



## Coral Bleaching and Diseases

### Module Summary

This module dives into two threats to coral reef health: coral bleaching and coral diseases. CCMI Educators will guide our virtual students LIVE from a coral reef ecosystem along the coast of Little Cayman in the Cayman Islands. As we explore this coral reef, students will be taught about coral bleaching; be given some key examples of coral diseases, their causes, and modes of transmission; be introduced to ongoing research into these threats; and encouraged to share suggestions for how individuals can make a positive difference. Students will be given an in-class activity sheet to complete during the live lesson to better assist with the understanding of the stated learning objectives.

### Year 4 & 5

#### Learning Objectives

- Describe coral bleaching and its impact on the reef
- Understand the difference between coral bleaching and diseases
- Recognize various coral diseases and their impact on the reef
- Explain why coral reefs are so important to humans and our planet
- Identify actions that can be taken by individuals to minimize impact on coral reefs and oceans

#### The Cayman Islands - Science National Curriculum Alignment

- Recognize that environments can change and that this can sometimes pose dangers to living things (Year 4).
- 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).
- Students, through firsthand experiences and using a range of resources, identify and classify locally occurring species of animals and plants using observable features (Year 5).
- Find out about other animals, including how they grow, feed, move and use their senses (Year 5).

#### Ocean Literacy Principles Alignment

- Ocean Literacy Principle #5: The ocean supports a great diversity of life and ecosystems.
- Ocean Literacy Principle #6: The ocean and humans are inextricably interconnected.
- Ocean Literacy Principle #7: The ocean is largely unexplored.



## Description of Live Lesson

This module will take place on a coral reef ecosystem along the coast of Little Cayman in the Cayman Islands. The CCMI educator will communicate constantly with the live lesson host and with the engaged remote audience. The CCMI team will take the audience through a series of learning objectives regarding two threats to coral reef health: coral bleaching and coral diseases, all in alignment with the National Science Curriculum of the Cayman Islands. Students will have an in-class activity sheet to complete during the live lesson, and they are encouraged to ask questions about to the educator at any time during the broadcast. Pre-recorded footage may be used to show key concepts, should these observations not be discovered naturally during the live lesson. During this module, students will be taught about coral bleaching; be given some key examples of coral diseases, their causes, and modes of transmission; be introduced to ongoing research into these threats; and encouraged to share suggestions for how individuals can make a positive difference.

## Live Broadcast Outline (45 mins)

- 00:00 - 03:00 Host welcomes students and introduces the Reefs Go Live (RGL) team
- 03:00 - 05:00 Host outlines the lesson and describes the RGL interactive portal
- 05:00 - 10:00 Educator introduces and describes coral bleaching
- 10:00 - 15:00 Questions on coral bleaching
- 15:00 - 20:00 Educator explains coral diseases
- 20:00 - 25:00 Questions on coral diseases
- 25:00 - 30:00 Educator outlines research centered around coral bleaching and disease
- 30:00 - 35:00 Educator gives hopes for the future and how the students can help
- 35:00 - 40:00 Final questions
- 40:00 - 45:00 Host recaps the live lesson and concludes the module

## In-class materials needed

- Internet connection
- laptop (or cell phone)
- projector
- speakers
- paper
- pencils/pens
- CCMI activity sheet
- CCMI lesson plan

