Terrapins in the Classroom Teacher Curriculum

GRADES K-12

The Wetlands Institute | Disney Worldwide Conservation Fund | Autumn 2016

Acknowledgements

In 2012, with support from the Disney Conservation Fund, The Wetlands Institute hosted a select group of teachers for an intensive training as part of the Terrapin Conservation Project. Participants in the project included Maggie Dugan (Upper Township Elementary School), Jane Krajewski (Quinton Township Elementary School), Mary Lyons (Millville Senior High School), and Lynn Tyszka (Holly Heights Elementary School).

These teachers worked alongside The Wetlands Institute staff, volunteers, and research interns from the Coastal Conservation Research Program to learn about the ecology, natural history, and conservation of Diamondback Terrapins and to gain hands-on experience with terrapin research. With this preparation, they developed learning activities based on terrapin biology and conservation for their respective grades.

The learning activities contained within this curriculum are adapted and modified from their hard work along with the work of The Wetlands Institute former Outreach Coordinator, Kaitlin Gannon, former Environmental Education Intern, Gabrielle Hubbard and current Director of Educational Program Development, Brooke Knapick.

Introduction to Northern Diamondback Terrapins

TERRAPIN DISTRIBUTION AND ECOLOGY

Diamondback terrapins (*Malaclemys terrapin*) inhabit brackish waters of the Atlantic and Gulf coasts of the United States. More closely related to freshwater turtles than to marine turtles, diamondback terrapins possess unique adaptations for life in water that varies widely in salinity.

For this reason, terrapins are the only species of turtle that live their entire life in coastal salt marshes, one of the most productive ecosystems on Earth, where food and other resources are abundant.

The diet of *M. terrapin* consists largely of invertebrates, such as fiddler crabs, blue claw crabs and blue mussels. Terrapins are an important predator of the salt marsh snails that feeds on salt marsh cord grass (*Spartina alterniflora*). When terrapins, and other predators, are removed, snails overgraze the cord grass leaving a barren mudflat (Silliman and Bertness 2002). For this reason, healthy terrapin populations are essential for maintaining salt marsh ecosystems.

THREATS TO TERRAPINS

Across their range, diamondback terrapin populations are in decline. Conservation status varies by state. Major threats to terrapins include commercial collection for food, habitat destruction, drowning in fishing gear, and road mortality. Given the declines in several diamondback terrapin populations that have been the subject of long term mark-recapture studies, the diamondback terrapin is also listed as Near Threatened by the International Union for the Conservation of Nature (IUCN; Baker et al. 2012).

Terrapins as food

Archaeological evidence suggests that *M. terrapin* was utilized for food in New Jersey prior to European settlement (S. Bierbrauer, personal communication); however, as human populations increased throughout the terrapin's range, the harvest reached unsustainable levels by the late 1800's and early 1900's. Captive propagation, for commercial purposes, was initiated by the United States government in the early 20th century because the range-wide population was believed to be in danger of extinction. With the advent of Prohibition and then the Great Depression, the demand for terrapin meat eventually decreased and the

depleted populations began to slowly recover. Although most states now have legislation that regulates the collection of *M. terrapin* (Watters 2004), this species is still taken from the wild in parts of its range. In 2006, the last year in which terrapins were legally harvested in Maryland, watermen reported a catch of 10,500 terrapins.

Habitat destruction and degradation

Habitat destruction poses a serious and ongoing threat to terrapin populations. The diamondback terrapin's range is coincident with dense areas of human population in the United States. Coastal development, particularly salt marsh draining, increased use of coastal waterways for commercial and recreational purposes, and loss of sand dunes on barrier beach islands, an important habitat for nesting, contribute to habitat loss and degradation.

Drowning in fishing gear

In states with a commercial blue crab (*Callinectes sapidus*) fishery, incidental drowning in crab traps is a major threat to *M. terrapin*. Terrapins, attracted to the bait, enter through an underwater opening, become trapped, and drown within a few hours (Wood 1997). Adult males, which are smaller than adult females, and juvenile females are caught more frequently than adult females due to the limitations on the size of the trap entrance. Ghost traps, which are crab traps that have been lost or abandoned and are no longer being checked, are a significant source of terrapin mortality. It is estimated that 2 million commercial crab traps are deployed annually throughout the range of *M. terrapin*, with approximately 25 percent of those traps becoming lost or abandoned (Guillory and Prejean 1998). Terrapins and other animals that enter ghost traps become trapped and die. The decomposing bodies become the "bait" for terrapins, blue claw crabs and other marine organisms that scavenge for food, creating a cycle that is only broken by removing the trap.

Over the years, student researchers and scientists at The Wetlands Institute have conducted projects that examine the impacts of ghost traps on biodiversity in the salt marsh surrounding The Wetlands Institute. In 2007, an intern located and removed 41 ghost traps. A minimum estimate based on skeletal remains in the

traps suggested that they contained at least 41 dead terrapins and the remains of other marine organisms, including 37 blue crabs. Although they are required in New Jersey, only four of the 41 ghost traps were equipped with Bycatch Reduction Devices (BRDs). This source of terrapin mortality could be greatly reduced if regulations to prevent bycatch were strengthened and enforced. Terrapins and other marine organisms in New Jersey's coastal waters would benefit from a trap removal program similar to the state-wide efforts organized in Virginia, North Carolina, Florida, Alabama, Mississippi, and Texas. The Wetlands Institute is working with state agencies to improve our ability to detect and remove abandoned fishing gear.

Road mortality

During the annual nesting season, adult female terrapins are frequently struck and killed by motor vehicles while attempting to cross roadways in search of nesting sites (Wood and Herlands 1997). The Wetlands Institute personnel have documented over 12,860 terrapin roadkills between 1991 and 2016. Additionally, hatchling terrapins migrating to water after emerging from the nest may also be run over on the road, but their carcasses are less conspicuous. Hatchling terrapins are frequently found trapped in storm drains during the periods of emergence from the nest in fall and spring. If these hatchlings are unable to escape, they may die from lack of food or exposure to chemicals that concentrate in storm water systems.

THE WETLANDS INSTITUTE'S RESEARCH AND CONSERVATION OF NORTHERN DIAMONDBACK TERRAPINS

Concerns about the local terrapin population led Dr. Roger Wood, former Director of Research at The Wetlands Institute, to establish the Terrapin Conservation Project in 1989. The project has grown and broadened in scope to become the Coastal Conservation Research Program (CCRP), where undergraduate interns work closely with research scientists at The Wetlands Institute on a wide variety of research and conservation projects, including Diamondback Terrapin Research and Conservation, Surveys of Breeding Birds in Coastal Habitats, Delaware Bay Horseshoe Crab Research and Conservation and Sea Level Rise Issues in the Coastal Salt Marshes. Over the past 20 years, over 200 college and university students from more than 100 academic institutions have participated in the CCRP program.

Bycatch Reduction Devices

The Wetlands Institute has been the leader in the development and testing of Bycatch Reduction Devices (BRDs) to keep terrapins and other non-target marine organisms from entering crab traps. In 1992, Dr. Roger Wood fashioned the first BRD prototype from a wire coat hanger. The rectangular device fits into the inner (narrow) end of entrance funnels in a typical commercial (Maryland-style) crab trap and prevents the entry of adult female terrapins. An important concern in the design process was to ensure that the BRD does not reduce the number or size of crabs caught. Results from the program's long-term studies suggest that not only do BRDs greatly reduce the number of terrapins caught by modified traps, they have also actually increased the marketable crab catch over unmodified traps of standard design (Wood 1997). In addition to reducing terrapin mortality, BRDs may prevent or reduce the number and diversity of other vertebrate animals that might be incidentally trapped in crab traps (Guillory and Prejean 1998). Although BRDs have been shown to be effective when tested in other states within the terrapin's range, only four states (New York, New Jersey, Delaware, and Maryland) have adopted regulations mandating the use of BRDs. The Wetlands Institute works with scientists and state agencies throughout the diamondback terrapin's range to advocate for the use of BRDs to reduce bycatch and loss of biodiversity in salt marsh ecosystems. Since 2012, The Wetlands Institute research scientists and staff have worked with high school students from The Marine Academy of Technology and Environmental Science, in Manahawkin, NJ to distribute BRDs and informational materials about biodiversity conservation to recreational crabbers.

Road patrols

During the nesting season, research scientists and student interns at The Wetlands Institute patrol a 38-mile transect of local roads searching for terrapins in need of assistance. In some cases, the terrapins are simply helped across the road, always in the direction they are traveling. Institute staff help hundreds of terrapins safely cross roads each year. Injured terrapins are given medical attention and, whenever necessary, sent to a local veterinarian who volunteers his services to the project. Life does not end when a terrapin is killed on the road. Depending on the amount of damage sustained, dead terrapins may be taken back to the laboratory so that undamaged

eggs can be retrieved from the carcass, washed, and then artificially incubated. Because terrapins exhibit temperature-dependent sex determination (TSD), recovered eggs are held at 30°C (86°F) throughout development to produce hatchlings that are all female. The resulting hatchlings are put into a year-long "head start" program (described below) to improve their chances of survival and released back into the wild. In this way, we attempt to offset the high mortality of adult female terrapins on the road, by increasing the number of females in the next generation. Each year, we find between 400-600 adult female terrapins killed on the road patrol transect and collect several hundred eggs for incubation and headstarting.

Headstarting

Terrapins hatched from the eggs of roadkilled females are reared at a special facility at The Richard Stockton College of New Jersey for ten months. Kept warm and well-fed through the winter, the resulting "headstarter" terrapins reach the size of a wild 3 or 4-year old terrapin in less than one year. Prior to their release into the salt marsh, headstarter terrapins are measured, weighed, and marked with a uniquely numbered microchip, similar to those injected in cats and dogs. These microchips allow for evaluation of the headstarting program. To date, several of these headstarters have been observed to return to nest on the nature trail at The Wetlands Institute. Ongoing research projects aim to determine the distribution, movements, and abundance of headstarted terrapins in the local population.

Barrier fencing

Conservation programs are not effective on their own in stabilizing populations unless the underlying reasons for decline are addressed; therefore, researchers at The Wetlands Institute seek to reduce roadkills and other factors that contribute to the high mortality rate for the local population. In 2004, an intern-driven project led to the installation of barrier fencing along one stretch of our standard road patrol. In an effort to reduce roadkills in areas of the road patrol transect known to be major "hot spots"; the fencing project has expanded over the years to include sections of the causeways that connect Seven-mile Island to the main land. Fencing material has been improved over the years with the goal of reducing costs of materials and labor while improving the barrier function. Currently, more than 11 miles of barrier fence has been installed along roads that cross the salt marsh.

