

Hawaii's Reef Fishes

Coral Reefs Supplemental Lessons

Unit Overview

Unit at a Glance:

This unit is designed to provide an enhanced understanding and appreciation for general fish anatomy and the physical adaptations they have developed over time to increase their ability to live and survive in the water. They will understand that while fish come in many shapes, sizes, and colors they all share the same basic anatomy with some specialized structures necessary for survival. Activities include a thought swap on what a fish needs to survive, dressing up as a fish, observing and comparing fresh fish, and more.

Hawaii Content and Performance Standards (HCPSIII) Addressed:

Standard 1: The Scientific Process: Scientific Investigation: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Benchmark

SC 4.1.1 Describe a testable hypothesis and an experimental procedure.

Standard 3: Life and Environmental Sciences: Organisms and the Environment:

Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment.

Benchmark

SC 4.3.2 Describe how an organism's behavior is determined by its environment.

Standard 5: Life and Environmental Sciences: Diversity, Genetics, and Evolution:

Understand genetics and biological evolution and their impact on the unity and diversity of organisms.

Benchmark

SC 4.5.2 Describe the roles of various organisms in the same environment.

SC 4.5.3 Describe how different organisms need specific environmental conditions to survive.

Background Information

What is a Fish?

The question, “What is a fish?” is a difficult one to answer. Originally, “fish” meant any animal that spends its entire life in the water. However, today the word “fish” usually means any of several types of aquatic animals that have gills throughout life, a backbone of some sort, and (generally) a streamlined body. There are five common characteristics found in most fish: a backbone, cold-blooded, live in water and have gills, have fins, and most (but not all) have scales.

Fish are very important and are some of the most diverse animals that live in the sea. They are one of the oldest and largest groups of vertebrate (with backbone) animals. They are ancestral to all others and make up over half of the total number of vertebrate species. Scientists who study fish are called ichthyologists. Ichthyologists have come to believe that the terrestrial (land) vertebrates including reptiles, birds, and mammals, have all descended from fishes that evolved (adapted) to live on land.

There are over 20,000 different kinds of bony fishes. Fish come in all shapes, sizes, and colors; but they share many traits because they are all adapted to aquatic life. Also fishes perform many of the same tasks that humans do in order to survive. These include obtaining food and oxygen, as well as, moving through their habitat using sensory receptors to avoid danger and reproduce. Not only are they one of the most diverse types of animal, they have many different adaptations such as camouflage, protective coloration, poisonous spines, etc. that allow them to live and survive in the water. Primarily, these adaptations serve as defense mechanisms from predators and other dangers of life in an aquatic environment. Some, like the puffer fish, can blow up their body to prevent them from being swallowed. Others, like the lionfish and stingray, have poisonous spines. The four-eyed butterfly fish has a false eyespot toward its tail so that a predator is fooled into thinking they are attacking the front of the fish. These are just a few of the many types of adaptations found in fish that help them survive.

Moving Through the Water:

The water surrounding the fishes is very different than the air around us, so it's not surprising that fish look quite different than us. Water is 800 times more dense than so, so most fishes are streamlined to cut down on drag, and have fins to help them swim. Fin and body shape are a direct reflection of the fishes lifestyle. The color of fishes is also a good indicator of where they live. Fishes that are found living on the bottom are often camouflaged to look like their surroundings, which might mean like a rock, sand, coral, etc.

Some examples include:

- Sleek fishes with large eyes and crescent-shaped tails (like tunas) are fast, constant swimmers.
- Stocky fishes with rounded or squared off fins are typically bottom dwellers.
- Snake-like fishes with reduced fins (like moray eels) like to live in crevices.

- Disc-shaped fishes that are flattened from side-to-side (like butterfly fishes) are found in highly maneuverable fishes.
- Pancake-shaped fishes (like flounder) are found on flat, sandy bottoms.

Escaping Predators and Obtaining Food:

Besides being highly maneuverable and swimming fast, using camouflage or being able to fit into holes and crevices, fishes also have other features that provide protection from becoming someone's dinner. Most fish are covered at least partially with scales and slime, which not only protect their skin from penetration by the teeth of predators, but also keeps some parasites and bacteria away.

Obtaining Oxygen

There is far less oxygen available in the water than in the air we breathe, so many fishes have gills instead of lungs like us. The gills have a very high surface area, and are very thin and delicate so the blood running through them is visible, making them bright red. However, because the gills are very delicate they also have a hard protective cover called a gill cover or operculum.

Sensing the Environment

Similar to humans that have 5 senses, so do fishes. These senses include: touch, vision, taste, smell, and hearing. Sound travels much better and faster in the water than through the air, so fishes do not have external ears like we do. Fish also have a "sixth" sense that we don't. They have a lateral line running along their side made up of tiny pits with sensory hairs and nerves to sense distant touch. This allows them to sense water movement nearby. The lateral line also helps schooling fishes, or fish that travel in large groups, stay together and helps predators find prey while prey avoid predators.

Hawaii is one of the most isolated archipelagos in the world and therefore lacks the high diversity of fish species that can be seen in other coral reef ecosystems around the world. However, it is unique in that 25% of Hawaiian fish species are endemic, meaning they can be found nowhere else in the world. This is a result of isolation and the strong need to evolve or develop unique physical characteristics that will make them better suited for survival in Hawaiian waters.

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