## Useful additional resources

- CCMI's coral bleaching experiment lesson plan: [www.reefresearch.org/what-we-do/education/teacher-resources/](http://www.reefresearch.org/what-we-do/education/teacher-resources/)
- CCMI's coral bleaching lesson teacher tutorial: [www.youtu.be/cNN8d8iRXPQ](http://www.youtu.be/cNN8d8iRXPQ)
- Hadaidi G and Voolstra C (2020) Corals Are Sick: Black Band Disease Is Attacking. Front. Young Minds. 8:6. doi: 10.3389/frym.2020.00006 [www.kids.frontiersin.org/articles/10.3389/frym.2020.00006](http://www.kids.frontiersin.org/articles/10.3389/frym.2020.00006)
- The Cayman Islands Department of Environment website: [www.doe.ky/marine/sctld/](http://www.doe.ky/marine/sctld/)
- SCTLD Volunteer Response Diver Training: [www.youtube.com/watch?v=FK\\_fap0hvfY](http://www.youtube.com/watch?v=FK_fap0hvfY)
- Raymundo, L.J., Couch, C.S., and Harvell, C.D. (2008) The Coral Disease Handbook. [www.agrra.org/wp-content/uploads/2019/03/General-Coral-Disease-Handbook.pdf](http://www.agrra.org/wp-content/uploads/2019/03/General-Coral-Disease-Handbook.pdf)
- Bruckner, A. (2009) Field Guide to Western Atlantic Coral Diseases. [www.agrra.org/wp-content/uploads/2019/03/Final-WA-disease-id-cards-Bruckner-2.pdf](http://www.agrra.org/wp-content/uploads/2019/03/Final-WA-disease-id-cards-Bruckner-2.pdf)
- ICRI/UNEP-WCMC (2010). Disease in Tropical Coral Reef Ecosystems: ICRI Key Messages on Coral Disease. 11pp. [www.icriforum.org/wp-content/uploads/2019/12/ICRI%20Coral%20Disease%20Key%20Messages\\_Dec%202010\\_FINAL.PDF](http://www.icriforum.org/wp-content/uploads/2019/12/ICRI%20Coral%20Disease%20Key%20Messages_Dec%202010_FINAL.PDF)



## “Coral Bleaching and Diseases” Key Terms

The CCMI educators may refer to the key terms below, which will be defined throughout the live broadcast. Some of these terms may be used in the definitions section of the in-class activity sheet that should be completed during the Reefs Go Live broadcast. Listen for your chance to learn some new vocabulary about our coral reef ecosystems!

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

**Climate change** - change in global weather patterns over time due to the effects of increased carbon dioxide in the atmosphere

**Coral bleaching** - process of corals appearing white due to the loss of the algae living inside of them

**Coral nursery** - place where scientists grow corals underwater on specialized structures with the goal of replenishing depleted coral reefs from what is grown in these places

**Ecosystem** - a community of living organisms in conjunction with the non-living parts of their environment, interacting as a system

**Outplanting** - transplanting of corals from a nursery onto a reef or other structure in the ocean

**Photosynthesis** - process by which green plants convert carbon dioxide and water into organic chemicals using the energy of light, with oxygen released as a by-product

**Reef flattening** - the loss of habitat due to complex reef framework collapse from a decline in branching coral species


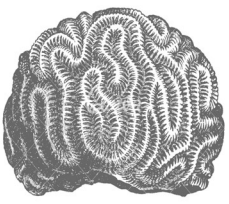
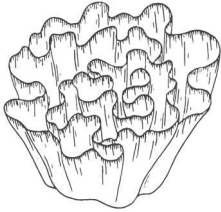
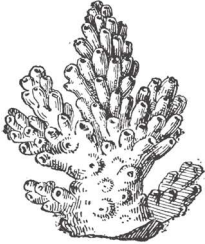

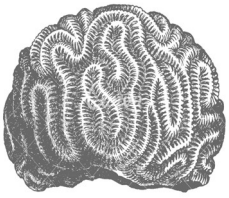
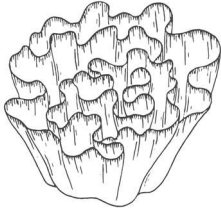
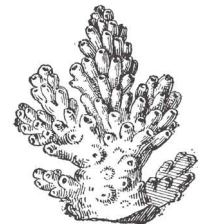
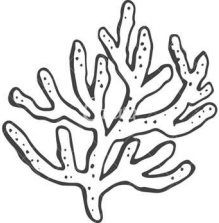
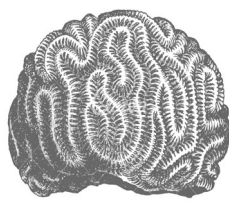
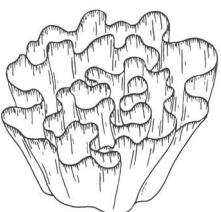
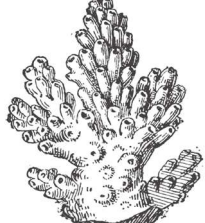
**Resilience** - ability of an ecosystem or species to bounce back from negative environmental influence

**Symbiotic relationship** - an interaction between two organisms where at least one of the organisms' benefits; however, the other organism may suffer, be unaffected, or benefit as well

**Zooxanthellae** - symbiotic algae that live in the tissues of coral polyps (and several other marine animals) and provides the coral with 90-95% of its needed energy and nutrients