LAWS AND REGULATIONS ON TERRAPINS

The harvest of diamondback terrapins has a long history. In the 1800's and early 1900's, the species was considered a delicacy, and was almost harvested to extinction. However, during Prohibition in the 1920's terrapin became less popular since one of the main ingredients in terrapin soup, sherry, could not be obtained (Brennessel 2006). The terrapin never regained its old popularity as cuisine, and this allowed populations to recover over time. However, the harvest of terrapins remains legal in many areas. Terrapin populations currently face many threats, and harvest for the pet trade and food markets overseas is a growing concern.

In early 2015, New Jersey Department of Environmental Protection (NJDEP) temporarily closed the harvest of terrapins in New Jersey for the remainder of the season (Nov. 1 through Mar. 31). In 2014, 3,500 terrapins were taken and shipped out of state. In addition, NJ Division of Fish and Wildlife Conservation Officers recently caught fishermen who had illegally harvested 800 terrapins in Absecon Bay. As a result of these events, the terrapin harvest was closed in 2015 and 2016 to allow the population status and current harvest regulations to be reviewed. The closure allowed time for NJDEP to assess the impact of the harvest on terrapins, and the sustainability of any future harvest. In July 2016, a bill passed through the state legislature making the harvest of wild diamondback terrapins illegal.

Frequently Asked Questions

Q. Why do people still harvest terrapins?

A. Terrapins are harvested for food and for the pet trade. Many are sent overseas to countries in Asia where turtle meat is popular. Due to their attractive appearance, terrapins make popular pets both in the US and overseas. The illegal pet trade is a concern for many turtle species including terrapins.

Q. Why is the harvest a concern?

A. Diamondback terrapins take a long time (up to 8 years) to reach an age where they can reproduce, and both eggs and young turtles have a low chance of survival. Adults have relatively few natural predators and a high chance of surviving to reproduce many times. Removing adults from the population can therefore be detrimental to the long term survival of the population. Because the legal harvest of terrapins included adults only (> 5 in), the harvest could contribute to population declines. In addition, the harvest regulations were very loosely written and there is no reliable record of the number of turtles removed each year, meaning it is impossible to know what the impacts of the harvest are.

Q. Do other states allow terrapins to be harvested?

A. Harvest is banned in MA, RI, CT, VA, NC, AL, NJ and TX. NY, LA, MD, SC, GA, FL, and MS allow some level of either commercial or non-commercial harvest, or both. Specific harvest regulations vary by state.

Q. What were the regulations for terrapin harvest in NJ prior to the closure?

A. Before the closure in NJ, the harvest was open Nov. 1 to Mar. 31. There was little restriction on the harvest aside from a size limit of 5 inches plastron (bottom part of the shell) length and a ban on the use of any type of net or trap to harvest terrapins. There was no limit on the number of turtles that could be harvested.

Q. What is The Wetlands Institute doing to help?

A. The Wetlands Institute worked with the Marine Academy of Technology and Environmental Science (MATES) to help support efforts to close the terrapin harvest in 2015. We will continue to work with local and state partners to help guide any changes to the terrapin's regulatory status, or other conservation actions that may be proposed. We support greater protection for the species and the recently passed bill to change their status to non-game species. We will continue to protect terrapins from other threats to their population on the roads and in the marshes.

Q. What can I do to help terrapins?

A. You can help terrapins by stopping and crossing nesting females when possible, by volunteering to assist with one of our terrapin projects, and by helping to educate others about the threats they face. You can read the new bill classifying terrapins as a nongame species and contact your representatives to thank them for their continued support of bill S-1625/A2949.

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Teacher to Student Introductory Terrapin Presentation

Use the linked Power Point (PPT) presentation below to introduce your students to terrapins. Some images and videos contained within the PPT may be too graphic for younger students. The PPT presentation can and should be edited to meet the specific needs of your classroom.

DIAMONDBACK TERRAPIN
INTRODUCTORY POWER POINT
(CLICK TO DOWNLOAD)

Grades K-4
Learning Activities

1.1 WHAT'S A TERRAPIN?

Grade Level

K-4th grade

Subject Areas

Science, Language Arts

Area of Focus

Biology

Duration

Prep: 10 minutes

Activity: 20-30 minutes

Skills

Comparison, reading comprehension, organizing, analyzing

Vocabulary

Reptile, cold blooded, brackish water, habitat, vertebrae, plastron, carapace, bridge region, scutes, camouflage, incubation, yolk sac

1.1 What's a Terrapin?

Overview

This introductory lesson into diamondback terrapins will provide your students with basic information about diamondback terrapins and their special adaptations to help them survive.

Objectives

Name and define the category reptiles.

Identify the parts of a turtle.

Explain possible reasons for the decrease in New Jersey's diamondback terrapin population.

Materials

Amazing Terrapins article or *Diamondback Terrapin Introductory PowerPoint*

Pictures of adult terrapins, hatchlings with yolk sac, sand terrapin nesting (included in *Amazing Terrapins* article)

Activity pages (*Terrapin Topography*, *Terrapin Word Search* and/or *Terrapin Basics*) as appropriate for grade level

Terrapin nest plaster mold (optional)

Turtle shell with backbone (optional)

Background

So what is a terrapin, really? What kind of animal is it? What does it like to eat? Diamondback terrapins are a type of

reptile. Reptiles are **cold-blooded** (**t**heir bodies cannot produce heat on their own) animals that have a body covered with scales or plates. Most live on land; all breathe air with lungs and lay eggs that often do not have brittle shells like those of birds.

Turtles have a soft body encased in a hard shell, called a **carapace**. The **plastron** (lower shell), and the **bridge region** (connects the carapace and plastron on both sides of the body) make up the entire external shell. **Scutes** are enlarged scales made of keratin that cover the shell. Human hair and finger nails are also made out of keratin! The turtle shell itself is made up of bone just like the bones in our bodies. The backbone or **vertebrae** is also part of the shell as well as the ribs that help protect the lungs. For that reason, despite what you see in cartoons, turtles cannot come out of their shells!

The diamondback terrapin is the only reptile that spends its entire life in **brackish water** (a mix of salty ocean water and fresh water) and because of this, diamondback terrapins are often found in **habitats** like estuaries and salt marsh wetlands.

Come springtime, the female terrapin lays approximately 8-12 eggs. They use their hind feet for digging a nest 4-6 inches deep. When the female has finished dropping and positioning her eggs, she will cover her nest and make it appear just as it was when she arrived. This is an example of **camouflage**. The temperature of the eggs during **incubation** will determine whether females or males will be produced. Higher temperatures above 30°C (86°F) will result in 100% females. Males are produced in an environment with lower temperatures below 28°C (82.4°F). Young turtles will develop and hatch about two months later. To get out of their shell, hatchlings break the eggshell with a special egg "tooth". This is not a real tooth, but a growth of keratin that will fall off shortly after hatching. It may take several hours to a whole day for a hatchling to emerge from its shell. A small **yolk sac** can often be seen on the bellies of hatchlings. The yolk sac is a part inside the egg and acts as a “lunchbox” for the baby, providing nutrients. The hatchling relies on it after hatching until it is able to find its own food.

Activity

1. Option #1: Distribute *Amazing Terrapins* article. As appropriate for the grade level, read (aloud or silently) the article. Discuss together the dangers terrapins face from egg to adult and ask students to name an interesting fact they learned about terrapins. Or, Option #2: Use the *Diamondback Terrapin Introductory PowerPoint* in place of *Amazing Terrapins* article.
2. Following the discussion and introduction to terrapins, as appropriate for the grade level, instruct students to complete the activity pages (*Terrapin Topography*, *Terrapin Word Search* and/or *Terrapin Basics*).

Amazing Terrapins

Diamondback terrapins are the only reptiles that spend their entire lives in salt marshes. They occur along the Atlantic and Gulf coasts from Cape Cod to Texas. The shells of terrapins range in color from light brown to almost black. Light brown shells are usually marked with dark concentric lines. Skin color is also variable, ranging from black to light gray, marked with black specks or lines. Adult females and males differ from each other. Females are larger. The shells of females average about eight inches long. Average shell length in males is five inches. Females also have larger, broader heads, deeper shells, and shorter tails.

The diet of terrapins is mostly crabs, salt marsh snails (periwinkles), and tiny bivalves (mussels and clams). They may occasionally scavenge dead fish. Terrapins occasionally bask in the sun on mud banks like pond turtles. Females leave the marsh each summer in search of sandy areas above the reach of the tide in which to lay their eggs. A shallow hole is dug with the hind legs. Eight to twelve eggs are laid. The female returns to the marsh after filling the nest hole and covering it with debris to hide it from predators. Many nests, however, are still found and dug up by animals like raccoons, skunk and fox.

The eggs hatch in about sixty days. If they hatch in the summer when it is still warm, the hatchling turtles, each about the size of a quarter, emerge from the nest. If the eggs were laid in July and hatch in the fall, the hatchlings may remain in the nest through winter and emerge in the spring. Hatchlings must face many dangers in the marsh. Small mammals (raccoons, foxes, skunks), large fish, crabs, small sharks and some birds (bald eagles, seagulls) eat baby terrapins. Other dangers include drowning in crab traps or being hit by boat propellers. Tragically, many females are run over and killed by automobiles as they search for suitable nesting sites.

Terrapin Topography

Name: _____

Identify and label the parts of this diamondback terrapin.

