KIDS ENVIRONMENTAL LESSON PLANS

This lesson plan developed by:

CALIFORNIA ACADEMY OF SCIENCES

Build a Coral Polyp

Overview:
By building an edible coral polyp, students will learn the anatomy of coral, review the differences between plants and animals, and learn about the unique symbiotic relationship between corals and zooxanthellae.

Ocean Literacy Principles:

5. The ocean supports a great diversity of life and ecosystems
6. The ocean and humans are inextricably interconnected
7. The ocean is largely unexplored

Key Concepts:

- learn the anatomy of a coral polyp
- review the difference between plants and animals
- learn about the unique relationship between corals and zooxanthellae

Materials:

- plates (1 per student)
- toothpicks (1 per student)
- reusable straw (1 per student)
- section of large banana (1 per student)
- sour candy straws or twizzlers cut into 1 inch pieces (6 per student)
- sugar sprinkles (same color as the sour candy straws or twizzlers)
- jam
- round crackers (1 per student)
- oyster crackers (5-6 per student)

- coral polyp illustration
- coral polyp worksheets (1 per student)
- colored pencils, crayons, or markers
- paper towels/rag for clean-up

Duration:
35-45 minutes

Physical Activity:
Low

Background:
Corals are animals that belong to the phylum Cnidaria, which contains sea anemones, jellyfish, hydra, and corals. The name "Cnidaria" comes from the Greek word "cnidos" which means stinging nettle. Cnidarians are radially symmetrical with an opening at one end that is surrounded by tentacles. The tentacles have specialized stinging structures called nematocysts that are used for protection and to capture prey. The tentacles bring food into the animal's one opening, which is used both to take in food and to expel waste materials. The coral animal, made up of its tube-shaped body, its tentacles, and its mouth, is called a coral polyp.

There are two main types of corals: hard corals and soft corals. Hard corals are classified within the subclass Hexacorallia because their tentacles are arranged around the mouth in multiples of six ("hexa" = six). They are called hard corals because they extract calcium and carbon from the ocean water and deposit a hard calcium carbonate skeleton that surrounds the lower portion of the body. Coral polyps fuse their skeletons together and form large coral colonies. These fused polyps are the basis for coral reefs. Coral polyps extend their tentacles from their skeleton to feed and withdraw into the skeleton for protection. Thus, the appearance of a coral colony can look very different depending on whether the polyps are extended or not. When hard coral polyps die, the calcium carbonate skeleton remains intact. You can often find pieces of white coral, the remains of former coral colonies, washed up on tropical beaches.

Soft corals are classified within the subclass Octocorallia because their tentacles are arranged around the mouth in multiples of eight ("octo" = eight). Soft corals do not produce a hard external calcium carbonate skeleton and therefore do not contribute significantly to the building of reefs. They do however have small, hard internal structures called spicules, which are uniquely shaped for each species and are used to help identify soft corals. When soft coral polyps die, they decompose and simply disappear, except for their small spicules.

Hard corals and some soft corals contain zooxanthellae within their tissue. Zooxanthellae are marine algae, some of which are free living and some of which live inside the translucent, fleshy tissue of many corals and other marine organisms. Zooxanthellae that live in marine animals have a mutually beneficial symbiotic relationship with their host. This means that both the coral and the alga benefit from being in the relationship. The zooxanthellae photosynthesize from

within their coral host and produce sugars that provide nutrition to both the zooxanthellae and the coral. In return, the coral provides protection and assists the growth of the zooxanthellae by passing on some of its waste, which the zooxanthellae use as a nutrient source. It is the colorful zooxanthellae that give coral their different colors and because zooxanthellae need sunlight to perform photosynthesis, they are the reason why corals need sunshine to survive.

If coral is affected by an environmental stress such as increased temperature or sedimentation, the zooxanthellae leave the coral and the coral turns white. This is termed coral bleaching. Although zooxanthellae can live freely in the water without coral, corals that normally contain zooxanthellae in their tissue cannot survive for long without their symbiotic algae. They will slowly starve. Thus, coral bleaching can be lethal for the coral if the coral polyps do not reacquire zooxanthellae. The phenomenon of coral bleaching is of particular concern as sea surface temperatures rise with human-induced climate change.

