



Coral Reef Biodiversity

Module Summary

This module is an immersive live dive where students will be taught how to identify a top-down food chain and a bottom-up food chain on a coral reef ecosystem. They will be given an in-class activity to assist with their learning and understanding of biodiversity and its importance to healthy coral reef ecosystems. They will also learn why healthy, biodiverse coral reefs are important on a planetary level, and why humans depend upon them. Students will learn about the major threats to biodiversity and how they can all have a positive impact. It's going to be a great dive on Little Cayman!

Suitable for Years: 4, 5, 6

Learning Objectives

- Describe the differences between a food chain and a food web.
- List some of the fish that make up the coral reef ecosystem in the Cayman Islands
- Learn what an ecosystem is and how different organisms play various parts
- Explain what happens when you remove a keystone species from a food chain or food web or what happens when you introduce an invasive species.
- Report on why these food chains and food webs are delicate and what we can do to keep them intact.
- Summarize why fish populations are important to coral reefs and to humans
- Think about and plan an activity to help coral reefs in the future

Science National Curriculum Alignment

- Order living things in a simple food chain and understand the dependency of one on the other (Year 6).
- Find out about other animals, including how they grow, feed, move, use their senses (Year 4).
- Investigate a local habitat, including the relationship between the animals and plants found there, and develop skills in classifying animals and plants by observing external features (Year 4).
- Find out how human activities create a variety of waste products; find out that some materials decay naturally while others do not.
- Understand that some waste materials can be recycled and that this can be of benefit to the environment.



Description of the live dive

The dive will take place on a pristine coral reef rich with marine life offshore of Little Cayman, Cayman Islands, BWI. The CCMI underwater educator will communicate constantly with the live lesson host (who will be topside on the boat) and with the engaged remote class. The educator will take the students through a series of observations, fun facts and learning objectives regarding biodiverse ecosystems, food chains, food webs, keystone species, and invasive species; all in alignment with the Science National Curriculum of the Cayman Islands. Students will have an in-class activity to complete during the live lesson, which they are welcome to ask questions about to our underwater educator at any time during the duration of the live broadcast. Pre-recorded footage and images may be used to show key interactions between different species on the reef to demonstrate inter-species interactions in a biodiverse reef ecosystem, should these not occur naturally on camera during the broadcast.

Live broadcast outline (30 mins)

00:00 - 02:00	CCMI host welcomes students and outlines the lesson
02:00 - 04:00	CCMI host introduces the educator and the in-class activity
04:00 - 7:00	Educator defines and shows examples of biodiversity
7:00 - 10:00	Educator describes the importance of keystone species and the negative ripple effects of biodiversity loss
10:00 - 12:00	Educator explains why biodiverse coral reefs matter to human life and planetary health
12:00 - 15:00	Questions
15:00 - 18:00	Educator discusses 5 main threats to biodiversity
18:00 - 20:00	Educator discusses what the students can do to help protect biodiversity
20:00 - 25:00	Questions
25:00 - 30:00	CCMI host recaps the live dive and thanks the students for joining

Materials

internet connection, laptop, projector, speakers, paper, pencils/pens, CCMI activity sheet, CCMI definitions list, CCMI fun fact sheet

Useful resources

- www.reefresearch.org/reefs-go-live
- www.projectaware.org
- www.doe.ky
- www.education.gov.ky
- www.oceanservice.noaa.gov/kids/
- <https://nationaltrust.org/ky/wp-content/uploads/2019/09/Sea-Sense-Guide2.pdf>
- <https://www.seafoodwatch.org/recommendations/download-consumer-guides>



Teacher Resources: Coral Reef Biodiversity Definitions List

Our CCMI educator and host will refer to a number of key terms which will be defined throughout the broadcast. We have also provided a definitions activity for students to complete while viewing the episode. The relevant terms are defined below.

