



## Coral Reefs

**Coral reefs** (cor-al reefs) are often called the “rain forests” of the sea. Do you know why? Both coral reefs and rain forests are **ecosystems** (eco-sys-tems) communities of plants and animals that live together in harmony. Both are colorful worlds filled with thousands of different kinds of plants and animals – so many that scientists have not discovered them all! Both are sources of new medicines and biochemicals.

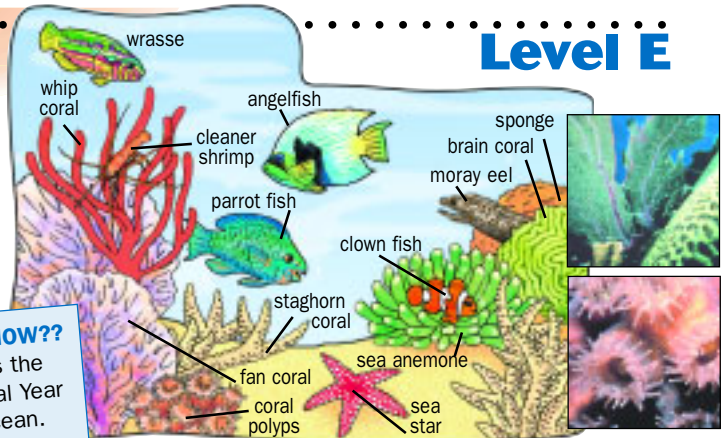
### Where Do Corals Grow?

Coral reefs are like busy underwater cities. They grow best in the warm, clear, shallow, salty waters of **tropical** (trop-i-cal) oceans (60% of all coral reefs are located in the Indian Ocean and Red Sea; 25% are located in the Pacific Ocean; and 15% are in the Caribbean). Cold-water coral reefs have also been found at higher latitudes.

Coral reefs are built by tiny animals called **coral polyps** (cor-al pol-y-ps). Polyps resemble little upside down jellyfish. For protection, they build stony cup-shaped houses called **corallites** (cor-al-lites) around their soft bodies. To build these houses, they use a chemical called **calcium carbonate** (cal-ci-um car-bon-ate) that they take from sea water. Calcium carbonate is also found in our bones and in eggshells. Polyps like to live close together with their houses connected to one another like an apartment building. Some of these “apartment buildings” are shaped like brains or fingers. Others look like moose antlers, cabbages, or boulders. Coral reefs take thousands of years to form and are made of millions of corallites.

### How Do Corals Survive?

Coral polyps are hunters. At night they catch tiny drifting animals called **zooplankton** (zoo-plank-ton) with their stinging **tentacles** (ten-ta-cles). During the day they hide. Hunting does not provide them with enough food, though. To help them survive, they have tiny plants living inside their bodies which make food using sunlight.



Level E

**DID YOU KNOW??**  
1998 was the International Year of the Ocean.  
1997 was the Year of the Reef.

Photo Top Right: Brain coral and sea fan  
Photography by: Steven Cook

Photo Bottom Right: Coral polyps on Molasses Reef  
Photography by: Brent Deuel

Images courtesy of the Florida Keys National Marine Sanctuary

These plant partners share their food with the polyps in exchange for a safe home.

Many coral reef plants and animals depend on each other for food, protection, and cleaning. Some are **diurnal** (di-ur-nal) or active during the day. Others are **nocturnal** (noc-tur-nal) and only come out at night. Reefs are also visited by many other animals looking for food or a place to have their young.

### Coral Reefs in Danger

For thousands of years, coral reefs have survived hurricanes and changes in the oceans. Today, coral reefs are in danger. Global changes in the Earth’s climate are making the oceans warmer. This warmth is one of many factors that can cause coral **bleaching** (bleach-ing), the whitening of coral colonies due to the loss of **symbiotic zooxanthellae** (sym-bi-ot-ic zo-o-xan-thel-lae) from the tissues of polyps.

**Pollution** (pol-lu-tion) from land, air and water is poisoning the reefs. And ships and divers may damage the coral accidentally. There are also predators such as seaweed that block sunlight and certain species of sea stars that eat the coral.

Today, many countries around the world are working to protect their coral reefs. Find out what they are doing and see if you can perform similar environmental activities in your community. Even if you live far from the ocean, you can help protect the world around you.