Vocabulary:

- **hard coral**: marine animal that produces a hard, calcium carbonate skeleton and grows into coral reefs
- **coral polyp**: a marine animal with a body shaped like a cylinder and tentacles around a central mouth
- **algae**: a general term for microscopic or larger aquatic plants. They differ from trees and bushes because they don't have true roots, stems, and leaves.
- **zooxanthellae**: tiny algae that sometimes live inside other organisms such as coral
- **tentacles**: a flexible body part that is used for feeding, grasping, or moving
- **predator**: animals that eat other animals
- **symbiosis**: a close relationship between two or more organisms of different species, which is often beneficial for one or both organisms

Activity:

Introduction:

1. Ask students, "How many of you think coral is a plant? How many of you think coral is an animal?"
2. Corals are animals! Go over some of the big differences between plants and animals (as appropriate for age level). Make a table on board or large piece of paper.
    - Plants
        - use the sun's energy to make food through a process known as photosynthesis
        - have roots, stems and leaves
        - generally do not move from one place to another
        - have chlorophypll in their cells to capture light energy
        - plant cells have walls
    - Animals
        - cannot produce their own food from the sun and must eat other organisms in order to get food and energy

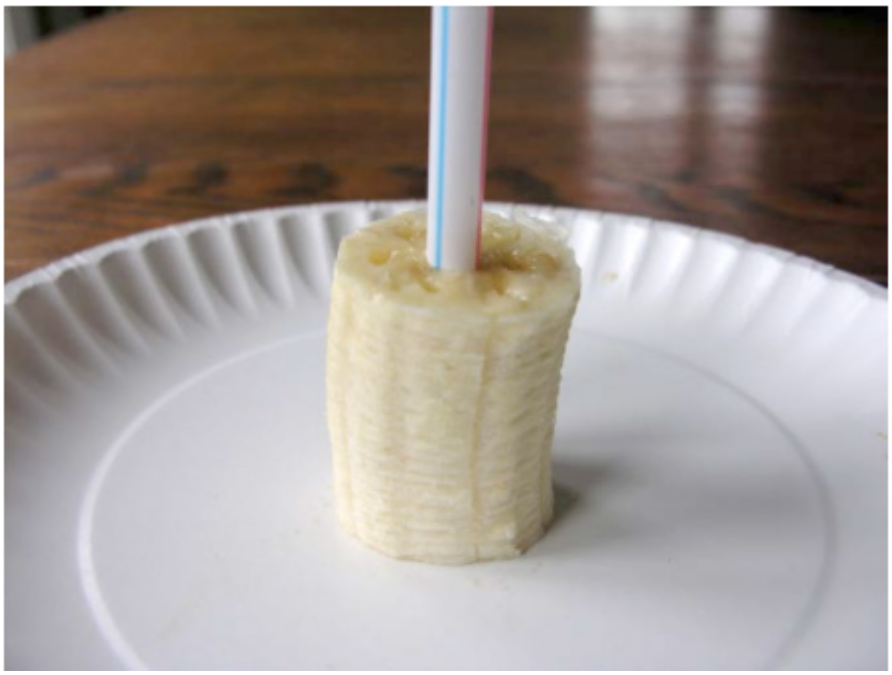
Build a Coral Polyp (cont.)

- do not have roots, stems and leaves
- generally can move to catch food
- do not have chlorophyll in their cells
- animal cells do not have walls and are more flexible and variable in shape

3. Show students image of coral polyp and discuss all of the labeled parts: tentacles, mouth, gut, skeleton, and zooxanthellae. Find pertinent information for this discussion in the background section above. *Note: It is very difficult to draw a typical coral polyp as there is a lot of variation in their forms. This illustration shows the basic components of coral polyps. Although the skeleton sits underneath the polyp in this illustration, the skeleton is actually outside the polyp itself and the polyp can contract and retract inside the calcium carbonate skeleton for protection.*
4. Ask students, "What makes this coral polyp an animal?" *It eats other organisms by capturing them with its tentacles. It does not have plant parts. It cannot make food from the sun's energy without the help of zooxanthellae.*
5. Tell the students they are going to do a very cool activity: make an edible coral polyp.
6. Hand out one plate of materials to each student.

