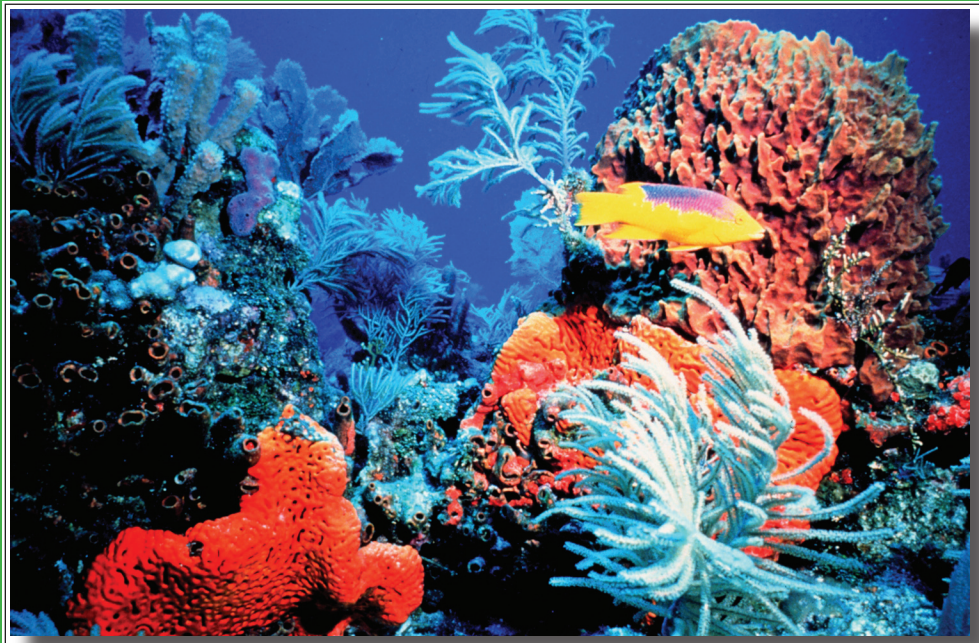

Make an Edible Coral Reef

Spanish hogfish at reef.
Coutesy Florida Keys National Marine Sanctuary

You have probably seen pictures of coral reefs before—lots of colors, fishes, and weird looking shapes! Coral reefs are not only beautiful to look at; they are also home to thousands of other species. In fact, scientists estimate that there may be another one to eight million undiscovered species living in and around reefs! Coral reefs support more species per square foot than any other marine environment. This abundance of living organisms is key to finding new medicines for the 21st century. Many drugs are now being developed from coral reef animals and plants as possible cures for cancer, arthritis, human bacterial infections, viruses, and other diseases.

Coral reefs are important for other reasons as well. Coral reefs are a breeding ground for many fish and other species, and millions of people and thousands of communities all over the world depend on coral reefs for food. In the United States, coral reef ecosystems support hundreds of commercial and recreational fisheries worth more than 200 million dollars. Local economies receive billions of dollars from visitors to reefs through diving tours, recreational fishing trips, hotels, restaurants, and other businesses based near reef ecosystems. Coral reefs protect shorelines against waves, storms and floods, and help prevent loss of life, property damage and erosion.

Despite their importance, many of Earth's coral reefs are in trouble. Severe storms, water pollution, overfishing, disease, global climate change, and ships running aground are some of the things that have destroyed or badly damaged many reefs. Because of these threats, coral reefs and all of the creatures that call them home may be in danger of disappearing if something isn't done to protect them. NOAA

What You Will Do

Make an edible model of a coral reef!

is one of many organizations participating in the U.S. Coral Reef Task Force, which was established in 1998 to protect and conserve coral reefs. Satellites are being used to map shallow U.S. coral reefs, as well as to watch for high sea surface temperatures that can damage corals and to detect harmful algae that can smother reefs. NOAA's National Undersea Research Program does research projects to learn more about coral reefs, and restores damaged reefs in marine reserves and among deep sea coral banks.

Coral reefs need your help, too! More people need to understand why coral reefs are important and what needs to be done to protect them. Here's a tasty way to start a conversation about coral reefs.

What You Will Need:

- ❒ One half sheet cake; if you want to bake your own cake you will need a box of cake mix and other ingredients listed on the box
- ❒ Icing in various colors
- ❒ Food coloring
- ❒ Marshmallows, licorice whips, small cookies, candy sprinkles, or other edible materials for modeling coral reef animals and habitat features

Warnings:

1. Get an adult to help with baking.
2. Don't eat too much!
3. Wash your hands before handling food! If more than one person is involved with this activity, you may also want to wear disposable gloves.

