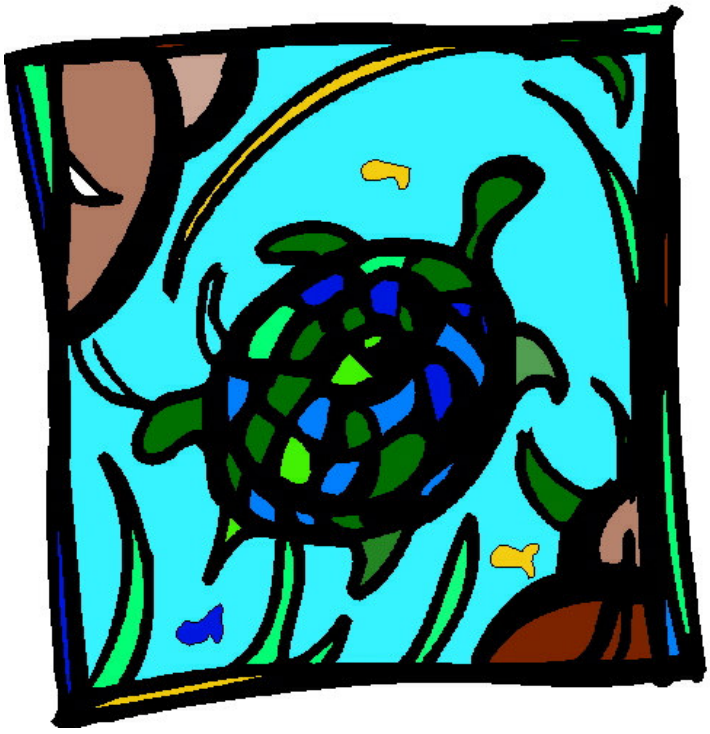
Ocean Life



Life Under the Sea

Oceans cover more than two-thirds of the Earth's surface. In fact some scientists have come to the conclusion that oceans cover nearly 70% of the Earth's surface and contain 97% of the Earth's water supply.

No other planet in our solar system has oceans. This makes the Earth's oceans *unique*.

What is an Ocean?

Oceans are giant bodies of water that contain *salt water*. There are five oceans on planet Earth: Pacific, Atlantic, Indian, Arctic, and Southern. It's really more like one big ocean; all of the world's oceans are connected. If you were to travel in a sailboat, you could sail to every ocean and every sea because they all join up.

The World's Oceans

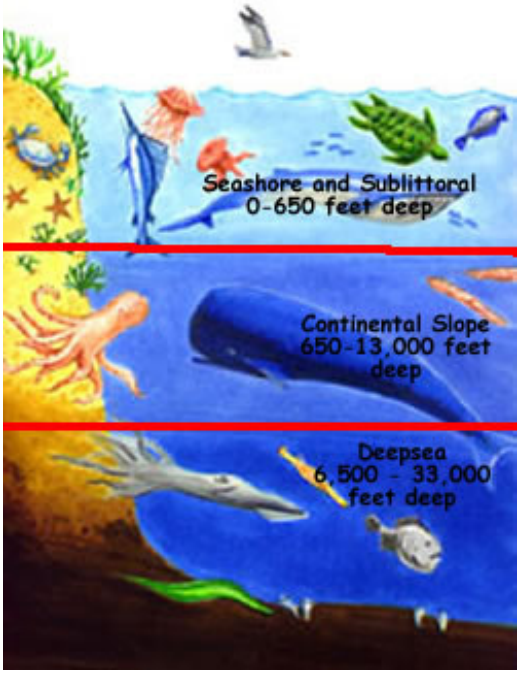
There are also smaller branches of oceans. We refer to smaller bodies of salt water as *seas*. The largest seas are the South China Sea, the Caribbean Sea, and the Mediterranean Sea. Do you know which continents these seas border?

So how big are the oceans, exactly?