Word Bank

Carapace **Nostril** **Scute** **Tail** **Claw**

Mouth **Eye** **Leg** **Neck**

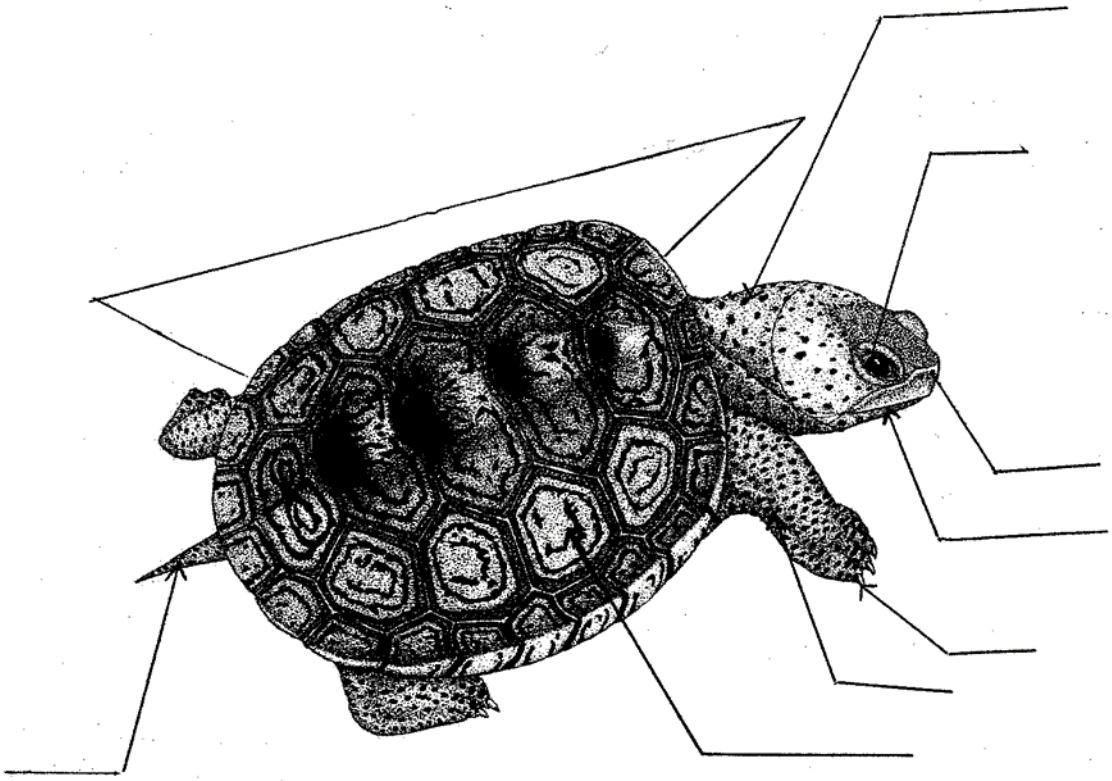


Illustration by Charles H. Miller

Terrapin Word Search

Name: _____

C	E	H	K	G	I	M	B	P	O	O	D	K	F	I
A	W	L	Q	P	S	L	L	R	D	P	L	L	H	T
R	Q	U	I	Y	U	A	S	K	A	O	V	F	O	P
A	J	R	H	T	S	Q	W	I	Y	C	Z	S	I	K
P	Y	Q	L	T	P	P	T	E	G	C	K	V	N	O
A	K	J	R	W	Z	E	X	A	E	P	X	I	H	O
C	D	O	C	M	B	T	R	G	D	Q	U	C	S	N
E	N	M	J	S	D	P	A	A	S	K	C	E	X	H
K	Q	X	R	E	L	L	V	R	O	K	F	W	E	D
S	T	Q	R	T	F	E	T	A	B	U	C	N	I	I
J	M	E	Z	U	V	E	R	T	E	B	R	A	E	D
M	U	Q	O	C	C	C	T	S	B	U	A	U	L	C
W	I	M	U	S	H	V	A	E	X	Y	B	D	C	G
T	A	T	O	I	M	X	J	L	V	Y	I	R	Z	K
C	P	H	H	F	E	P	G	X	H	T	R	I	H	B

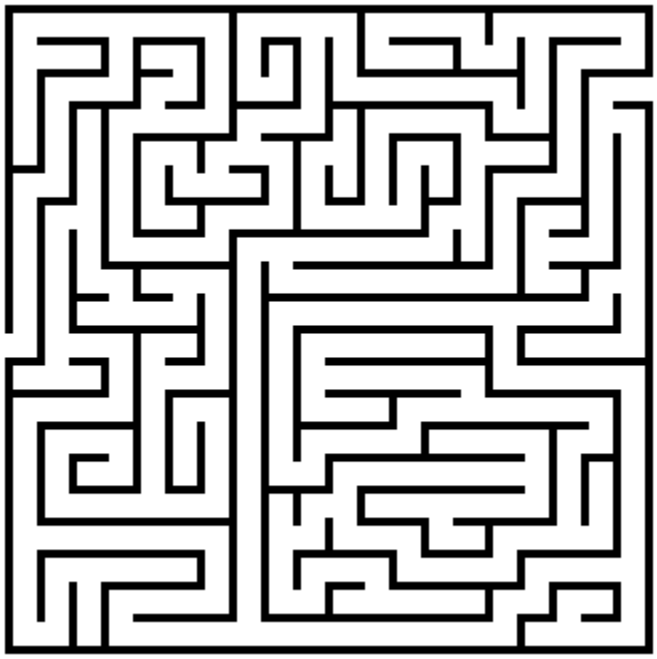
BRACKISH
CAMOUFLAGE
CARAPACE
INCUBATE
PLASTRON
REPTILE
SCUTES
VERTEBRAE
YOLK

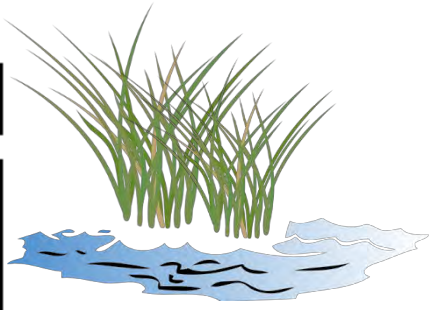
Created by Puzzlemaker at DiscoveryEducation.com

Terrapin Basics

Name: _____

Help this terrapin get back to the safety of the salt marsh from a dangerous roadway!





Can you draw the other half of this shell?

Grades K-4
Learning Activities

1.2 SALT MARSH LIVIN'

Grade Level

K-4th grade

Subject Areas

Science

Area of Focus

Habitat

Duration

Prep: 15 minutes

Activity: 30 minutes

Skills

Organizing, analyzing

Vocabulary

Wetland, habitat, saturated, salt marsh, brackish water, Northern Diamondback Terrapin, reptile, cold-blooded, carapace, plastron, scutes, carnivore, carrion, predators

1.2 Salt Marsh Livin'

Overview

Students will learn about the life of the native Northern Diamondback Terrapin, *Malaclemys terrapin* within its natural habitat of the salt marsh.

Objectives

Identify and characterize species found within the salt marsh.

Recognize the adaptations needed for diamondback terrapins to live within the salt marsh.

Identify the natural predators to the diamondback terrapin that are found within the salt marsh.

Materials

Laminated copies of the *Salt Marsh Background*

Diamondback Terrapin Introductory PowerPoint

Laminated copies of the *featured animals, plants, and eggs with descriptions*

Background

There are many different kinds of wetlands. Many people know of swamps, bogs (especially ones that house cranberries), but many are unfamiliar with salt marshes, though they may see them every day. A **wetland** is an area of land that is wet! Or you can call it a **habitat** (an environment that is home it many living things) containing sediment, vegetation, and water (14 straight days of water to be exact). If the soil is not **saturated**, or soaked, with water for 14 days in

a row, it is not considered a wetland. **Salt marshes** are a little different from the rest. While other wetlands contain fresh water, salt marshes contain **brackish water.** Brackish water is a combination of both salt water and fresh water. The salt marsh also protects the mainland by acting as a buffer against coastal storms and prevents flooding from the input of high tides and extend beyond the shores of southern New Jersey, continuing along the Atlantic and Gulf Coast.

Without the salt marsh, our native Northern Diamondback Terrapins, *Malaclemys terrapin* would not be able to survive. The **Northern Diamondback Terrapin** is the only type of turtle that is adapted to live within the brackish water environments for their entire lives, hence why they live within the salt marsh waters. The salt marsh provides a home, nutrients, and suitable nesting habitats for this turtle. The Northern Diamondback Terrapin is considered a subspecies that ranges from Massachusetts to Virginia.

What is a terrapin? A terrapin is a **reptile**. It is covered in modified scales called **scutes**. All reptiles breathe using lungs, lay eggs, and are **cold-blooded** (they have a body temperature that changes with the environment). Like all turtles, terrapins have a shell. The top of the shell is called the **carapace** and the bottom part is called the **plastron.** The shell is covered in modified scales called scutes. Diamondback terrapins show a variety of colors and patterns. Their shells range from pale yellow-green to a dark greyish black. Their skin can consist of black spots, splotches, or streaks. Adult females are usually 8-10 inches long, while adult males are only about 5-7 inches long.

Terrapins are **carnivores**. Carnivores are animals that mainly or only eat meat. Terrapins eat fiddler crabs, snails, and small bivalves, fish, marine worms, insects, and **carrion** (dead and decaying flesh). Female terrapins come out of the salt marsh in late spring and summer to lay their eggs. They use their back legs to dig a hole 6-8 inches deep to lay their eggs. They can nest up to three times per season and can lay 8-12 eggs each time.

Predators (an animal that hunts a smaller and/or weaker animal) to terrapins can vary. Terrapin eggs are eaten by fox, raccoon, and skunk. The hatchlings are easy prey to gulls, crows, egrets, herons, and fish. As adults, their predators include raccoons, gulls, bald eagles, and crows. One well known predator to terrapins are humans. In the late 1800s and early 1900s they were considered a delicacy, and cooked into terrapin stew. Terrapins also fall victims to humans in other ways as well. Terrapin nesting habitat has decreased dramatically due to coastal development.

Coastal development is not the only danger to these turtles. When the female terrapin comes out of the salt marsh waters to lay their eggs, they usually look for higher grounds, which lead them to crossing the roads. While crossing the roads, many female terrapins don't survive as a result from being hit by vehicles. Commercial crab traps are also unsafe for terrapins. Many are attracted to the crab bait and are stuck once

inside the trap. Many terrapins drown this way. However research and conservation efforts at The Wetlands Institute and across the US are helping terrapin populations, keeping them and the salt marsh habitats safe.

Activity

As appropriate for the age group, quiz students on the background information or portions of the *Diamondback Terrapin Introductory PowerPoint*.

Questions can include:

1. What is a brackish water environment?
2. How long can Northern Diamondback Terrapins live?
3. Name two characteristics of a turtle.
4. How big can the male and female Northern Diamondback Terrapins get?
5. What states can Northern Diamondback terrapins live in?
6. Name the reason why diamondback terrapins end up as road kill?
7. What do Northern Diamondback Terrapins eat?
8. What is another word used to describe the "scales" on a terrapin?
9. How many eggs can a female terrapin lay, and how deep is the nest?
10. Define "wetlands."

After the quiz, divide students into groups (with a maximum of 5 people per group). Provide each group with the following materials:

1. A laminated copy of the *Salt Marsh Background*
2. Laminated copies of the *featured animals, plants, and eggs with descriptions*

Direct students to divide the featured animal, plant and egg pieces amongst their groups. Have students read the descriptions of each piece out loud within their groups. Next, have students place their pieces in their correct locations on the salt marsh background. After the groups are finished, make sure, that they have placed each piece in its correct location.

Salt Marsh Background

Phragmites - an invasive plant species to the New Jersey salt marshes. It forms in an areas that have been disturbed by humans.

2

Male Northern Diamondback Terrapin – adult males are only 5-7 inches long. After they are born, they will live within the salt marsh waters for their entire lives.

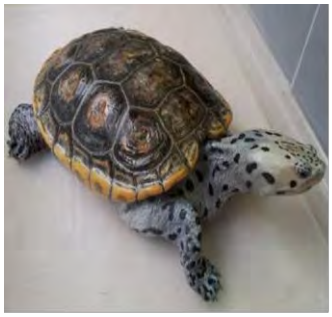
4

Terrapin Eggs – are laid by the female terrapin and are usually buried in a hole that is 6-8 inches deep.

