



## **WAVE on Wheels Outreach**

### **Turtle Time Presentation**

#### **Grades 6-8**

#### **Time requirement**

1 Hour

#### **Group size and grade**

Up to 50 students maximum

#### **Materials**

3 species of turtle & tortoise

Turtle Artifacts Bin

WAVE Tablecloth

#### **Goal**

Through live turtle and tortoise encounters, students will be excited, engaged, and educated about the wonders of turtle life and the importance of conservation.

#### **Objectives**

1. Students will be able to list 5 adaptations a turtle has including a combination of internal and external body parts as well as behaviors.
2. Students will be able to list at least 5 species of turtle and tortoise and identify a unique characteristic to that species.
3. Students will be able to discuss biological factors relating to turtle population numbers, individual growth rates, and reproduction success.
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 turtle conservation efforts as well as how they can help save turtles and other aquatic animals.

6. Students will be able to design and describe a method for monitoring and minimizing human impacts on turtle environments.

### **Theme**

Turtles and tortoises have similar but distinct adaptations to survive in their environment.

### **Kentucky Core Academic Standards – Science**

#### **Sixth Grade – MS. Matter and Energy in Organisms and Ecosystems**

06-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organism and populations of organisms in an ecosystem.

LS2.A: Interdependent Relationships in Ecosystems

#### **Seventh Grade – MS. Growth, Development, and Reproduction of Organisms**

07-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

07-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

#### **Eighth Grade – MS. Interdependent Relationships in Ecosystems**

08-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

#### **Eighth Grade – MS. Human Impacts**

08-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

ESS3.C: Human Impacts on Earth Systems

### **Background**

#### *Turtles are Reptiles*

Turtles and tortoises are reptiles. Reptiles are cold-blooded or ectothermic animals, which means they depend on external sources to maintain their body temperatures. Scales or scutes protect reptiles from abrasions and loss of body moisture. Reptiles breathe air through lungs. Most reptiles hatch from eggs which are typically covered in soft, leathery shells. Reptiles include crocodilians, snakes, turtles, and lizards.

#### *A Turtle or a Tortoise*

All tortoises are turtles, but not all turtles are tortoises. Tortoises are a specific group within the larger turtle classification. Tortoises and turtles are similar; however, a turtle lives mainly in

water and a tortoise lives on land. Since turtles spend most of the time in water they have webbed feet for swimming. Turtles can live in the ocean or in freshwater, like ponds and lakes. Tortoises do not have webbed feet since they walk on land. Another difference is their shells. A tortoise shell is large and dome-shaped while most turtle shells are flat and hydrodynamic.

#### *Turtle (including Tortoises unless Specifically Stated) Adaptations*

Turtles have a shell that is made up of 59-61 bones covered by plates called scutes which are made of keratin, like human fingernails and hair. They cannot crawl out of the shell because the spine and rib cage are connected to the shell. They also feel pain and pressure through the shell as nerves run throughout the shell. The upper shell of a turtle shell is called the carapace, and the bottom portion is called the plastron. These sections are connected on the side by bony structures called bridges. A specie's shell shape is an adaptation to environmental factors. Dome-shaped shells are more difficult for predators to crush. Flat, streamlined shells aid in swimming and diving. Small, cross-shaped plastrons give more efficient leg movement for walking along the bottom of ponds and streams. In addition to the protection of their shell, various types of turtles have a variety of defensive adaptations. Box turtles have a hinged shell capable of encapsulating their entire body, while many tortoises have bulky, tough, and sometimes spurred front legs that will protect their head once pulled into the shell. Snapping turtles have a smaller plastron but are more aggressive, and some turtles, like musk turtles, can emit a foul smelling odor.

Turtles also have a built-in navigation system in the form of tiny magnetic particles in their brain that help the turtle process unique magnetic signatures. The planet's core contains iron and is surrounded by a layer of molten metal which moves slightly causing fluctuations in the magnetic field. This creates unique signatures which allow female sea turtles to relocate their birth beach in order to lay eggs at their place of birth.