ANTHROPOGENIC- human impacts on the environment, ecosystems, biodiversity, and natural resources, caused directly or indirectly

BIODIVERSITY- the variety of life in a particular area/ecosystem, in this case referring to different species

ECOSYSTEM- a community of living organisms in conjunction with the nonliving components of their environment, interacting as a system

FUNCTIONAL REDUNDANCY- when multiple species fulfill the same or similar role in an ecosystem's function, which supports biodiversity

FOOD CHAIN- simple representation to show how energy moves from producers to consumers in an ecosystem (what eats what)

FOOD WEB- representation of what eats what in an ecosystem, showing interlocking food chains

KEYSTONE SPECIES- organism that plays a critical role in an ecosystem, often with a disproportionate effect on other organisms in that system

TROPHIC LEVEL- classification of organisms (living things) according to the position which they occupy on a food web (producers, consumers, predators)



Fun Fact Sheet: Coral Reef Biodiversity

1. Parrotfishes are a well-known group of herbivores and have a beak-like mouth (which is how they got their name) that they use to scrape algae from the reef structure (Streelman et al. 2002).
2. Herbivorous fishes such as parrotfishes, damselfishes, and surgeonfishes help keep macro and turf algae populations low so that coral larvae have a better chance to settle and survive on the reef (Monterey Bay Aquarium 2004).
3. Sea urchins, crabs, and some species of sea snails are examples of important herbivores besides fishes which also keep macroalgae densities low (Paine 1995).
4. A keystone species is an organism that other organisms in that ecosystem depend on, and its absence would cause a significant change in that ecosystem. Long-spined sea urchins, one such keystone species, play a critical role in keeping reefs healthy through herbivory (Precht 2015).
5. Food chains start with primary producers. On the reef, the most common producer is phytoplankton, a marine organism that produces its own food through photosynthesis (Miller et al. 1996).
6. Primary producers on the reef also include, algae, seagrasses and coral (specifically the zooxanthellae within the coral polyps) (Miller et al. 1996).
7. Every other living thing in the food chain which does not make its own food is a consumer; consumers can be herbivores, carnivores, or omnivores (Miller et al. 1996).
8. The feeding relationships in an ecosystem consist of many food chains, which are all interconnected into a larger network called a food web (Encyclopedia Britannica 2017).
9. Coral reefs are important because they protect our coastlines from storm damage, provide habitat for many commercially important fishes, and are estimated to generate \$375 billion USD in economic and environmental services worldwide annually (Costanza et al. 1997).
10. A great example of mutualistic symbiosis on Cayman's reefs is the relationship between the giant anemone and Pederson's cleaning shrimp. The tiny shrimp are immune to the anemone's sting and thereby protected from predators by living within the anemone's tentacles. In turn, the anemone gets a thorough cleaning of parasites and removal of any nearby waste (Wood 2007).
11. A common commensal symbiotic relationship seen in the Cayman Islands is the nuclear feeding between an apex predator and another consumer, such as a stingray and a barjack, a shark and a remora, or an eel and a Spanish hogfish. Nuclear feeding is when an apex predator does the hunting and the following consumer picks up the leftovers. At the same time the consumer is also protected from other predators by traveling with their companion (Zandonella 2016).

Coral Reef Biodiversity In-Class Activity Sheet

FILL IN THE BLANKS BELOW WITH SOME OF THE KEY TERMS FROM THIS LESSON

All living being depend on each other. A _____ is a simple representation of "what eats what", showing feeding relationships between different living beings in an ecosystem. A _____ is an organism which is very important to an ecosystem; if it is missing, that may have a significant impact on the whole ecosystem. _____ is how we describe the variety of life in a particular area.

DESCRIBE LIVING BEINGS THAT EXIST IN THE ECOSYSTEM WHERE YOU LIVE: _____

WHAT IS ONE ACTION THAT YOU CAN TAKE TO PROTECT BIODIVERSITY AND HELP CORAL REEFS? _____

OUR UNDERWATER EDUCATOR MAY ENCOUNTER AND NAME MANY OF THE ORGANISMS BELOW. CAN YOU IDENTIFY THEM? FILL IN THE NAMES YOU KNOW!



1. _____

2. (INVASIVE SPECIES!) _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. (draw your own)
