DEERING ESTATE

SHARK RESEARCH & CONSERVATION PROGRAM
MIAMI

Marine Conservation Science & Policy: Mangroves

Grade Level:

4th – 12th

Subject Area

Science
Biology

Duration

1.5 Hrs

Benchmarks:

Body of Knowledge

Life Science
Nature of Science
Physical Science

Big Idea

Organization and Development of Living Organisms.
The Practice of Science

Standards

SC4.L.17.4
Recognize ways that plants and animals, including humans can impact the environment.

SC.8. G.5.2
Describe the impact of human modifications on the environment and ecosystems.

SC.912L.17.16
Discuss the large-scale environmental impacts resulting from human activity.

Focus Question

What are mangroves? What animals live in this habitat and what services do they provide? How can we better protect this environment?

Objectives

Students will explore the mangrove ecosystem and some of the animals that live in this habitat. Students will learn to:

- Identify three species of mangroves and some of the animals that live in this habitat.
- Analyze the importance of this ecosystem and the pressures that threaten it.
- Elaborate an educational commercial explaining the key features of mangroves, what services they provide, and how to protect them.

Student will discuss how this habitat can be protected for future generations. This will be a project-based activity where students will explore the mangrove habitat.

Background

Mangroves are trees and shrubs that grow in the tropical and subtropical coastal intertidal zones, thriving in the hot, muddy, salty conditions that would kill most plants. They survive through complex adaptations including a filtration system that extracts freshwater by eliminating up to 90% of the salt from the seawater. Mangroves also hoard freshwater in thick succulent leaves to minimize evaporation, and have elaborated a root structure strong enough to maintain the mangrove upright, anchored fast despite beating waves and shifting sediment.[1] These high-arching roots are a distinctive feature of many mangroves, and some species have even evolved ways of using their roots to breathe. Because of these ingenious adaptations, over 80 species flourish along coasts, with three species particular to Florida.

These Florida species include the red, black and white mangroves, each characterized by distinct features. The red mangrove, *rhizophora mangle*, grows right along the water's edge, and is easily identified by its prop-roots, the reddish, tangled mass that make the mangrove appear to be standing on the water. This species uses lenticels to aid in respiration, thousands of cell-size breathing pores that take in oxygen at low tide and then close tightly to keep the tree from drowning at high tide. Features include dark green leaves with lighter undersides, small white flowers, and long, torpedo-shaped seedlings called **propagules** that actually germinate while still attached to the fruit so that they are ready to root the moment they fall.

The black mangrove, *Aviccenia germinans*, is usually found just inland and on slightly higher elevations than the red mangrove. This species can be recognized by its **pneumatophores**, the black pencil-like projections that pop up from the sediment and can grow up to 30 cm, taking in oxygen during high tide. The leaves tend to be somewhat narrower than those of the red mangrove and are often encrusted with salt as they excrete salt in filtering the water.

The white mangrove, *Languncularia racemosa*, occupies higher ground than the red and black mangroves, and is prominent in high marsh areas. This species usually has no visible

Vocabulary:

Mangrove:
A tree or shrub that grows in chiefly tropical coastal swamps, which are flooded at high tide. Mangroves often have thick, tangled roots and form dense thicket that is a crucial habitat for many species.

Pneumatophores:
Thin, pencil-like roots that stick up through the sediment and act as snorkels for some mangrove species

Lenticels:
Cell-like breathing pores on the aerial roots of some mangroves that take in oxygen at low-tide and close up during high tide.

Propagules:
Elongated seedpods of the mangroves which are already germinated and ready to root when they fall from the tree, and may withstand up to a year floating in salt water until they land in a suitable spot.

Red Mangrove:
A Florida species that grows right along the coast and features arching red roots that rise above the water, dark leaves and long propagules.

Black Mangrove:
This Florida species grows slightly inland, and sends out thousands of black, pencil-like pneumatophores and often has salt-encrusted leaves.

White Mangrove:
This Florida species prefers to be further inland, producing spikes of light green flowers and two small glands at the base of each leaf.

Deforestation:
The clearing of forests that results in environmental damage

Environmental Stewardship:
The responsible use and protection of the natural environment through conservation and sustainable practices.