Growth rates of turtles can be effected by many environmental and genetic factors. Turtles may possess indeterminate growth meaning they have the potential to grow their entire lives. However, as they reach adult size more energy is used for reproduction, defending territory, and body maintenance than on new growth. It is well documented that growth rates in ectotherms are significantly affected by the amount of food intake. More recent studies are also showing that water temperature and carbon dioxide levels may affect the growth rate and potential as these factors can effect metabolic rates. Additional studies suggest influences such as differentiating diets play a major role in embryonic development, which may lead to growth abnormalities. Over time, these issues could lead to genetic variations influencing inherited abnormalities.

Turtles are typical thought of as being solitary animals; however, this is an understudied area of animal behavior. One study trained Florida Red-bellied Cooters (*Pseudemys nelsoni*) to dislodge clear plastic bottles to obtain food pellets. These turtles not only showed rapid learning, but required minimal retraining. Additionally, they investigated whether turtles could

vicariously learn by observing other experienced turtles that had learned the task. All turtles showed evidence they learned not only to follow others to the bottles but also to approach the correct bottle that contained food reinforcement. This study of social behavior, learning, and cognition of turtles will hopefully spark interest in turtle behavior and cognition. Pancake tortoises are surprisingly social and stay in larger groups as long as there is adequate food. As many as ten tortoises have been found sharing the same crevice. Turtles also show symbiotic relationships with other species including mutualistic relationships with cleaning species including remoras and tangs.

Female turtles can lay between 2-200 leathery eggs depending on the species and the environmental factors affecting that species. In general, turtles do not exhibit parental care; however, the yellow mud turtle does remain at the nest site for up to 38 days. It appears that predation rates are lower when the female remains with the nest suggesting some degree of parental care. Since turtles lack gender-determining chromosomes, temperature differentiation leads to male or female offspring. Cooler, shaded areas of the nest lead to more males and warmer, sun-lit areas lead to more females.

#### *Turtle Diets*

Most turtles are omnivores, which means they eat plants and animals, such as fish, snails, worms, and insects. Most tortoises are herbivores eating grasses, leafy plants, flowers, fruits, and even cacti. Some sea turtles prefer eating jellyfish. Turtles lack teeth but have a large beak specifically shaped to their dietary needs. Carnivorous turtles usually have sharp ridges for slicing through their prey. Herbivorous turtles have serrated ridges to cut through tough plants. Turtles use their tongues to swallow food, but they cannot stick their tongues out to catch food.

#### *Turtle Predators*

Sea turtles are mostly preyed on by large sharks, for example tiger sharks. Some turtles can be eaten by crocodilians, canines, cats, raccoons, and types of birds that will pick up smaller turtles and drop them onto a rock which breaks the shell so they can eat them. One of the biggest predators of all species of turtle is humans.

#### *Food Web Connections*

As with most predators, turtles 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 an 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 turtle who eats the

fish that feeds on the plant which converted the sunlight is known as a secondary consumer, hence a process that directly related back to the sun as the primary energy source. An apex consumer is the top of the food chain or web with few to no natural predators at adult size such as an alligator, shark, or large cat.

### *Turtle Conservation*

It is important to dispose of trash properly. Recall that turtles have small brains and can easily be confused by food items. Sea turtles eat jellyfish, and if a plastic bag gets into the water it resembles a jellyfish. The turtle may think it is food and consume it causing severe issues to their body. It is also important to avoid bright lights by beaches because sea turtle hatchlings use the light of the moon to find water. They will seek to brightest horizon which may sometimes be in the wrong directions thanks to human influences. Increased pressure from other fisheries can also have an indirectly negative effect on turtle species. As more prey items are harvested from freshwater environments and oceans, fewer food resources are left for predators. A limiting resource is an environmental condition that limits the growth, abundance, or distribution of an organism or a population of organisms in an ecosystem.

