



DEERING ESTATE



SHARK  
RESEARCH &  
CONSERVATION  
PROGRAM



## Marine Conservation Science & Policy: Coral Reefs

### Grade Level:

4<sup>th</sup> – 12<sup>th</sup>

### Subject Area

Science

Biology

### Duration

1.5 Hrs

### Benchmarks:

#### Body of Knowledge

Life Science

Nature of Science

Physical Science

#### Big Idea

Organization and Development of Living Organisms.

The Practice of Science

#### Standards

##### SC.K.N.1.1

Collaborate with a partner to collect information.

##### SC.K.N.1.4

Observe and create a visual representation of an object.

##### SC.8. G.5.2

Describe the impact of human modifications on the environment and ecosystems.

##### SC.912L.17.16

Discuss the large-scale environmental impacts resulting from human activity.

### Focus Question

What is a coral reef? What organisms make up this ecosystem and why are they important? What are the threats to this ecosystem and how can we protect it?

### Objectives

Students will explore the coral reef and discover some of the organisms that live in this habitat.

Students will learn to:

- Identify the features of a coral reef and some of the animals that live in this habitat.
- Analyze the importance of this ecosystem and elaborate ways to protect it.
- Elaborate an educational brochure explaining key features of this habitat.

Student will discuss the importance of this habitat and how it can be protected for future generations. This will be a project-based activity where students will apply new knowledge to create an educational brochure.

### Background

While corals are usually categorized as ancient animals, they actually have features that place them in the unique position of resembling plants, animals and minerals. Corals are individually known as polyps, tiny, simple organisms related to jellyfish and anemones that consist almost entirely of a stomach and a tentacled mouth that is used to snare and ingest plankton. These animal-like traits of consuming other organisms are then counterbalanced by their relationship with zooxanthellae, microscopic, single-celled algae that live inside each polyp. **Coral polyps** and **zooxanthellae** have a **symbiotic relationship**, with the corals providing nutrient to the zooxanthellae and who provide nutrients to the polyp through photosynthesis. By receiving energy from the Sun and remaining rooted in the photic zone, this relationship lends the coral plant-like traits. In addition, each polyp forms a calcium carbonate exoskeleton, with thousands of polyps constructing coral colonies together with the mineral strength to house millions of marine organisms. Some of these colonies form the largest living structures on Earth, such as the Great Barrier Reef in Australia which be seen from space.

**Coral reefs** are formations of the skeletal remains of coral polyps, built up over thousands of years and found in coastal waters in tropical and subtropical oceans all around the world. Coral reefs are usually found at depths of 0-450 ft, but some slow-growing coral without zooxanthellae have been found thriving in the dark, cold depths 20,000 ft. below the surface. A common misconception is to group corals as hard and soft, while they are actually divided into three sub-groups according to their cellular symmetry as viewed under microscope (i.e. 8-sided symmetry means that each polyp has eight tentacles and eight membranes).

Coral can reproduce sexually by synchronous spawning or they can divide their cells in a form of asexual reproduction. When building a coral colony, three main types of coral reefs can be formed: fringing reefs that hug the coastline; barrier reefs that run parallel to the shore but are separated by a channel; and atolls, which are ring-shaped and are often topped with sand around an inner lagoon. To allow for photosynthesis and a healthy reef system, most

## Vocabulary:

### **Coral Polyps:**

Tiny soft-bodied organisms that excrete a protective calcium carbonate exoskeleton that accumulates to form coral reefs.

### **Zooxanthellae:**

A microscopic algae living inside coral polyps, lending them their color and providing some energy through photosynthesis.

### **Coral Reef:**

A formation of the skeletal remains and living coral built up over thousands of years to form an elaborate ecosystem.

### **Symbiotic Relationship:**

When two organisms form a relationship that can be beneficial to both (mutualism) or only one (parasitism).

### **Coral Bleaching:**

The loss of the colorful zooxanthellae due to environmental stress, leaving only the translucent coral polyps that appear white or bleached. It is important to remember that bleached coral is not yet dead.

### **Biodiversity:**

The variety of life surviving in an ecosystem or habitat.

## **Background**

Corals need clear, warm, shallow water unclouded by sediment, plankton or seaweed. If allowed to thrive, coral reefs form immense habitats for other species.