Ocean	Area (square miles)	Average Depth (ft)	Deepest depth (ft)
Pacific Ocean	64,186,000	15,215	Mariana Trench, 36,200 ft deep
Atlantic Ocean	33,420,000	12,881	Puerto Rico Trench, 28,231 ft deep
Indian Ocean	28,350,000	13,002	Java Trench, 25,344 ft deep
Southern Ocean	7,848,300 sq. miles	13,100 - 16,400 ft deep	South Sandwich Trench, 23,736 ft deep
Arctic Ocean	5,106,000	3,953	Eurasia Basin, 17,881 ft deep

Oceans are enormous, three dimensional living spaces. They are home to vast amounts of *biodiversity*. Marine animals and plants are some of the most fascinating organisms on Earth, as well as some of the least understood.

Oceans are divided up into three general layers: 1. Seashore and Sublittoral Zone, 2. Continental Slope, and 3. Deepsea.



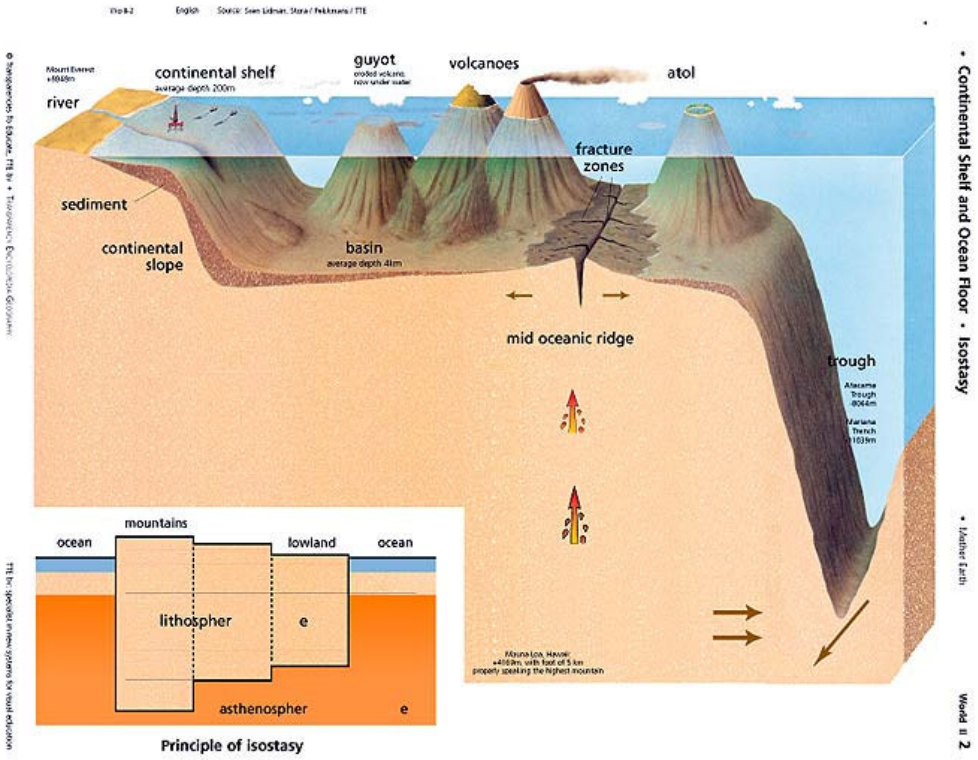
As you travel deeper into the ocean, the water becomes darker and colder. Each layer of the ocean has particular marine animals that live there. All of the animals have *adapted* to their respectful home. Most of the animals live within a particular depth range, but some change levels depending on whether it is day or night.

At the seashore and Sublittoral layer the water is warmed and lit by the sun's rays. Here, *plankton*, jellyfish, flying fish, sharks, dolphins, and turtles, and many others swim effortlessly through the ocean. As we head deeper into the Continental slope, we might find lantern fish, squid, and prawns. Once you reach the deepest depths of the ocean, animals receive very little sunlight, and therefore must be able to survive despite the cold, dark conditions. In the deepsea, you'll find small fish with large mouths and stomachs such as gulper eels, widemouths, anglerfish, and rattail fish.

