

TITLE: Biodiversity in Marine Environments

PRIMARY SUBJECT: Science

GRADE LEVEL: 6th - 12th

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CONCEPTS / TOPICS TO TEACH:

Marine ecosystems are essential for the overall health of both marine and terrestrial environments. Each ecosystem performs certain functions that are critically important for the organisms living there. The large biodiversity of species living in these ecosystems allows them to be resistant to change. It is important for students to understand the abiotic and biotic factors (high school only) that define a marine ecosystem, how species adapt to their marine environments, and how human impact has begun to weaken these ecosystems.

STANDARDS ADDRESSED:

| COMMON CORE | NGS STANDARDS |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <u>CCSS.ELA-LITERACY.WHST.6-8.1.B</u> Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. | <u>MS-LS2-2.</u> Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. |
| <u>CCSS.ELA-LITERACY.WHST.9-10.7</u> Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. | <u>HS-LS2-8.</u> Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce. |

General Goal(s):

Introduce students to major marine ecosystems and explore the biodiversity of each environment. Determine why specific species thrive in certain environments and what adaptations help them succeed. Use creative writing to further understanding of biodiversity in marine ecosystems.

Specific Objectives:

Students will use investigative research skills to synthesize innovative thinking. This activity will allow students to engage in scientific writing, creative and critical thinking, literacy and vocabulary development while creating a new species based on true environmental conditions and demonstrating appropriate adaptations and physiology compatible with an assigned environment.

Required Materials:

- Access to computer or tablet
- Marine ecosystem handout

Anticipatory Set (Lead in):

- Q: Sea turtles are air breathing animal like humans, so what adaptations might they have to help them live in an aquatic environment?
- A: Bigger lungs or the ability to breath hold for longer, maybe powerful flippers to stay near the surface or some way to control their buoyancy.
- Q: Octopuses are animals that lack a skeleton or much in the way of external protection, so what adaptations might help them deter predators?
- A: They can change color and skin texture to blend in, they can also move their body to mimic other animals and act like an impostor. They can also ink to temporarily blind a predator.
- There are a number of ways that animals in the sea are specially adapted for the variety of environments they live in, and in this activity we will explore the connections between specialized environments and adaptations.

ACTIVITY

Students (can be done as partners, at teacher's discretion) will be assigned a marine ecosystem (coral reef, mangroves, deep sea, or kelp forest) and will create and design their own unique marine organism that lives in that ecosystem (must be scientific and based in logic) but encourage students to be creative and innovative in designing their creature. At teacher's discretion students can be given free range, or assigned a specific phylum such as echinoderm, arthropod, mollusk etc. to futher their understanding and exploration of taxonomy.

Using the handout and websites listed, have students research their assigned ecosystem and give time for students to brainstorm and begin creating their creature. They will then write a one page paper explaining why the organism would succeed in their assigned environment and what adaptations it has that would give it an advantage in it's marine environment. Finally, they will create an image of their marine organism using drawing, painting or computer generated art.

*For high school students review biotic/abiotic factors of marine environments and discuss how that shapes each specific ecosystem

ASSIGNMENT OUTLINE

Marine Ecosystem: Highlight the important factors about assigned marine ecosystem

Description: A general description of the physical features of your organism and what makes it unique

Feeding habits: What does it eat and how does it hunt/find food?

Adaptations: What special characteristics does the organism have that helps it succeed in it's environment

Family: What existing marine organism from this ecosystem would be related to the creature?

WRAP UP

- Have students present the marine organism they created and discuss which new organism would thrive best in its environment and why
- Compare and contrast the marine environments with students and discuss why each environment is important in it's own way
- To further your students understanding of marine ecosystems you can

GLOSSARY OF LESSON TERMS

- Ecosystems- Community and interactions of living and nonliving things in an area
- Biotic factors- Any living component of an ecosystem
- Abiotic factors- Any non living component of an ecosystem
- Biodiversity- The number of species and genes they contain
- Symbiotic relationships- Diverse organisms that live together that may or may not be beneficial to both parties
- Photosynthetic- The use of sunlight to synthesize nutrients from carbon dioxide and water
- Adaptations- The process of change in which an organism becomes better suited to its environment
- Nutrient- substance an organism needs for energy, growth, and life.

