



WAVE on Wheels Outreach

Shark Cart Presentation

Grades 3-5

Time requirement

1 Hour

Group size and grade

Up to 50 students maximum

Materials

2 Epaulette Sharks – in large transport cooler

1 or 2 – water coolers (depending on the length of trip and need for a water change)

Mobile Shark Cart

Blue basket (including Pump, Shark Net, Electrical Cord, Paper towels)

Thermometer

Shark Artifacts Bin

Shark Emergency Water

WAVE Tablecloth

Goal

Through a live shark encounter, students will be excited, engaged, and educated about the wonders of aquatic life and the importance of conservation.

Objectives

1. Students will be able to list 5 adaptations a shark has for aquatic life including a combination of internal and external body parts as well as behaviors.

2. Students will be able to identify what sharks eat.
3. Students will be able to list at least 5 species of shark and identify a unique characteristic to that species.
4. Students will be able to describe that all energy in a food web originated from the sun.
5. Students will be able to discuss shark conservation efforts as well as how they can help save sharks and other aquatic animals.

Theme

Sharks are often misunderstood animals that play an important role in their environment.

Kentucky Core Academic Standards – Science

Third Grade - 3. *Interdependent Relationships in Ecosystems*

3-LS2-1. Construct an argument that some animals form groups that help members survive

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

LS2.D: Social Interactions and Group Behavior

Third Grade - 3. *Inheritance and Variation of Traits: Life Cycles and Traits*

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment

Fourth Grade - 4. *Structure, Function, and Information Processing*

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

LS1.A: Structure and Function

Fifth Grade - 5. *Matter and Energy in Organisms and Ecosystems*

5-PS3-1. Use models to describe that energy in animal's food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

PS3.D: Energy in Chemical Processes and Everyday Life

Fifth Grade - 5. *Earth's Systems*

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

ESS3.C: Human Impacts on Earth Systems

Background

Sharks are Fish

Sharks are a type of fish. They live underwater, breath water through gills, have a protective layer of scales covering their body, and are cold-blooded, or ectothermic. Worldwide there are more than 22,000 species of fish. Sharks fall into a special group of fish known as cartilaginous fish including sharks, rays, skates, and guitarfish. This group has a skeleton made of cartilage rather than bone like most fish known as bony fish. Bony fish have gas-filled swim bladders that allow vertical movement in the water column. On the other hand, sharks do not have swim bladders. They rely on lift created by their pectoral fins similar to the lift created by the wings of an airplane. Sharks also have a large oily liver, and since oil is less dense than water it creates additional buoyancy. There are several other distinct differences between sharks and bony fish. The chart below can be found at:

http://www.sharkproject.org/haiothek/index_e.php?site=evolution

	Cartilaginous fish (Chondrichthyes)	Bony fish (Osteichthyes)
Skeleton	Cartilage	Wholly or partially ossified
Gill slit cover	Open gill slits	Gill cover
Swim bladder	Not present	Present
Skin surface	Covered in dermal teeth	Covered in scales

Shark Adaptations

Sharks have several unique adaptations that help them survive in their environment. In general, sharks are darker on top and lighter below. This is a type of camouflage known as countershading. Countershading aids many aquatic animals, including sharks, as they are more difficult to see because their light undersides blend in with the sunlight. The darker upper body blends in with the ocean depths which are black as sunlight completely dissipates. Dermal denticles protect the shark and have a series of raised ridges giving sharks their sandpaper feeling. These ridges reduce drag and noise generated by a shark swimming enabling them to move efficiently in ghost-like silence. Sharks also have specialized sensory organs that detect electrical fields. These organs, called ampullae of Lorenzini, aid sharks in locating their prey by detecting tiny electrical signals from the prey's muscles. Finally, sharks have a lateral line running along each side of their body. This vibration detection area allows a shark to feel disturbances in the water column.

Shark bodies as well as shark tails, or caudal fins, come in a variety of shapes and sizes. These are adaptations to the environment of that shark species. A fusiform, or torpedo shape, is adapted for open water, while depressiform, or flattened, is adapted for living on the bottom of the ocean. A homocercal, or forked, caudal fin is built for constant swimming over long distances, while a long un-forked tail aids in maneuverability as well as living near the bottom.

Sharks are typically thought of as being solitary animals. This is true for many species; however, some species do form groups for a variety of reasons including protection from predators, hunting behavior, and defending territories. Sharks also show symbiotic relationships with other species including mutualistic relationships with cleaning species including remoras and shrimp.

Shark Diets

Animal diets are closely related to the dentition, or teeth, of those animals. Sharks are no exceptions. A stereotypic shark jaw has sharp pointed teeth on top and bottom which function similar to a fork and knife tearing off pieces. Shark species with these teeth include the Great White, Bull, Hammerhead, Sand Tiger, Black Tip, and many others. Some species have small round teeth similar to human molars designed for crushing and grinding prey with hard bodies and exoskeletons. These species typically have a mouth on the underside of their body rather than on the front of their head and include the Guitarfish (Shark Rays), Epaulette, Nurse, and Zebra Sharks. Finally, some sharks do not have teeth including Basking and Whale sharks. They obtain food by swallowing large amounts of water and filtering out organisms.

Shark Species

The Newport Aquarium currently displays Black Tip Reef Sharks, Nurse Sharks, Zebra Sharks, Sand Tiger Sharks, Sandbar Sharks, Scalloped Hammerhead Sharks, Epaulette Sharks, Leopard Sharks, Hound Sharks, Pajama Sharks, Cat Sharks, Horn Sharks, and a few others. The Aquarium will never display a Whale Shark, Great White Shark, or Bull Shark largely due to size restrictions as well as the behavior of those species. The Whale Shark is the largest fish in the ocean reaching lengths of more than 40 feet and weighing more than 20 tons. The smallest shark is currently thought to be the Dwarf Lanternshark or the Ninja Shark reach lengths of 6-8 inches maximum. The species implicated in the most shark attacks include the Great White Shark, Tiger Shark, and Bull Shark. The species displayed for the outreach program is an Epaulette Shark. These unique sharks are bottom dwellers with crushing dentition. They exhibit several adaptations for life in a tide pool habitat.