Living in water is much different than living on land. Since water is *denser* than air, larger animals can survive in water that might not be able to live on land. For example, a giant blue whale can measure close to 100 feet long. This animal would not be able to move on land – it would simply be too heavy.

What Does the Ocean Floor Look Like?

If you were to drain the water from all of the oceans, you would have a landscape of mountains, deserts, forests, and volcanoes. Everything in the oceans is done on a grand scale. Some of the mountains would be higher than Mt. Everest, the deserts would make the Sahara look like a sandbox, there would be trenches much larger than the Grand Canyon, and the volcanoes would erupt with much more regularity than those found in continental costal areas or mountain ranges.



Giant cracks, volcanoes, trenches and deserts make up most of the ocean floor

Who lives in an ocean?

As we all know there are wide variety of animals who call the ocean home. When we think of animals in the ocean, the first thing that comes to mind is probably a fish. Yet, there are mammals, birds, reptiles, and invertebrates that all call the ocean home.

Since there are so many different types of animals that live in the ocean, we'll have to be selective in the ones we choose to study. Since we're going to Costa Rica, perhaps we should discuss some of the marine animals who live near there.

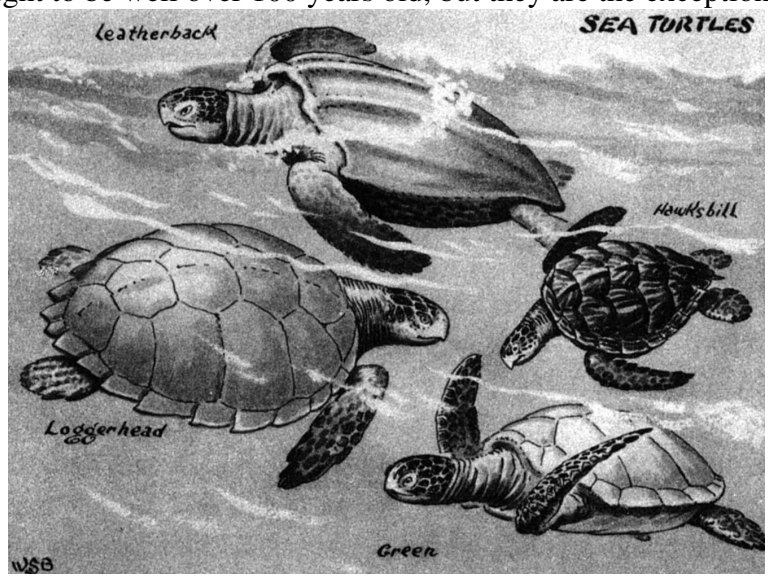
One of the reasons The Wilderness Classroom decided to travel to Costa Rica was because of the amazing sea turtle population there. There are seven species of sea turtles found in the world's oceans (green, hawksbilled, Kemp's ridley, leatherback, flatback, loggerhead, and Olive ridley). 5 of these species make their way to Costa Rica to lay

their eggs. The only two species of sea turtle not found in Costa Rica are the flatback and the Kemp's Ridley turtle.

To lay their eggs, female sea turtles navigate 1,000s of miles of open ocean to come home to the same stretch of beach that they were born on.

Sea turtles are amazing swimmers. The male sea turtles spend their entire lives in water. The females only come out of the water to lay their eggs. And what's more amazing is that the females always make it back to the same stretch of beach where they were born. This is a natural phenomenon that will continue to baffle scientists for years to come.

Sea turtles are a very special animal of the ocean. They survive tremendous odds to reach maturity (only 1 in 1,000 sea turtle hatchlings survive their first few years). Many scientists devote their entire careers to studying sea turtles, but they know relatively little of the sea turtle. Most scientists agree that sea turtles live to be about 70 years old. Some turtles are thought to be well over 100 years old, but they are the exception.



In Costa Rica there are many biological reserves dedicated to preserving the breeding habitat for sea turtles. Sea turtle eggs are a treasured commodity in many countries and

fetch high prices. Because of this, scientists and volunteers must keep diligent watch over the sea turtle eggs to protect them from poachers and predators.