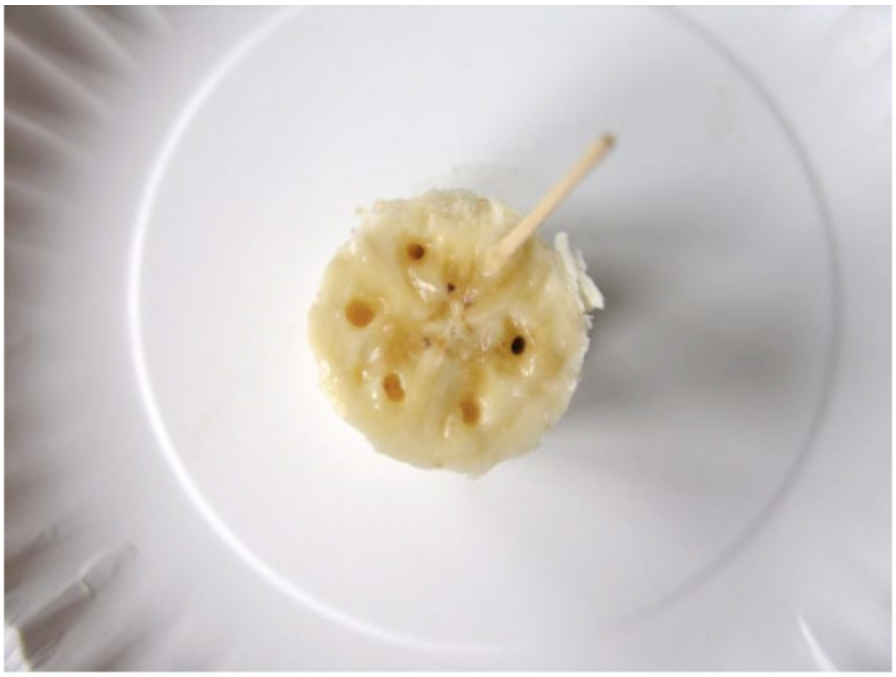
Procedure:

1. Make a hole (the mouth) in the top half of the banana with a straw. Be careful not to go all the way through the banana as coral polyps have one hole, not two.



Build a Coral Polyp (cont.)

2. Create six holes with a toothpick surrounding the central mouth.



3. Poke 6 candy straws or twizzlers (the tentacles) into the holes.

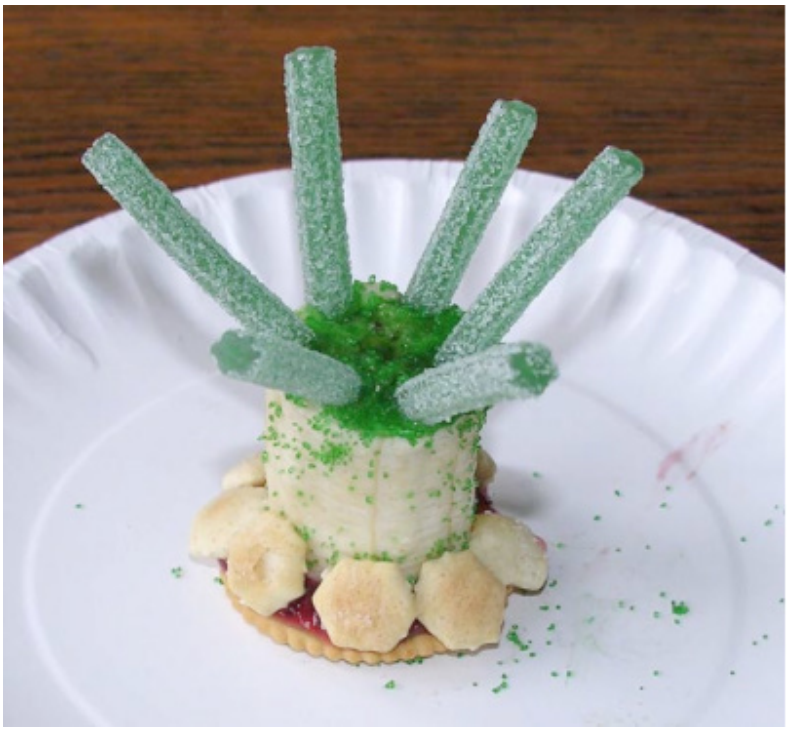
Build a Coral Polyp (cont.)

4. Add sprinkles (zooxanthellae) to the banana.

5. Add round cracker and jam (coral is attached to the substrate).

Build a Coral Polyp (cont.)

6. Add oyster crackers around the base (calcium carbonate skeleton).



7. Students can place individual coral polyps together to form a colony.

Build a Coral Polyp (cont.)

Discussion:

1. Hand out one coral polyp worksheet to each student.
2. Students draw their coral polyp and answer the questions on the worksheet.
3. Remind students that there are a lot of different animals that live on reefs. People sometimes call coral reefs the "rainforests of the ocean" because there are so many different animals there, just like in the rainforests.
4. Discuss coral reef threats and conservation with your students. Explain that coral reefs are in danger of disappearing because of changes that people are making to the oceans.
    - What do you think people are doing to change the reefs? *fishing too much, polluting, physically damaging the reef by taking coral or anchoring on top of coral, breaking off coral while swimming, taking coral for jewelry, developing coastal areas which can cause increased sediment in the water and smother coral, and climate change is making the water too warm and too acidic.*
    - What can we do? *reduce, reuse, and recycle to help stop pollution, don't get too close to reefs, don't buy coral jewelry, reduce fossil fuel emissions associated with climate change, and help spread the word to friends and family.*
5. Tell students they can pretend to be predatory fish, such as parrotfish, that eat coral. Students can eat their polyps, but since fish don't have hands encourage your students to eat without using their hands.

