Northern Diamondback Terrapin Hatchling Care and Biosafety Guide

Produced by the Marine Academy of Technology and Environmental Science

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Northern Diamondback Terrapin: Overview

Northern Diamondback Terrapins are an estuarine species that inhabit the northern part of the east coast, as far north as Cape Cod, Massachusetts, and as far south as Cape Hatteras, North Carolina (Egger, 2016). The predominant habitats of Northern Diamondback Terrapins are sheltered coastal locations with brackish water, such as bays, sounds, salt marshes, mangrove swamps, and estuaries (Brennessel, 2006). The colorful and varied patterns on their shells and bodies distinguish them from other species. Possession of terrapins is illegal in most states across their habitat range. Terrapins are designated as threatened and/or endangered species in Massachusetts and Rhode Island. In New Jersey, they are a candidate special concern species (DiLeo, 2015). The following guidelines are meant for sanctioned “head start programs” that rear hatchlings to improve their chance for survival in the wild. These guidelines are not intended to promote the non-sanctioned rearing of terrapin hatchlings for hobby or pet trade.

Nesting

From early May to early August, mature female terrapins lay their eggs on sandy beaches, and occasionally upland gravel areas, above the high tide line ("Northern Diamondback Terrapin," 2018). In the state of New Jersey, the eggs are laid in clutches of 4-20 eggs (Wnek, 2010).

Emergence

Approximately 60-90 days after the eggs are laid (in late summer), hatchlings will emerge from their nests (Conserve Wildlife). Occasionally, they will stay in the nest through winter, which is known as overwintering (Project Terrapin, 2018). Conservatively, one in 100 hatchlings survive to adulthood, with natural predation being one of the most prominent threats (Project Terrapin, 2018). At Island Beach State Park, Project Terrapin found a 98% nest predation rate (J. Wnek, personal communication, May 2018). Predators include mammals such as raccoons and birds such as gulls and egrets (Brennessel, 2006).

Northern Diamondback Terrapin Hatchling at three months old. This hatchling still has an egg tooth, which was used for breaking out of the shell during hatching.

Development

Male terrapins reach maturity in 3-5 years, growing 10-14 cm in length (Conserve Wildlife). Males are typically smaller than females and have thicker, longer tails. Females reach maturity after 6-9 years, growing 15-23 cm long (Conserve Wildlife). Females are typically larger than males and have thinner, shorter tails.

Comparison of mature male terrapin (left) to mature female terrapin (right). Mature females can grow up to 23 cm long while mature males can only grow up to 14 cm long.

Comparison of mature male terrapin (left) to mature female terrapin (right). A mature male has a thicker, longer tail, while a mature female has a thinner, shorter tail.

Why are Hatchlings Headstarted?

Decreased Population

In the late 1800s and early 1900s, terrapins were hunted extensively for their meat, which drastically depleted the population to near extinction in some areas across their range ("Diamondback Terrapin," 2018). Terrapins have lost natural nesting habitat to the development of coastal communities, which has caused reproduction rates to decrease significantly. Additionally, thousands of terrapins die every year by drowning in crab pots or being run over while crossing roadways in search of a nesting habitat (Wood & Herlands, 1997).

Mission Statement

Caring for newly hatched terrapins and monitoring their growth for several months before releasing them into the wild increases terrapin survival rate (Roosenburg, 2013). Terrapins are less vulnerable to predators when they are given extra time to grow before they are exposed to predation, increasing the chances of a terrapin surviving to adulthood. The long-term goals of head start programs are to help sustain terrapin populations in areas where there are high rates of hatchling predation, and to provide a sense of stewardship for students and classrooms, in order to promote natural resource conservation. Head start programs should be state-approved as per the state holding requirements for the possession and care of terrapins. Head start programs are not intended to produce monetary gain or support the pet trade.

Hatchlings Set-up Requirements

Recommended hatchling tank set-up. System includes heat lamp, UVB bulb, and basking area.

Basking Area

Hatchlings should be provided with a basking area to rest on in their tanks. A basking area can be a sloped area, a large rock, or a commercial basking platform. Hatchlings will use their basking area to warm up or to rest. There should be no crevices where hatchlings could get trapped and possibly drown.