Trouble in the Ocean?

People once thought that the ocean was so big, that nothing we did could ever affect it. Since the ocean is such a large ecosystem and habitat to some of the Earth's wildest creatures, it unfortunately is one of the most fragile. Pollution, global warming, habitat destruction, and over-fishing are just a few of the problems facing the oceans and seas today.

Even the smallest disturbance in the ocean can have enormous and lasting impacts for years to come. For if you impact one section of the ocean the rest is bound to be affected. The ocean is a very balanced ecosystem. There are many symbiotic relationships between marine plants and animals and between animals and other animals. Every thing that has a negative impact on one being, will ultimately have a negative impact on a variety of different species.

But, the more we learn about the fascinating relationships the organisms of the ocean have developed over time, the more we can learn what is needed to be done to save the Earth's oceans.

Activities for the Classroom

Title: Ocean Life Relationships

Objective: Students will begin to understand the complex relationships between the ocean's living organisms by creating a food pyramid.

State Standards Met:

12.A.2a Describe simple life cycles of plants and animals and the similarities and differences in their offspring.
12.A.2b Categorize features as either inherited or learned.
12.A.3c Compare and contrast how different forms and structures reflect different functions.
12.B.2a Describe relationships among various organisms in their environments. (e.g. predator/prey, parasite/host, food chains, and food webs.
12.B.2b Identify physical features of plants and animals that help them live in different environments.
12.B.3a Identify and classify biotic and abiotic factors in an environment that affect population density, habitat and placement of organisms in an energy pyramid.
12.B.3b Compare and assess features of organisms for their adaptive, competitive, and survival potential

Method: Line students up around the room. Have them hold hands. At the front of the line, the teacher will squeeze the first student's hand, representing the sun's energy. That student will then squeeze the next hand, and so on down the line, representing the transfer of energy. Have the student at the end tell when the squeeze reaches him or her. Begin the game again, but this time have one student removed from the chain. Have students explain what were to happen if one piece of the energy chain were to be broken.
Next come up with a list of animals found in the ocean. Classify each animal according to what they eat (this could be as simple as identifying herbivore/carnivore or as complex as including all three different types of plankton). Discuss predator-prey models within the ocean.
Discuss what happens when the populations of prey becomes weakened. What happens to the predator? What happens to the prey when predators are removed?
Use the Ocean Food Pyramid worksheet to place the animals in their correct order.