Background

roots, but can develop peg roots, shorter, stouter versions of pneumatophores that aid in respiration in oxygen-deprived sediment. The white mangrove produces oval leaves with two distinguishing white glands at the base called neotrines, which excrete salt, and light green flowers.

These three species cover 469,000 acres in Florida, and play a vital role in establishing habitat for many species. Mangroves provide essential feeding and breeding grounds for fish, crustaceans, mollusks, birds, turtles, oysters, and even alligators. Mangroves are often deemed "nature's nursery", hosting at some point in their life cycle an estimated 90% of recreationally important fish and serving as nesting grounds for many endangered bird species.[2] Aside from providing essential habitat, mangroves contribute key environmental services. Their elaborate root systems accumulate organic matter, forming a rich ecosystem while slowing water flow, filtering harmful nitrates and phosphates, and sometimes even collecting enough sediment to create small islands. Mangrove forests help stabilize shorelines against erosion and form a buffer zone that helps to reduce hurricane and storm surge damage. Although coastal habitats like mangroves cover less than 20% of the total ocean area, they account for more than half of the carbon sequestered in ocean sediments, mitigating climate change through "blue carbon."

Despite their importance, mangroves are disappearing faster than the rainforest, with only an estimated 50% of mangrove forests intact, many of these in poor condition.[2] The worldwide greatest threat to mangroves is **deforestation** for shrimp farms, which in turn contaminate aquifers and remaining mangroves with chemical waste from antibiotics, pesticides and fertilizers. Millions of acres of mangroves have also been cut for agriculture and real estate development, which further compromise surviving mangroves by pumping industrial, and organic wastes into water supplies, which then negatively affects the fishing industry. In Florida, coastal development most threatens mangroves.

As fisheries decline and coastal areas become more exposed and vulnerable to storm damage, people are investigating in mangrove restoration and protection projects like living shorelines. Resolutions vary depending on locally specific threats, including legal action against shrimp farms, books teaching elementary students **environmental stewardship**, replanting thousands of acres of mangroves, and promoting ecotourism to provide jobs while protecting this valuable ecosystem. Due to damage from coastal development, Florida implemented the Mangrove Protection Act to conserve and restore this valuable ecosystem.

Everyone can help protect the mangroves by keeping the water clean, being vigilant and reporting damage to the appropriate authorities, talking to others to educate them on the benefits of mangroves, and getting involved with volunteer groups replanting and maintaining the mangroves. Buying sustainably raised shrimp at the grocery store and donating money and time to mangrove restoration projects are also helpful. It's important to take part and help save the mangroves and the rich variety of life that depends upon them.

Supplemental Resources

1- Ocean Portal. Smithsonian National Museum of Natural History. http://ocean.si.edu/mangroves
2- Virtual Tour: "Mangroves: Protectors of the Coast." Odyssey Earth. http://www.odysseyearth.com/videos/mangroves-protectors-of-the-coast/
3- Virtual Tour: "Lifecycle of the Red Mangrove." Odyssey Earth http://www.odysseyearth.com/videos/the-life-cycle-of-the-red-mangrove/

Vocabulary:

Mangrove:
A tree or shrub that grows chiefly along tropical coastal shorelines, which are flooded at high tide. Mangroves often have thick, tangled roots and form dense forest that is a crucial habitat for many species.

Deforestation:
The clearing of forests that results in environmental damage

Environmental Stewardship:
The responsible use and protection of the natural environment through conservation and sustainable practices.

Extension Activity:

Have students write a postcard to their mom and dad from the mangroves, summarizing today's lesson to describe the ecosystem they are "visiting" and explain its importance.

Assessment:

Students will complete the mangrove worksheet after class, and write an explanatory entry in their science journals responding to the following prompt:
If you could be an animal in the mangrove ecosystem, which animal would you be and why? How would the mangroves support you?

Program Partner:

Protect the Mangroves! Commercial

Materials

- Lined writing paper
- Blank paper
- Pencils or pens
- Coloring utensils (markers, crayons, or colored pencils)
- Tape or glue as needed
- Props that may be available

Procedure

1. Divide students into groups of four and supply each group with paper and coloring utensils.
2. Have students imagine that they are a Mangrove Protection Organization that wants the city of Miami to protect its mangroves, while a construction company wants to cut down the mangroves to build a shopping mall.
3. Each group will choose a name for their fictional protection organization and a slogan to present their message to protect the mangroves (i.e. Save the Miami Mangroves!)
4. Have students define the mangrove habitat and make a list of benefits that mangroves provide to the community.
5. Using the definition and list of benefits, students will write and prepare a commercial convincing voters to protect the mangroves. They may decide to use props, prepare a visual or sign with the paper and colors, and may decide to use animals as characters. (Remind them of script format:
   Brenda: "Hello"
   Bobby: "Hi!")
6. Have each group present their commercial.

