

College Guild
PO Box 6448, Brunswick ME 04011

ENVIRONMENTAL ISSUES

UNIT 3 OF 5

The Oceans

Salt water covers over 70 percent of the Earth's surface. Marine life serves as the primary source of food for more than 3.5 billion people and provides the basic ingredients for many medicines. In addition, the oceans support recreation and tourism all over the world. About 40 percent of the world's population lives within 60 miles of the sea. Many of these people depend on a healthy and productive ocean for their livelihoods.

1. Envision in your mind three separate shorelines – places where the land meets the ocean – and provide brief descriptions for each. Describe how it feels to be at each one.
2. Which of these shorelines is most appealing to you? Why?

The oceans are home to millions of animal, plant, fungus, and insect species, with many more discovered every day. Here is a picture of one of the more recent discoveries, “the ghost octopus”, so called because of its resemblance to the cartoon character Casper the Friendly Ghost. It was found near Hawaii, at a depth of about two and one half miles.



The oceans have inspired humans to create great works of art from Moby Dick, Herman Melville's story of a sea captain's obsessive search for the Great White Whale, to French composer Claude Debussy's composition, *La Mer* (The Sea) which uses music to describe the ocean's various moods. These moods have also been captured by countless visual artists, such as Katsushika Hokusai in his woodblock print *The Wave*, and Frederick Church in his painting, *The Icebergs*.



The Wave, by Katsushika Hokusai



The Icebergs, by Frederick Church

3. **Sketch a scene involving the ocean in one of its many moods. The scene can, but doesn't have to, include people, vessels, or marine life such as fish or seabirds. The sketch should speak for itself, but feel free to say a few words about any mood or message you're trying to convey. (Don't worry about being a good artist – just give it a try!)**
4. **Write a short story in which the ocean plays a significant part. Again, the story could contain humans but doesn't have to.**

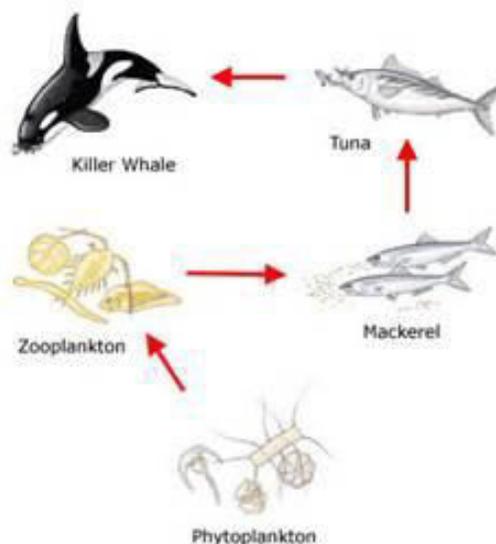
A popular book of the nineteenth century was Two Years Before the Mast by Richard Henry Dana, in which he describes his experiences as a seaman on a merchant vessel. These experiences included violent storms, icebergs, and outbreaks of scurvy (a disease caused by diets containing inadequate amounts of Vitamin C). On a more positive note, the voyage provided Dana with exposure to the people and culture of California, which, at the time, was part of Mexico.