Heat Source

Heat lamps with infrared heat bulbs must be provided in the hatchlings' tank. The heat lamp must be at least 75 watts, and must be placed at least 31 to 45 cm over the basking area (Project Terrapin, 2018). In addition to a heat lamp, a lamp with a UVB, or daytime, bulb must be in place. A submersible heater should be used if the water temperature drops below 20 degrees Celsius (70 degrees Fahrenheit) ("Hatchling Head Start Program," 2018). It is recommended that water temperatures be maintained at 22 degrees Celsius (76 degrees Fahrenheit).

Filtration

Hatchling tanks should use an appropriate filtration system that will not cause hatchlings to be entrapped in the filter intake. The use of a properly rated submerged filter is recommended (Project Terrapin, 2018). For example, a 20-gallon tank that is filled halfway with water should use a filter rated for 10-20 gallons. Proper filtration and movement of water, as well as filter maintenance, is important for a healthy system.

Salinity

Hatchlings should be transferred from a sandy environment into freshwater when their yolk sacs have dissolved completely. Newly emerged hatchlings have very soft shells and have been found to be stressed in brackish water, where the salinity is as low as 3 ppt (Muldoon, 2010). Salt water should be introduced after their shells become hard and after they are feeding regularly. The water's salinity can be increased gradually to reach 10-15 ppt and should be maintained at this level until the hatchling release date approaches. At this time (late winter or early spring), the salinity may be slightly adjusted to match the salinity levels of the release site. The salinity found to promote the growth of hatchlings is in the high single-digits, low double-digits, and no more than 12 parts per thousand. Moderate salinities from 7-12 parts per thousand are optimal (Rowe, 2018). Due to the fluctuation of terrapin growth rates, hatchling growth and response to feeding should dictate when salinity is to be increased.

System Maintenance

An example of a system with poor water quality conditions, indicated by discoloration and the presence of algae. Water changes should be done at least once a week, or more often if needed.

Water Changes

At least once a week, or as often as needed, the tank water should be changed. The water may become discolored, which could be caused by waste excretion or algal growth, and the tank should be cleaned immediately. Algal growth in the tanks may be enhanced by UV light. If algal growth becomes excessive, water should be changed more frequently, and lights should be adjusted. In addition to algal growth on the tank, hatchlings may also experience algal growth on shells. Proxy brushes or toothbrushes with soft bristles may be used to remove algae from hatchling shells and from any rocks or surfaces. Gently scrub the hatchling shell with a proxy brush and warm, clean water.

Feeding

Terrapins can be monitored for intake of food, and it is recommended that they be fed a consistent amount of food. For example, small hatchlings may eat approximately two protein pellets. Floating protein pellets are preferred. The brand used by Project Terrapin is Tetra's ReptoMin Floating Food Pellets Mini® and other recommended brands are ZooMed® and Wardley's®. After the hatchlings have become accustomed to eating the food pellets, brine cubes can be introduced as a food source, especially when trying to increase growth. Brine cubes can also be found at pet stores. Because brine cubes are kept frozen, they need to thaw before placement into the hatchling tanks. Place the brine cube into a small container of freshwater, similar to the temperature of the tank water. When the cube is finished thawing, the brine shrimp can be separated from one another by gently mixing or swirling the container. The brine can be poured directly into the hatchling tanks. If hatchlings grow large enough, whole shrimp or small fish may be introduced. The shrimp or fish, also kept frozen, must also be defrosted in a small container of freshwater. Once defrosted, the shrimp or fish should be cut up into small pieces. It is advisable to feed the terrapins in a separate container so that it reduces competition in their holding tank, and the hatchlings do not equate their holding tank with feeding.

