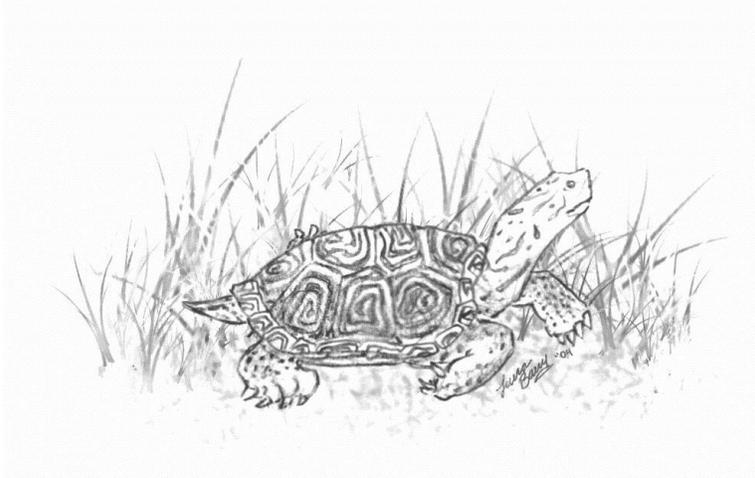
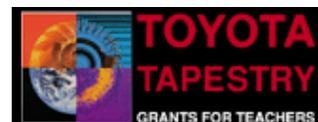


Diamondback Terrapin Nesting Ecology Activity



Egg, hatchling and juvenile survivorship

Activity developed through the Marine Academy of Technology and Environmental Science in Manahawkin, New Jersey. Produced through students in “Project Terrapin” with the generous support of the following supporters.



Diamondback Terrapin Egg and Juvenile Survivorship Activity

Introduction for the Educator (100 egg activity)

Diamondback terrapins are turtles that inhabit estuaries along the east and Gulf coasts of the United States. They range from Cape Cod, Massachusetts to northern Mexico. Terrapins were harvested in the late 1800's through the early 1900's as a food source with a high demand leading to reductions in their populations across their range. In the 1930's, terrapins became less desirable food sources and populations increased in areas with good habitat, but not much is known about populations in certain areas. What makes terrapins so interesting are their markings, which are highly variable and prominent. Reasons for the variation include genetic diversity and some variations in their patterns could be linked to environmental conditions.

Female terrapins grow larger than males and some females could be as large as 23 cm (9 inches) in carapace length. Males are smaller and may reach sizes of 15 – 18 cm (6 or 7 inches) as adults. In terms of maturation, females in New Jersey can mature in 7 – 9 years, while males can mature in 3 – 5 years. Females will nest on bay beach areas adjacent to marshes where they can deposit up to 18 eggs (called a clutch of eggs). The mean clutch size at Sedge Island, Barnegat Bay, New Jersey is around 12 eggs (Wnek, 2006 and 2007). The nesting female terrapin will dig a nest, deposit eggs and immediately return to the water. The depth of the nest depends on the compaction of soil and depth at which the female can dig. Eggs are deposited as deep as 21 cm (9 inches). Temperature of the nest influences the gender of terrapins; Eggs incubated at temperatures above 28 Celsius will mostly develop as female and below this temperature, male.

Eggs are somewhat soft, considered cleidoic, which allows for gas exchange during incubation. After approximately two months, terrapins emerge from their nest and make their way to vegetation and nearby marshes. From this point, little is known about their growth and life stage, but we know they live and feed within marsh habitats. Some of their food resources include snails, shrimp, crabs, and fish to name a few.

The goal of this activity is to learn about the basic life history characteristics of the diamondback terrapin. You will be assigned a specific egg number. Although there may be 4 – 18 eggs in a nest, we have an activity for 50 and 100 eggs that would be from multiple nests on the North Sedge Island, Barnegat Bay, New Jersey. The goal is to successfully hatch, emerge from the nest, and become an adult terrapin. Gender will not be addressed at this point.

A PowerPoint addressing the life history, biology, research and conservation of this species is available for additional information. Also, please see the terrapin reference list for additional information. Here we go...

Items recommended for the activity:

You can use 100 ping pong balls or plastic practice golf balls and number them from 1 to 100 using a permanent marker. These represent the egg numbers and types

Depending on the number students in the class they could be divided in groups. For example, with a class of 32 students, there can be 8 groups of 4 students. Each of the students in the group would get 3 numbered eggs at random. The group of 4 students with a total of 12 eggs would represent an entire clutch of eggs. The remaining eggs can be distributed at random to individuals in different groups so that some of the groups have 13 eggs total and four individuals have 4 eggs.

At the end of the activity, the surviving individual within the clutch is the one remaining!

If you cannot get plastic balls to simulate eggs then number pieces of paper. Remember, there are typically 9 – 16 eggs at Sedge Island, Barnegat Bay, New Jersey. You can divide the groups up accordingly to meet the requirements of the clutch and class sizes.

References for the classroom:

www.dtwg.org (an organization of terrapin biologists, conservationists and educators)

www.wetlandsinstitute.org (a leader in terrapin conservation, research and education)

www.terrapiainstitute.org (a non-profit in Maryland dedicated to terrapin conservation)

Diamonds in the Marsh: A Natural History of the Diamondback Terrapin by Barbara Brennessel, 2006. University Press of New England, New Hampshire, ISBN: 13:978-1-58465-536-7

A Day in the Salt Marsh by Kevin Kurtz. Sylvan Dell Publishers, ISBN: 978-0-9777423-1-8 (appropriate for children 3 – 7 years of age).