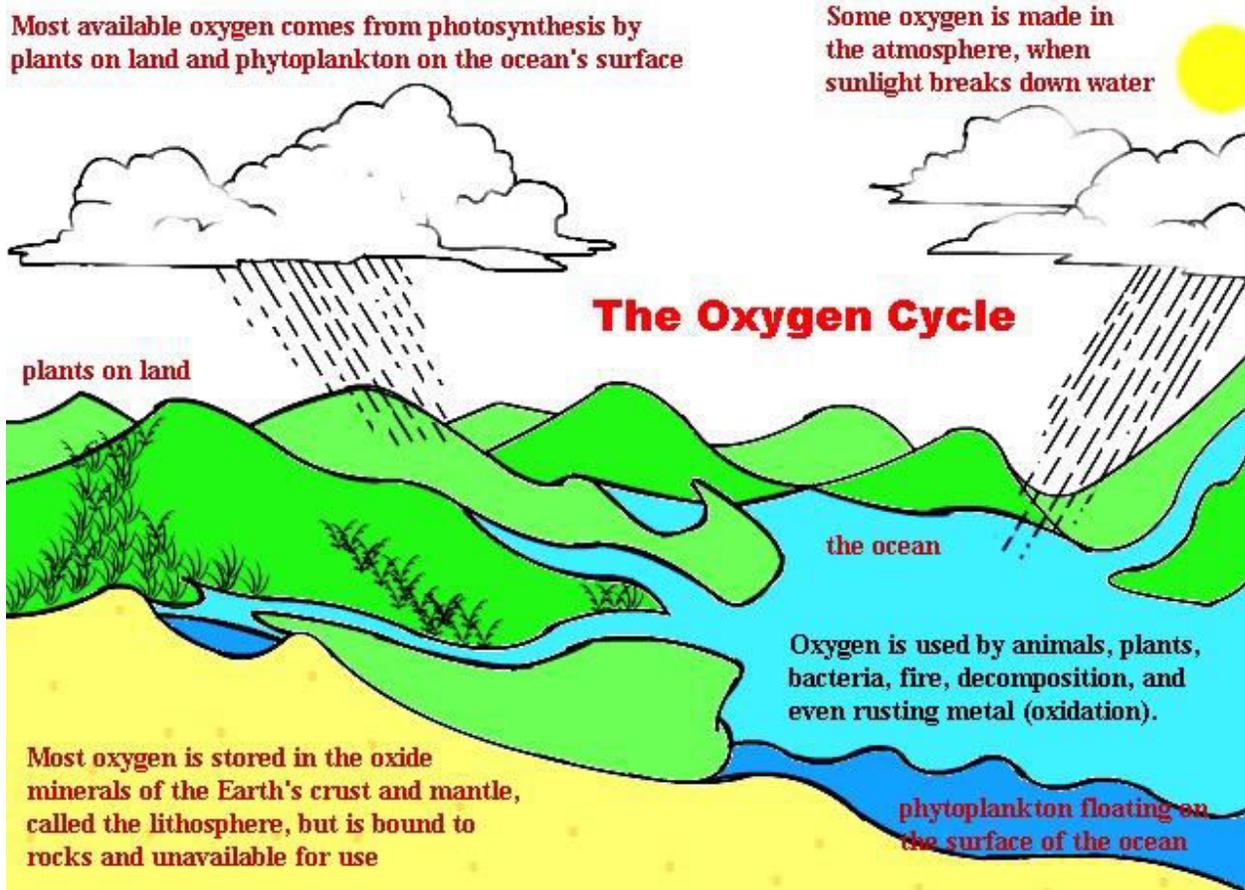
5. **What do you think the advantages and disadvantages of being on a long ocean voyage would be (for example on a fishing boat, on a passenger ship, or in the Navy)?**
6. **Would you rather read a novel or poem about the sea, listen to music about it, or see an art show featuring paintings of the ocean?**
7. **Imagine you are writing a novel in which the ocean plays a part. What is your story's plot?**

Officially, there are five oceans – Pacific, Atlantic, Indian, Arctic and Southern – but since their boundaries are not clearly marked and their waters flow freely among them, it makes as much sense to think of there being just one great Ocean. Here are some other ocean-related facts.

- The longest living marine animal is the bowhead whale, which can live for more than 200 years and weighs between 75 and 100 tons.
- The average depth of the ocean is 2.7 miles. The deepest part is almost 7 miles down. The world's highest point, Mt. Everest, could be dropped into the ocean's deepest part, the Challenger Depth near the Philippines, and still be more than a mile beneath the surface.
- Less than 10 percent of the oceans' space has been explored by humans.
- More than 97 percent of the water on Earth is in the oceans.

As is so often the case when studying the natural environment, everything in the ocean is connected, directly or indirectly, with everything else. For example, marine organisms, especially phytoplankton, contribute significantly to the process by which oxygen cycles among the atmosphere, the earth's crust, and the ecosystems on the earth's surface, thus ensuring a livable planet for all species. On the next page is a diagram illustrating this process. (Photosynthesis is the process by which plants, phytoplankton and other organisms convert light energy from the sun into chemical energy to help the organism grow.) Another example of interconnectedness is the food chain, as illustrated by the following drawing.





8. Pick three species in the ocean ecosystem and tell how they are interconnected. They can include humans, fish, seabirds, mammals, plants, or anything else you can think of.

Given their vastness, you might think the oceans are indestructible, but they are surprisingly fragile. They and the creatures who live in them are currently facing four distinct, but related, threats.

1) **Acidification.** More than one quarter of the carbon dioxide pumped into the atmosphere as a result of burning fossil fuels falls back into the ocean. Surface water is 25-35% more acidic today than it was at the beginning of the Industrial Revolution, around 1760. This is harmful in two ways. First, the additional CO₂ gives the water a corrosive quality that erodes some animals' shells or skeletons and also makes it more difficult for them to grow shells in the first place. Those animals include oysters, clams, mussels, and scallops. Higher acidity levels threaten coral reefs, which provide habitat for one fourth of the world's marine species. Second, as the oceans become more acidic, they lose their ability to absorb excess carbon from the atmosphere, thus increasing the overall warming effect.

9. We burn fossil fuels (oil, coal, natural gas) in order to heat our homes. How can we stay warm without putting so much CO₂ into the atmosphere and, ultimately, the ocean?
10. The cars and trucks we drive are also powered by a fossil fuel – gasoline. How can we reduce our use of this fuel?