Hatchling Care

Signs of Stress

Any noted abnormal behavior may serve as a sign of stress. Common signs of stress include blotches on the shell, spots of fungus, shell softening, and tail pieces missing. If a hatchling has spots of fungus or a soft shell, it may indicate that they are swimming too often and do not bask (Herlands et al., 2004). Stress is often caused by over-aggressive terrapins. Over-aggressive terrapins may nip the tails of other hatchlings or cause atypical patterns in other terrapins. Atypical patterns may include running from other terrapins, basking or swimming too often, or not entering the water when fed. If this is the case, determine which terrapin is aggressive and isolate it. Contact the provider of the terrapins, and in extreme cases the over-aggressive terrapin should be returned or raised in isolation.

Calcium Supplements

Be sure to include a varied diet with ample calcium. Protein enhancement in food pellets usually contain calcium as a supplement for hatchlings. Additionally, the introduction of cuttlebones may reduce the occurrence of terrapins biting each other and provide an additional calcium source (Robin Scott, personal communication, October 2011).

Hatchling Measurements

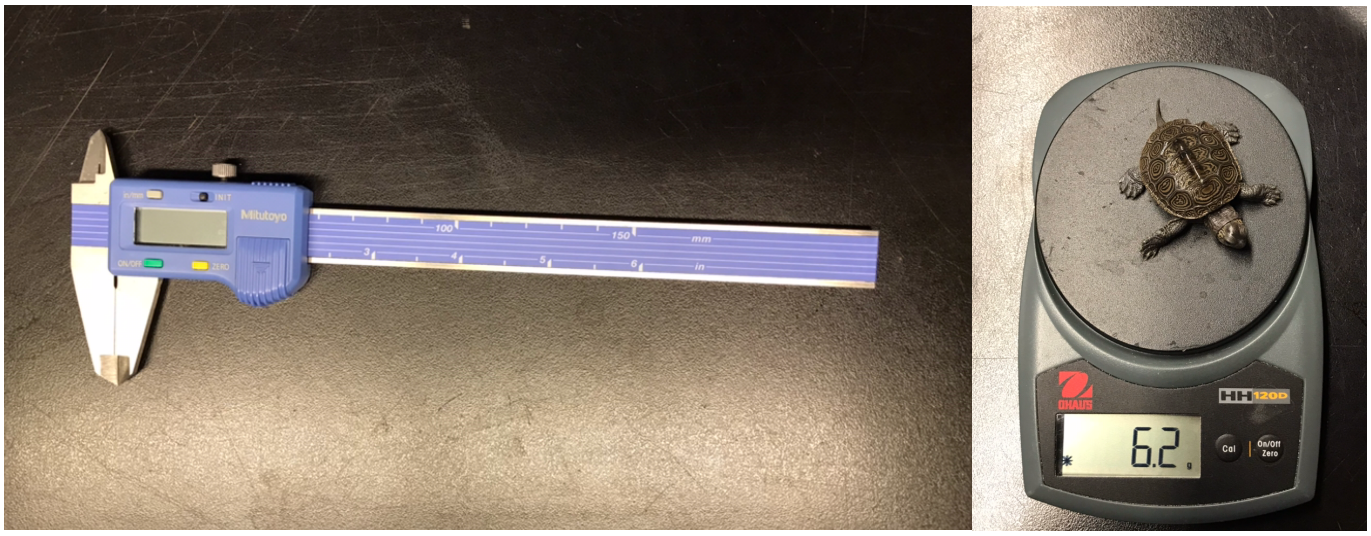
Hatchlings can be marked using a small spot of non-toxic nail polish. This can be useful in tracking the individual growth of each hatchling.

Marking Hatchlings

In order to differentiate between hatchlings, the carapace of each hatchling can be marked with a different color of non-toxic nail polish. A small spot of polish is sufficient. Individually marking each hatchling helps to provide identification to monitor their growth. Hatchlings should be notched or tagged prior to release, but only by trained, state-sanctioned researchers.