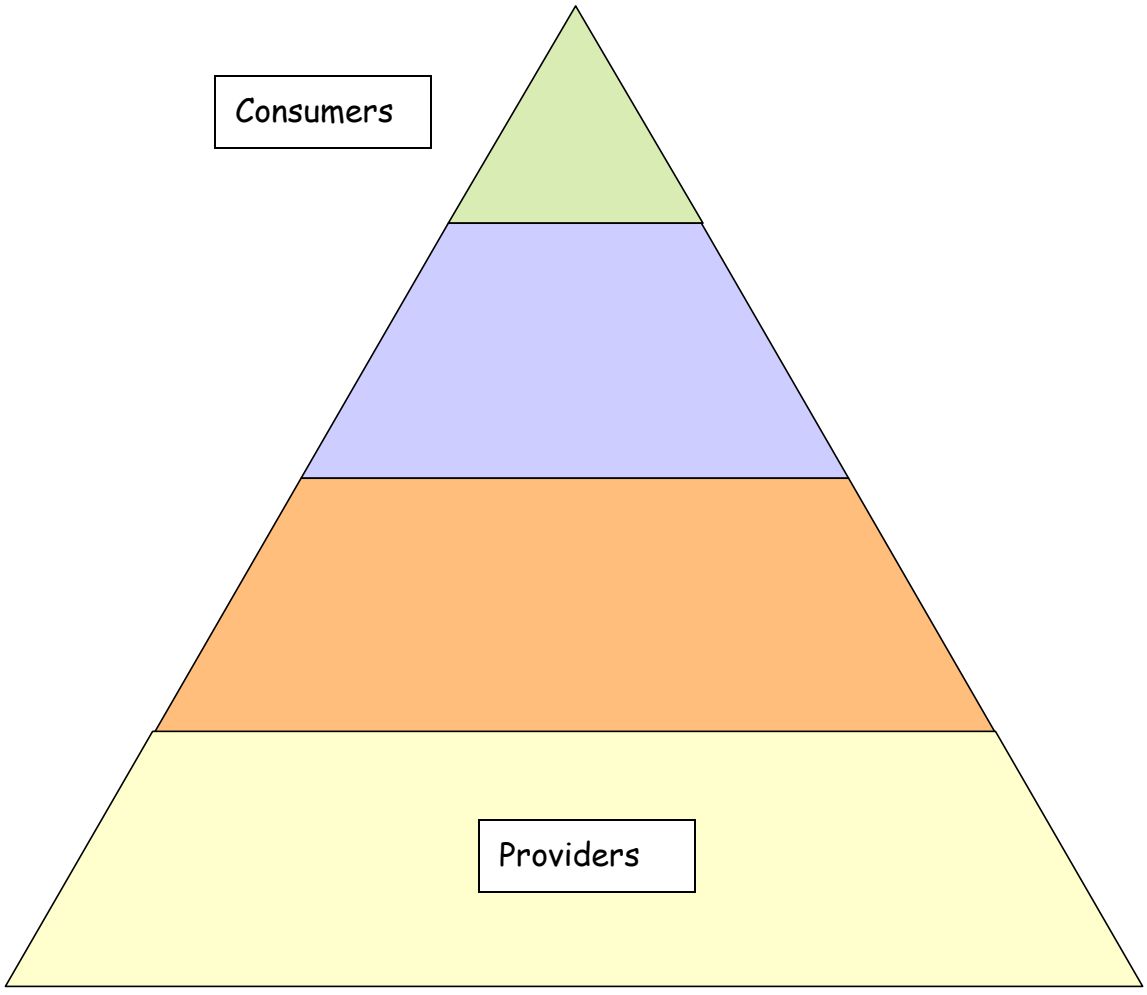
OCEAN LIFE FOOD PYRAMID

Every living creature in the ocean relies on other plants or animals to provide them with food. This is referred to as the ocean's balance. Pollution, global warming, and other factors threaten this balance. Think about where each of the following organisms fit into the ocean's food pyramid.

Whale **Shark** **Sea Algae** **Phytoplankton** **Tuna** **Sea Horse**

Krill **Dolphin** **Sea Turtle** **Seaweed** **Corral** **Shrimp**

Jellyfish **Seal** **Lobster** **Herring** **Zooplankton**



Title: Learn The Ocean's Currents

Objectives: Students will better understand the World Ocean's currents and be able to chart them on a globe. Students will learn about the influences of wind, water temperature, landmasses, and water density on currents.

State Standards Met:

12.B.2a Describe relationships among various organisms in their environments. (e.g. predator/prey, parasite/host, food chains, and food webs.

12.B.3a Identify and classify biotic and abiotic factors in an environment that affect population density, habitat and placement of organisms in an energy pyramid.

12.B.3b Compare and assess features of organisms for their adaptive, competitive, and survival potential

Materials:

2 pie tins
Map of the world or globe
Pinch of oregano or chili powder (any herb that floats)
Straws
Food Coloring
Table Salt

Procedure: Have students brainstorm what they think the ocean's currents are caused by. Wind, water temperature, density, and landmass obstruction are the major causes of currents.
Fill the first pie tin with cold water.
Put the pinch of herb into the water and have students blow from the middle of the pie tin to the outer edge. Have students record their observations.
Using the globe, point out that the wind they created is analogous to the Equatorial Currents flowing west at the Earth's equator. These currents are forced into a clockwise rotation in the Northern Hemisphere and a counterclockwise rotation in the Southern Hemisphere because of the Earth's rotation and the landmasses that obstruct the waters' flow.