Coral reefs are estimated to be some of the most valuable and diverse ecosystems in the world, supporting about 2 million species. Florida is home to several reef systems, including a fossilized reef, one of only two world-wide, in Crandon Park on Key Biscayne, and the third largest barrier reef system in the world, extending 150 miles from Soldier Key to the Dry Tortugas. Some species found on South Florida reefs include sea turtles, lobster, nurse sharks, eels, and a vast array of colorful fish. Like the polyps and their zooxanthellae, many of these species also display symbiotic relationships: some corals have shrimp and crabs that live in their branches, defending the coral from predators while the coral provides shelter. Other fish hide among the tentacles of jellyfish, baiting the trap for other fish while eating the leftovers. The **biodiversity** of the reef is considered the key to finding breakthrough cures for cancer, arthritis, human bacterial and viral infections and other diseases. Healthy reefs provide goods and ecological services to local economies through tourism, fishing, recreation, and other businesses, contributing an estimated \$7.6 billion in Florida alone. Coral reefs also buffer coastal shores from wave action, reducing erosion and storm damage as well as protecting harbors and ports.

Despite their importance, the globe's coral reefs form only 1% of the entire marine environment, an area about the size of France, and an estimated 80% are endangered or threatened.<sup>2</sup> Many of these threats are human-caused, stemming from overfishing, destructive fishing practices like trawling, grounding or overfishing, collecting for aquariums, dredging and other coastal impacts, scarring from motorboat propellers and anchors, warmer waters temperatures due to global warming, and even lack of awareness and appreciation. However the most significant threat to coral reefs is land-based pollution from runoff, litter, coastal development, agriculture, sewage treatment, leaking fuels, and petroleum spills. Scientists have recently discovered that a chemical commonly found in sunscreen and other lotions, benzophenone-2 or BP-2, can kill juvenile corals. This continued damage is causing **coral bleaching**, or the loss of the zooxanthellae, which leaves and the coral turns white. Though coral can survive a bleaching event, they are more vulnerable to stress and subject to mortality.

Actions to take to protect valuable coral reefs include: don't buy or take home corals, as it is illegal to do so; look for coral-safe labels on sunscreen and other beauty products; keep beaches clean and reduce household chemical and pesticide use because all drains lead to the sea; throw back small fish when fishing in accordance with law, be careful that the anchor doesn't damage the reef, and keep only what you are going to eat; practice good stewardship by reducing freshwater use, recycling, and educating others on resources like the Coral Reef Protection Act, the South Florida Coral Reef Initiative, and the Florida Keys National Marine Sanctuary. By taking action to protect coral reefs now, this valuable ecosystem will continue providing valuable environmental, medical and economic services for future generations.

## **Supplemental Resources**

1- Coral Reef Conservation Program. National Oceanic and Atmospheric Administration.

[http://oceanservice.noaa.gov/education/kits/corals/coral11\\_protecting.html](http://oceanservice.noaa.gov/education/kits/corals/coral11_protecting.html)

2- "Corals and Coral Reefs." Ocean Portal. Smithsonian Natural Museum of Natural History.

<http://ocean.si.edu/corals-and-coral-reefs>

3- Virtual Tour: The Coral Reef Habitat. Odyssey Earth.

<http://www.odysseearth.com/videos/the-coral-reef-habitat/>

## Vocabulary:

### **Coral Polyp:**

Tiny soft-bodied organisms related to sea anemones that excrete a protective calcium carbonate exoskeleton that accumulates to form coral reefs.

### **Coral Reef:**

A formation of the skeletal remains and living coral built up over thousands of years to form an elaborate ecosystem.

### **Coral Bleaching:**

The loss of the colorful zooxanthellae due to environmental stress, leaving only the translucent coral polyps that appear white or bleached.

## Extension Activity:

Have students research their favorite reef organism. Each student will prepare a brief description of the organism, a visual representation, and explain why they think their chosen organism is interesting and important.

## Assessment:

Have students complete the coral reef worksheet after class. Have them write a paragraph in their journal comparing threats and protective measures of coral reefs to those of other marine ecosystems they've studied.