6

Spartina alterniflora – smooth cordgrass that occurs in low oxygen areas of the salt marsh.

3



Female Northern Diamondback Terrapin – adult females are only 8-10 inches long. They will only come out of the salt marsh waters to lay their eggs during nesting season.

5

Great White Egret – one of the natural predators to Northern Diamondback Terrapin hatchlings.

1

Laughing Gull – a natural predator to the hatchling and adult Northern Diamondback Terrapins.

7

Grades K-4
Learning Activities

1.3 IT'S A GIRL THING

Grade Level

K-4th grade

Subject Areas

Science, Art, Math

Area of Focus

Nesting and Conservation

Duration

Prep: 10 minutes

Activity: 30-40 minutes

Skills

Creativity, reading measurements on thermometers and rulers

Vocabulary

Viable, eggectomy, extracted, , incubation, physical change

1.3 It's a Girl Thing

Overview

Students will learn and understand the terrapin nesting season, including the dangers female terrapins face searching for the perfect nesting spot and how The Wetlands Institute helps give terrapins a second chance.

Objectives

Describe how roadkill females contribute to the diamondback terrapin population decline.

Learn how The Wetlands Institute is helping to save the species.

Read thermometers and determine if male or female turtles will be produced.

Create a model terrapin egg.

Materials

For each student: Cube of clay (or *Model Magic*), a ruler, *It's a Girl Thing* activity sheet

Large thermometer model (optional)

Diamondback Terrapin Introductory PowerPoint

Background

Diamondback terrapins face many dangers, many of them come from human activity. One of the most detrimental factors to terrapin populations are busy cars along the salt

marsh habitat. Many people are on their way to the beaches which coincides with terrapin nesting season.

While looking for a suitable nesting site above the high tide line, female terrapins often are unable to cross safely to the other side. Because of development of barrier beach resorts, the dunes (the original terrapin nesting habitat) have been destroyed leaving the terrapins a dangerous alternative of nesting alongside heavily trafficked roads.

Road patrol volunteers help cross females safely in the direction in which they were heading. However, if a terrapin has been hit and the eggs are potentially **viable** (healthy embryo inside), they will take her back to the lab and perform an "**eggectomy**". This is a special word for a surgical procedure where undamaged eggs are **extracted** (removed) from the female. Once eggs are removed, they are gently washed with distilled water and then carefully placed in a bed of 1.5 inch deep vermiculite. The date is recorded on a chart that is attached to the lid of the egg box container. They are placed in an incubator at 30°C (86°F) to ensure females are produced. You can mathematically estimate the amount of turtles lost in the Cape May county patrol area by taking the 1 female plus 10 (average) potential eggs=population decrease of 11 turtles. Multiply 11*500 (average roadkills in Cape May County) = about 5,500 diamondback terrapins lost if we do not try to save the mothers and their eggs.

Extracted eggs are pink in color. When eggs turn white, they are viable. If they are grey or buff in color, they will not produce a hatchling. **Incubation** takes 7 or 8 weeks. Incubation is the process when an embryo inside of an egg turns into the hatchling by keeping the surrounding environment at the proper temperature for development. After discussing characteristics of reptiles in activity *1.1 What's a Terrapin*?, explain that reptiles develop in the shell differently that other animals that are born from shells, such as birds. Temperatures in the nest determine whether most are born as boys or girls. In the case of the diamondback terrapin, higher temperatures above 30°C (86°F) will result in 100% females. Males are produced in an environment with lower temperatures below 28°C (82.4°F). Baby turtles go through a **physical change** while they are growing inside the egg. Physical change is change to the form of a

substance without really changing what it is. For example, ripping a piece of paper. Even though it is in smaller pieces, you still have paper.

Activity

1. Start by creating a physical change. Ask students to use their rulers and cube of clay to form a 3-dimensional oval terrapin egg. The length of the egg should be 4cm and the width should be about 2cm.
2. Review how to read a thermometer scale using a large model. Using the *It's a Girl Thing* activity sheet, have students record each temperature in both Fahrenheit and Celsius. Students should also label whether it will be a boy or girl at that temperature.
3. To close the lesson, ask students to discuss why the female diamondback terrapin population is decreasing.

It's a Girl Thing

Name: _____

You just learned that incubation temperature determines whether female or male diamondback terrapins are produced in the nest.

Remember:

Below 28 degrees Celsius (82.4 degrees F) = 100% males

Above 28 degrees Celsius (82.4 degrees F) = mostly females

... and above 30 degrees Celsius (86 degrees F) = 100% females

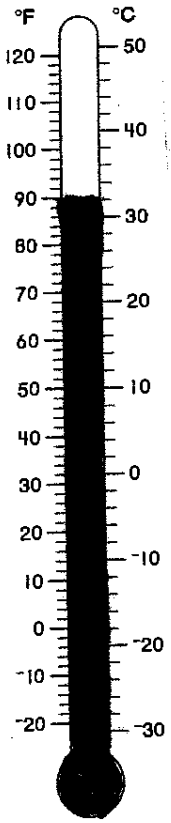
Directions:

1. Record the temperatures below to the nearest degree in both Fahrenheit and Celsius
2. Circle whether a female or male is most likely to be produced.

1. _____ Degrees F

   _____ Degrees C

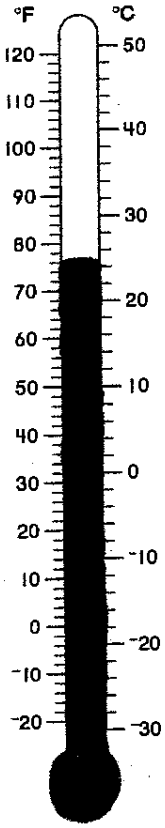
   Male or Female



2. _____ Degrees F

   _____ Degrees C

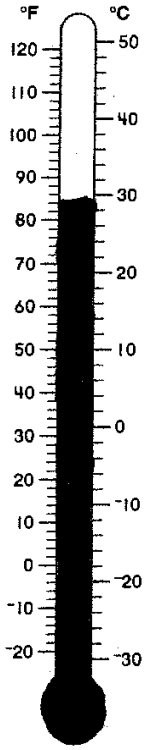
   Male or Female



3. _____ Degrees F

_____Degrees C

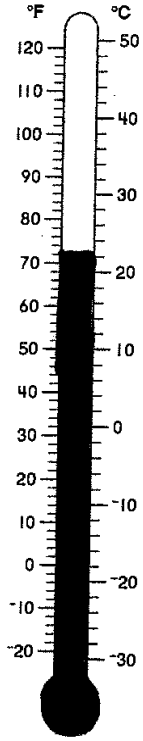
Male or Female



5. _____ Degrees F

_____Degrees C

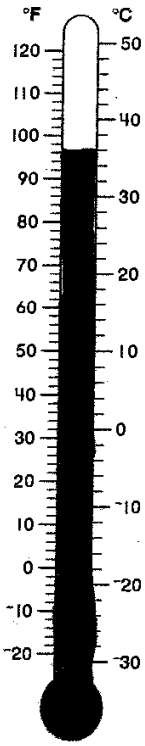
Male or Female



4. _____ Degrees F

_____Degrees C

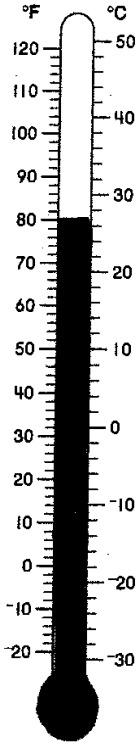
Male or Female



6. _____ Degrees F

_____Degrees C

Male or Female



Grades K-4
Learning Activities

1.4 ECO ENGINEERS

Grade Level

K-4th grade
(Can be modified for grades 5-8)

Subject Areas

Science, Art

Area of Focus

Putting It All Together

Duration

Prep: 10 minutes

Activity: 30 minutes or longer

Skills

Problem-solving, creative thinking

Vocabulary

Predation, scientists, engineers, inventions

1.4 Eco Engineers

Overview

Students will learn about some of the hardships terrapins face and then design and build an invention to help alleviate this hardship.

Objectives

Learn about the struggles of diamondback terrapins due to human impacts.

Think of ways to solve problems terrapins face using creative materials.

Be introduced to other inventions and ideas done to help other wildlife.

Materials

Drawing paper plus crayons and markers

Clay (or *Model Magic*)

Glue, scissors (if appropriate)

Other craft supplies such as toilet or paper towel tubes, popsicle sticks, cotton balls, string, rubber bands, plastic eyes, brass brads, cardboard clay, foam, Legos®....the list goes on!

Copies of *Helping Hands* activity sheets

Audio/Visual equipment and *Wildlife Overpass* video
http://www.nbcnews.com/video/how-wildlife-engineers-build-safer-roads-for-animals-and-plants-527043651772

Background

It's tough being a terrapin. As if living in the wild was not hard enough, terrapins face many struggles each and every day both natural and manmade. A natural struggle for terrapins is **predation**. Terrapin eggs are eaten by fox, raccoon, and skunk. The hatchlings are often prey to gulls, crows, egrets, herons, and fish.

Unfortunately, terrapins also face many manmade struggles. In the late 1800s and early 1900s terrapins were considered a delicacy, and cooked into terrapin stew. Thankfully, this practice is no longer as popular as it once was, but terrapins still face many manmade dangers. Unfortunately, terrapin nesting habitat has decreased dramatically due to coastal development. Since there is not as much nesting habitat, female terrapins are often hit by cars when looking for suitable nesting areas or terrapin hatchlings may fall into storm drains as they make their way from the nest into the marsh. Additionally, commercial crab traps are also unsafe for terrapins. Terrapins are attracted to the crab bait and can become stuck once inside the trap. Since terrapins breathe air, many terrapins drown this way.

