



## Lesson Plan - Reef Resiliency and Restoration

### Module Summary

This module is an immersive live dive where students will be taught about how coral reef health is in decline due to human-caused climate change. They will also learn that CCMI's research on coral resiliency and restoration is helping us to better understand how we can try to repair some of the damage that humans have caused to coral reefs. Participants will be given a choice of worksheets or the RGL booklet to assist with their learning and understanding of coral restoration techniques such as fragmenting, coral nursery research, and outplanting. Students will leave this lesson with a better understanding of coral reef ecosystems, ecological concepts, and environmental stewardship.

### Years 4 & 5

#### Learning Objectives

- Understand biodiversity and its importance at the ecosystem level
- Define why humans need healthy coral reefs
- Describe the effects of human-caused climate change on coral reef health
- Define 'restoration' and explain examples i.e., coral restoration
- Think about 'resiliency' as it relates to corals. What other organisms may be resilient?

#### 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, and use their senses (Year 4)
- Investigate 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 - Living things and their habitats)
- Investigate the conditions necessary for growth of familiar plants including light, heat and water (Year 5)
- Describe the life process of reproduction in some plants and animals (Year 5 - Living things and their habitats)

#### Working Scientifically Skills (Cayman Islands - Science National Curriculum)

- Record findings using simple scientific language, drawings, labelled diagrams, bar charts, and tables (Year 4 - Living things and their habitats: Working Scientifically Skills)



- Reporting and presenting findings from enquires, including conclusions, causal relationships, and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations (Year 5 - Living things and their habitats: Working Scientifically Skills)

### **Ocean Literacy Principles Alignment**

- Ocean Literacy Principle #3: The ocean is a major influence on weather and climate.
- 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.

### **Description of Live Lesson**

This module will take place on a coral reef ecosystem along the coast of Little Cayman in the Cayman Islands, where the CCMI team will guide students through a series of learning objectives. A topside host will communicate in real time between the students joining in as our remote audience/virtual dive buddies and an underwater educator. Some of CCMI's coral restoration research projects will be discussed, with students being shown demonstrations related to our underwater coral nursery. Key messages will be delivered, highlighting lessons learned from CCMI research projects, all in alignment with the Science National Curriculum of the Cayman Islands and the United Kingdom, in addition to the Ocean Literacy Principles. Educators will have a choice of worksheets to engage their students according to their comprehension level and a supplemental Reefs Go Live booklet to complete during the live lesson, which they are encouraged to ask questions about to the host or 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.

### **Live Broadcast Outline (40 mins)**

00:00 - 05:00	Opening video, welcome to RGL, and introduction
05:00 - 15:00	Why humans need healthy coral reefs
15:00 - 20:00	Climate change and global warming; How does this affect coral reef health?
20:00 - 25:00	Restoration techniques including reproduction, coral nurseries, and outplanting
25:00 - 30:00	What is resiliency and how does it give us hope for future coral reefs?
30:00 - 35:00	Presenters recap the live lesson and concludes the module
35:00 - 40:00	Final Q&A, thank you, goodbye, and closing credits video roll

### **In-class materials needed**

- internet connection
- laptop (or cell phone)
- projector
- speakers
- paper
- scissors, ruler & pencils/pens
- CCMI activity sheet(s) or RGL booklet
- CCMI lesson plan



## Worksheet Descriptions

We want to give teachers, educators, and Reefs Go Live facilitators options related to our supplemental materials, as we understand that all classes and learners are different. Therefore, we have created a suite of lesson relevant materials to choose from. This allows students and/or participants to complete the entire activity pack or select which pages would be most beneficial to them. Below, we have compiled some suggestions on different activities you can do with your class to accompany the worksheets and/or Reefs Go Live booklet.

### What is a Coral Nursery?

This is a 'fill in the missing word' activity, however this could also be used as a cut and paste activity where students match the images with the correct description. This can then be taken one step further, with the students being asked to arrange the images and matching description in the order of coral nursery steps.