Worksheet Answer Key

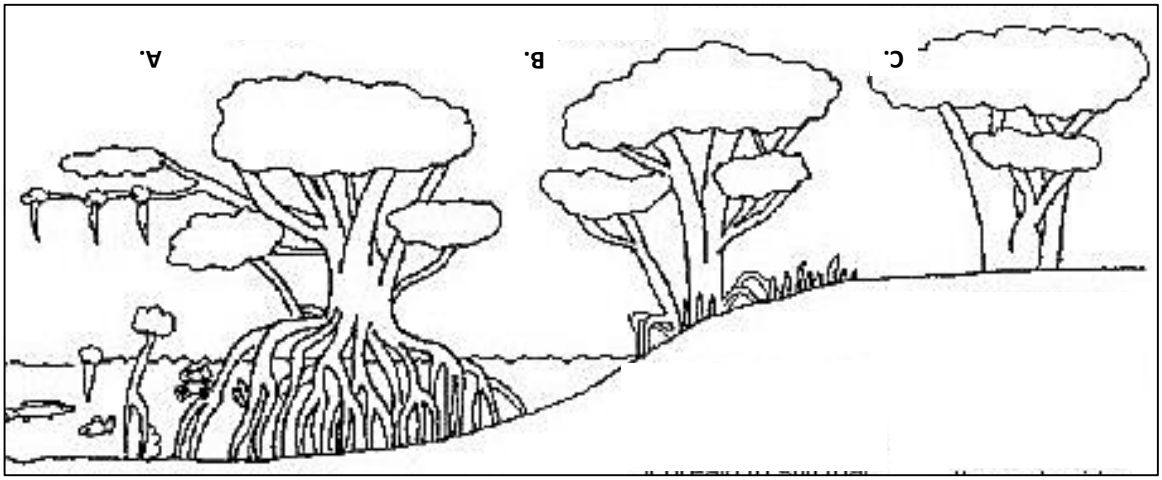
1. Black Mangrove: B
2. White Mangrove: C
3. Red Mangrove: A
4. Word Scramble:
   Coast
   Habitat
   Fish
   Erosion
   Hurricanes
   Deforestation
   Planting

Mangroves

Mangroves are trees or shrubs that grow in tropical and subtropical coastal swamps which are flooded at high tide. Mangroves have thick, tangled roots and form a dense thicket that is a crucial habitat to many marine and terrestrial species. Three species can be found in Florida, each forming an essential part of the mangrove ecosystem, protecting coasts from erosion, reducing flooding, and providing a home for many animals including oysters, turtles, fish, crocodiles, and birds such as the brown pelican and roseate spoonbill.

Draw lines to match the name of the mangrove with the corresponding picture and description.

1. Black Mangrove	2. White Mangrove	3. Red Mangrove



a. This species grows slightly inland, sending out thousands of black, pencil-like pneumatophores to aid in respiration, and often has salt-encrusted leaves.	b. This species prefers to be further inland than the others, producing spikes of light green flowers and two small glands at the base of each leaf.	c. A species that grows right along the coast and features arching red roots that rise above the water, dark leaves and long propagules.

4. Mangroves are important species that grow along the (OTASC) _____, forming a dense thicket that provides (BAHTTAI) _____ for many organisms. Many of the (FHSI)_____, crustaceans and mollusks that we eat are born here, that's why the mangroves are often called "nature's nursery". Mangroves also protect our coastlines from (ORSEINO)_____ by securing the sediment with their strong root systems, and reduce flooding and damage during strong storms like (URIRAENCSH) _____. Unfortunately, many mangroves are being damaged by (NIASRFDEOETTO) _____, the cutting down of large tracts of forests. We can help protect the mangroves and the animals that live in this habitat by educating others and (LTANPNGI)_____ new mangroves for future generations to enjoy.