## Program Partner:

## Coral Reef Brochure

### Materials

- Writing paper for drafts
- White or construction paper for brochures
- Coloring utensils (colored pencils, markers, or crayons)
- Pens or pencils

### Procedure

1. Divide students into groups of four and explain that each will be designing an educational brochure of the coral reef. Show an example of a brochure so they understand the folded layout.
2. Each brochure should answer some of the following questions:
  - What is a coral?
  - What is a coral reef and where can they be found?
  - What animals live on the coral reef?
  - Why are coral reefs important?
  - What threatens the coral reefs and how can we protect them?
3. Members of the group may want to divide the questions, and each write a draft of their response before combining everyone's section to form their final brochure.
4. Each group should illustrate their brochure and present it to the class. Encourage discussion comparing and contrasting the information elaborated, asking students why they find corals and other reef organisms interesting and important.

## Worksheet Answer Key

1. Figure 1 shows a bleaching event, Figure 2 shows a healthy reef.
2. Answers may vary: Figure 1 shows a bleached reef, with very few fish around a colorless reef, while figure 2 demonstrates many interacting fish species swimming and sheltering amongst many species of colorful, healthy coral reef.
3. It is important to protect coral reefs from bleaching because they form the foundation of an ecosystem, and their loss causes a devastating species loss.
4. Ecosystem
  - Jellyfish
  - Anemones
  - Polyps
  - Zooxanthellae
  - Symbiotic
  - Structure
  - Food
  - Shelter
  - Humans
  - Fishing
  - Tourism
  - Clean
  - Footprint

## Coral Reefs

Coral reefs are important habitats that are currently endangered around the world. They face many threats including overfishing and pollution which are causing coral bleaching. Coral bleaching is when the coral polyp loses their colorful and helpful zooxanthellae from inside their stomachs, leaving them white in appearance. Coral bleaching occurs when the coral is stressed or in danger and affects the rest of the coral reef ecosystem.

Answer the following questions using the figures on the right:

1. Which of the figures shows a coral bleaching event and which shows a healthy reef? \_\_\_\_\_  
 \_\_\_\_\_

2. What are some of the differences between the figures? \_\_\_\_\_  
 \_\_\_\_\_

3. Judging from the figures, why is it important to prevent coral bleaching?  
 \_\_\_\_\_  
 \_\_\_\_\_

Figure 1

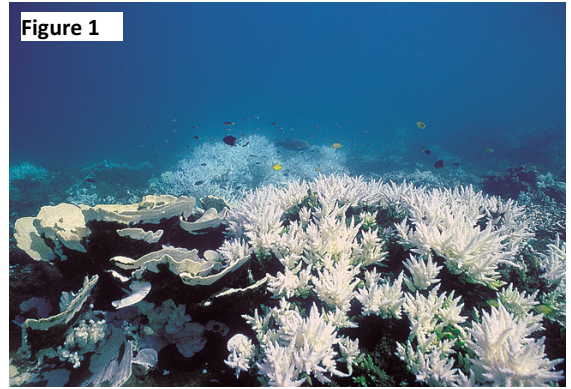


Figure 2



### Word Bank

- Food
- Ecosystem
- Jellyfish
- Footprint
- Zooxanthellae
- Structures
- Clean
- Anemones
- Symbiotic
- Polyps
- Tourism
- Shelter
- Humans
- Fishing

4. A coral reef is a \_\_\_\_\_, a place where organisms live together. The reef is made of coral, tiny animals related to \_\_\_\_\_ and \_\_\_\_\_. Individual coral are called \_\_\_\_\_ and inside each lives a microscopic algae called \_\_\_\_\_. These two organisms have a \_\_\_\_\_ relationship, as they both help each other to survive. Corals build large \_\_\_\_\_ of the reef as they grow, providing \_\_\_\_\_ and \_\_\_\_\_ to many diverse organisms. Coral reefs are also important to \_\_\_\_\_, helping reduce erosion, providing medicinal cures, and supporting the \_\_\_\_\_ and \_\_\_\_\_ industries. We can help protect this critical habitat by keeping the beach \_\_\_\_\_, using only coral-safe sunblock, and reducing our carbon \_\_\_\_\_ by walking or biking instead of driving. We can also protect coral reefs by educating others to protect this important ecosystem for future generations.