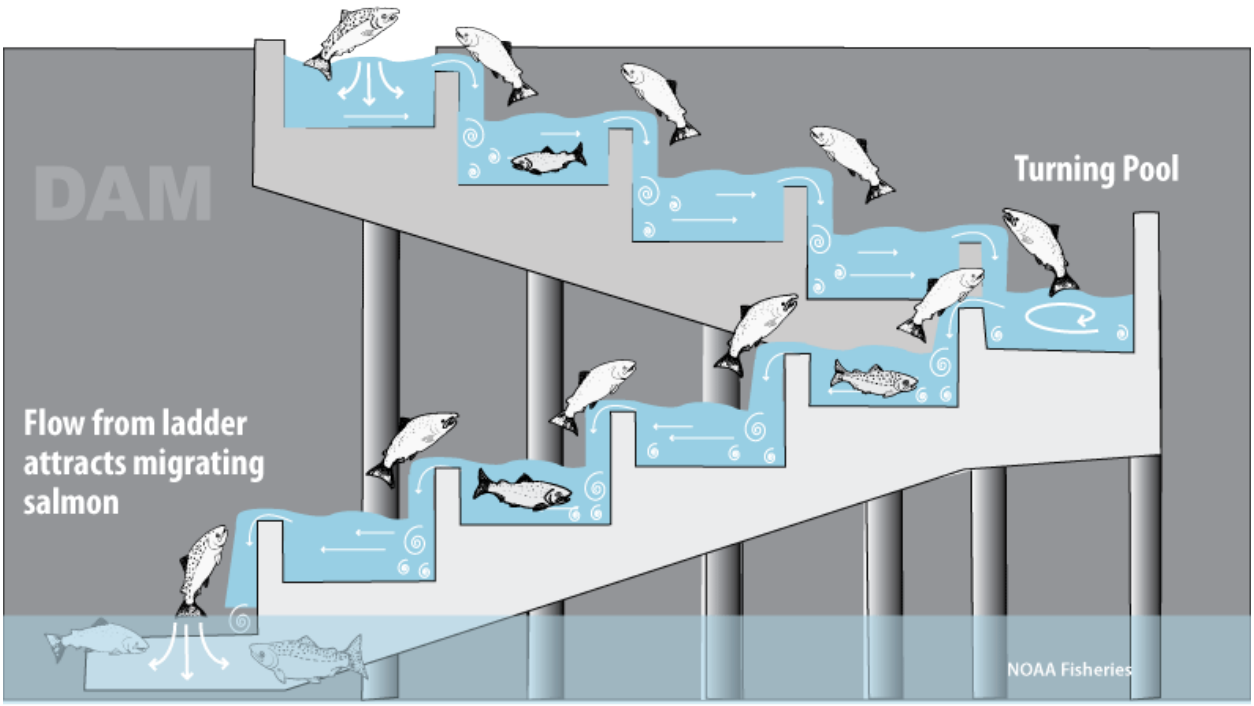
Because of all these factors, and others, there are less terrapins then there use to be in the wild. We understand this topic can be sad to talk about, but there's good news! **Scientists** and **engineers** are coming up with ways to help terrapins! But, what's an engineer? Engineers are not only people that operate trains, engineers are people whose job it is to solve problems by using special skills involving math, science, technology, building, and/or construction. There are also many different kinds of engineers. Some solve problems by creating new tools, machines, robots, or other neat **inventions**.

Activity

1. After reviewing the dangers terrapins face because of natural predators and human impacts, share with students the *Helping Hands: Meet Richard, a 13 year old Eco Engineer!* activity sheet and/or play the *Wildlife Overpass* video.
2. Have students pick a terrapin limiting factor, like roadways or being caught in traps or falling into storm drains. Tell them their job is to make a creation that would help terrapin populations thrive in the wild.
3. Depending on allowed time, have students paint or draw their invention on paper or canvas. If you have more time, students are encouraged to create a small model of their invention using craft supplies and whatever other materials are available.
4. After completion of their invention, have students show their invention to the class and explain how it will help terrapins.

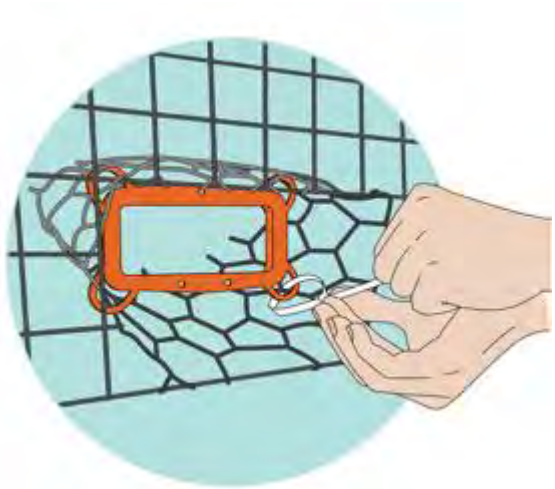
Helping Hands: Fish Ladders.

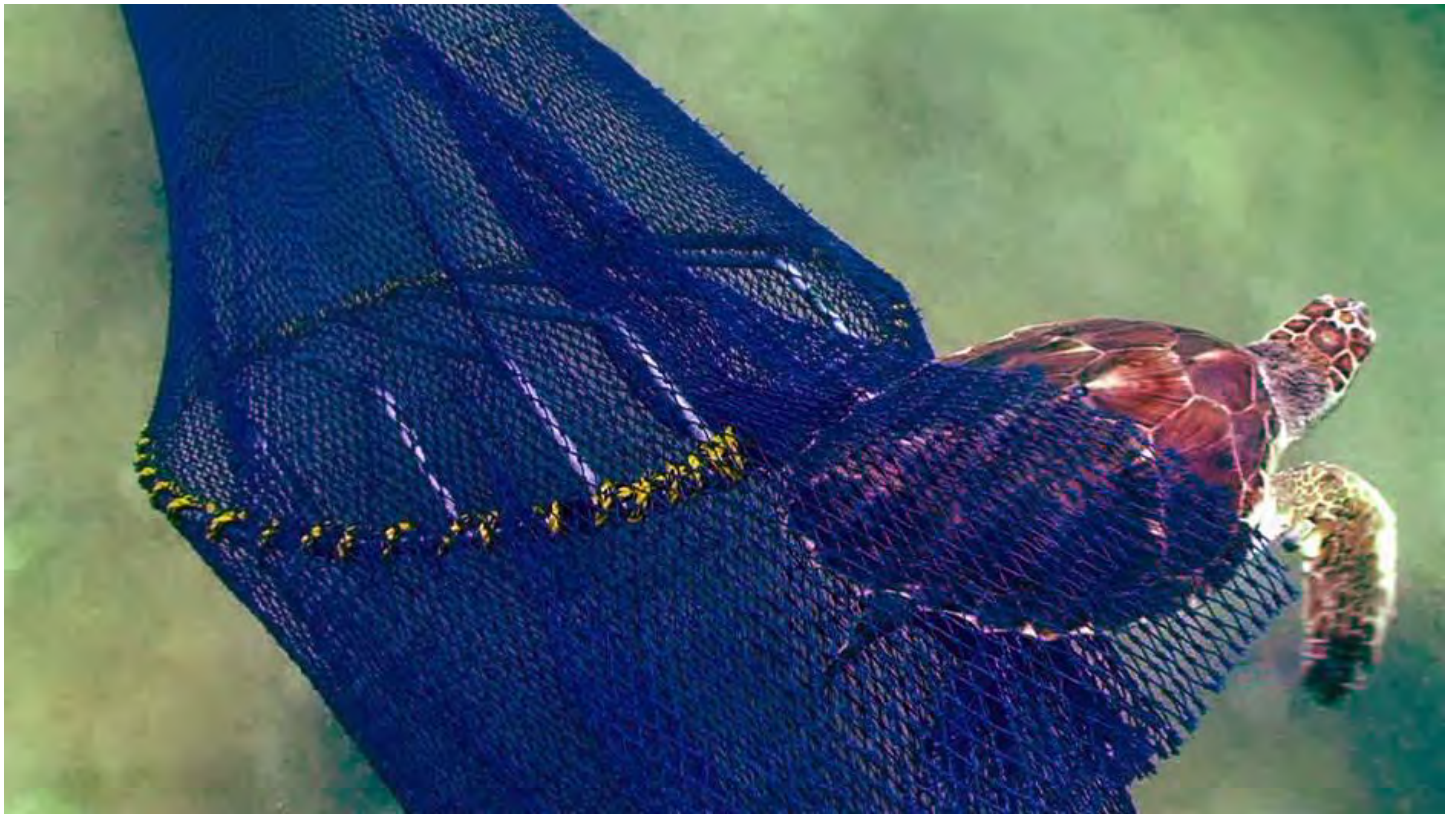
Fish ladders were built to help fish hop over dams in rivers. Manmade dams have blocked fish from swimming up river where they go to lay eggs. Fish ladders help them swim over the dam and continue up or down the river.



Helping Hands: Bycatch Reduction Device (BRD)

These help terrapins and other marine animals from getting harmed in fishing gear



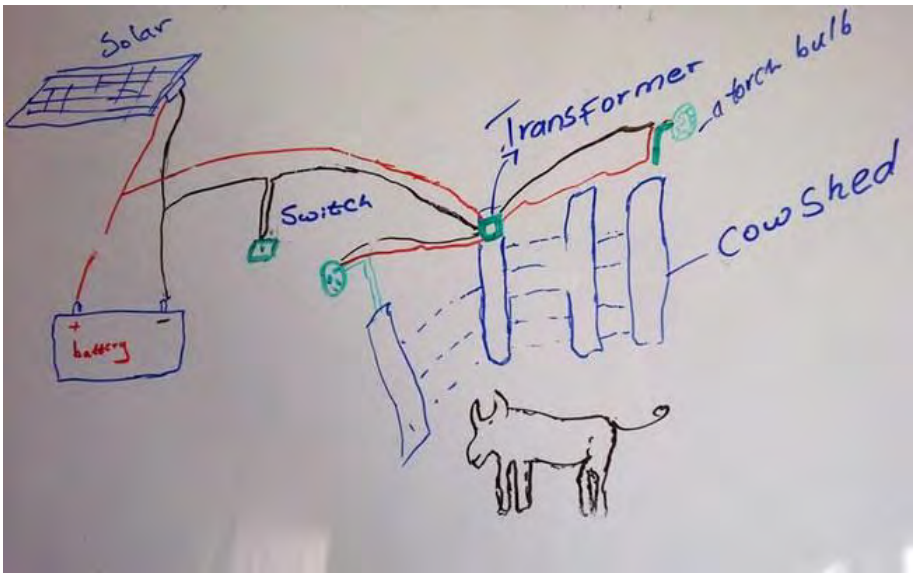


Helping Hands: Meet Richard, a 13 year old Eco Engineer!

Richard's invention is helping lions, his family, and his farm.

In 2013, a 13 year old boy in Kenya, named Richard Turere, came up with a low cost and environmentally friendly product to protect his family's livestock. His product also is protecting one of Africa's apex predators from being killed.

This is Richard and his home.



This is Richard's original invention, using solar power to keep lions away from his family's farm.

Watch and listen to Richard tell his story!
https://www.ted.com/talks/richard_turere_a_peace_treaty_with_the_lions?language=en

Note to teachers: Please watch video before playing to students to vet graphic images.

Grades 5-8
Learning Activities

2.1 TOTALLY TERRAPIN TRIVIA

Grade Level

5th – 8th grade

Subject Areas

Science

Area of Focus

Biology

Duration

Prep: 15 minutes

Activity: 45 minutes

Skills

Analyzing

Vocabulary

Native, species, salinity, estuaries, carapace, plastron, scutes, marginal scutes, vertebral scutes, anomalies, carrion, camoflauge, incubation, Bycatch Reduction Device (BRD)

2.1 Totally Terrapin Trivia

Overview

This introductory lesson into diamondback terrapins will provide your students with basic information about diamondback terrapins, their adaptations and their life within the salt marsh.