# Weekly Lab

Please see **Teaching Notes** before beginning this lab.

Which water sample has the most salt?  
How can you find out? For each step below make a prediction **BEFORE** you conduct the test.

### DID YOU KNOW??

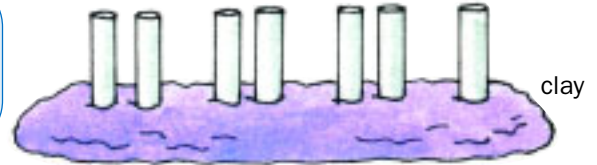
The saltiness of sea water affects how divers sink and float. Salty water makes it easier to float.

### DID YOU KNOW??

The ocean contains enough salt to cover all the land on Earth with a layer 500 feet thick!

**You need:** clear plastic drinking straws cut into seven 3 inch (7.5 cm) pieces, colored pencils, eye droppers or pipettes, modeling clay, a cup of clear water, and red, blue, and yellow saltwater samples your teacher will give you

straw test tubes



**Step 1:** Stick 7 straw pieces vertically into the clay. These will be your test tubes and test tube holder.

**Step 2:** For **Test A** – Use your eye dropper to fill the 1st test tube half way with some of the yellow sample. Next, carefully drip a little of the blue sample into the same test tube. (Keep your eye dropper above the test tube and rinse the dropper out in clear water after each use.) What happened? Record your results by coloring **Test A** to the right.

eye dropper or pipette

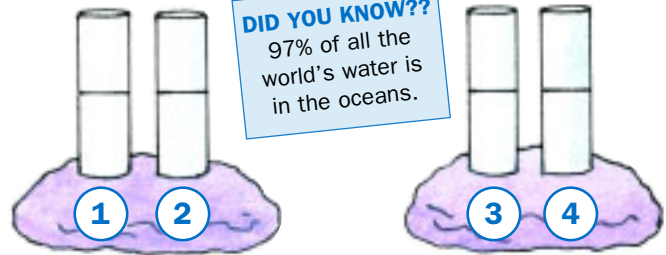


Yellow Sample Red Sample Blue Sample Clear Water

**Step 3:** In the 2nd test tube – test the same colors, but this time put the blue sample in first and drip the yellow in second. Color your results in the 2nd test tube in **Test A** to the right. Which color sample is heavier (more dense)?

### DID YOU KNOW??

97% of all the world's water is in the oceans.



Test A yellow and blue

Test B yellow and red

**Step 4:** For **Test B** – Use your eye dropper to fill the 3rd test tube half way with some of the yellow sample. Carefully drip some of the red sample into the same test tube. What happened? Use your colored pencils to record your results in **Test B** to the right.

**Step 5:** In the 4th test tube – test the same colors, but this time put the red sample in first and drip the yellow in second. Record your results in the other test tube in **Test B**. Which color sample is heavier (more dense)?

### DID YOU KNOW??

More than 3 million tourists visit Hawaii's coral reefs every year!



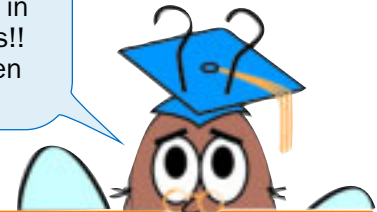
Test C blue and red

The BIG TEST

**Step 6:** For **Test C** – Use your eye dropper to fill the 5th test tube half way with some of the blue sample. Carefully drip some of the red sample into the same test tube. What happened? In the 6th test tube, reverse these colors, putting the red sample in first. Again, color your results.

**Step 7:** When you think you know which color is the most dense and which color is the least dense, it is time to create a “density tube”. You will do this in **The BIG TEST**. Using the 7th test tube, first add the color that you think is most dense. Fill up about 1/4 of the tube. Then add the one that is the next densest (another 1/4 of the test tube) and finally add the least dense one (1/4 of the test tube).

If you are right, your colors will stay in separate layers!! If they mix, then try again...



**Step 8:** Write about your results (see page 3).

**Challenge:** Using the test tube from step 7 add clear water to the tube, filling it to the top. What do you observe? Why do you think this happened?