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Build a Coral Polyp (cont.)

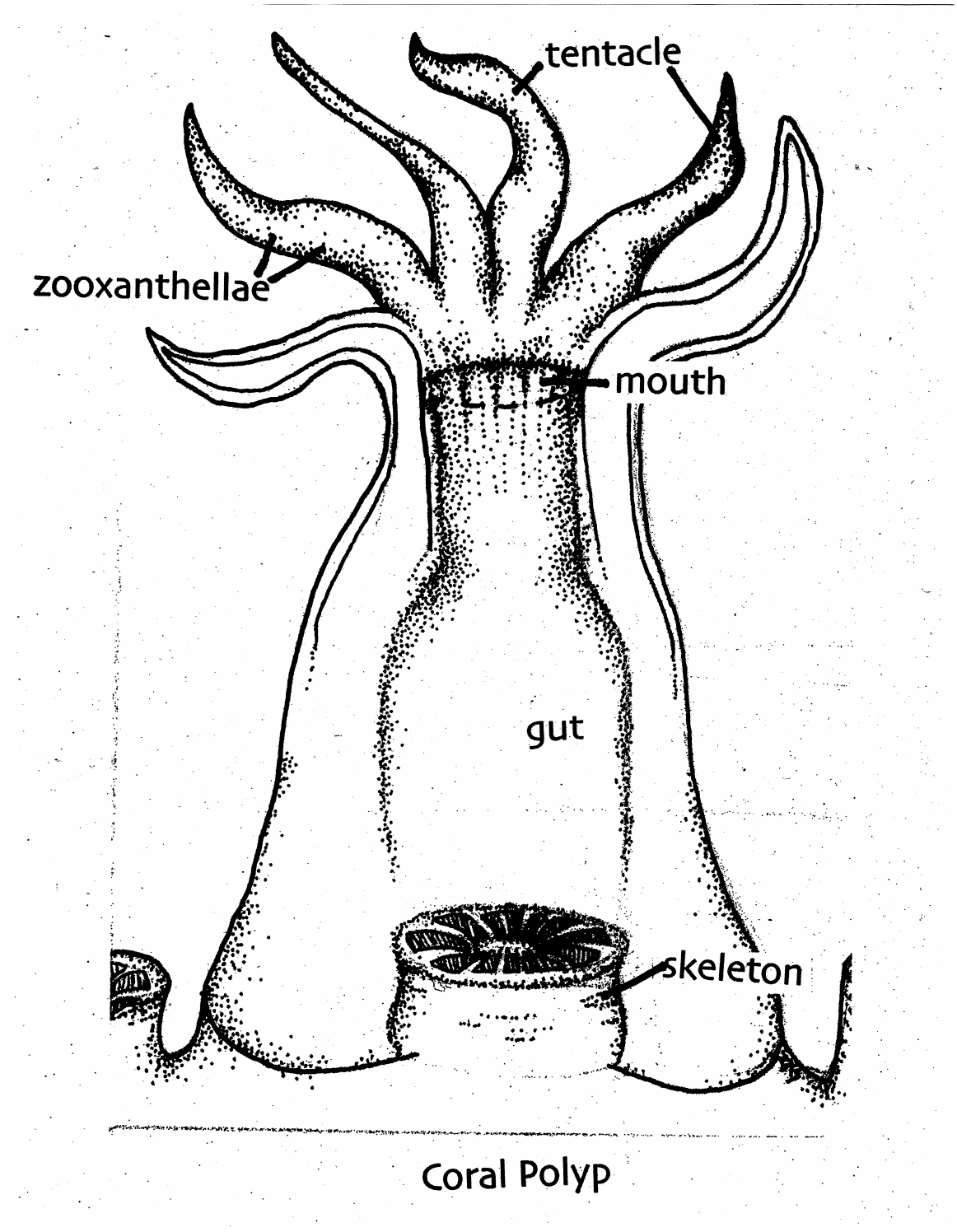

Illustration by Diane T. Sands

Coral Polyp Parts

What do these parts represent?

Banana

Oyster Crackers

Candy straws/twizzlers

Round Cracker

Sprinkles

Hole in the Center