



Life on the Edge: Exploring Deep Ocean Habitats

Alien Invasion

FOCUS

Invasive species

GRADE LEVEL

5-6 (Life Science)

FOCUS QUESTION

How do alien species enter non-native habitats, what problems are associated with these species, and what can be done about them?

LEARNING OBJECTIVES

Students will be able to compare and contrast "alien species" and "invasive species."

Students will be able to explain positive and negative impacts associated with introduction of non-native species, and give a specific example of species that produce these impacts.

Students will be able to describe at least three ways in which species may be introduced into non-native environments.

Students will be able to describe possible actions that can be taken to mitigate negative impacts caused by non-native species.

MATERIALS

None

AUDIO/VISUAL MATERIALS

- Blackboard, marker board with markers, or overhead projector with transparencies and markers for group discussions

TEACHING TIME

One 45-minute class period, plus time for student research

SEATING ARRANGEMENT

Groups of 4-6 students

MAXIMUM NUMBER OF STUDENTS

30

KEY WORDS

Hard bottom
Lophelia
Lionfish
Alien species
Invasive species

BACKGROUND INFORMATION

For hundreds of years, thousands of fishermen have harvested U.S. coastal waters of the Atlantic Ocean and Gulf of Mexico. Yet, the marine habitats of the adjacent outer continental shelves and slopes are poorly studied and in many cases completely unknown. Until recently, most scientists assumed that these habitats did not support large or productive biological communities. Although no one had actually visited the edges of the continental shelves for a first hand look, they believed that the extensive commercial fisheries depended upon migrations from other areas and/or nutrients carried in from deeper or coastal waters. But once they actually began exploring the area more thoroughly, scientists found many diverse and thriving benthic communities.

Between North Carolina and Florida, several unique habitats are found where the topography of the outer continental shelf is extremely rugged and swept by the powerful currents of the Gulf Stream. Hard or “live” bottom habitats support diverse biological communities that include valuable fish and invertebrate resources. On the edge of the continental shelf where depths range from 80 to 250 m, hard bottom communities provide the foundation for the food web of many commercially important species. But while scientists have studied many hard bottom communities within the range of SCUBA gear, they know very little about the ecology of these communities in deeper waters.

Even deeper, on the middle of the continental slope, the deep-sea coral *Lophelia pertusa* forms another almost-unexplored habitat. Here, in depths of 400 to 700 m, branches of living coral grow on mounds of dead coral branches that can be several meters deep and hundreds of meters long. Unlike corals that produce reefs in shallower waters, *Lophelia* does not have symbiotic algae and receives nutrition from plankton and particulate material captured by its polyps from the surrounding water. *Lophelia* mounds alter the flow of currents and provide habitats for a variety of filter feeders. Scientists suspect that many other organisms may also inhabit deep-sea coral reefs, including commercially important fishes and crustaceans. But they don’t know for sure, because most of the hard bottom and deep-sea coral habitats on the edge and slope of the continental shelf are still unexplored.

The 2003 Life on the Edge Expedition will search previously unexplored hard bottom habitats and deep coral banks on the edge and slope of the continental shelf adjacent to the coasts of North and South Carolina and define the biological communities living in these habitats. Scientists on the mission plan to keep a particularly sharp eye out for an alien species spotted during the 2002 Islands in the Stream Expedition. Because they often go where no one has gone before, scientists

on Ocean Exploration expeditions expect to see unusual and unexpected things. But members of the Islands in the Stream expedition saw an animal that was not only unusual and unexpected, but unwelcome as well: an Indo-Pacific lionfish, equipped with venomous spines and definitely alien to the Atlantic coast! This activity focuses on alien species and invasive pests, the problems they cause, and what can be done about them.