Objectives

Identify and characterize species found within the salt marsh.

Recognize the adaptations needed for diamondback terrapins to live within the salt marsh.

Identify natural predators to the diamondback terrapin.

Materials

Diamondback Terrapin Introductory PowerPoint

Terrapin Trivia activity cards

Shell Diagram activity sheet

Background

The northern diamondback terrapin, *Malaclemys terrapin,* is a **native** reptile to New Jersey and an important part of the salt marsh ecosystem it lives in. Terrapins are turtles who have been given the special name of "terrapin" because it is the only **species**, or type, of turtle that is adapted to live in brackish water. Brackish water is a combination of both salt water and fresh water. The **salinity** (amount of salt) of these marsh waters can vary depending on its location. The salt marshes and **estuaries** (a partly enclosed body of brackish

water where one or more sources of fresh water is flowing into it, with a free connection to the open ocean) provide shelter, food, and suitable nesting habitats for terrapins. The Northern Diamondback Terrapin geographical range is from Massachusetts to Virginia. However there are other kinds of terrapins, known as a sub-species that live in other areas of the coastal US like Florida and along the Gulf Coast.

Like all turtles, terrapins have a shell. The top of the shell is called the **carapace** and the bottom part is called the **plastron.** The shell is covered in modified scales called **scutes**. Scutes that run along the edges of the shell are called **marginal scutes,** the scutes found along the vertebrae are called **vertebral scutes.** Recognizing the types of scutes on a turtle shell can be helpful to scientists in identifying different turtles in the wild. Researchers will record and ID terrapins by tagging them and also recording scute **anomalies** or abnormalities.

Diamondback terrapins also are very unique in that they can have diverse colors and skin patterns. Their shells range from pale yellow-green to a dark greyish black. Their skin can consist of black spots, splotches, or streaks. Adult females are usually 8-10 inches long, while adult males are only about 5-7 inches long. Females are larger for carrying eggs.

Terrapins have a diet consisting of fiddler crabs, snails, small bivalves, fish, marine worms, insects, and **carrion** (dead and decaying flesh). They also have a variety of predators, especially during their first few years. Terrapin eggs are eaten by fox, raccoon, and skunk. The hatchlings are easy prey to gulls, crows, egrets, herons, and fish. As adults, their predators include raccoons, gulls, bald eagles, crows, and even humans. In the late 1800s and early 1900s they were considered a delicacy, and cooked into terrapin stew.

As adults, breeding season begins once springtime arrives. Come May and June, female terrapins look for nesting grounds along barrier islands and lays approximately 8-12 eggs. They use their hind feet for digging a nest 4-6 inches deep. When the female has finished dropping and positioning her eggs, she will cover her nest and make it appear just as it was when she arrived. This is an example of **camouflage**. The temperature of the eggs during **incubation** will determine whether females or males will be produced. Higher temperatures above 30°C (86°F) will result in 100% females. Males are produced in an environment with lower temperatures below 28°C (82.4°F). Young turtles will develop and hatch about two months later. To get out of their shell, hatchlings break the eggshell with a special egg "tooth". This is not a real tooth, but a growth of keratin that will fall off shortly after hatching.

When the female terrapin comes out of the salt marsh waters to lay their eggs, they usually look for higher ground, which lead them to crossing the roads. While crossing the roads, many female terrapins do not survive as a result from being hit by vehicles. However, scientists and researchers form The Wetlands Institute install what are called barrier fencing. Barrier fencing prevents turtles from crossing the busy

roads. However, even with barrier fencing, it is estimated that within Cape May and Atlantic counties, an average of over 1,000 female terrapins are killed on roadways. Something else that helps terrapin populations are **Bycatch Reduction Devices** or BRDs. These are rectangular plastic barriers that are placed onto crab traps. Terrapins are known for getting trapped in these and drown as a result. But with BRDs, terrapins will not become victims to crabs traps and crabbers can still catch crabs.

The Wetlands Institute stays busy keeping up with current terrapin data and developing new ways in protecting them.

Activity

This activity should be completed after the major concepts about the diamondback terrapin have been covered using the *Diamondback Terrapin Introductory PowerPoint*. Before beginning, you may wish to distribute the carapace and plastron diagrams to help students identify the number of scutes or scales. This will also help grasp necessary vocabulary.

Be sure to make an extra copy of each page of the game cards. It will serve as your answer key. Questions start in the left column and go down. The next answer is at the top of the right side of the same page and, once again, works down. Each page is set up this way.

1. Carefully cut out the cards. Laminate for durability.
2. Shuffle the cards.
3. Deal a card out to each student. If you have fewer students than cards, ask for volunteers who want an extra. Tell the students to read their cards silently.
4. Ask the student who has the card that says "I have the first card" to stand. Tell him/her to read the whole card.
5. Explain that the student who has the answer to the first question (that was just read) should stand, read the answer from their card and then continue to read the new question that is at the bottom of the card.
6. The student with that answer should stand and repeat the process.
7. Turns will continue until all cards have been read. The game is over when the final student reads "Congratulations, team! You rocked at Totally Terrapin Trivia!"

Shell Diagrams

The three main types of scutes include:

- Vertebral
- Marginal
- Costal

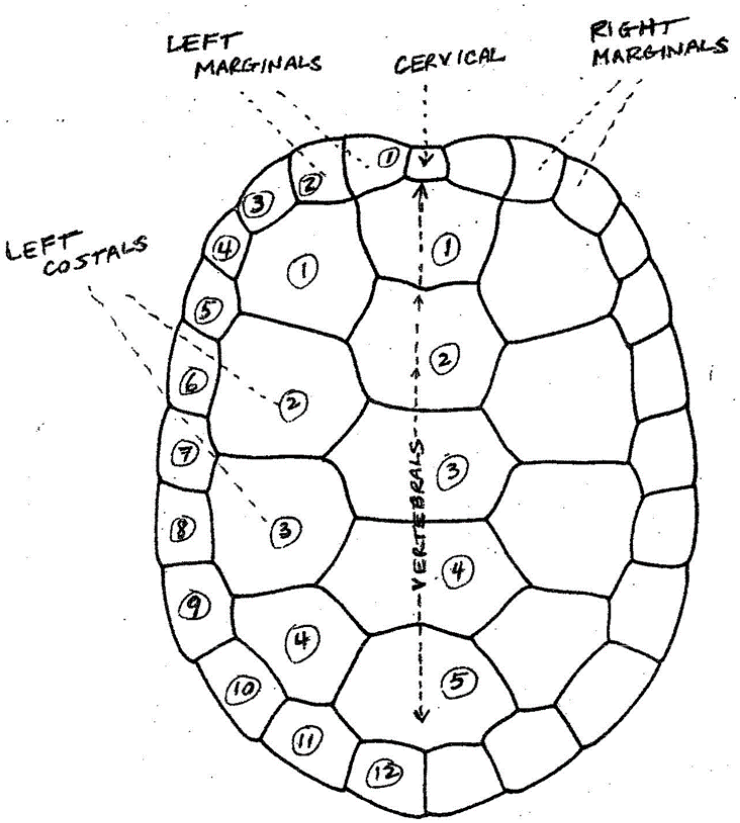
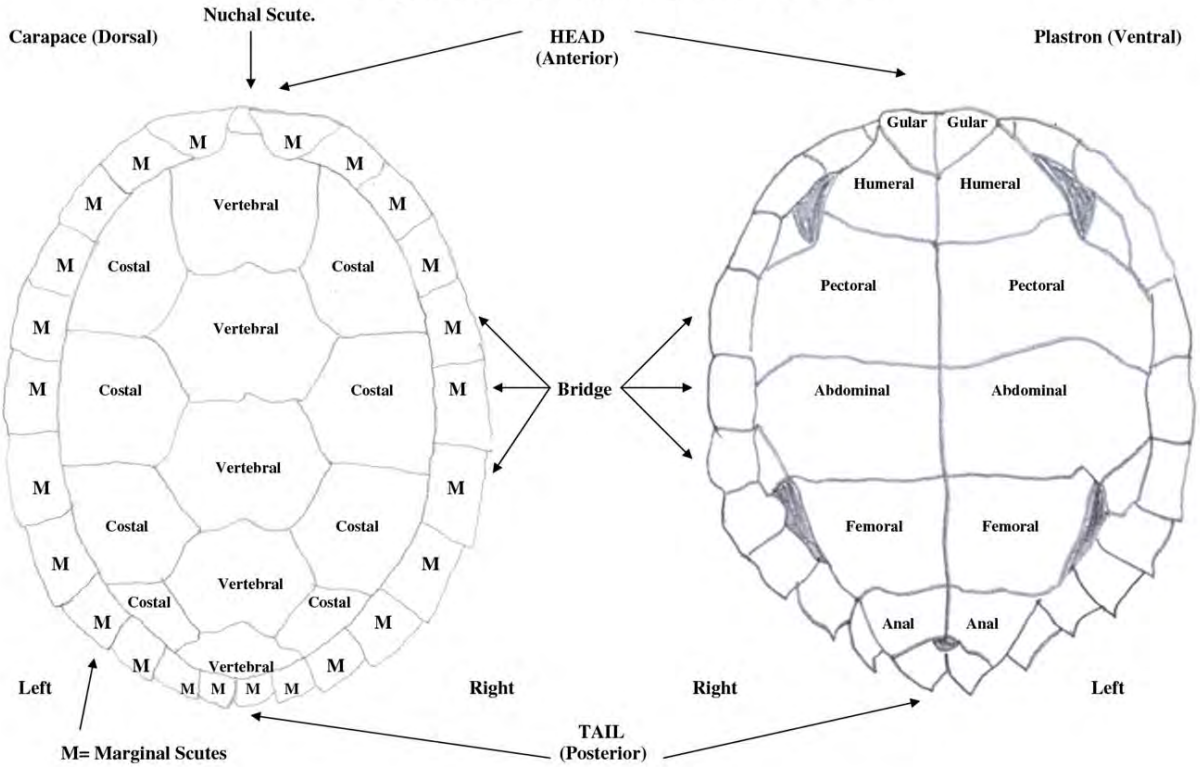


Diagram of Scutes of Carapace and Plastron for Chelonians.



I have the **first card**. Who has what classifies a diamondback terrapin as a vertebrate?	I have **carapace**. Who has the word for the bottom part of the shell?
I have a **backbone**. Who has the location of a diamondback terrapin's backbone?	I have **plastron**. Who has a synonym for the enlarged scales on a turtle's shell?
I have the **underside of the carapace**. Who has the category of vertebrates to which terrapins belong?	I have **scutes**. Who has the number of vertebral scutes on the carapace?
I have **reptiles**. Who has the word for top part of a turtle shell?	I have **five**. Who has the usual amount of marginal scutes found on each side of a terrapins carapace?

