

## Dive 3: Lesson Plan - Lionfish: The Perfect Invader

### Module Summary

This module is an immersive scientific dive where students experience an underwater lionfish surgery first-hand. Invasive species are seen as one of the major threats to ecosystems and lionfish have numerous traits and behaviours that allow them to cause severe impacts. Students are given an in-class activity to help them learn about how lionfish spread around the Caribbean, what makes them the perfect invader, and how they impact the food chain. The dive will include a demonstration of a live lionfish being acoustically tagged and released for scientific purpose.

### Year 6

#### Learning Objectives

- Define an endemic versus invasive species
- Explain how predator-prey relationships and reproduction influence the impact of lionfish
- Theorize on lionfish movement around on Cayman reefs and why
- State how a healthy ecosystem may be able to adapt and counteract threats from invasive species
- Develop an adaptive management strategy for lionfish using scientific lessons learned

#### Science National Curriculum Alignment

- Order living things in a simple food chain and understand the dependency of one on the other (Year 6).

#### Description of the live dive

The dive follows CCMI lionfish research team around a pristine coral reef on a mission to acoustically tag a lionfish. 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 lionfish 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 lesson. Pre-recorded footage and images are included to demonstrate portions of the underwater surgery or impacts of invasive species, adding to these processes that were discovered naturally during the broadcast. To demonstrate the methods that CCMI scientists are using to explore lionfish movements, students will watch the educator handle a pre-caught lionfish and surgically implant an acoustic tag. Students will also be shown one of the receivers in the water column deployed near the tagging site that picks up the signal from each acoustic tag.



### 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 explains the external anatomy of the lionfish
- 10:00 - 25:00 Educator performs surgery on a live lionfish
- 25:00 - 30:00 Questions
- 30:00 - 35:00 Educator releases the lionfish and explains results from data
- 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.reefresearch.org/what-we-do/conservation/lionfish-management/](http://www.reefresearch.org/what-we-do/conservation/lionfish-management/)
- [www.reef.org/lionfish](http://www.reef.org/lionfish)
- [www.projectaware.org](http://www.projectaware.org)
- [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/)

## Fun Fact Sheet - Lionfish: The Perfect Invader

1. Lionfish are native to the Pacific and Indian Oceans and the Red Sea. These fish were first recorded in the western Atlantic Ocean in the mid-1980s, and they have since spread throughout the Gulf of Mexico and the Caribbean Sea (Schofield 2009, Schofield 2010).
2. Lionfish are popular aquarium fish, and they were mostly likely introduced through aquaria owners releasing their fish into the wild (Semmens et al. 2004).
3. Invasive lionfish in the Atlantic and Caribbean are made up of two species: *Pterois volitans* (the red lionfish) and *Pterois miles* (the devil fire fish) (Schofield 2009).
4. Red lionfish (*Pterois volitans*) is actually a hybrid of *P. miles* (Indian Ocean) and *P. russelii* (Pacific Ocean) (Wilcox et al. 2017).
5. Lionfish can tolerate an impressive range of temperatures, pressure, and salinity. This allows them to occupy a range of habitats including coral reefs, seagrass meadows, mangrove forests, and artificial reefs (Morris and Whitfield 2009).
6. Bacteria associated with lionfish exhibit antibacterial activity against known fish pathogens, which may help lionfish avoid infection (Stevens et al. 2016).
7. Recent research at CCMI shows that lionfish can reproduce year-round, with a single female able to release thousands of eggs every 1.5 – 3 days. A single female can produce approximately two million eggs per year (Albins and Hixon 2010).
8. Lionfish are part of the family *Scorpaenidae*, which means they are related to the common rock fish or scorpionfish (Schofield 2009).
9. Lionfish also blow jets of water directed toward their prey. These jets may confuse or distract prey, and often result in prey fish facing the attacking lionfish, which increases the probability of head-first capture and swallowing (Albins and Lyons 2012).
10. Lionfish have been found to eat more than 40 different species of reef fishes as well as crustaceans, mollusks, and other lionfish (Morris and Whitfield 2009).
11. Lionfish are venomous; they have 13 dorsal spines, three anal spines, and one spine on each of their ventral fins. The spines all contain a neurotoxin. Stings can cause extreme pain, sweating, respiratory distress, and in some cases, even paralysis (Badillo et al. 2012).
12. As lionfish are venomous (rather than poisonous), their light, white, flaky meat is edible. There are now lionfish cookbooks available and they have been described as a delicious, delicately flavoured fish similar in texture to grouper (Williams 2010).
13. In an effort to reduce lionfish densities, many countries have started removal programs via spearfishing, hand-netting, or trapping (de León et al 2013). CCMI coordinates a Little Cayman Community Cull every week, after which the fish get dissected and then sent to the resorts on island to sell to guests. Over 19,000 lionfish have been removed from Little Cayman since the start of the invasion.

## In Class Activity Sheet - Lionfish: The Perfect Invader

You're the scientist! Help our CCMI scientist to dissect the lionfish. Below is a diagram of a lionfish's external anatomy. Using your knowledge of fish from previous lessons, help our scientist label each part of the lionfish. Remember to identify for the scientist which parts are **VENOMOUS** so that he/she doesn't prick themselves by accident! Also, make sure to tell our scientist which parts of the lionfish are edible so that he/she can have a delicious lionfish dinner! When you are done helping our scientist with the dissection, don't forget to colour in the lionfish to teach others what they look like out on the reef. Thanks for all of your help!