LEARNING PROCEDURE

1. Review the general geographic location and form of the continental shelf adjacent to the U.S. Atlantic coast. Tell students that very little is known about the ecology of the edge and slope of the shelf, but that recent explorations have found diverse and thriving benthic communities. Show students (or have them visit) web pages from the 2002 Islands in the Stream Expedition describing the sighting of a lionfish (<http://oceanexplorer.noaa.gov/explorations/02sab/logs/aug02/aug02.html>). Ask students what they know about lionfish. Depending upon their responses, you may want to have them research this species, or you may want to tell them that this fish has venomous spines and is a native of the tropical Pacific Ocean, not the Atlantic! Ask students how the lionfish could have wandered so far from home. The most likely explanation, of course, is that humans are responsible; probably someone with an aquarium accidentally or deliberately released the lionfish into the ocean. Tell students that between 2000 and 2002, 49 lionfish were reported off the coast of North Carolina from locations at depths of 85 to 260 feet. Ask what problems might result from the introduction of lionfish to the U.S. Atlantic coast. Human injury is one possibility, as well as competition with native species, some of which might affect economically important fisheries.

“Alien species” and “invasive species” have been defined by NOAA’s National Center for

Coastal Ocean Science:

“Alien” species are non-native or nonindigenous species that have been introduced, either intentionally or unintentionally, into a region; these alien species have been able to establish populations that are able to successfully reproduce in the region. Such populations often appear, flourish for a while in relatively restricted areas of the coastline, and then die out. “Invasive” species, however, are thriving alien populations, expanding their range with generally increasing ecological, environmental, economic, or human health consequences.

2. Tell students that their assignment is to research other examples of alien and invasive species, and to prepare a report that
 - describes positive and negative impacts associated with introduction of non-native species;
 - gives specific examples of species that produce these impacts;
 - describes at least three ways in which species may be introduced into non-native environments; and
 - describes possible actions that can be taken to deal with the negative impacts caused by non-native species.

You may want to direct students to the websites listed under “Resources.”

3. Have student groups present and discuss their research findings. Students should realize that not all non-native species are considered harmful, though they may still have had negative impacts on native ecosystems. Eight of the nine most economically important plants in the United States originated outside the country. On the other hand, there is a sizable list of deliberately or accidentally introduced species that have had distinctly negative impacts. Students should realize that there is always the possibility that introduction of a non-native species will have unforeseen consequences.

This is particularly relevant in the case of exotic pets (such as lionfish) which may be thoughtlessly liberated when they are no longer wanted, with potentially serious results.

THE BRIDGE CONNECTION

www.vims.edu/BRIDGE/ – Click on “Ocean Science” in the navigation menu to the left, then “Biology,” then “Exotics” for resources on non-native species

THE “ME” CONNECTION

Have students write a short essay about how non-native species have been of personal harm or benefit.

CONNECTIONS TO OTHER SUBJECTS

English Language Arts; Social Studies

EVALUATION

Reports prepared in Step 2 provide an opportunity for evaluation.

EXTENSIONS

Log on to <http://oceanexplorer.noaa.gov> to keep up to date with the latest Life on the Edge Expedition discoveries, and to find out whether researchers have made additional sightings of non-native species.

RESOURCES

http://shrimp.bea.nmfs.gov/research/lionfish_factsheet.pdf
– Lionfish fact sheet

http://oceanservice.noaa.gov/outreach/pdfs/nccos_invasives.pdf
– Fact sheet on the National Centers for Coastal Ocean Science Alien Species Early Detection and Warning System

http://www.cast-science.org/cast-science.lh/pubs/ip20_photoA2.htm
– Council for Agricultural Science and Technology issue paper on invasive pest species

<http://oceanexplorer.noaa.gov/explorations/02sab/logs/aug02/aug02.html> – Log entry for lionfish sighting during the 2002 Islands in the Stream

Expedition

<http://www.wsg.washington.edu/outreach/mas/nis/handling.pdf> – A booklet on the handling and disposal of non-native aquatic species

<http://oceanica.cofc.edu/activities.htm> – Project Oceanica website, with a variety of resources on ocean exploration topics

<http://pubs.usgs.gov/of/of01-154/index.htm> – U.S. Geological Survey Open-File Report 01-154 “Sea-Floor Photography from the Continental Margin Program”

NATIONAL SCIENCE EDUCATION STANDARDS

Content Standard A: Science As Inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Content Standard C: Life Science

- Populations and ecosystems
- Diversity and adaptations of organisms

Content Standard F: Science in Personal and Social Perspectives

- Populations, resources, and environments
- Natural hazards

- Risks and benefits

FOR MORE INFORMATION

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