I have **twelve**. Who has the term used for a scute that is not normal?	I have **snails, fiddler crabs and small bivalves**. Who has the man-made device that traps terrapins underwater?
I have an **anomaly**. Who has the geographical range of diamondback terrapins?	I have **commercial-style crab traps**. Who has the term for unwanted species caught in traps or nets?
I have the **US coastline from Cape Cod to Florida and around the Gulf Coast**. Who has the kind of water terrapins live in?	I have **bycatch**. Who has the name of the device used to prevent terrapins from entering crab traps?

I have **brackish water**. Who has the types of food terrapins like to eat?	I have **bycatch reduction device**. Who has the average number of eggs a female terrapin will carry
I have **8 to 12**. Who has the reason why female terrapins are frequently run over by cars?	I have **nest temperature**. Who has the incubation temperature that will produce females??
I have **due to loss of nesting habitat, terrapins are forced to search for nesting grounds near roadways**. Who has the item that has reduced the number of roadkill female terrapins?	I have **30 degrees C or 86 degrees F**. Who has the amount of time it takes for incubation?

I have the **terrapin barrier fences**. Who has the average number of adult females killed along roadways within Cape May and Atlantic Counties?	I have **7-8 weeks (average 2 months)** . Who has what terrapins do to survive during winter?
I have over **1,000 adult females**. Who has the factor which determines male or female inside the egg?	I have **hibernation**. Congratulations! You rocked at Totally Terrapin Trivia!

Grades 5-8
Learning Activities

2.2 TERRAPIN TRACKING

Grade Level

5th – 8th grade

Subject Areas

Science

Area of Focus

Habitat

Duration

Prep: 20 minutes

Activity: 2 weeks total

Skills

Observation, data collection, journaling, analysis, problem-solving, critical thinking

Vocabulary

Populations, biodiversity, invasive species

2.2 Terrapin Tracking

Overview

Terrapins and other animal populations are estimated using different tracking methods. Through this activity, students will understand and practice this method with their teachers and peers.

Objectives

Understand research methods to study terrapin populations and behavior.

Understand current conservation efforts and methods used by scientists at The Wetlands Institute and abroad.

Practice common population research and wildlife monitoring methods.

Materials

Terrapin Tracking Introductory PowerPoint

Different multicolor snap bracelets (10 total)

For each student: copies of school map (10 total) and *Instructions for Terrapin Tracking*

Pictures of Terrapin microchip and other types of tags used on animals from Activity 3.3 *Terrapins, On Your Mark*

Background

Humans have tracked animals for thousands of years. *Why?* Tracking helps tell a story of where animals go, how they behave and interact with other animals. Also animals and

animal **populations** are indicators of the health of the environment which we all depend on. We can see changes to health, life span, movements, climate, **biodiversity** (variety of species), **invasive species** (animals introduced to an environment by humans and have negative impacts), and the spread of infectious diseases.

Wildlife biologists will use different methods to track species such as photographing unique physical markings, or tagging the individuals. There are different tags scientists can use to help with wildlife research and conservation. Satellite tags, radio collars, tattoos, or plastic tags. In terrapin research, the turtles may have microchips, metal or plastic tags, or a notch in their shell. Other shell anomalies, or differences, are recorded for ID purposes as well.

Activity

As needed throughout the activity, use the *Terrapin Tracking Introductory PowerPoint* to introduce students to wildlife tracking, terrapin tracking and to explain the activity.

Each day over the next week, two "turtles" will be "tagged" and "released" into your school. Using the following tagging and release schedule.

- Monday – Turtles with tag # 1 and 2
- Tuesday – Turtles with tag # 1 and 2, plus Turtles with tag # 3 and 4
- Wednesday – Turtles with tag # 1, 2, 3, and 4, plus Turtles with tag # 5 and 6
- Thursday – Turtles with tag # 1, 2, 3, 4, 5, and 6, plus Turtles with tag # 7 and 8
- Friday – Turtles with tag # 1, 2, 3, 4, 5, 6, 7, 8, plus Turtles with tag # 9 and 10

Throughout the tag and release observation period, students will:

- keep track of them;
- monitor their movements;
- figure out where they spend the most time, and
- develop a "conservation plan" based on their data.

At the end of the observation period, students will:

- collect the data and discuss compilation strategies;
- analyze the data; and
- develop a conservation plan based on their data results.

After the students have had a chance to collect, analyze and develop a conservation plan. Discuss the following with them:

1. Tell about any challenges you had.
2. Were the “turtles” easy to find and observe?
3. What did you like/not like about the activity?
4. What problems did you encounter while doing the activity?
5. How would you change the activity to make it more authentic? or to solve any problems or challenges?

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Instructions for Terrapin Tracking

As part of a "Research Team" it is your job to note turtle sightings over the next two weeks. When you see a turtle, make a note on your map for the day. For instance, if you see the PURPLE SPOTS turtle in the main office, record a 5 for the main office. Fill in the Tracker Sheet as much as possible.

1. Make your notes as soon as you can after a turtle sighting. If you forget later, and you're not certain where you saw the turtle, do not record where you think you saw it.

2. You should only be looking for "turtles" when a class is not in session. That means you can look for them before and after school, at lunchtime, and between classes.

3. Once you see a turtle, you may not observe it again for 30 minutes. (For example, you see the PURPLE SPOTS turtle in the office, you cannot come back a minute later, see it there again, and consider it a "second" sighting. If it hasn't moved in 30 minutes – that would be a second sighting.)

4. Keep your observations to yourself. Your individual observations matter. There's no room on your map for anyone else's sightings, or for sightings that someone else told you about – even if they are on your "research team".

5. You might not see every turtle every day. And not every turtle may be out every day. That's OK, it's supposed to happen that way. So don't fudge your data – that's not good science!

6. Use a new map and corresponding tracker sheet for each day. You should have 10 maps total.

7. Be nice to the turtles! A good scientist would never harm the animals he or she is studying.

Terrapin Tracking Tracker Sheet!

Name: _____

School: _____

Date: _____

Time	Tag #	"Habitat"(Location)	Observed Behaviors

Terrapin Tracking Questions

What do you want to find out from doing this tracking experiment?

What is your hypothesis? Do you think you will be able to track all turtles? Multiple times?

What kind of results have your found? What kind of conclusions can you formulate?

Now knowing your results, briefly describe your conservation plan.

Evaluate the Exercise:

1. What did you like about the activity?

2. Tell about any challenges you had.

3. Were the "turtles" easy to find and observe?

4. What did you not like about the activity?

What problems did you encounter while doing the activity?

Grades 5-8
Learning Activities

2.3 MAPPING OUT THE SCIENTIFIC METHOD

Grade Level

5th – 8th grade

Subject Areas

Science, Language Arts

Area of Focus

Nesting/Conservation

Duration

Prep: 5 minutes

Activity: 30-40 minutes

Skills

Critical thinking, formulating questions, interpretation, analysis

Vocabulary

Scientific Method, hypothesis, analyze, conclusion

2.3 Mapping Out the Scientific Method

Overview

Using the scientific method, students will explain the effectiveness of terrapin barrier fencing along roadways.

Objectives

Learn the steps of the scientific method.

Use the scientific method to formulate a hypothesis and conclusion after reviewing geographical data.

Write an expository essay detailing their scientific process.

Materials

For each student: A copy of *Terrapin Road Kill Geographical Map,* a copy of *Using the Scientific Method to Look at the Effectiveness of Terrapin Barriers*, and graph and composition paper

Background

Asking questions is what makes a good scientist. All scientists use The Scientific Method. **The Scientific Method** is the process by which scientists explore the answers to questions about our world. You can use the scientific method every day to help answer basic questions. You may be using the scientific method every day in your life and not even realize it!

You first formulate a question. What interests you? It could be something such as "What is the best route to get to the grocery store?" Next, you formulate a hypothesis. A

hypothesis is an educated guess. What you think will be the outcome or answer to your question? My hypothesis to my question is "I think the best route to the grocery store is a drive down Main Street and making the left onto First Street. Instead of taking the Highway".

Next is to test your hypothesis with an experiment. Your experiment is to time your route for both directions to see which is fastest. **Analyze** (examine and make sense of the information) the results you've collected and then draw a **conclusion**. Below are again the steps to the scientific method.

<u>The steps of the scientific method are:</u>

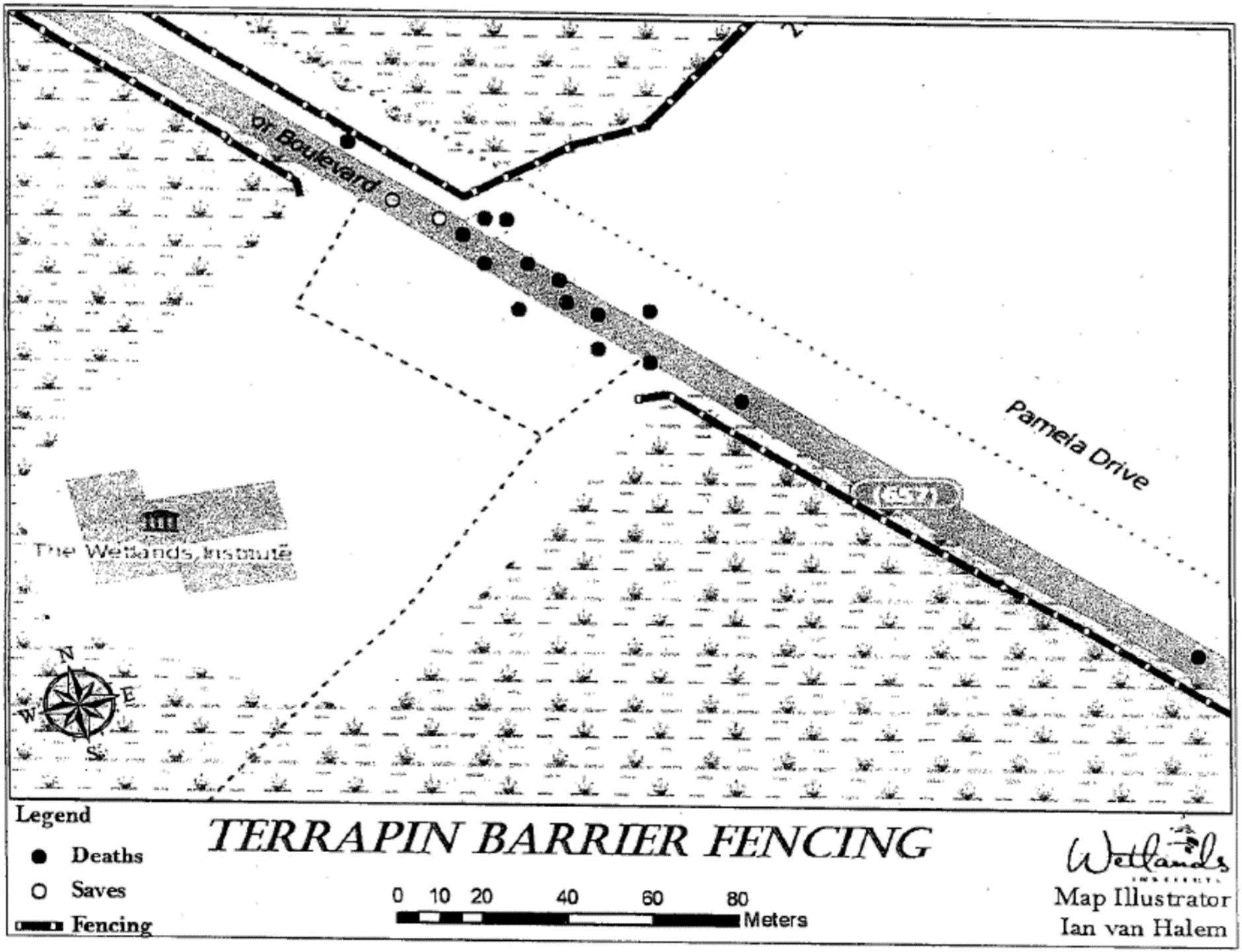
1. Ask a question.
2. Make a hypothesis.
3. Test the hypothesis with an experiment.
4. Analyze the results of the experiment.
5. Draw a conclusion.
6. Communicate results.