## “Coral Bleaching and Diseases” In-Class Activity Sheet

Our CCMI researchers need your help! The table below shows four different species of reef building corals, first while they are healthy, then while they have a coral disease, and finally as they have recovered (these are the resilient corals). Right now, none of our corals have any zooxanthellae, so they must be bleached! Colour in each coral (to give it the zooxanthellae it needs to survive) in order to help it recover from its bleaching event, but also to reflect if that coral is healthy, diseased, or resilient. If you are unsure what a coral disease looks like, ask the underwater educator during Reefs Go Live! Have fun and thanks for your help giving our corals back their zooxanthellae!


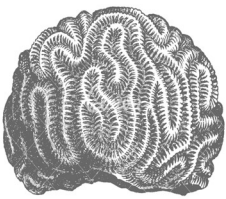
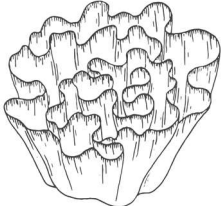
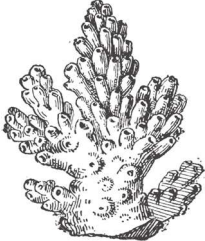

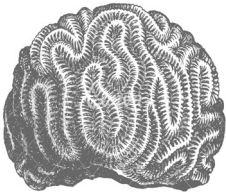
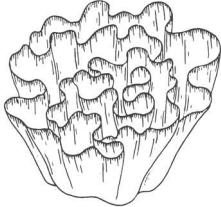
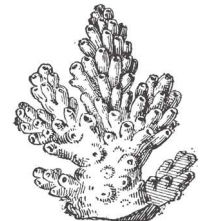

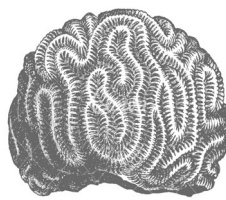
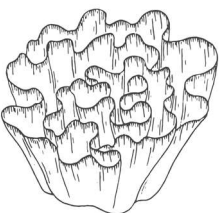
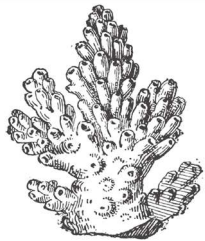
Healthy corals				
Diseased corals	 Aspergillois	 Black Band Disease	 SCTLD	 White Band Disease
Recovered (Resilient) corals				

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

Corals and their Zooxanthellae have a Symbiotic relationship where both organisms benefit from their interaction with each other. This interaction is so important, that without its zooxanthallae, the coral loses its colour and its nutrients in a process known as Coral bleaching. If a coral reef has too many bleached corals and can't recover, Reef flattening occurs and there is a loss of habitat for other reef organisms. These organisms live in a balanced community known as an Ecosystem. Anthropogenic impacts can directly or indirectly cause harm to this balanced ecosystem. However, you can help reduce your impacts by volunteering with a Coral nursery.

## “Coral Bleaching and Diseases” In-Class Activity Sheet

Our CCMI researchers need your help! The table below shows four different species of reef building corals, first while they are healthy, then while they have a coral disease, and finally as they have recovered (these are the resilient corals). Right now, none of our corals have any zooxanthellae, so they must be bleached! Colour in each coral (to give it the zooxanthellae it needs to survive) in order to help it recover from its bleaching event, but also to reflect if that coral is healthy, diseased, or resilient. If you are unsure what a coral disease looks like, ask the underwater educator during Reefs Go Live! Have fun and thanks for your help giving our corals back their zooxanthellae!

Healthy corals				
Diseased corals	 Aspergillois	 Black Band Disease	 SCTLD	 White Band Disease
Recovered (Resilient) corals				

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

Corals and their \_\_\_\_\_ have a \_\_\_\_\_ where both organisms benefit from their interaction with each other. This interaction is so important, that without its zooxanthallae, the coral loses its colour and its nutrients in a process known as \_\_\_\_\_. If a coral reef has too many bleached corals and can't recover, \_\_\_\_\_ occurs and there is a loss of habitat for other reef organisms. These organisms live in a balanced community known as an \_\_\_\_\_. \_\_\_\_\_ impacts can directly or indirectly cause harm to this balanced ecosystem. However, you can help reduce your impacts by volunteering with a \_\_\_\_\_.