

8. What are the names of the major oceans? Which is the largest and deepest ocean on Earth?
9. What is the world ocean? How is this explained?
10. What is salinity? Where does the ocean's salinity come from?
11. What are the causes of waves, tides and currents?
12. Why are shorelines considered to be such a difficult place to live? What adaptations do creatures have that live in this kind of ecosystem?
13. Describe some creatures of the coral reef and their adaptations.
14. What are the three zones of the open ocean ecosystem? What kinds of creatures live in each zone?
15. Where is life more abundant: warm tropical waters or cold water? Explain.
16. What was learned from the experiment with brine shrimp?
17. Why is it important for us to study and understand marine ecosystems?

### Follow-up Discussion

Research indicates that students will retain their previous misconceptions about a topic, in preference to new information, until they actively recognize and correct their own errors. Therefore, it is important to have your students re-examine the facts/beliefs they put on their "Everything We Think We Know About..." list. It might also be helpful to review the list by marking each entry with a "+" or "-" to show which facts were correct and which were incorrect.

Thought-provoking discussions provide a good way to assess the overall depth of student understanding. The following are some suggested discussion topics.

- Why are the world's oceans sometimes called "the final frontier"?
- How do factors like salinity, temperature, sunlight, wind, depth and ocean floor contour affect marine life?
- What suggestions do you have for protecting the oceans from the threat of pollution?

### Follow-up Activities

- An ideal classroom investigation would be to set up, maintain and study a tropical saltwater aquarium. Students can learn a great deal from testing and maintaining pH and other chemical balances and observing the plant and animal creatures that thrive in such a habitat.
- Design a "Save the Oceans" campaign to raise awareness of the importance of protecting the oceans from pollution and other threats. Students can create fact sheets, posters or newsletters to share the information they have learned about the health of the oceans.
- A field trip to an estuary, beach or aquarium would be ideal. As an alternative to a trip, invite marine ecologists from local universities to present information to your classroom.

### Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at [www.LibraryVideo.com](http://www.LibraryVideo.com)

- [educate.si.edu/resources/lessons/currkits/ocean/main.html](http://educate.si.edu/resources/lessons/currkits/ocean/main.html)  
The Smithsonian Institute presents six different interdisciplinary lesson plans on the ocean as part of their exhibit called "Ocean Planet." These lessons address ocean resources, pollution, marine life and similar topics.
- [vathena.arc.nasa.gov/curric/oceans/index.html](http://vathena.arc.nasa.gov/curric/oceans/index.html)  
The Athena Web site contains information and activities for students interested in learning about wetlands and oceans.

### Suggested Print Resources

- Cerullo, Mary. *Sea Soup: Phytoplankton*. Tilbury House, Gardiner, ME; 2000.
- Fredericks, Anthony D. *Exploring the Oceans: Science Activities for Kids*. Fulcrum Resources, Golden, CO; 1998.
- Littlefield, Cindy. *Awesome Ocean Science*. Williamson Publishing, Nashville, TN; 2002.
- Madin, Kate. *Down to a Sunless Sea: The Strange World of Hydrothermal Vents*. Raintree Steck Vaughn, Austin, TX; 2000.

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### TITLES

- CONIFEROUS FORESTS
- DECIDUOUS FORESTS
- DESERTS
- FRESHWATER ECOSYSTEMS
- GRASSLANDS
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## Marine Ecosystems

### Grades 5-8

Students in grade 5-8 classrooms possess a wide range of background knowledge. Student response to this video program is sure to be varied, so the teachers at these grades need all the help they can get! This guide has been designed to help the 5-8 science teacher by providing a brief synopsis of the program, preview and follow-up questions, activities, vocabulary and additional resources.

**Before Viewing:** Extensive research tells how important it is for the teacher to discover what the students know — or think they know — about a topic, before actually starting a new unit. Therefore, after prompting discussion with the pre-viewing questions, lead your class to create an "Everything We Think We Know About..." list. You may also wish to preview key vocabulary words, and have students raise additional questions they hope will be answered.

**After Viewing:** Have your students share video excerpts that fascinated or surprised them, then challenge your students to prove or disprove the accuracy of the facts they put on their "Everything We Think We Know About..." list. Discuss what else they learned and use the follow-up questions and activities to inspire further discussion. Encourage students to research the topic further with the Internet and reading resources provided.