Plan for Independent Practice:

- Ask students to do research about how human impacts are affecting their marine environments and how that is causing them to change
- Encourage students to explore symbiotic relationships found in each marine ecosystem
- Have students watch “Blue Planet” Episode 2 “The Deep” and have a class discussion about the challenging environment this creates for the various organisms that live in this environment

Suggested Reading:

Learn about the amazing adaptations of the leafy seadragon:

<https://bradyoactivefacts-leafyseadragon.weebly.com/adaptations.html>

Oceanic Research Group's excellent fact pages:

<http://www.oceanicresearch.org/education/films/adap.html>

Smithsonian's Ocean Portal:

<http://ocean.si.edu/category/adaptations>

Potential Connections to Other Subjects:

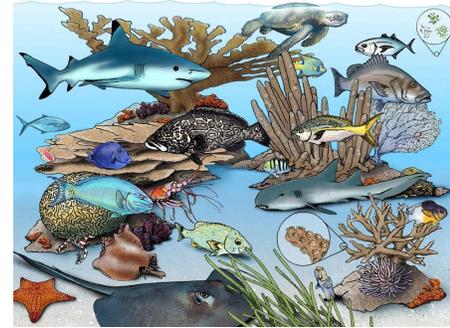
Art: drawing, design, graphics

Language: vocabulary development, scientific writing, literacy

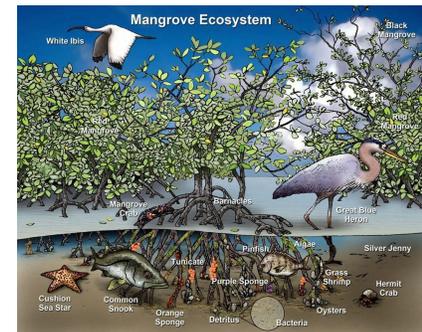
Ecology: basic biology, ecosystem connections

MARINE ECOSYSTEMS

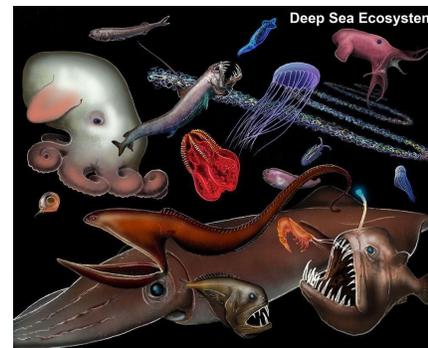
Coral Reefs are primarily found in tropical and subtropical regions of the ocean. They are one of the most biologically diverse marine environments and are home to everything from sponges, jellies, octopus, manta rays, and sharks. They provide these marine organisms with nursery grounds, shelter, and feeding areas vital to their survival. The ocean's reefs contain over 4,000 different species of fish and hundreds of coral species. Because reef building corals rely on the sun to make their food and energy, these ecosystems are generally found in low water depths where they can get maximum exposure to sunlight and good water flow.



Mangrove Forests are groups of trees that lie along tropical coastlines rooted underwater in salty sediment. Mangroves have the ability to cover coastlines in sturdy patches known as mangrove forests. The dense root systems trap sediment which help prevent erosion and provide protection from waves and storms. Mangrove forests host a rich diversity of animal species and the intricate root systems provide shelter and act as vital nursery grounds for many marine organisms. This ecosystem has incredible biodiversity comprised of algae, mollusks, crustaceans, insects, reptiles, birds, fish, and mammal species.



Deep Sea environments are largely unexplored but take up the majority of the oceans space. It is an intense ecosystem that has little to no sunlight and temperatures close to freezing. However, there is still much biodiversity found in this mysterious ecosystem. Researchers have discovered that thousands of marine organisms call the deep sea home. Many fishes, corals, jellies, crustaceans and worms have adapted to survive in this extreme environment.



Kelp Forests are found in coastal regions that have cool nutrient-rich waters. Because they are a species of algae they rely on sunlight to generate food and energy. Kelp attaches to the seafloor and eventually grows to the water's surface, some growing as tall as 150 feet! This ecosystem provides an important habitat for thousands of species of invertebrates, fishes, marine mammals and other algae. Many organisms



use the thick blades of kelp as a safe shelter against predators or even rough storms. Mammals such as seals, sea lions, whales, sea otters and many species of birds depend of kelp forests for food.