Next heat up about 50 ml of water.
Add a heaping tablespoon of salt and a few drops of food coloring.
Pour the hot water/salt solution into the cold water.
Observe and record how the denser water behaves when added.
Have students draw connections between the water behaves in the pie tins and how it might behave at the Earth's poles and Equatorial regions.

Web Resources:

http://www.geog.ouc.bc.ca/physgeog/contents/8q_1.html - A great map of the Earth's currents, their directions, and names.

Title: Simulate water pollution in your own classroom

Objective: Students will better understand how water pollution behaves and its effects on the aquatic ecosystems. Students will learn what causes water pollution and how to prevent it.

State Standards Met:

11.A.2a Formulate questions on a specific science topic and choose the steps needed to answer the questions.
11.A.2b Collect data for investigations using scientific process skills including observing, estimating and measuring.
13.A.2d Compare the relative effectiveness of reducing, reusing, and recycling in actual situations.
13.A.2f Analyze how specific personal and societal choices that humans make affect local, regional, and global ecosystems.
13.A.3e Identify advantages and disadvantages of natural resource conservation and management programs.
13.A.3f Apply classroom-developed criteria to determine the effects of policies on local science and technology issues (e.g. energy consumption, landfills, water quality).
12.E.2c Identify and classify recyclable materials.
12.E.3b Describe interactions between solid earth, oceans, atmospheric organisms that have resulted in ongoing changes of Earth.
12.E.3c Evaluate the biodegradability of renewable and nonrenewable natural resources.

Materials:

Aquarium or other large container for water
Rectangular Box
Water
Watering Can
Spray Bottle
Green Food Coloring (pesticides/fertilizer)
Vegetable Oil (motor oil)
Soil/Sand/Pebbles (erosion)
Grass Clippings (or shredded paper) and Twigs
Cafeteria Waste and Trash

Procedure: Set up the aquarium in the front of the classroom. Set the box on top quarter-sized hole in the bottom. Explain to students how watersheds work. Have students think of pollutants (human and natural) that would get flushed into the watershed during a rainstorm. Have them identify where these pollutants are likely to originate from (pesticides and fertilizer would come from agricultural areas, motor oil and trash might come from urban areas, etc.). Make a list on chart paper in the front of class.
Divide the students into five groups.

Assign each group a pollutant from the list of Materials. Have each group hypothesize what their pollutant's reaction to the water will be. Hypothesize about the environmental impacts caused by each pollutant and its effects on the soil, people, animals, and plants. Also discuss whether the pollutant is biodegradable or not, biotic, or abiotic.
Have each group come up and add their pollutant into the aquarium. Make sure each student records their observations.
Once all of the pollutants are added to the water, create scenarios for removing them.

Questions for the Chat Room

Topic: Sea Turtles and Coastal Areas of Costa Rica

Why are sea turtles so important to the Earth's oceans?

What is being to help preserve the sea turtle habitat?

What are some of the problems facing sea turtles today?

Where do sea turtles live? What do sea turtles look like?

How do female sea turtles find their way back to the same stretch of beach to lay their eggs?

Once the eggs are laid, what happens? What are some of the problems sea turtle eggs face?

How many species of sea turtle are there in the world? How many live in Costa Rica?

Have you met any marine biologists? What types of things do they do everyday? Where do they work?

Who lives on the coasts of Costa Rica?

What is the coast like? Are there many animals that live on the coast?

What types of activities are there to do on the coast or in the oceans?

Are any of the coastal areas of Costa Rica protected? How do they protect the beach, tide pools, and ocean?

What type of scientists study sea turtles?

What do people who live on the coast do for a living?

What types of food do they eat?

Do the ocean's currents affect life in the coastal villages? What about rainfall?

How do most people get around in the coastal villages?

Are there other animals that are endangered or threatened in the coastal regions? What is happening to their populations?

Glossary:

Adaptation – *n.* 1. An alteration or adjustment in structure or habits, often hereditary, by which a species or individual improves its condition in relationship to its environment. 2. Change in behavior of a person or group in response to new or modified surroundings.
Biodiversity – *n.* 1. The number and variety of organisms found within a specified geographic region. 2. The variability among living organisms on the earth, including the variability within and between species and within and between ecosystems.