Measuring Growth

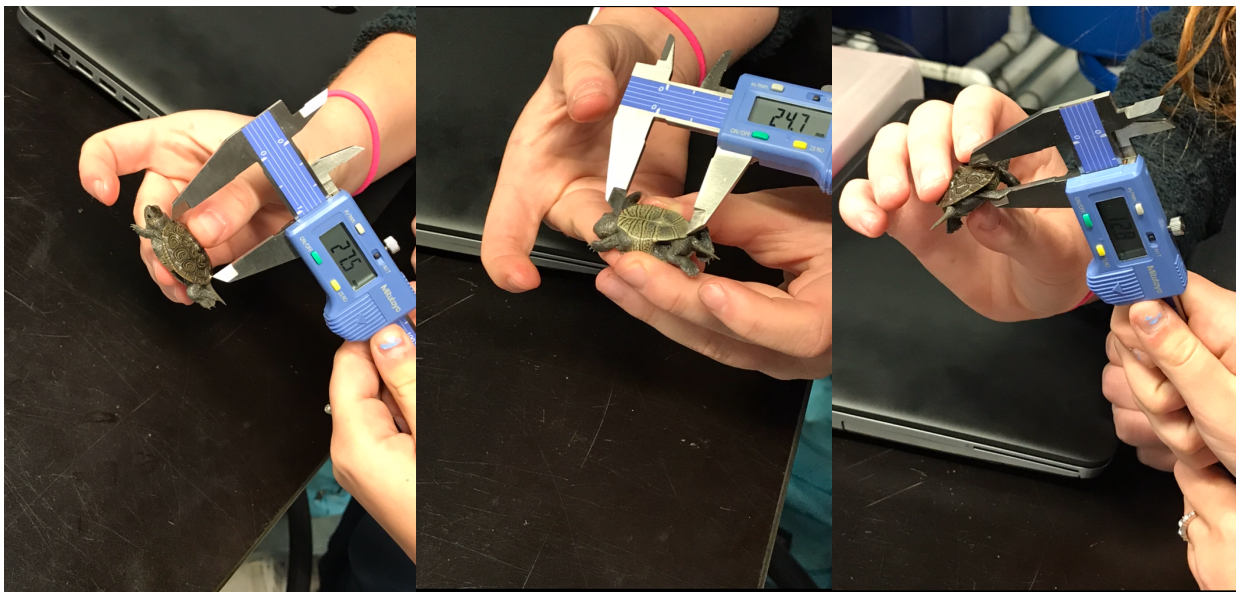
Monthly measurements are recommended for each hatchling in order to properly assess the growth of the terrapins. In order to measure the hatchlings, a small (15cm) digital, plastic caliper is appropriate for measuring carapace length and width, plastron length, and shell height. However, the use of a transparent millimeter-scale ruler will work as well. For weight, a balance with 0.1 gram accuracy is recommended to determine the mass of each hatchling.



A small, digital, plastic caliper (left) should be used to measure the hatchlings. Be sure to “zero” out the caliper before measuring a hatchling. A balance with 0.1 gram accuracy (right) should be used to determine the mass of the hatchlings. Be sure to “zero” out the balance to receive an accurate mass

Measuring Growth continued...

When handling hatchlings, be sure to follow the safety guidelines listed below. To measure the length, width, or height of a hatchling with the caliper, the device must first be “zeroed” out to ensure the measurements are accurate. If using a caliper, the two edges of the caliper are slid apart and then gently pushed together until they are touching both ends of the part of the shell that is being measured. Record the number displayed on the screen in the corresponding space on the measurement sheet. Calipers should be used with care in order to avoid hurting the hatchling’s shell, such as by tightening the ends too much. If the terrapins are kept separately, wipe the caliper with a disinfectant between measurements. Be careful not to use alcohol on the face of a digital caliper as it could alter the readout feature.



Using a digital caliper, the carapace length (left), plastron length (center), and shell height (right) are measured.

Measuring Growth continued...

To record the mass of a hatchling using a balance, the scale should be zeroed and excess sand or water that may be present on the hatchling should be removed before massing the terrapin. If the balance cannot determine the terrapin's mass due to the hatchling's continuous movement, try to calm the terrapin by gently holding it in place. An empty plastic container may also be used to measure active hatchlings. Place the plastic container on the scale, zero the scale, then place the terrapin in the container to get an accurate weight.