The WAVE Foundation's Aquatic Conservation Fund supports a variety of organizations whose chief mission is to protect natural resources and environments. Each year, the Newport Aquarium, in partnership with the North Carolina Wildlife Resources Commission's Sea Turtle Project, receives a hatchling loggerhead sea turtle that needs rehabilitation. Newport Aquarium biologists care for this turtle for about a year, and then return the young sea turtle to the ocean. Over the past several years the fund has purchased a satellite tag for the sea turtles. Guests are not only able to watch the young turtle grow over the course of a year, but then have the opportunity to follow its movements after being released by in the wild. The information gathered from the tags will relay crucial information to better understand sea turtle behavior, migratory patterns, etc. The tag is linked with [seaturtle.org](http://www.seaturtle.org) and tracking information can be found online at the link:

[http://www.seaturtle.org/tracking/index.shtml?tag\\_id=142039&full=1&lang](http://www.seaturtle.org/tracking/index.shtml?tag_id=142039&full=1&lang).

The fund also supports a small island in Florida that is doing big work toward protecting sea turtles. They placed billboards on the island to educate vacationers about how they can protect the nesting sea turtles during their visit. The messages include turning off lights during nesting season, not interacting with a beached female or hatchlings if observed on the shore, and communicating the location of new nests to the appropriate local watch group so they can closely monitor the nest and collect valuable data. To take further action, the Conservation Fund also adopted a sea turtle nest and covered the costs of the protection until it hatches. Nest protection may include a predator exclusion device, clear markings so people stay away, or nest excavation and captive incubation on occasion.

## Vocabulary

Adaptation – the process by which an animal or plant species becomes fitted to its environment through body parts and behaviors

Carapace - the hard upper shell of a turtle, crustacean, or arachnid

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

Consumers – organisms of an ecological food chain that receive energy by consuming other organisms

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

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

Limiting factor - a factor present in an environment that controls a process, particularly the growth, abundance or distribution of a population of organisms in an ecosystem

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

Oviparity - producing eggs that mature and hatch after being expelled from the body

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

Plastron - the part of a turtle shell forming the underside

Predator – An animal whose diet consists of other animals

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

Producers – an organism that produces its own food (i.e. using photosynthesis) serves as a source of food for other organisms in a food chain

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).

- Bearly Growing – Students will compare similarities and difference between the growth of black bears and humans.
- Bottleneck Genes – Students will (1) describe biodiversity as it relates to natural systems, species, or individuals; (2) articulate that genetic diversity is essential to the health of a species because it facilitates adaptation to change and provides sources for new genetic material; (3) explain how natural selection favors individuals with traits adapted to their environment; and (4) explain that for a wildlife population to sustain itself, there must be enough habitat to support a healthy-sized population that will carry a healthy-sized gene diversity.

- Career Critters – The students will (1) identify five examples of how wild animals and plants can be used to manage some environmental problems, and (2) describe and give examples of an organism and its niche.
- Carrying Capacity – Students will (1) formulate and test hypotheses related to wildlife populations and carrying capacity, and (2) describe the significance of carrying capacity.
- Changing Attitudes – Students will (1) give an example of a change in attitudes related to a wild animal or the environment, and (2) describe factors that may influence changes in attitudes.
- Ecosystem Facelift – Students will (1) describe interactions or interdependency of organisms within an ecosystem; (2) articulate that managing an ecosystem as a whole, and not just for one or a few species, is essential for ensuring ecosystem diversity; and (3) relate the increase of wildlife populations to the improvement of habitats.
- Ethi-Reasoning – Students will (1) examine their own values and beliefs related to wildlife and other elements of the environment, (2) listen to and respect the right of other to maintain different values and beliefs, and (3) evaluate possible actions they might take that have an effect on wildlife and the environment.
- Litter We Know – Student will (1) identify and evaluate ways that litter pollution can endanger wildlife, and (2) propose ways to help eliminate these dangers to humans and wildlife.
- Oh Deer! – Students will (1) identify and describe food, water, and shelter as three essential components of habitat; (2) describe factors that influence carrying capacity; (3) define “limiting factors” and give examples; and (4) recognize that some fluctuations in wildlife populations are natural as ecological systems undergo constant change.

## 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/>

Turtle Information - <http://ocean.si.edu/slideshow/meet-seven-sea-turtle-species>

Turtle Information - <http://animals.sandiegozoo.org/animals/turtle-tortoise>