How to Do It:

1. If you aren't familiar with coral reefs, read the sidebar "What is a Coral Reef?" You may also want to look at books about coral reefs or check out the Web sites listed under "Want to Do More?"

A purple soft coral. Courtesy Florida Keys National Marine Sanctuary

A healthy coral reef ecosystem contains thousands of species, so you can't really include everything in your model. Instead, plan a model that is colorful and interesting, using the images on these pages for ideas. Remember, the main idea is to create a model that will help start a conversation about coral reefs (and is also good to eat!). Before you actually make your model, make a list of what plants or animals you want to include, and what materials will be used to show them on the model. Mounds of icing can be used for boulder-shaped corals. When icing mounds have hardened they can be sculpted to form caves and overhangs. Small cookies could represent plate-shaped corals. Coconut colored with green food coloring could be used for seagrass. Sponges could be modeled with small pieces of sponge cake (of course). Licorice whips could represent branching corals. Gummy fish or fish crackers on toothpicks can represent fish. Raisins or chocolate chips might be sea urchins. Of course, there are many more possibilities, and you probably already have a pretty good idea of things you could use in your model.

2. If you plan to bake you own cake, mix the batter according to instructions on the box, and bake the cake in an oversized flat pan like a broiler pan or turkey roasting pan. Your cake will probably take less time to bake than the time stated on the cake mix box, because your cake will be thinner than usual.

3. The flat cake is the base of your model reef. Add the features you planned in step 1 to complete the model. This is a lot of fun to do with two or three other people, but be sure you wash your hands and wear disposable gloves so you can safely eat the model later.

4. Show your model to your friends, parents, school, or other groups, and talk about why coral reefs are important, why they are in trouble, and what we can do to help save them. If you are using your model at school, your teacher may be able to arrange for you to make a presentation about coral reefs to another group of students, perhaps a younger class. When you have finished your presentation, you can say, "Now it is time for us to have a direct interaction with this model reef." Which means everyone can eat the cake!

Grey snappers at the reef.
Courtesy Florida Keys National Marine Sanctuary

Want to Do More?

http://www.coris.noaa.gov/about/ – Information about coral reefs from NOAA's Coral Reef Information System

http://www.coralreef.noaa.gov/outreach/thingsyoucando.html – Things You Can Do to Protect Coral Reefs from NOAA's Coral Reef Conservation Program

http://www.coralreef.noaa.gov/news/welcome.html – NOAA's Coral Reef Newsletter

http://www.coralreef.noaa.gov/outreach/welcome.html – Coral Reef Conservation Program, Education and Outreach

http://oceanservice.noaa.gov/education/kits/corals/welcome.html – Coral Reef Discovery Kit from NOAA's National Ocean Service

http://www.latimes.com/news/local/oceans/la-oceans-series,0,7842752.special – A five-part series from the Los Angeles Times about what is happening to Earth's oceans

Barrel sponges.
Courtesy Florida Keys National Marine Sanctuary

Elkhorn coral and a white spotted filefish.
Courtesy Florida Keys National Marine Sanctuary

Butter hamlet fish with soft corals.
Courtesy Florida Keys National Marine Sanctuary

What is a Coral Reef?

Corals are animals that do not have backbones, and are related to jellyfish. The large boulders that we see in pictures of coral reefs are colonies of many individual coral animals called polyps ("PAH-lips"). Polyps are made of an outer cell layer called epidermis ("ep-ih-DERM-iss") and an inner cell layer called gastrodermis ("gas-tro-DERM-iss"), with a jelly-like substance called mesoglea ("mez-oh-GLEE-uh") in between. Each polyp makes its own cup-shaped skeleton called a calyx ("KAY-lix)" from limestone (calcium carbonate). The base of the calyx is called the basal plate, and the outer walls of the calyx are called the theca ("THEE-kuh"). Vertical partitions called septa extend part-way into the cup from the inner surface of the theca. The outer surface of the theca is covered by the soft tissues of the coral. Polyps have a mouth surrounded by a ring of arms called tentacles. The tentacles have stinging cells called nematocysts ("nee-MAT-oh-sists") that polyps use to capture food. Most corals are carnivorous, and feed on small floating animals or even fish. Many corals also feed by collecting very small bits of floating material on strings of mucous, which they pull into their mouths. Food is digested by digestive filaments in the stomach. Waste is expelled through the mouth.