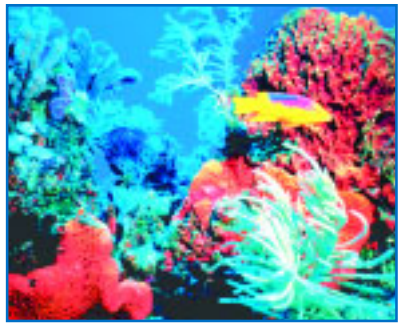


# Math

## Graphing the SST (Sea Surface Temperature) Surrounding Coral Reefs



Healthy Coral  
Image courtesy of  
The Florida Keys  
National Marine  
Sanctuary



**SCIENCE SAYS:** Coral bleaching is the whitening of coral colonies due to the loss of symbiotic zooxanthellae from the tissues of polyps. This loss exposes the white calcium carbonate skeletons of the coral colony. Changes in a coral's environment (such as disease, excess shade, increased levels of ultraviolet radiation, pollution, salinity changes and increased temperatures) can cause this to occur.



Partially bleached coral  
Image courtesy of OAR/National  
Undersea Research Program (NURP),  
University of North Carolina at  
Wilmington  
Photography by: S. Miller

Scientists at NOAA (National Oceanic and Atmospheric Administration) routinely monitor the temperature of the ocean surface around the globe. This Sea Surface Temperature (SST) data can be graphed or plotted and used to predict stresses on coral colonies.

Visit the **coral reef watch** web site at:  
[http://coralreefwatch.noaa.gov/satellite/current/sst\\_series\\_24reefs.html](http://coralreefwatch.noaa.gov/satellite/current/sst_series_24reefs.html)  
and select 3 locations each from the Northern and Southern Hemispheres.

For each station, they should record the following information on their data sheet: SST on the first day of the current month, latitude, longitude, and name. Then make a bar graph of the data in two ways:

1. In the order you collected the data, and
2. With the bar graph ordered from warmest to coldest.

Which representation do you think is the most useful? Tell why you think so.

**DID YOU KNOW??**  
The coral reef ecosystem in the Florida Keys is the third largest in the world. It covers over 225 miles (360 km).



# Writing In Science

On page 2, you created a "density tube." Write about this experiment in your science journals. Explain what you did and what you observed. Why do you think the different samples had different densities?

**DID YOU KNOW??**  
In order to stay healthy, large fish regularly visit "cleaning stations" on the coral reefs. There, tiny "cleaner" shrimp and fish eat the parasites and dead tissue off of the larger fish's bodies.

**DID YOU KNOW??**  
Nearly 1/4 of all sea creatures live at least part of their lives on a coral reef!!

**Drop a grain of *cooked* rice into the "density tube."**  
**What do you observe?**

**Write about how you could use this "density tube" to determine which of 2 items is denser than the other. Hint: The objects can't be too heavy.**



**DID YOU KNOW??**  
Clown fish live among the stinging tentacles of sea anemones. Their skin is covered with slime to keep them from getting stung. Clown fish and anemones help protect each other.

