



## Dive 5: Lesson Plan - Herbivory: Remember to Eat Your Reds, Greens and Browns!

### Module Summary

This module is an immersive scientific dive where students will learn about herbivorous fish found on the reef and why they are important in maintaining a healthy reef ecosystem. The CCMI team will place feeding ropes on the reef; these are used to determine which fish species are important herbivores. Students will be able to participate in a live session by counting the number of fish and individual bites on each kind of alga on our feeding ropes. Students will work with our scientist to discover the important role of herbivores on coral reefs and how we can better manage these species in order to help keep our reefs healthy.

### Year 4, 5

#### Learning Objectives

- Define “herbivore” and learn how these animals feed
- Describe a keystone species and the effect of their loss on the environment
- Explain why herbivores are important for a healthy reef ecosystem
- Discover which herbivore and algae species are most important on the reefs surrounding the Cayman Islands
- Discuss an effective management strategy for local herbivorous fish populations

#### Science National Curriculum Alignment

- Find out about other animals, including how they grow, feed, move and 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 (Year 4).
- Investigate the conditions necessary for the growth of familiar plants including light, heat and water (Year 5).

#### Description of the live dive

The dive takes place on a coral reef rich with marine life, particularly algae and hopefully herbivorous fish. The underwater educator communicates with the lesson host on the boat and with the engaged remote classes that were live at the time. The educator takes the students through a series of fun facts and learning objectives regarding reef ecosystem health and herbivory in alignment with the Science National Curriculum of the Cayman Islands. Students will have an in-class activity to complete during the lesson. The dive depicts the numerous different herbivores and algae on the reef as well as showing clips of an unhealthy reef without herbivores for comparison. Pre-recorded footage and images are used to show keystone species, algae, and herbivores on the coral reef, to add to the plants and animals observed naturally during the live broadcast. The dive concludes with students using the scientific method to examine what herbivorous fish are found on the reef and which algal species different herbivores prefer to eat.



### Live broadcast outline (45 mins)

- 00:00 - 03:00 CCMI host welcomes students and outlines the lesson
- 03:00 - 05:00 CCMI host introduces the educator and the in-class activity
- 05:00 - 10:00 Educator describes a healthy reef ecosystem
- 10:00 - 15:00 Educator points out different types of algae and herbivorous fish
- 15:00 - 20:00 Questions
- 20:00 - 25:00 Educator explains feeding assays and feeding ropes
- 25:00 - 35:00 Interactive feeding ropes activity
- 35:00 - 40:00 Questions
- 40:00 - 45:00 CCMI host on the boat recaps the live dive and concludes the lesson

### Materials

Internet connection, laptop, projector, speakers, paper, pencils/pens, CCMI activity sheet, and CCMI fun fact sheet.

### Useful resources

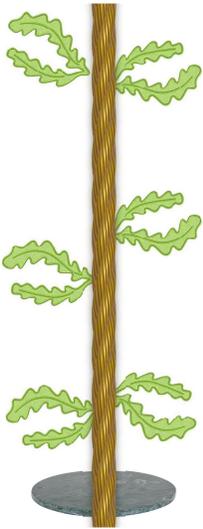
- [www.reefresearch.org/reefs-go-live](http://www.reefresearch.org/reefs-go-live)
- [www.doe.ky](http://www.doe.ky)
- [www.education.gov.ky/education/curriculum](http://www.education.gov.ky/education/curriculum)
- [www.oceanservice.noaa.gov/kids/](http://www.oceanservice.noaa.gov/kids/)
- [www.reefresilience.org/coral-reefs](http://www.reefresilience.org/coral-reefs)
- [www.projectaware.org](http://www.projectaware.org)

## Fun Fact Sheet - Herbivory: Remember to Eat Your Reds, Greens and Browns!

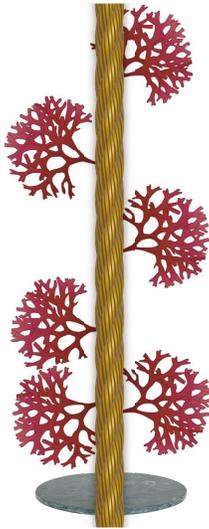
1. Herbivores are an important part of the coral reef ecosystem because they help keep seaweed density down, creating space for coral larvae to settle (Ludwig 1997).
2. Parrotfishes are a well-known group of herbivores and have a beak-like mouth (which is how they got their name) that they use to scrape algae from the reef structure (Streelman et al. 2002).
3. Surgeonfishes are another group of herbivores and get their name from the ‘scalpel’ they have at the base of their tail (used for defence).
4. Herbivorous fishes such as parrotfishes, damselfishes, rabbitfishes, 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).
5. Sea urchins, crabs, and some species of sea snails are examples of important herbivores besides fishes which also keep macroalgae densities low (Paine 1995).
6. Parrotfishes are responsible for excreting much of the sand on the beaches that we enjoy. Some individuals produce more than 381 kg of sand per year (Perry et al. 2015).
7. Some parrotfish species sleep at night by resting on the sea floor and surrounding themselves in a mucus sac. The mucus sac reflects light so that many predators cannot detect them while the parrotfish sleeps (Grutter et al. 2010). Other parrotfish rely on camouflage to avoid being eaten at night.
8. 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).
9. Even though urchins may seem like simple animals, they also have to rely on learned behaviour. Martin Moe, a marine aquarist, was trying to breed them and release them onto the reef. He found that those reared in aquaria were eaten almost immediately once they were put onto the reef - they hadn’t learnt that they needed to hide from predators!
10. Parrotfish, on the other hand, have a pestle and mortar in their throat and a gut that relies on mechanical grinding of food. Because of this, they have no problem eating the hard, calcified algae (National Geographic, 2013).
11. The Bermuda chub is another important herbivorous species in the Cayman Islands, but there is not much known about them in the Caribbean. There are two species that are visually indistinguishable, and we don’t know which one we have here (Moore 1962).
12. Chub can travel several kilometres every day looking for food and form groups (called “schools”) in the hundreds of fish (Eristhee, 2001).

## In Class Activity Sheet - Herbivory: Remember to Eat Your Reds, Greens and Browns!

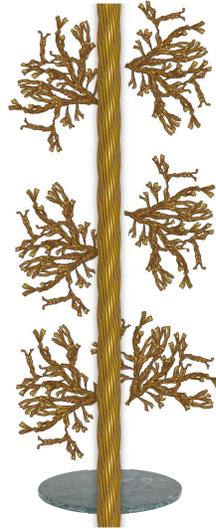
You're the scientist! Help our CCMI scientist calculate the impact that herbivorous fish have on algal communities. Observe the different herbivorous fish in the live lesson for one minute, taking a tally of how many times each type of fish bites these feeding ropes: **green algae**, **red algae**, or **brown algae**. When one minute is up, tally the tick marks. This total will tell you which fish prefer certain kinds of algae over another, giving you an overall impact statement regarding herbivory on the reef.



Green Algae



Red Algae



Brown Algae

Total:	Total:	Total:
Total:	Total:	Total:
Total:	Total:	Total:



Parrotfish



Tang



Chub