Most reef-building corals have very small polyps, about one to three millimeters in diameter; but all of the polyps in a whole colony can make a limestone rock that weighs several tons! Individual polyps in a coral colony are connected by a thin band of living tissue called a coenosarc ("SEE-no-sark").

A colony of star coral. Courtesy Commander William Harrigan, NOAA Corps (ret.), Florida Keys National Marine Sanctuary

As the polyps grow and multiply, the coral colony may become shaped like boulders, branches or flattened plates. Some corals form tall columns, others resemble mushrooms, and some simply grow as a thin layer on top of rocks or the skeletons of dead corals.

When corals reproduce, they release free-swimming larvae that can be carried many miles away by ocean currents. A new reef begins when these larvae attach to underwater rocks or other hard surfaces along the edges of islands or continents.

As the corals grow and expand, other animals and plants join the reef system. Sponges and soft corals (sea fans and sea rods) are particularly visible on many reefs. Various types of seaweed and algae are also important. Some of algae produce limestone structures that add to the overall reef structure. Fishes and many other types of animals take advantage of shelter provided by the reef, and feed on algae and bacteria that grow on surfaces within the reef.

Most reef-building corals also contain algae that live inside the soft tissue of the polyp. These algae are called zooxanthellae (pronounced "zoh-zan-THELL-ee"), and like other algae are able to use energy from the sun to make food. So the corals and algae have a relationship that is called "mutualistic." This means that the coral and algae both benefit from the relationship: The coral gives the algae a protected environment and chemicals the algae need to make food. In return, the algae provide the coral with food, oxygen and help remove wastes from the coral. This relationship allows corals to grow in waters that do not have much food available.

Besides providing corals with food, zooxanthellae are also responsible for the bright colors of many corals. When corals are stressed, particularly by high temperature, the polyps lose their zooxanthellae and the coral colony becomes completely white. This is often called "coral bleaching." Coral polyps can live for a short period of time without zooxanthellae, but if bleaching lasts too long the coral may die.

Why are Coral Reefs in Trouble?

Coral reefs face numerous hazards and threats. Scientists estimate that 20 percent of all coral reefs are pratically destroyed and are not likely to recover. Twenty-four percent are in critical condition and may die soon, and another 26 percent are threatened. Most scientists believe this damage is caused by a combination of natural stresses and human activities. (from Status of Coral Reefs of the World: 2004)

Reef scene. Courtesy Thomas Gibson. Florida Keys National Marine Sanctuary

Some of the biggest problems are:

Excessive Fishing – Many coral reefs have very few fishes because they have been captured for food or aquariums. In healthy reef ecosystems, fishes graze on algae. Without the fishes, algae can grow rapidly and smother coral polyps. Some algae produce poisons that make the problem even worse.

Destruction of Habitats – Some fishing methods completely destroy living reefs. Fishing with large nets that are dragged across the bottom (bottom trawling) is extremely destructive. In some countries, fishermen use dynamite to stun fish, which also kills coral animals and damages the reef structure.

Pollution – Chemical poisons from sewers, farm runoff, and many other sources kill corals and many other ocean species. Fishermen in some areas use cyanide which kills coral polyps as well as fishes.

Invasive Species – Plants and animals that do not naturally live on reefs can damage the reef ecosystem. Some invasive seaweeds can grow rapidly enough to smother reef-building corals.

Ocean Warming – Reef-building corals in shallow water need warm temperatures and most are found in the tropics. But if the temperatures rise a few degrees above normal, corals can overheat. "Coral bleaching" is often the result of overheating, and is happening more often as many areas on Earth become warmer. If the temperature drops again, corals may recover. But in many cases, the corals die.

"The Rise of Slime" – Many reefs are becoming overgrown with marine algae and films of bacteria. Part of the problem is pollution. In the Gulf of Mexico, for example, fertilizer pollution causes excessive growth of algae that is responsible for a "dead zone" the size of New Jersey. Removal of fish that normally feed on algae and bacterial films is another cause. Habitat destruction, overfishing, and pollution also kill natural filters like oysters and sponges that normally help clean the water.

The big problem is that many people do not understand what is happening to Earth's ocean, and what the ocean will be like in the future. So one of the most important things we can do is inform others, and learn more about what needs to be done. Check out the Web sites under "Want to Do More?" and *http://www.coralreef.noaa.gov/outreach/thingsyoucando.html*.