## Program Summary

Biomes are “life zones” — large regions of the world that share similar characteristics. Each biome is made of many distinct ecosystems, which are communities of plants and animals and the nonliving environment that surrounds them. Marine ecosystems are part of an aquatic biome containing salt water, and include such diverse environments as seashores, coral reefs, open ocean, estuaries and salt marshes. The salt water found in these marine ecosystems accounts for 97% of the Earth’s water supply. Though we sometimes speak of specific oceans like the Pacific, Atlantic, Indian and Arctic, in truth, they are all connected in one continuous world ocean.

In marine ecosystems, there are many abiotic, or non-living factors, including water temperature, oxygen levels, salinity and sunlight. Living components of an ecosystem, like plants and animals, are called biotic factors. There is constant interaction between the abiotic and biotic factors of an ecosystem, resulting in organisms that are uniquely adapted to survive in their particular environment.

Salinity is the amount of dissolved salts and related minerals in the water. These dissolved minerals are deposited over time into the ocean from the land, and can affect the organisms that make the ocean their home. Ocean waters are constantly in motion because of waves, tides and currents, so organisms must be able to adapt in order to survive. The depth of the ocean ecosystem also affects the biotic factors found there. Generally speaking, the deeper one goes, the less sunlight is available, the greater the pressure, the lower the temperature, and the species diversity is more restricted. In the tropics, the average water temperature is 28 degrees Celsius (82 degrees Fahrenheit); however, in most places, the average ocean temperature is just above freezing.

Shoreline ecosystems have many names: coastline, seashore, beach, tide pool and the intertidal zone. Shores include the area covered by the ocean during high tides and exposed to the air and sun at low tides. Shorelines can be steep and rocky, flat and sandy, or even icy. Living in this environment is very challenging, requiring special adaptations. Hard shells of animals and a gooey coating on seaweed serve as protections against drying out in the hot sun. Mussels, barnacles and other shellfish anchor themselves to rocks with strong threads, while ghost crabs burrow into the sand to keep from being washed away by powerful waves.

Coral reef ecosystems are found in warm tropical waters. These delicate ecosystems are home to almost 40% of the world’s fish. Sadly, even small changes in temperature and chemical composition of the water can create problems for these beautiful but threatened ecosystems.

The open ocean is divided into layers or zones, according to depth and degree of sunlight. The top layer is called the sunlit zone, or the photic zone. This is the layer through which sunlight can penetrate; therefore, it is the only layer where substantial photosynthesis can take place. Vast numbers of free-floating microscopic plants, called phytoplankton, fill this layer, supplying oxygen and acting as the base of the marine food chain. Zooplankton, microscopic animals, feed on phytoplankton and also find themselves at the bottom of the ocean’s food chain. Nekton are the creatures in the oceans that are able to swim independently. Creatures that live on the ocean floor are called benthic organisms, and can be found in the deepest layer of the ocean, called the aphotic zone. Here the temperatures are consistently near freezing and the water is totally without light. Only a few well-adapted creatures are able to inhabit this high-pressure environment.

Salt marshes and estuary ecosystems exist along the shorelines, where freshwater and salt water mix. Salt marshes, which are shallow, muddy and densely filled with grasses, are often called the nurseries of the ocean, because of the high level of nutrients and protection offered to creatures that start out life here. Estuaries are deeper and more open than marshes, and are home to clams, oysters, crabs and larger creatures, such as the endangered manatee.

## Vocabulary

The following words are included for teacher reference or for use with students. They are listed in the order in which they appear in the video.

**biomes** — Areas of the world that have similar climates and ecosystems, usually named for a dominant feature. A biome contains many smaller specialized ecosystems. There are two types of aquatic biomes: freshwater and marine.

**ecosystem** — A place where communities of living things interact with each other and with nonliving components, such as soil and water.

**marine ecosystems** — An aquatic biome defined by the presence of water with a salt concentration of more than one percent. Marine ecosystems include seashores, coral reefs, open ocean, estuaries and salt marshes.

**habitat** — The specific environment where an animal lives; this includes physical and biological factors such as temperature, climate, light and the presence of food and shelter.