Bioluminescence – *n.* Emission of visible light by living organisms such as the firefly and various fish, fungi, and bacteria.

Camouflage – *n.* 1. The method or result of concealing personnel or equipment from an enemy by making them appear to be part of the natural surroundings. 2. Concealment by disguise or protective coloring.

Carnivore – *n.* 1. A flesh-eating animal. 2. Any of various predatory, flesh-eating mammals of the order Carnivora, including the dogs, cats, bears, weasels, hyenas, and raccoons.

Continental shelf – *n.* A submerged border of a continent that slopes gradually and extends to a point of steeper descent to the ocean bottom.

Crustacean – *n.* Any of various predominantly aquatic arthropods of the class Crustacea, including lobsters, crabs, shrimps, and barnacles, characteristically having a segmented body, a chitinous exoskeleton, and paired, jointed limbs.

Density – *n.* 1. The quality or condition of being dense. 2. a.The quantity of something per unit measure, especially per unit length, area, or volume. b.The mass per unit volume of a substance under specified conditions of pressure and temperature. 3. The number of individuals, such as inhabitants or housing units, per unit of area.

Gills – *n.* The respiratory organ of most aquatic animals that breathe water to obtain oxygen, consisting of a filamentous structure of vascular membranes across which dissolved gases are exchanged.

Invertebrate – *n.* Lacking a backbone or spinal column; not vertebrate.

Mammal – *n.* Any of various warm-blooded vertebrate animals of the class Mammalia, including humans, characterized by a covering of hair on the skin and, in the female, milk-producing mammary glands for nourishing the young.

Oceanography – *n.* The exploration and scientific study of the ocean and its phenomena. Also called *oceanology*.

Plankton – *n.* The collection of small or microscopic organisms, including algae and

protozoans, that float or drift in great numbers in fresh or salt water, especially at or near the surface, and serve as food for fish and other larger organisms.

Predator – n. An organism that lives by preying on other organisms.

Sea – *n.* The continuous body of salt water covering most of the earth's surface, especially this body regarded as a geophysical entity distinct from earth and sky.

Transparent – *adj.* Capable of transmitting light so that objects or images can be seen as if there were no intervening material.

Unique – *adj.* Being the only one of its kind.

Online Resources:

Oceanic and Atmospheric Administration web site
http://www.noaa.gov/
This site offers good news and educational information about the Earth's oceans.

Missouri Botanical Garden's Index of Salt Water Animals
http://mbgnet.mobot.org/salt/animals
Ocean animals galore from an unlikely source!

Fishbase
http://www.fishbase.org
A great resource for almost every types of fish in the oceans, seas, lakes, and rivers of the world.

Earthwatch Web Activities
http://teacher.scholastic.com/activities/explorer/oceanlife/index.htm - A really well done series for 3rd-5th graders in conjunction with Scholastic and Earthwatch. Learn about nesting Leatherback turtles in Costa Rica and help scientists monitor them.

Ocean Planet
http://seawifs.gsfc.nasa.gov/ocean_planet.html
The Smithsonian's list of information, photos, and lessons and activities following their Ocean Planet exhibit.

Office of Naval Research
http://www.onr.navy.mil/focus/ocean/motion/default.htm
A great resource for learning more about tides, currents, and waves. Test your new found knowledge with their online quizzes.

Ocean Life For Kids
http://www.calstatela.edu/faculty/eviau/edit557/oceans/linda/lwelcome.htm
A good resource for introducing younger students to the wonders of the oceans.

Oceans Alive!
http://www.abc.net.au/oceans/alive.htm
Oceans Alive! is the Australian Broadcasting Company's oceanography website with nice photos and content.

SEA Lesson Plans
http://www.sea.edu/k12LessonPlans/k12pgmtop.htm - A comprehensive group of lessons, thematic units, and quick activities brought to you by a very cool program that I would have loved to know about when I was in school.