



Monitoring Invasive Species in Flower Garden Banks National Marine Sanctuary

Lesson Specifications

Age

8 – 12

Timeframe

3 hours

Materials

Lesson:

- Computer and projector with screen or TV
- Videos (links included in lesson plan) and internet connection

Scuba:

- All required scuba gear
- Dive slates
- Compasses
- Meter tape or rulers for each buddy team

Key Words

Invasive species, predator, ecosystem

Standards

Ocean Literacy Principles 5, 6



A lionfish in Flower Garden Banks National Marine Sanctuary. Photo: G.P. Schmahl/ NOAA.

Activity Summary

This lesson introduces students to Flower Garden Banks National Marine Sanctuary. Students will learn about invasive species, specifically the lionfish, and how they can impact marine environments. Students will also learn about ways some marine protected areas address this threat.

Learning Objectives

Upon completion of this lesson, students will be able to:

- Define invasive species.
- Identify two threats that lionfish present to Flower Garden Banks National Marine Sanctuary.
- Identify two actions that can be taken to minimize the threat of invasive species to marine ecosystems.

Essential Questions

1. What is an invasive species?
2. How do invasive species impact marine ecosystems?
3. What actions can we take to combat the threat of invasive species?

National Marine Sanctuary Diver Performance Requirements

At the surface, students will:

- Streamline gear prior to entry.
- Demonstrate proper descent techniques and awareness of the environment.

Underwater, students will:

- Locate and identify lionfish using hand signals.
- Record the necessary information to report a lionfish sighting, in buddy teams.



A map of the National Marine Sanctuary System in the U.S. and its territories.

Background Information

Flower Garden Banks National Marine Sanctuary (FGBNMS) is one of the marine protected areas in the National Marine Sanctuary system. These special underwater places are protected for their biological, ecological, and cultural significance.

Flower Garden Banks National Marine Sanctuary lies 70 to 115 miles off the coasts of Texas and Louisiana where three underwater gardens, East Flower Garden Bank, West Flower Garden Bank and Stetson Bank, emerge from the depths of the Gulf of Mexico. These banks are separated from each other

by miles of open ocean ranging from 10 to 30 miles. The banks of the sanctuary are small underwater mountains created by salt domes. The tops of these banks are covered in gardens of coral, sponges and algae that provide habitat for a variety of tropical wildlife. The remote location of East and West Flower Garden Banks helps to maintain some of the world's healthiest remaining coral reefs.

These premier diving destinations harbor the northernmost coral reefs in the continental United States and serve as regional reservoirs for hundreds of shallow water Caribbean reef fish and invertebrates, manta rays, whale sharks and coral heads bigger than cars.



One major threat to coral reef ecosystems, like Flower Garden Banks, is invasive species. An invasive species is any plant, animal or other organism that is not native to an ecosystem, but is currently found there, and is likely to cause economic or environmental harm, or harm to human health.

One invasive animal threatening Flower Garden

Banks National Marine Sanctuary is the venomous lionfish. Lionfish are originally from the Indo-Pacific Ocean. Scientists speculate that they spread in the Atlantic Ocean when people released unwanted lionfish from home aquariums. Since they have no natural predators in the Atlantic Ocean, lionfish populations have boomed.

Lionfish are an invasive species in the Atlantic Ocean, where they have no natural predators. Photo: Greg McFall/ NOAA

The number one concern regarding lionfish is they will eat almost anything that will fit into their mouths. This includes small fish, invertebrates (animals without backbones) and the young of large fish. As lionfish eat away at reef fish this impacts the overall distribution of animals and plants on the reef. If they eat too many herbivores (animals that eat only plants) algae may get a foothold in the reefs and take up space that would otherwise be occupied by corals. If they eat too many juvenile snapper and grouper that may impact fishing industry and food availability for people. With their voracious appetites, lionfish can consume up to 90 percent of juvenile and small fish on coral reefs. In Flower Garden Banks National Marine Sanctuary, they are consuming the young of commercially important species like grouper and snapper. Another concern is the venomous spines found on lionfish, which are painful if a diver comes into contact with them. Populations of lionfish increase very quickly and are rapidly becoming a problem for the sanctuary.

Although it is unlikely that lionfish will be ever fully eliminated from the Atlantic Ocean, there are ways to help minimize their impact on the marine sanctuary. One way to help is to report lionfish sightings. Scientists can use this data to keep track of lionfish populations and distributions. Finally, the most important step is prevention. Never release aquarium fish or other pets into the wild.

Vocabulary	
Invasive species	A species that is not native to a particular location and has negative effects on the environment and/or economy.
Predator	Any animal that hunts and kills other animals for food.
Ecosystem	All of the living things in a given area interacting with each other and their environment.

