



Lesson 1: Underwater Cities – Design Your Own Coral Reef

Theme: Coral biology

Grade Levels: 3-5

Duration: Two 45- to 60-minute class periods

Students will learn about basic coral reef biology and construct coral reef models.

Next Generation Sunshine State Standards:

SC.3.N.1.1 Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

SC.3.L.15.1 Classify animals into major groups (mammals, birds, reptiles, amphibians, fish, arthropods, vertebrates and invertebrates, those having live births and those that lay eggs) according to their physical characteristics and behaviors.

SC.4.N.1.1 Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

SC.4.L.17.4 Recognize ways plants and animals, including humans, can impact the environment.

SC.5.N.1.1 Define a problem, use appropriate reference materials to support scientific understanding, and plan and carry out scientific investigations of various types such as systematic observations; experiments requiring the identification of variables; collecting and organizing data; interpreting data in charts, tables and graphics; analyze information; make predictions and defend conclusions.

SC.5.L.14.2 Compare and contrast the function of organs and other physical structures of plants and animals, including humans. For example, some animals have skeletons for support – some with internal skeletons others with exoskeletons - while some plants have stems for support.

SC.5.L.17. Compare and contrast adaptations by animals and plants that enable them to survive in different environments such as life cycle variations, animal behaviors and physical characteristics.

OBJECTIVES

- Understand basic coral biology.
- Use coral reefs to compare and contrast habitats and ecosystems.
- Apply the engineering design process to create a coral reef.

MATERIALS

- Lesson 1 PowerPoint.
- Coral models.
- Engineering design process sheet (one per team).
- Picture cards (one set per team).
- Recycled materials (one set per team).
- Scissors (one pair per team).
- Masking tape.
- Markers or crayons (one set per team).
- Reflection sheet (one per student).



VOCABULARY

ZOOXANTHELLAE:	photosynthesizing algae that get their energy from the sun; they live inside the coral's tissues and provide the coral with nutrients (pronounced zoo-zan-thell-ee)
ECOSYSTEM:	a combination of living and nonliving things
HABITAT:	a place where all the things an organism needs to survive are located, including food, shelter, water and air
CORAL:	an animal made up of one or even thousands of identical polyps with stinging cells and tentacles that build a calcium carbonate - or limestone - skeleton
INVERTEBRATE:	animal without a backbone

Lesson Procedure

Coral Biology

Use accompanying PowerPoint, coral models in the trunk and picture cards for visuals throughout the lesson.

Ask students if they know what a coral is (plant, animal, rock, etc.).

Many students do not know how to classify corals. Corals look like plants but they are invertebrate animals. Invertebrates are animals without a backbone. Corals have stinging cells and tentacles like jellyfish, but they do not swim around. They are attached to the reef structure on the seafloor. Some corals are soft while others are hard. They come in a variety of shapes and colors.

Corals are made of hundreds and sometimes even thousands of interconnected coral polyps locking together to form the structures that create the shapes we recognize as reef corals. As corals grow and multiply their polyps, they create calcium carbonate skeletons. When corals die, the calcium carbonate skeletons remain. This is known as limestone. *Show examples of corals in the trunk and the picture/video resources in PowerPoint. Point out the shapes and textures of each different coral.*

Ask the students where corals can be found.

Corals can be found in oceans all around the world. Tropical coral reefs are found 30 degrees north and south of the equator. Florida's Coral Reef is technically a sub-tropical reef. Corals need just the right temperature, salinity and sunlight to thrive and grow. They can be found in many places ranging from shallow warm water where there are rocky bottoms to shipwrecks deep in the sea. For a reef to form, corals need a hard surface to settle on and grow. Coral reefs are home to thousands of plants and animals.

Ask students if they have ever seen a coral before or can describe what they look like.

Corals come in a variety of shapes, sizes and colors, and they can be hard or soft. The soft corals move back and forth in the water, while the hard corals are rigid and stay in place. Corals range in colors from green, blue, purple, pink, gold and many colors in between. Some corals have branch-like shapes, similar to trees, while others grow in mounds on the ocean floor. They can be tube-shaped, cylinder-shaped and sphere-shaped.

If a coral is an animal how does it eat?

The main way that coral polyps get energy is through tiny plant cells called zooxanthellae. The zooxanthellae use a process called photosynthesis to convert sunlight into energy. They give some of their energy to the coral polyp in return for protection. Coral polyps also eat plankton. Their stinging cells help them catch plankton. As corals grow, they build their skeleton underneath them while the living polyps continue multiplying on the surface.

Ask students if they know what lives on a coral reef.

Thousands of plants and animals can live on a coral reef. They are known as rainforests of the sea because they are home to many creatures such as sea turtles, sharks, sea stars, sand dollars, lobster, shrimp, stingrays, and fish ranging from tiny gobies to goliath groupers. *See accompanying pictures in PowerPoint or use books located in the trunk for many more examples of the animals that live on Florida's Coral Reef.*

Ask students how people can enjoy a coral reef.

People can't breathe underwater like fish, but they can visit coral reefs by snorkeling or scuba diving. Coral reefs are beautiful sites to observe.

Ask students if a coral reef is a habitat or an ecosystem.

An ecosystem is the combination of living and nonliving things. An ecosystem includes several habitats. A habitat is a place where all the things an organism needs to survive are located (food, shelter, water, air, etc.) A coral reef is an ecosystem that provides habitats for many creatures in the ocean.



Photo by FWC Fish and Wildlife Research Institute

Underwater Cities: Design Your Own Coral Reef

Students will use the engineering design process to design and build a coral reef with a variety of recycled materials. Working in teams of three to four students, walk the students through the engineering design process. *These steps can be broken up over a couple of class periods - work these into your schedule for the day as necessary.*

Step 1 (Suggested time: five minutes)

Ask: Identify the problem or need

Explain to students that our special friends (use picture cards with animals that live on the reef) need a place to live. Design and build a coral reef for them. Students will review the picture cards to see what animals will be living on the reef.

What is the problem we want to solve?

We want to create a coral reef that provides a home for the species on the picture cards.

What should this accomplish for the animals that live on the reef?

Provide food and shelter for the marine species on the reef.

Step 2 (Suggested time: up to 10 minutes)

Imagine: Brainstorm what the corals will look like and what's needed on the reef

Keep this as a verbal discussion with the team. Each team member can have two minutes to explain what they think they should create with the recycled materials. The team will need to come to an agreement on what to include on the reef.



Photo by FWC Fish and Wildlife Research Institute

Step 3 (Suggested time: 10 minutes)

Plan: Draw a plan of what your reef will look like

Team members work together to draw their design. This portion should be a simplified diagram of their design plan. Using the provided materials, students should come up with a design. Encourage creativity! They may use the materials however they decide to engineer their corals. Things for the students to consider: what materials do we have, what types of corals do we want to include, how can we shape them and hold them together.

Step 4 (Suggested time: 30 minutes)

Create: Build your reef

Team members work together to build their designs. Give time reminders regularly. Walk around the room and check in with each team, helping them in problem-solving as needed.

Step 5 (Suggested time: 20 minutes)

Improve: Talk with your team

Share designs with the class. Have the team reflect on how their reef came out and if there's anything they would improve on it. Record reflection on design sheet.

Lesson Wrap-up

Students may answer questions on the reflection slide (also below) to demonstrate their knowledge.

1. Why is your reef successful?
2. Is there anything you would change or improve?
3. How did your team work together?
4. What was your favorite part of the project?



Photo by FWC Fish and Wildlife Research Institute