Mangrove Ecology & Adaptations

Summary

In this activity, students will first learn about the environmental adaptations of mangroves, then apply this knowledge in the creation of an imaginary organism that has adaptations applicable to a specific habitat.

Objectives

At the conclusion of the lesson, students will be able to:

- explain the ecological and economic importance of mangrove forests
- describe the adaptations mangroves have developed to better survive in their habitat
- use their knowledge of adaptations and how adaptations relate to habitats to design an organism that has specific adaptations to survive in a particular habitat

Time

1 period

Background

Mangroves are short, gnarled, salt-tolerant trees and bushes that inhabit tropical and subtropical coastal environments where the water has a high salt content. They are typically found in shallow intertidal areas along sheltered coastlines or in brackish estuaries. Mangrove forests are some of the most productive and biologically rich ecosystems on Earth. They provide habitat for a wide variety of marine organisms. They also stabilize shorelines, protecting them from excessive erosion during storms, and protect reefs from land-based pollution and siltation. However, mangrove forests are seriously threatened in many areas, including the Bahamas. Less than half of the original area covered by mangroves remains, and much of the existing forest is degraded.

Mangroves are not a strong competitor species. Instead, over time, they have developed several unique adaptations that allow them to thrive in harsh salt water or brackish environments where other plants cannot survive. There is typically little oxygen in the muddy soil that mangroves grow in. Therefore, mangroves have developed root structures that allow them to obtain oxygen directly from the air. These aerial roots, called pneumatophores, rise from the soil into the air above the low tide level. Mangroves also have small openings (lenticels) in their bark that allow oxygen to diffuse into the plant and down into its underground roots. To anchor themselves, many mangrove species have prop roots that arch out from the tree into the soil, helping the plant to withstand strong coastal waves. In addition, some species of mangroves have developed salt glands, salt-filtering roots, or salt-excreting leaves and branches in order to prevent the buildup of high salt concentrations inside the plant. This filtering system is so effective that fresh water can be drunk from a cut mangrove root!

The Island School has several ongoing projects related to mangroves. Students focus on mangrove planting and stabilization projects, with the long-term goal of developing a model for sustainable and ecologically sound coastal development projects worldwide.

Teacher s Notes

The main focus of this activity is the manner in which organisms adapt to survive and prosper in various habitats. Mangroves are an excellent example of how organisms adapt to a harsh, changing environment. Students are asked to synthesize what they have learned about mangrove adaptations in order to create an imaginative new organism that is also well adapted to its chosen habitat.

Elementary: The provided worksheet can be used, with minor modification, with a broad range of age levels, and does not require a detailed knowledge of mangroves. You may wish to use a more familiar example of adaptation with younger students and alter the activity to have students draw and label an imaginative creature that would survive well in one room of their home.
Middle School and High School: All students that have studied Life Science should be able to complete the worksheet. More focus on mangrove adaptations should be provided at the high school level, and high school students should also be encouraged to do the first Extend the Experience activity. To save time in Step 4, set up in advance folders of reference materials for each chosen habitat type.

Vocabulary

Adaptation, brackish, intertidal zone, mangrove, neritic zone, pneumatophore

Materials

Photographs or diagrams of mangrove plants, *Creature Feature Worksheet* (provided), reference materials (books, magazine articles, websites) on Eleutheran habitats

Procedure

1. Begin the lesson by explaining what an adaptation is, providing some examples (e.g., many birds' beaks are adapted to eating different types of foods). Some adaptations specific to the coral reef ecosystem are listed below:

   Cleaner shrimp: This colorful shrimp feeds itself by setting up a cleaning station on the reef. Larger fish visit the cleaner and float motionless while the shrimp removes parasites and dead skin. Some fish even invite the shrimp into their mouths to clean, but never harm the bite-size crustacean.

Nurse shark: Nurse sharks "taste" along the ocean bottom with fleshy whiskers called barbels. When they detect a tasty crab or spiny lobster hidden in the coral, they open their mouths and suck their prey from its hiding place like a living vacuum cleaner. Nurse sharks have flat teeth and powerful jaws for grinding and crushing shells.
Four-eyed butterfly fish: The four-eyed butterfly fish fools predators with color. Its true eyes are camouflaged in black stripes on its head, but it has two large "false eye" spots on its tail. The false eyes may confuse predators. Mistaking these for the true eyes, a hunter is likely to attack the eye spots and miss the fish's head, allowing the butterfly fish to swim off in an unexpected direction.

2. Ask students to provide additional examples of organisms that have adapted to their environment in order to survive.
3. Next, provide photographs or diagrams (available on websites (see Resources) and in many botany and marine biology texts) of mangroves, and describe the habitat in which they exist. Stress the difficulties of surviving in an environment with such high salt concentrations and changing conditions. Ask students what they think would happen to a typical plant if it was watered with salt water. (It would quickly die.) Point out the specific mangrove adaptations noted in the Background section and ask students to hypothesize how each of these adaptations helps the mangrove to survive and prosper in its habitat.
4. Have students choose one of the habitats that exist on and around Eleuthera, then find out more about the organisms that live there. Tell students to focus on the types of adaptations that such organisms have to help them to survive in their habitat. To aid them in their research, provide students with access to appropriate reference materials, such as short book excerpts, magazine articles, or selected websites. Possible habitats to focus on include: coral reef, mangrove forest, rocky shore, sandy beach above the high-tide line, cave, intertidal zone, neritic zone (shallow water below the low-tide level), open ocean surface zone, and open ocean deep zone.
5. Have students complete the provided *Creature Feature Worksheet* by creating a plant, animal or other living organism that would be well adapted to the habitat selected in Step 4.

Extend the Experience

- Have students research the current status of mangrove forests around the world and the causes of mangrove forest destruction. Then, have students make a poster or write a short paper on the ecological and economic importance of mangrove forests and what actions they believe should be taken to address the loss of mangrove habitat.
- Humans are adapted for life on land, not in the water. What equipment do scuba divers use to adapt to the underwater environment? How does this equipment work? Compare the adaptations of a scuba diver with the adaptations of a fish and/or dolphin.