2) **Warming.** 80% of the heat added to the climate system in the last 200 years has been absorbed by the oceans. This warming can have negative impacts, both on certain marine species and on people who depend on a healthy ocean for their economic wellbeing. Researchers have established a link between warmer ocean temperatures off the western coast of North America and massive die-offs of starfish. In some locations, the entire starfish population has disappeared. This is especially troublesome because starfish are a *keystone species* – that is, a species which may not be the most numerous or powerful in a given ecosystem but which plays an important role in maintaining the health of that ecosystem. In this case, starfish often prey on sea urchins, mussels, and other shellfish that have no other natural predators. If the starfish is removed from the ecosystem, the mussel population explodes uncontrollably, driving out most other species, while the sea urchin population destroys coral reefs. Warming of the oceans can also affect where certain types of seafood live and thus have a negative impact on those who make their living by fishing. For example, the lobster population off the coast of southern New England, has dropped substantially in recent years. The warmer waters in that region are causing many of the lobsters to migrate slowly northward to the Gulf of Maine where the temperature is more suitable for them. Those that remain off the coasts of Rhode Island and Connecticut are either diseased or too small to be harvested. As a result, lobster fishing in that region no longer makes economic sense for many people. The lobster industry in Maine is benefiting from these changes of course, but these benefits are expected to be temporary as continued warming drives the lobsters even further north to Canadian waters.

11. When the same number of fishermen compete for a declining number of fish, conflict is bound to arise. How can communities ensure that everyone is treated fairly?

12. In many communities, fishing has been a way of life for several generations. What can state or federal governments do to help fishermen transition to other ways of making a living?

3) **Pollution.** This pollution takes many different forms, including accidental oil spills and intentional dumping of fuel and garbage by passing ships. Nitrogen based fertilizer applied by farmers to increase their fields' productivity often seeps into nearby rivers and is carried to the ocean. This nitrogen replaces the oxygen in the sea water and creates large "dead zones" where healthy marine life is almost nonexistent. More than 400 dead zones have been identified throughout the world, including a large one in the Gulf of Mexico at the mouth of the Mississippi River. One of the largest sources of ocean pollution is plastic. Plastics are everywhere in modern life – from paper clips to furniture to automobiles. About one third of the plastics in the United States are used for packaging and transporting food and various consumer items. Much of this is carelessly thrown away and eventually winds up in the oceans. It gradually breaks down into micro particles and is eaten by small sea creatures such as phytoplankton, who are eaten by larger creatures, on up the line to humans. These plastic particles can be harmful to all of the creatures along this food chain, including us. It has been estimated that, unless we come up with better ways of disposing of plastic bags and wrapping material, the total weight of plastics in the ocean will exceed the weight of all sea creatures by 2050.

13. Name three common uses for plastic in today's world.

14. Why is plastic used in these ways? In other words, what benefits does plastic provide?

15. What can be done to keep this plastic from ending up in the ocean?

On the next page is a photograph of a beach cleanup in Hawaii. Fifty large garbage bags of trash, mostly plastics, were found.



4) **Overfishing.** Overfishing occurs when more fish are caught in a given area than the fish population can replace through natural reproduction. Gathering as many fish as possible may seem like a profitable practice, but overfishing has serious consequences. The results not only affect the balance of life in the oceans, but also the social and economic well-being of the coastal communities who depend on fish for their way of life. The Atlantic codfish provides one example of overfishing, though there are numerous others throughout the world. In 1950, about 700,000 tons of cod were caught off the coast of Canada. This number rose to nearly 2,000,000 tons in 1970, but then declined steadily until 1992 when only 20,000 tons were caught. At that time, the Canadian Federal Government decided to impose a moratorium on cod fishing until fish populations could recover to sustainable levels. This moratorium is still in place and it's not clear whether the cod population will ever return to its previous levels.

The main culprit in overfishing is technology. Traditional fishing methods were not capable of depleting the fish supply in a given area of the ocean, but large "factory ships" can dredge the seabed and use massive nets to pull in thousands of fish at a time. In the process, they can also disrupt the seabed and cause further environmental damage. This type of fishing also results in "by-catch" – fish and other marine species that are not the target of the fishing vessels but simply happen to be in the wrong place at the wrong time and are caught up in the nets. There are about 20 million tons of by-catch each year.

16. Present a plan to prevent overfishing. Think of how it would affect fishermen, consumers and businesses that rely on fishing.

17. What's the most important step our country should take to protect the oceans?

So far, most of the picture we've presented has been pretty grim. But there are people and organizations all over the world working to address these challenges. Here are a few of the steps being taken: participating in clean ups for beaches and rivers, using reusable cloth bags instead of disposable plastic ones for carrying groceries, purchasing only seafood that has been sustainably harvested.

Remember: First names only & please let us know if your address changes