Terrapin research scientists are always using the scientific method in testing things like the effectiveness of barrier fencing along roadways. Do you think it is effective in keeping terrapins off the road and thus helping terrapin populations? Check out the geographical map of terrapin barrier fencing and do the activity below.

Activity

1. Hand out materials listed
2. Working with partners, groups, alone, or as a class examine the geographical map.
3. After the activity, have the students write an expository essay detailing their scientific process.

Terrapin Road Kill Geographical Map



Mapping Out the Scientific Method

Research intern Ian has been collecting and mapping data to see if terrapin fencing along roads is effective in protecting nesting diamondbacks. Use Ian's data on the following page to create a graph and reach your own conclusion using the scientific method.

What does Ian want to know?

Question:
_____
_____
_____
_____

What do you think Ian will find?

Hypothesis:_____
_____
_____
_____

Look at the geographical map closely. Write down notes of what you see on the map.

What are some things he discovered?

Conclusion:_____
_____
_____
_____

Communicate Results:

Write a brief report in paragraph form regarding your data collection, observations, and conclusion.

Grades 5-8
Learning Activities

2.4 ANOTHER DAY AT THE OFFICE

Grade Level

5th – 8th grade

Subject Areas

Science, Language Arts

Area of Focus

Putting It All Together

Duration

Prep: 5 minutes

Activity: 30 minutes

Skills

Reading, comprehension

Vocabulary

Internship

2.4 Another Day at the Office

Overview

Ashley, a research and conservation intern from 2012, wrote what a typical day for her working at The Wetlands Institute. Students read her story about what it's like working as a field research scientist for the summer. Students then answer the comprehension questions about her experience.

Objectives

Develop an understanding and comprehension of the story and other written text.

Use context clues to extract meaning of words.

Explain problems facing diamondback terrapins, while determining cause and effect, problems and solutions.

Infer and respond to story questions.

Explain reasoning for choosing to become, or not wish to become, a research intern.

Materials

For each student: A copy of *A Day in the Life of a Research Intern* activity sheets

Background

Many hard working Americans have started their carriers from the ground-up. In this competitive working world,

volunteering or interning with different companies and organizations can be very beneficial in pursuing the education or career for your dreams.

An **internship** is a temporary position with an emphasis on on-the-job training rather than just employment, and it can be paid or unpaid. Internships can be very rewarding, but also a lot of hard work. Many jobs actually require potential hires to have a previous internship or two in order to gain proper job knowledge and experience.

Internships don't just look good on paper, they are much more than that. Internships can help mold a person into who they will become as a professional, whether they decide to become a scientist or not. These experiences can also help college students find the right career path that suits them. After an internship, many students change their mind about following a particular carrier. Maybe it's not what they expected, and that's ok! Either way, they are important, students will remember their internship experiences for the rest of their lives!

The day in the life of a research intern at The Wetlands Institute can be a very rewarding job. However, it is not for the faint of heart! While working here in the field, you may encounter the following: heavy lifting, mud, heat, water, animal dissections, animal excrement…you get the idea. It's not for everyone, but for those that don't mind, it can be a blast! Plus have some great experiences and make new friends along the way. Read Ashely's story and what a typical "day in the office" is like for her.

Activity

1. Distribute *A Day in the Life of a Research Intern* activity sheets.
2. Students will work individually to reading the story and answer corresponding comprehension questions.

A Day in the Life of a Research Intern

Hi, my name is Ashley. I am a student at Michigan State University. This summer I was selected from a great many applicants in the United States to be one of twelve terrapin research interns at the renowned Wetlands Institute in Stone Harbor, NJ. It is a great honor because The Wetlands Institute is number one in continued research for the preservation and conservation of the diamondback terrapin. I am very excited to have been selected to work at this prestigious institute.

Since my arrival in May, I have been starting my morning with the 5 o'clock road patrol. Another intern and I will travel a forty-mile route in search of nesting terrapin females who need help crossing roads. This is necessary because females need to nest on higher ground, which may, at times, be on the opposite side of the road. Male terrapins remain in the marsh's tidal creeks or estuaries.

In addition to helping turtles cross roadways, we will also collect dead terrapins that have been hit. We check to see if they still have eggs inside of them. These terrapins are taken back to The Wetlands Institute's lab to perform an "eggectomy". This is an operation where we cut viable eggs (if any) out of the dead female and place them in an incubator to hatch for our head start program. Stockton College in New Jersey helps us incubate the eggs at a temperature that will produce females. You see, like with all reptiles, the temperature of the nest determines whether a terrapin is a male or female. Warmer nests produce mostly females and cooler nests produce males. When the hatchlings emerge out of the egg, they will be raised and cared for. After one year, they are microchipped for research purposes and released back into the wild. The tiny microchip, that is the size of a grain of rice, is placed in the rear leg of the terrapin with a needle. When you run a scanner over the area, an identification number will show up on the screen. With this we can check any turtle captured in the future to see if they have been here before.

Sometimes the terrapin is flattened so badly that we just take the coordinates of our location with the GPS and respectfully toss her remains back into the marsh. If the terrapin doesn't have eggs and has not been smashed too badly, we will measure the carapace and plastron before we return her there.

We arrive back at The Wetlands Institute at 8:30 a.m., just in time for the morning meeting. All interns are present and we discuss our research projects with senior scientists. Other ongoing terrapin projects requiring our assistance are also discussed. At 9 a.m., I am off to collect data for my research project.

I am trying to determine the effectiveness of terrapin fencing or barriers that keep females away from busy roads. To do this, I will walk along a mile stretch of road and search both sides for places where a terrapin began to nest, but changed her mind. I also look for places where she did nest, but a predator came and ate the eggs or young turtles leaving the shells behind. First, after locating the holes, I will measure from

where the road begins to the center of the nest. Next, I will take the nest's GPS coordinates. After that, I will count the eggshells, if found, to estimate how many eggs were in the nest. Last, I will fill the nest hole and throw the shells back into the marsh.

This can be long, hard work. Today the temperature is in the high nineties. There also are biting flies, ticks and poison ivy everywhere! I have found sixty nests on one side alone. I look at my watch and it is 12:30. It is time to return to the Institute for lunch. It is nice and cool here, so I eat and relax for sixty minutes.

Now I must walk the institute's trail to search for nesting terrapins. I see one up ahead laying her eggs. I patiently wait for her to finish and cover the nest. She camouflages the nest so well, it is nearly impossible to find it unless watched the process of her laying the eggs. After nesting is complete, I place a red flag beside the spot so we can return to put a protective cage over it to prevent predators from eating the eggs. Next, I quickly retrieve the terrapin so I can take her back to the lab to measure, weigh, and check for shell anomalies that differ from their normal pattern. Following, I will scan and microchip her if necessary. This female does not have a chip, so I ask another intern to help me while I insert one. We return her to the area we found her, cover her nest with a protective enclosure, and return to the lab. It is now 2:45.

A fellow intern, Jess, needs help checking the storm drains across from the Institute for her research project. We all help one another when we can, so I have offered to give her a hand. Hatchlings or baby terrapins will often fall through the holes in storm drains trying to find their way back to the marsh. Once they are in the storm drain, they have no way of getting out. Using a fishnet attached to a bamboo pole, we will scoop any terrapins out of the drain. Many die because the drains often contain chemicals from things like fertilizers or oil and gas residue. There is no way to escape unless it rains hard and they are swept out of the drain's overflow pipe or back out of the top of it, if it overflows. There are no turtles there today, so we return to the lab.

It is 3:45. Ben is in the lab when I return. He is a senior researcher who is working to become a doctor of science. His research project determines the amount of terrapins that die accidentally in crab traps. Ben has found a ghost or abandoned trap with terrapin bones in it. By gluing the bones back together, he can determine how many terrapins have died in the trap. He is hoping his research may bring about a law that requires all traps to have excluders (a device that prevents adult terrapins from entering the traps). I help Ben glue the bones. Then, I hit the trail once more.

It is the height of nesting season and we find two more females laying nests. Females carry three clutches or groups of eggs. We estimate she lays each clutch about eighteen days apart. After we finish collecting data and enclosing the nest, it is now 6:00 and time for dinner.

At 7:00 I sit in my dorm room on the second floor of The Wetlands Institute and enter the data from the day into my computer for my research project. The interns that were doing evening road patrol enters around 8:00 p.m. with a terrapin that is alive, but badly injured. She cannot be saved, so one of the senior scientists will give her a shot to put her to sleep. After, we will perform an "eggectomy" so her babies can have a chance to live.

I return to my data at 9 p.m. and finish at 10. I head to the shower and in bed by 10:30. It has been a long day, but tomorrow we will begin all over again. I will continue my work here until the end of July. I close my eyes with the rewarding feeling that I am now a proud and active steward in terrapin conservation and strongly feel that I am making a difference. I am so lucky to be a part of this incredible process so that the diamondback terrapin might live on for generations to come.

Use context clues to determine the meaning of the following words

Viable (Paragraph 3)

Anomalies (top of page 2)

Steward (last paragraph)

Short answer questions

When Ashley is discussing her research project, what does she mean when she says she is “trying to determine the *effectiveness* of the terrapin barrier fencing”?

Explain what an “eggecomy” is. Why is this procedure performed?

Name one problem terrapins face and how you can help. This could be a small change or big change going towards helping terrapins.

Your thoughts

What personality traits do you think it would it take to be a research scientist intern like Ashley? Why?

Is this something that would interest you and your future career? Why or why not?

What career(s) interest you?