

Procedure

Teacher Demonstration

1. Place a pot of water on a hot plate on at the front of the room. Caution students to stay at a safe distance.
2. When the water is hot, hold a pan of ice above the rising water vapor. (Wear an oven mitt for protection.)
3. Drops of water should condense on the bottom pan of ice, then fall and return to the pot of hot water.
4. Challenge the class to explain what is happening, and identify where this process might be observed in nature.

Student Project

1. Gather a supply of dirt, sand, rocks, grass, and other materials or go out on a collecting expedition with your students.
2. Arrange the materials on the bottom of the plastic storage tub, and dampen them well. Place the empty cup near the center of the tub.
3. Cover the tub tightly with plastic wrap, and secure the wrap with tape or a rubber band. It's important to get an airtight seal.
4. Observe the tub over a number of days, at different times of day. Encourage students to notice what appears on the underside of the plastic wrap, and inside the cup.
5. Ask students to explain what they observe.

Explanation

Both the demonstration and the student project are models of the water cycle (also called the hydrologic cycle). The water cycle is the continuous circulation of moisture on Earth, especially between the atmosphere and the Earth's surface.

During the cycle, water changes between gaseous and liquid states through the processes of *transpiration*, *evaporation*, and *precipitation*.

- *Transpiration* is the emission of water vapor by plants.
- *Evaporation* is the change of water from a liquid to a gas state.
- *Precipitation* (or condensation) is the change of water from a gas to a liquid state.

The ocean plays a big role in the water cycle. Water evaporates from the ocean into the atmosphere. Water is returned to the ocean through precipitation (rain and snow). Some rain and snow falls directly into the ocean, while other precipitation enters the ocean through surface runoff from land.