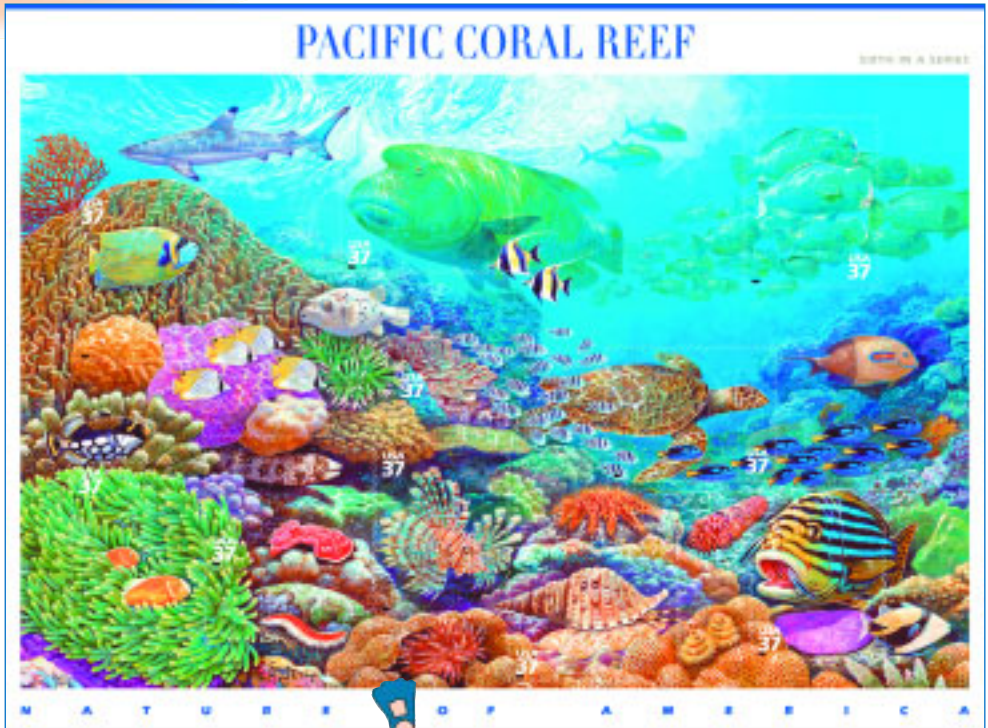




## FYI – Further Your Interests

### Stamp Collecting

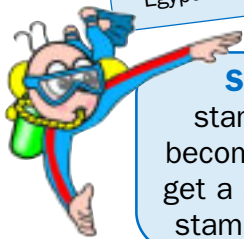
Take a look at this sheet of Coral Reef stamps issued by the U.S. Postal Service in January 2004. Notice how the animals that live on the reef are easily hidden or **camouflaged** (cam-ou-flaged). How many distinct animals and plants can you find? As you tally, put an “X” over the animal or plant. Then select two of the species and learn more about them.



© 2003 U.S. Postal Service, preliminary design, sixth in a series of “Nature of America” stamps.

#### DID YOU KNOW??

Some coral reefs are older than the Egyptian pyramids!!



#### SCIENCE SAYS...

Are you a stamp collector? Do you want to become one? If so, you may want to get a sheet of these neat Coral Reef stamps from your local post office.



Think globally too. Other countries have issued coral reef stamps.



## Meet the Scientist

**Niels Lindquist**, Marine Biologist  
University of North Carolina at Chapel Hill  
Institute of Marine Sciences  
Morehead City, NC

#### DID YOU KNOW??

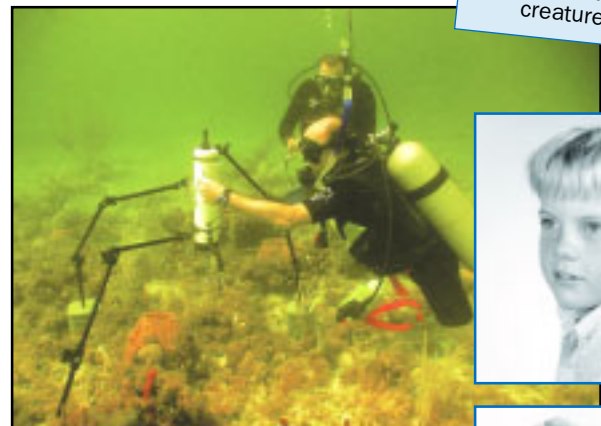
New medical research is using coral as a base to grow new bones for people.

#### DID YOU KNOW??

Coral reefs are the largest structures ever built by living creatures.

**Dr. Niels Lindquist** (at right, in front) works with fellow aquanaut, Jeremy Weisz, to set up an ADV (acoustic doppler velocimeter). The ADV measures the speed and direction of moving seawater. It does this by comparing the sound wave frequency emitted by the ADV with that returning to the ADV after bouncing off particles moving in the water. It is much like throwing a ball against a wall. Here, the aquanauts are measuring the rate of water flowing out of sponges to determine the volume of water that sponges pump through their bodies.

In August 2004, Dr. Lindquist and others were conducting experiments from an underwater laboratory called **Aquarius** in the Florida Keys. The arrival of Hurricane Charley (a very strong hurricane) caused the scientists to leave Aquarius on day 4 of a planned 10-day mission.



Dr. Niels Lindquist, (above, front), is working with Jeremy Weisz to set up an ADV. Image courtesy of Chris Martens.



Top right, Niels Lindquist in the fifth grade.

Bottom right, Niels Lindquist at age 13.