### The Story of ACER the Staghorn Coral!

This is a reading and comprehension activity, or you can have students read ACER's story and then act the story out. Alternatively, students can use this as an example to create their own story board for a super coral! Students can name their own coral protagonist and create a story about a super coral which is both disease resistant and thermotolerant to share with the class.

### Become a CCMI Marine Biologist: Identifying SUPER CORALS!

This activity is more of a higher ability activity, breaking down the research currently being conducted at CCMI. This activity will challenge students to 'think like a scientist' and use their working scientifically skills. Students must categorize the corals, giving students red, yellow, and green colored pencils or markers to circle the corals which are dead, resilient, and/or resistant to disease. Once they have circled the corals with the appropriate color, they will find it easier to put the fragment into the categories according to its number (ie. ACER #3). Students then repeat this method of circling with different colors in the thermotolerance table, so they can easily see which corals are both thermotolerant and resistant or resilient to disease. Identifying the SUPER CORALS which are best for outplanting back onto the reef.

### Useful additional resources

- CCMI mini-module 'How do scientists grow coral - Frame Cleaning':  
<https://youtu.be/IRnsqDi2GmU> and lesson plan:  
<https://a9bf1e.a2cdn1.secureserver.net/wp-content/uploads/2019/09/Mini-Module-Lesson-Plan-How-do-Scientists-Grow-Coral-Frame-Cleaning.pdf>
- CCMI mini-module 'How do scientists grow coral - Measuring Corals':  
<https://youtu.be/Y9Gm7z7XlaE> and lesson plan: <https://a9bf1e.a2cdn1.secureserver.net/wp-content/uploads/2019/09/Mini-Module-Lesson-Plan-How-do-Scientists-Grow-Coral-Measuring-Coral.pdf>
- Panter C, Baines O, Draper E, Hunt L, Schrodt F, Veeken A, Viner C and Field R (2022) Ecosystem Restoration: What, Why, How, and Where?. *Front. Young Minds.* 10:856833. doi: 10.3389/frym.2022.856833



- Coral Reefs for Kids: An educational guide focused on coral reefs, some of our oceans' most colourful and valuable ecosystems. <https://coral.org/wp-content/uploads/2022/10/Coral-Reefs-For-Kids-V4.pdf>

## “Reef Restoration and Resiliency” Key Terms

The CCMI educators may refer to the below key terms, which will be defined throughout the live broadcast. Some of these terms may be used in accompanying worksheets or our Reefs Go Live booklet to be completed during the live lesson. Listen up for your opportunity to learn some new vocabulary about our coral reef ecosystems!

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

**Climate Change** - change in global weather patterns over time, largely due to increased carbon dioxide in the atmosphere as a result of human activities

**Coral Nursery** - a place where scientists grow corals underwater on specialized structures

**Coral Reef** - marine structure composed of a layer of living coral atop coral skeletons, minerals, and organic matter

**Critically Endangered** - This is an even higher level of risk than being endangered. When a species is critically endangered, there are very few of them left in the wild, meaning there is a very high risk of the species disappearing from the Earth (becoming extinct) in the near future.

**Endangered** - in great danger or at risk of becoming extinct

**Extinct** - when there are no more of that kind of species left in the world

**Fragmenting** - a process which mimics asexual reproduction where pieces of coral are carefully broken, with the goal of growing each piece into a new individual coral

**Global Warming** - significant increase in the “normal” temperature of Earth over the last century

**Keystone Species** - a species that has a big impact on its ecosystem because if it were to disappear, it would cause major changes and problems for the rest of the system.

**Macroalgae** - large algae with thick blades that often live attached to a substrate (surface) in dense beds



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

**Resilience** - the ability to recover from or respond to a stressor or disturbance

**Restoration** - renewal of a damaged, degraded, or destroyed ecosystem by active human intervention

**Species** - taxonomic group containing individuals that resemble one another, are able to interbreed, and their offspring are also able to reproduce