Marine Academy of Technology and Environmental Science “Project Terrapin” at www.ocvts.org (Lessons and basic presentations for all grade levels)

<http://www.pwrc.usgs.gov/bioeco/terrapi.htm> (US Geological Survey Information)

<http://www.scaquarium.org> (South Carolina Aquarium: Lessons for elementary school students)

http://www.aqua.org/animals_diamondbackterrapin.html (National Aquarium in Baltimore, Maryland)

Research experiences for educators:

<http://www.earthwatchexpeditions.org/US/exped/avery.html> (EarthWatch expedition for educators at Barnegat Bay, New Jersey)

Stage one. Eggs dug in a nest in late June with a 60 day incubation period overall. There is a 60% survivorship based on research at Sedge Island, Barnegat Bay, New Jersey. Here is the first 30 days...

Egg #	Factors contributing to failed egg development
4	Rainstorm flooding the nest
8	Rainstorm flooding the nest
9	Soil compaction preventing gas exchange
13	Soil compaction preventing gas exchange
16	Eaten by egret
23	Eaten by crow
33	Eaten by crow
35	Eaten by raccoon
42	Eaten by raccoon
50	Eaten by mink
51	Eaten by mink
54	Eaten by mink
60	Eaten by mink
65	Dessication
69	Dessication
71	Eaten by mink
77	Eaten by mink
83	Inadvertently dug up
90	Eaten by a crow
92	Eaten by a crow

Stage two. Congratulations! Eggs continue to incubate in late July with a 60 day incubation period overall. There is an overall 60% survivorship of embryos.

Egg #	Factors contributing to death
5	Dessication
6	Eaten by red fox
14	Eaten by red fox
20	Eaten by crow
26	Soil too compacted; improper gas exchange
28	Eaten by raccoon
34	Dug up by a mink and eaten
36	Too low in the nest and waterlogged at high tide
46	Accidentally dug up by caretaker putting up a fence
47	Overcrowded nest with lack of oxygen
53	Overcrowded nest with lack of oxygen
57	Dug up by a mink and eaten
62	Dug up by a mink and eaten
64	Dug up by a mink and eaten
70	Inadvertently dug up
74	Ants got into the egg
76	Flood inundated nest with water

79	Flood inundated nest with water
88	Roots penetrated the egg
97	Roots penetrated the egg

Emergence. The terrapins have developed well and two months later, in mid-August are emerging from the nest, making your way to the salt marsh. Congratulations! You have emerged, but...

Hatchling #	Factors contributing to death
1	Eaten by a Herring gull
15	Eaten by a crow
22	Eaten by a red fox
24	Accidentally stepped on by a person walking on the Island
32	Exhaustion
37	Bit by a fiddler crab
40	Starvation
56	Starvation
59	Accidentally hit by lawn mower on Island
68	Eaten by egret
73	Eaten by a Herring gull
75	Eaten by a Herring gull
81	Cold stunned in late fall
86	Cold stunned in late fall
93	Cold stunned in late fall

Juvenile Stage. You are living in the marsh and growing during your first years of development. There are many obstacles and challenges ahead.

Hatchling #	Factors contributing to death
7	Made way to low marsh ditch and eaten by blue crab
11	Eaten by an Osprey
17	Didn't survive your first winter
18	Eaten by a red fox that came to the marsh during low tide
19	Caught in a commercial-style crab pot and drowned
21	Boat propeller cut you
25	Ventured to the next marsh and current took you.... exhaustion
29	Went off marsh to swim in shallow water – Striped Bass ate you
38	Exhaustion
41	Eaten by an Osprey
44	Eaten by a River Otter
52	Eaten by a River Otter
58	Crossed from one marsh into another, across the roadway & a car hit you
61	Eaten by red fox at marsh edge
72	Eaten by red fox at marsh edge
80	Caught in strong current and taken out to the ocean during outgoing tide
84	Caught in a commercial-style crab pot

85	Caught in commercial-style crab pot
89	Illegally taken by someone who saw you basking and sold you
96	Big storm tide in winter disrupted your hibernation and you died
99	Big storm tide in winter disrupted your hibernation and you died
100	Disease

Sub-adult Stage. You are living in the marsh creeks and water bodies in the estuary growing to adulthood.

Juvenile #	Factors contributing to death or removal from the system
2	Too curious... drowned in a commercial-style crab pot
3	Eaten by a red fox
10	Got too close to a motor boat and its propeller
12	Ended up in a market as a food source
31	Storm caused you to emerge during winter and you froze
39	Fought with a blue crab and lost
43	Small enough to be eaten by an Osprey
45	Too much time in a commercial-style crab pot
49	Disease
55	Disease
66	Got too close to motor boat and its propeller
67	Big storm disrupted your hibernation and you froze
78	Got too close to the high marsh and a red fox grabbed you
82	Drowned in a commercial-style crab pot
87	Drowned in a commercial-style crab pot
95	Caught under a pier and you couldn't get out
98	In commercial-style crab pot with numerous blue crabs – they won

Adult Stage. You almost made it to the adult stage. Congratulations! You are approximately 5 – 7 years old.

Adult #	Factors contributing to death
30	Made landfall at Island Beach and didn't make it across the roadway
48	Drowned in a commercial-style crab pot
91	Drowned in a commercial-style crab pot
94	Too close to a motor boat and you were hit by the propeller

Congratulations to Adults #27 and #63! You have made it. In actuality you haven't, because if you are nesting females, it will be approximately 7 years to nest.

Based on becoming a reproductive female adult.... #63 you tried to go into a commercial-style crab pot and couldn't access it because it had a "bycatch reduction device" (terrapin excluder) and #27 you crossed the roadway to nest at High Bar Harbor on Long Beach Island and were hit. Therefore, #63 – Congratulations!