Creating Coral – A Study of the World's Coral Gardens

Age: High School

Objective

- **To educate students on what coral reefs are, why they are important and the dangers that coral reefs are facing in the world today.**
- **To demonstrate in the classroom how coral polyps create their calcium carbonate cups.**

Background Lesson

One of the most beautiful displays of colour and texture in the world, coral reefs also support an ecosystem with amazing diversity unparalleled anywhere else on the planet. Unfortunately, these reefs are also some of the most fragile and endangered ecosystems in the world, extremely vulnerable to temperature, light or environmental changes. Humans also are very damaging to coral reefs, mainly in their attempt to collect fish from these areas for food or to sell to exotic pet stores. Fishing methods used by humans include using explosives or cyanide to stun the fish and pick them out from between the corals.

Environment

Environments allowing for the establishment of coral reefs require both shallow and warm waters. Coral reefs are confined to 30ºN and S latitude where outside of this range near-shore marine environments make the transition to kelp forests. The depth range suitable for coral reefs to develop must allow for sufficient light penetration so that photosynthesis may occur. Corals also require clean, clear water.

Structure

A cross section of a coral reef includes the *reef crest*, *buttress zone*, *lagoon*, and *patch reefs*.

There are three types of coral reefs: fringing reefs, barrier reefs and atolls.

Fringing Reefsare located right at the shore of a continent or island. Oftentimes, fringing reefs will develop when corals grow around young, newly formed islands. Fringing reefs have either an extremely shallow lagoon or none at all.

Barrier Reefscan be found some distance offshore. The reef is found between the open sea and a lagoon that separates the reef from the land. Barrier reefs can sometimes form during the subsidence of an island when corals will continue to grow outward from the island towards the sea.

Atolls consist of a number of coral islets that form a ring around where a now submerged island used to exist. The area within the ring is known as the lagoon. This type of coral reef is commonly found scattered throughout the Pacific and Indian Oceans.

What are Corals?

Corals are actually living animals. They belong to the phylum Cnidaria which also includes jellyfish, hydras and sea anemones. Corals are what is known as a sessile creature. This means they cannot move but bind to a substrate and use their tenticles to collect food and oxygen from moving currents.

Although a coral appears to be a single organism, it is actually a collection of individuals known as polyps. The individual coral polyps secrete a hard calcium carbonate skeleton which serves as a base for the entire colony. Different species of corals form colonies of different sizes and shapes leading to the great diversity we see in a coral reef. Examples include fan corals and brain corals.

Each coral polyp is attached by its base to the calcium carbonate exoskeleton. The soft polyp extends above the skeleton, reaching with its tentacles for food which it takes in through its mouth into its open gut.

Most corals form a symbiotic relationship with an algae known as zooxanthellae. This algae receives from the coral carbon dioxide, nitrates and phosphates, all of which are required for prolonged photosynthesis and algal life. The algae provides the coral with oxygen and removes wastes from the coral. It also provides very important metabolic materials such as glucose, glycerol and amino acids from which the coral may obtain energy.

Apart from all the nutrients the coral acquires from the zooxanthellae, the algae blanket also provides each coral with a unique and beautiful colour. This is what is responsible for the vibrant beauty of the coral reefs.

Corals in Danger

Today, 10 percent of the world's coral reefs have been destroyed. In the Philippines, 70% of the area's once healthy coral reefs no longer exist. Humans, both directly and indirectly, are responsible for this damage and show no signs of stopping.

Indirectly, humans have altered the habitat of corals so much that they can no longer survive. Corals require a delicate balance of salinity, temperature, oxygen levels and light. Human alteration of these factors have resulted in damage to corals known as coral bleaching. This is when the zooxanthellae algae that covers the coral and provides it with nutrients can no longer survive and either dies or leaves the coral. Because it is the zooxanthellae that gives coral its colour, the reef takes on the plain white colour of the coral's calcium carbonate shell.

Biological alterations due to overfishing have also damaged the delicate coral reef ecosystem. Periodically, the crown-of-thorns sea star, a coral predator, experiences population outbreaks. This greatly damages the population of corals in the area. Outbreaks in algal populations is also extremely damaging to corals as increased algal levels block out the sun from the corals' zooxanthellae layer. This causes the zooxanthellae to die, subsequently resulting in coral death.

Currently, poor fishing techniques are damaging the coral reefs more than any environmental or biological alteration. In order to catch the fish that live in and around the coral reefs, fishermen lay explosives in the bed of a coral reef and upon detonation collect all the stunned fish from the area. This kills not only the fish but the entire habitat from which the fish are taken. Another technique is pouring cyanide into the reefs. They then rip through the coral and pick all the stunned fish out from in between. This destroys the coral not only from poison but also from being torn apart.

The Activity

In order to create a coral that appears as one, coral polyps secrete a calcium carbonate layer. This forms a hard exoskeleton that defines the shape of the coral. The calcium carbonate layer is what is exposed when coral bleaching occurs.

This experiment will simulate the crystal formation of coral polyps creating their calcium carbonate shell.

Materials

- **Plastic bowl (for each student)**
- **Pieces of charcoal, brick, tile, sponge or cement**
- **Water**
- **Salt**
- **Liquid bluing (found in bleach)**
- **Food colouring**
- **Measuring tablespoons**
- **Masking tape**
- **Pens**

Procedure

1. **Attach a piece of masking tape to each student's bowl and have them write their name on it with the pen.**
2. **Place pieces of charcoal, brick, tile, sponge or cement into the bowl.**
3. **Into the bowl add two tablespoons of water, two tablespoons of salt, and two tablespoons of liquid bluing. Place them onto a countertop overnight.**

4. **The next day, add two more tablespoons of salt and return to the countertop.**
5. **On the third day, two more tablespoons of each salt, water and bluing. Make sure you pour this directly to the bottom of the bowl, not over the substrate. Add some food colouring directly to the substrate.**
6. **By the third day, crystals should have began to form. In order to help the crystals to continue to grow keep adding two tablespoons of each salt, water and bluing each day. If the formation has not started to grow you may choose to add two tablespoons of household ammonia.**

These crystals from in a way that is similar to coral reefs.

Possible Assignments

Provide each student with a World Map and have them indicate where the world's largest coral reef, The Great Barrier Reef, is located. Using the internet, have students look up other coral reefs in the world and research their reef. Students should look into which organisms are present in the reef and what dangers the reef is facing.

Have students bring in pictures of corals or fish that live in coral reefs and a few sentences of information about them. Spread these pictures out throughout the classroom and have students "explore" the coral reef. You can even turn it into a scavenger hunt.

Have students research organizations that work to protect coral reefs. There are hundreds of organizations worldwide and each student can research their own. Questions to consider include why the organization considers the reefs important to save and ways they are going about helping them.