Procedure – Classroom

1. Use the provided PowerPoint to introduce students to Flower Garden Bank National Marine Sanctuary and the challenges presented by invasive species, such as lionfish.
2. Assess for student understanding by asking the following questions (answers in italics):
 - What invasive species are scientists finding in Flower Garden Banks National Marine Sanctuary? *Lionfish.*
 - Why are lionfish a threat to coral reef ecosystems? *As lionfish eat away at reef fish, this impacts the overall distribution of animals and plants on the reef.*
 - What can we do to help? *Report lionfish sightings, never release aquarium fish or other pets into the wild.*
3. The instructor will evenly assign each student a role: lionfish, grouper, or snapper. Students will be given a card that has a picture of the animal they are assigned. These can be put on strings and worn as necklaces or taped to shirts.
4. Designate an area with visual boundaries for the tag game. This can be done by laying out a rope or describing the boundary points to students.
5. This game is a version of “Everybody’s It.” Every student has the ability to tag other students while simultaneously avoiding being tagged. Decide how you would like students to move around the space you are using for the activity (running, walking, speed walking). Explain these rules to students, as well as how to tag others safely (soft tag, avoid pushing).
6. Once a student is tagged, they have been “eaten” and will sit down.
7. Groupers and snappers only need to be tagged once before sitting down. Lionfish need to be tagged three times before sitting down.
8. After 5-10 minutes of playing, or when only lionfish remain, stop the game and ask the following questions: What fish are left standing? What fish was the hardest to eliminate?
9. Explain to the students that, just like in the game, lionfish have few natural predators on the reef in Flower Garden Banks National Marine Sanctuary. This means that as lionfish consume other fish, their population grows in relation to other fish on the reef.

Preparation – *Pool Mission*

Students will:

- Practice dive skills while meeting diving performance requirements and sanctuary learning objectives.
- Practice identifying and reporting lionfish sightings by recording information, such as the location of the dive the time of day, the number of lionfish sighted, the compass heading direction from the mooring buoy, the size of each lionfish, and the depth of the location where the lionfish were sighted.

Prior to the mission, the instructor will set up the underwater environment in the pool. This will include setting up lionfish (by laminating the provided cutouts or using toy lionfish) at different locations around the bottom of the pool. The instructor will also set up a buoy and downline. This will mimic the mooring buoy that would exist in open water.

Procedure

1. Before the pool dive, the instructor will introduce students to lionfish reporting. This will include outlining what information students need to collect:
 - a. Location of the dive, the time of day
 - b. Compass heading from the mooring buoy
 - c. Number of lionfish sighted
 - d. Size of each lionfish
 - e. Depth of the location where the lionfish were sighted, as well as how to record this information using the provided dive slates

Instructors should also remind students why it is important to report lionfish sightings to local or national marine regulatory agencies. This may also be a good time to review compass skills with students.

2. Prior to pool entry, buddy teams will record the necessary information on their slates, including the location and time of day.
3. Underwater, students will work in buddy teams to locate lionfish. When they find a lionfish, they will identify it using a hand signal.
4. Students will note the location of the lionfish and record any physical features that may help to identify the site (such as ladder, tile markings on the bottom of the pool, etc.).

5. Students will record a compass heading from a known point (in this case the buoy line) to the lionfish in order to help future divers locate the lionfish for removal.
6. Students will record the number of lionfish located at each site.
7. Students will use meter tape or a ruler to estimate and record the size of each lionfish.
8. Upon completion of the pool mission, assess student understanding by asking:
 - a. What did you notice about the lionfish?
 - b. Was it easy or difficult to collect the data?
 - c. How many lionfish did you see?
 - d. What can we do to minimize lionfish populations?

Education Standards	
Dive Industry Standards	This lesson could be paired with: PADI AquaMission Creature ID Specialist SSI Marine Life Ranger NAUI Junior Scuba Ranger
Ocean Literacy Principles	5: The ocean supports a great diversity of life and ecosystems. 6: The ocean and humans are inextricably interconnected.

Additional Resources

NOAA's Office of National Marine Sanctuaries: This site contains information on each of the sites in the National Marine Sanctuary system. <https://sanctuaries.noaa.gov/>

Flower Garden Banks National Sanctuary

This site will provide background on Flower Garden Banks National Marine Sanctuary, educational materials, and information on research being conducted at the site. <https://flowergarden.noaa.gov/>

Invasive Lionfish

This site outlines information on lionfish and their invasion of the national marine sanctuary system. <http://sanctuaries.noaa.gov/lionfish/>

Invasive Lionfish at Flower Garden banks National Marine Sanctuary

These sites provide more information on how invasive lionfish are impacting Flower Garden Banks National Marine Sanctuary. <http://flowergarden.noaa.gov/education/invasivelionfish.html>
<http://flowergarden.noaa.gov/science/lionfishresearch.html>

Ocean and Climate Literacy Principals

The ocean and climate literacy principals outline the key facts that an ocean and climate-literate person should understand. <http://oceanservice.noaa.gov/education/literacy.html>

Red Lionfish– Portrait of an Invasion

This poster outlines the red lionfish invasion in the Atlantic.
<https://lionfish.gcfi.org/sites/default/files/documents/2.pdf>

Lionfish By the Numbers

This infographic visually illustrates how lionfish are impacting marine environments.
<http://sanctuaries.noaa.gov/lionfish/invasive-lionfish-by-the-numbers.pdf>

Collecting and Handling Lionfish

This video tutorial and PowerPoint outlines best practices for collecting and handling lionfish.
<http://www.reef.org/lionfishtutorials>

Invasive Lionfish Portal

This website contains a wide range of research and materials on invasive lionfish.
<http://lionfish.gcfi.org/>

Lionfish Poster

This poster highlights sea creatures that are at risk in the Gulf of Mexico due to the lionfish invasion as well as ways people can help.
http://flowergarden.noaa.gov/document_library/eddocs/fgbllionfishposter.pdf

For More Information

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