Biosafety and Handling

Decontamination and Sanitation

Hatchlings that are intended to be released should not be kept in the same room as other animals that will be kept permanently. By sharing the same air space as other animals, headstarted hatchlings have a greater risk of contracting and transmitting diseases. Similarly, hatchlings should not be kept in the same room as other turtle species or populations to further reduce the risk of disease transmission.

It is important to use only the materials, habitat, and tools assigned when caring for hatchlings. To sterilize measuring tools such as the calipers and balances, a 10% bleach solution should be used followed by adequate rinsing after treatment. Before switching between separate groups of hatchlings, measuring tools should be sanitized with isopropyl alcohol spray or wipes. Hatchling tanks should be cleaned and sanitized as needed. The frequency of cleaning and sanitizing will depend on the amount of hatchlings per enclosure. After cleaning any tanks or placing hatchlings on surfaces, the area must be cleaned and sanitized to prevent the spread of disease. Hands must be washed before touching any measuring tools or equipment in storage. Furthermore, measuring tools and equipment must also be sanitized before returning to storage (National Resource Management, 2014).

All items including basking areas and the filtration system should be decontaminated by soaking them in bleach.

Before Handling the Terrapin

Before handling any terrapin, the handler must thoroughly wash his/her hands with soap and warm water. This prevents the spread of diseases from human to terrapin; hatchlings and wild terrapins have a lower chance of transmitting diseases, but they can still catch certain diseases from humans (Centers for Disease, 2018). Do not use hand sanitizer prior to handling hatchlings as it can compromise the health of a hatchling. Sanitizer is acceptable to use if it is the only option after handling terrapins, but never before. The area where the terrapin will be handled should be cleaned in order to prevent the spread of disease to the terrapin (U.S. Food and Drug, 2016). Too much handling may cause stress; therefore, terrapins should not be handled in excess.

Always wash hands with warm, soapy water before handling a terrapin. This helps to prevent the spread of diseases from human to terrapin.

Do not use hand sanitizer before handling hatchlings as it can compromise the health of the hatchling. Hand sanitizer should only be used as a last resort after handling a terrapin.

While Handling the Terrapin

While handling the terrapin, it should be held firmly but gently from the side of the shell, right-side-up. Dropping a terrapin may cause trauma; therefore, terrapins should always be handled close to a surface. Handling terrapins during sick seasons (i.e. flu season) is less desirable due to a high risk of passing the sickness on to the terrapins (Centers for Disease, 2018).

Always hold a terrapin from the sides of the shell with a firm but gentle grip. Be sure to keep the terrapin right-side-up and handle the terrapin close to a surface at all times.

After Handling the Terrapin

Thoroughly wash hands with soap and warm water after handling the terrapins. Terrapins are able to carry microorganisms, such as Salmonella sp., which can cause serious infections in humans (U.S. Food and Drug, 2016). Hand sanitizer should be used as a last resort when cleaning hands.

Accountability

All schools that are placed in charge of hatchlings take on the responsibility of taking care of the terrapins and are therefore accountable for terrapins provided by the agency. There will be a designated person who will act as the supervisor for the program representing the school, organization, or group raising the hatchlings. It is not recommended that students are given hatchlings to take care of over weekends or breaks. However, in the case that students take terrapins home, provide a take-home accountability contract. If terrapins die or are stolen, contact the school supervisor immediately, who will then contact the agency or group sponsoring the program. It is recommended that all terrapin providers require each school to return all terrapins (even those that died) to verify that all terrapins are accounted for. This will deter any individual that promotes black market sales or theft of terrapins, which is not acceptable.

Schools are accountable for the terrapin hatchlings provided to them.

Case Studies

Rumson-Fair Haven Regional High School

For the past ten years, Project Terrapin has been an essential part of my educational instruction, resulting in students and I raising and releasing over one hundred Diamondback Terrapins. These terrapins have been used in a wide variety of instructional methods, with many diverse learners, both in and out of my classroom. Some of the lessons I have focused on include ecological issues, such as water quality and sustainability, general biology, and herpetology. However, the scope of the lesson can be quite broad. For example, involving students with multiple disabilities, I focused more on on measurement and animal care and students from advance courses focus on water quality and terrapin anatomy and physiology. This year we were able to expand the lessons involving terrapins to outside the science classroom, using them in art classes and foreign language classes to bring environmental awareness to the community. However, the overarching focus, no matter the class or audience, has consistently been the importance of the species.