Food Web Connections

As with most apex predators, sharks play a critical role in their ecosystem as a top down control mechanism for the environment's food web. Apex predators consume tertiary and/or secondary consumers, which consume primary consumers, which consume producers, which produce energy from the sun through photosynthesis. The main source of energy for all

ecosystems initiates from the sun in the form of solar energy. Through the process of photosynthesis, plants convert this energy into oxygen and glucose. Because of this conversion, green plants, some bacteria, and algae are labeled as producers. An animal, such as a herbivorous fish, who consumes the plant, is known as a primary consumer, because it receives the energy from the plant which converted the energy from the sun. The shark who eats the fish that feeds on the plant which converted the sunlight is known as a secondary consumer, hence a process that directly relates back to the sun as the primary energy source. An apex consumer is the top of the food chain or food web with few to no natural predators at adult size.

Shark Conservation

As the demand for shark products increase, so does the concern for shark populations and the sustainability of global fisheries. Sharks are characterized by slow growth rates, late maturity, and fewer offspring. These factors leave many species of animals, including sharks, vulnerable to overfishing. Sharks may be caught as bycatch in other fisheries or directly targeted for markets such as the shark fin soup industry.

The WAVE Foundation's Aquatic Conservation Fund supports a variety of organizations whose chief mission is to protect natural resources and environments. Misión Tiburón's goal is to promote the conservation and responsible use of marine resources, especially of sharks, through the development of integrated projects of marine education and scientific research. Their current project is titled "Conservation of Scalloped Hammerhead Shark (*Sphyrna lewini*) and its critical habitats in the Eastern Tropical Pacific." The Fund is also supporting the University of Hawaii's Hawaii Institute of Marine Biology with Scalloped Hammerhead tracking using various satellite tags. Finally, WAVE is assisting the O'Seas Conservation Foundation in Shark Science and Youth Education. By integrating shark tagging with youth education, this innovative approach will enhance our knowledge pertaining to an understudied species and will help to secure our future through the education and motivation of our environmentally conscious youth.

Vocabulary

Conservation – the study of the loss of Earth's biological diversity and ways this loss can be prevented

Depressiform – flattened or dorso-laterally compressed

Diversity - the variety of life found in a place on Earth or the total variety of life on Earth

Environment - the external conditions, resources, stimuli etc. with which an organism interacts

Fusiform – torpedo shaped, tapering at both ends

Habitat – the place where an organism or a community of organisms lives, including all living and nonliving factors or conditions of the surrounding environment

Homocercal – forked, appearing outwardly symmetrical but with the backbone passing into the upper lobe

Mutualism - two organisms of different species exist in a relationship in which each individual benefits from the activity of the other

Photosynthesis - process by which green plants and some other organisms use sunlight to synthesize foods from carbon dioxide and water

Predator – an animal whose diet consists of other animals

Prey – an animal who is eaten by other animals, or predators

Survive – the continuation of life or existence

Symbiotic - organisms that live together; however, the relationship is not necessarily beneficial to both. (ie parasite-host)

Extension Activities

Project WILD Activities. Please contact your state Project WILD coordinator for more information. See <http://projectwild.org/KentuckyCoordinator.htm> (for Kentucky) or <http://www.projectwild.org/ProjectWILDCoordinators.htm> (for other states).

- Energy Pipeline – Students will (1) explain why energy dissipates at each trophic level, (2) contrast the transfer of energy and the recycling of organic material within an ecosystem, and (3) relate the role of each trophic level to ecosystem dynamics.
- Grasshopper Gravity – Students will (1) describe the relationship between the structure and function of grasshopper; (2) generalize that wildlife ranges from small to large organisms and exists in a variety of forms; and (3) recognize that people have influence on other animals, and with that influence comes the responsibility to act with compassion.
- Graphanimal – Students will identify characteristic life forms in two different environments.
- Playing Lightly on the Earth – Students will (1) distinguish between games that are damaging and not damaging to the environment, and (2) invent games with a benign effect on the environment.
- Surprise Terrarium – Students will (1) identify camouflage as an example of an adaptation, and (2) describe the importance of adaptations to animals.
- Too Close for Comfort – Students will (1) describe possible negative consequences for people and wildlife under conditions of crowding, and (2) identify ways people can behave in order to reduce negative consequences of crowding for wildlife.
- What Bear Goes Where? – Students will (1) identify three species of bears and their habitats, and (2) generalize that animals have adapted in order to live where they do.

Make Your Own Sharkometre! -

https://www.sharktrust.org/shared/downloads/educational_resources/sharkometer.pdf

How a Shark Jaw Works! -

<http://sharkopedia.discovery.com/shark-topics/feeding-hunting-diet/#how-a-sharks-jaws-work>

Resources

WAVE Foundation - <http://www.wavefoundation.org>

Project Wild - <http://www.projectwild.org>

Project Wet - <http://www.projectwet.org>

Project Learning Tree - <http://www.plt.org>

Endangered Species Information -

<http://education.nationalgeographic.org/media/endangered/>

Shark Information - <http://www.discovery.com/tv-shows/shark-week/>

Shark Information - <http://sharkopedia.discovery.com/>

Shark Information - <https://www.flmnh.ufl.edu/fish/discover/species-profiles/hemiscyllium-ocellatum/>

Conservation Efforts - <http://wavefoundation.org/conservation/conservation-fund/>