**biotic factors** — All the living or once-living organisms in an ecosystem.

**abiotic factors** — Non-living things like water, air, sunlight, minerals, soil, climate, wind and fire.

**climate** — An environment’s average weather conditions including temperature and rainfall. Climate is the most important element in determining what kinds of organisms can live in an area.

**polar zone** — The frigid areas found in bands around the North and South poles, characterized by freezing conditions, minimal sunlight and low diversity of plant and animal life.

**tropical zone** — The geographic area found in a broad band around the equator, characterized by the greatest amount of sunlight and annual rainfall and the greatest diversity in plant and animal life.

**temperate zone** — Large areas located in the bands between the polar and tropical zones; characterized by a climate consisting of a warm season and a cold season with equal lengths.

**salinity** — The amount of dissolved salts in water; salts and other minerals are washed into the ocean from rivers.

**wave** — Movement at the surface of the ocean caused by pulses of energy moving through the water, raising and lowering it. The most common source of energy for waves is wind.

**tides** — The twice or once daily rise and fall of water level at the shoreline caused primarily by the gravitational pull of the moon.

**currents** — Movements of ocean water caused by wind patterns and differences in water density. Currents can occur at the surface or deeper in the ocean and can be temporary or permanent.

**shorelines** — Ecosystems found at the edges of the ocean, covered by water during high tide and exposed to the air at low tide.

**sand** — Small rock pieces that have been broken down to a size which is between .05 to 2 mm; sand may originate from rocks on land or from coral and the broken shells of sea creatures.

**sand dunes** — Large mounds of sand that build up along shorelines; the roots of plants such as beach grass and sea oats help keep the sand in place, preventing erosion.

**coral reef** — A marine ecosystem located in warm tropical waters that is based on structures built by coral. They have been called the tropical rainforests of the ocean because of the great diversity of life found there.

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**symbiotic relationships** — Close associations between organisms of different species, where at least one organism benefits from the association. Coral are living animals with symbiotic algae living inside of them; the algae provide food through photosynthesis, and the coral provide protection for the algae.

**camouflage** — An adaptation that helps creatures to blend in with surroundings so that they appear less obvious to their predators.

**photic zone** — The part of a body of water through which sunlight can penetrate. “Photo” means light. It is where photosynthesis occurs, where there are higher levels of oxygen, and where most plants and animals live.

**plankton** — Tiny free-floating organisms that live in great numbers in the photic zone of all bodies of water. There are two types: plant-like phytoplankton that produce oxygen through photosynthesis and zooplankton that feed on phytoplankton.

**food chain** — The path that material and energy take when moving from the sun and passing from organism to organism in an ecosystem.

**nekton** — Another name for all active, free-swimming creatures in the ocean.

**twilight zone** — The ocean layer below the photic zone, which receives very little sunlight.

**benthic zone** — The ocean floor, where clams, sponges, worms and other benthic creatures dwell.

**aphotic zone** — The very deepest ocean zone, which is totally dark, near freezing, and holds little life.

**salt marsh** — A transitional marine ecosystem in which many grasses grow in soft, wet land covered by a mix of salt water and fresh water.

**estuary** — Partly-enclosed coastal body of water where fresh waters of rivers mix with salty ocean water. Estuaries serve as the “nurseries” of the marine biome and are home to many oysters, crabs and clams.

## Pre-viewing Discussion

Before students generate their list of “Everything We Think We Know About...” for this topic, stimulate and focus their thinking by raising these questions so that their list will better reflect the key ideas in this show:

- Where did life on Earth begin?
- What are some different ecosystems that make up the world’s oceans?

After the class has completed their “Everything We Think We Know About...” list, ask them what other questions they have that they hope will be answered during this program. Have students listen closely to learn if everything on their class list is accurate and to hear if any of their own questions are answered.

## Focus Questions

1. What is a biome? What is an ecosystem?
2. What are some examples of land biomes?
3. Where are marine ecosystems found?
4. What are some examples of marine ecosystems?
5. How much of Earth’s total water supply is fresh water? How much is contained in marine ecosystems?
6. What are the biotic factors of an ecosystem? How are they affected by the abiotic factors?
7. How can water temperature influence the plants and animals in an aquatic ecosystem?

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