As the hatchlings grow and develop, the care that I offer changes as well, although there are some things that remain constant. The terrapins are always supplied with a UVB bulb, a non-light emitting heat source such as a ceramic bulb, a large area for them to come out of the water, and a healthy diverse food source, that I discuss more in depth below.

As the terrapins age, their living environment also progresses. When the terrapins are a few weeks old, they are kept in a five or ten gallon tank, depending upon the amount of terrapins, with a screen lid for adequate ventilation. The amount of water in the tank is kept to a level where the terrapins can swim but can easily rest on their back legs and have their heads out of water. I also keep one side filled with a slope of aquarium gravel or sand so that the terrapins can come completely out of the water and rest. On the side of the tank that has the “land area”

Rumson-Fair Haven Regional High School

I use a non-light emitting heat bulb that is on at all times to supply a constant basking/resting area. On the water side, I use a UVB tropical bulb that is on a timer to turn on for eleven to twelve hours a day. The water that I use is left out for twenty four hours or has a dechlorinator added before it is changed. My students and I perform water changes daily or every other day. When the terrapins are a month old, the water level will be raised to where they cannot touch the bottom on the water side. Once the terrapins reach two months old, the same setup is kept but they are moved to a forty gallon breeder tank. In addition, at this stage, I add a water circulator in order to acclimate the terrapins to swimming in a current. At four months old, I raise the water level again and insert a floating platform in addition to a land area. After five months, the land area is removed and only floating docks are used.

The terrapins' diet is another element that evolves as they grow. The hatchlings are offered ZooMed hatchling formula 2-3 times a day. I use this as a preferred starting food source and continually as one of the meals offered throughout their care. After about two months, I start to offer different foods such as shrimp, scallops, tilapia, or killifish for one of the meals. To ensure they are eating on the weekends and the feeding schedule is maintained, the terrapins must be taken home by either a student or myself. At the two month point, the salinity is raised to 2-5ppt. Every month until the hatchlings are released, I raise the salinity by 2-5ppt until 20-25ppt is reached. However, every 2-3 days the terrapins are placed in freshwater so that when they are released they are adjusted to moving between different salinity levels.

This is a remarkable program and an important educational tool to any level of student. The terrapins create excitement for the learners and unique lessons for the staff that utilize them. Yearly, I am privileged to work with the MATES school and Dr. Wnek with project terrapin and creating unique lessons for my students.

— Michael Haughwout

Rumson-Fair Haven Regional High School

Michael Haughwout of Rumson-Fair Haven Regional High School with head-started hatchlings. Haughwout has used Project Terrapin as an educational resource for the past ten years and has successfully raised and released over one hundred hatchlings.

Case Studies

Pinelands Middle School

Project Terrapin is a wonderful hands-on experience to bring the environment into the classroom. The students learn how to take on responsibility not only in the classroom while caring for the terrapins, but also how to be a responsible citizen to our ecosystem, by living eco-friendly. Student have learned about topics across the curriculum including the testing of salinity for chemistry, the ecology of the Barnegat Bay, and the anatomy and physiology of the terrapins, the statistics of the clutch sizes and population growth, measuring the size of the shells, and even the origin of their name, terrapin. By bringing this unit of lessons together in a closing event, students are able to return their terrapins to the Bay and live out the lives in their habitat they have learned to understand so well. Taking the classroom to the outdoors brings the project full circle as the students are able to apply all they have learned to their experience on the last day with the class' terrapins.

— Amanda Traina

References

Brennessel, B. (2006). The Northern Diamondback Terrapin Habitat, Management and Conservation[Pamphlet]. Norton, MA: Wheaton College. http://www.dtwg.org/Bibliography/Gray/Brennessel%202007.pdf

Centers for Disease Control and Prevention. (2018). Healthy Pets Healthy People. Retrieved from https://www.cdc.gov/healthypets/pets/reptiles/turtles.html

Conserve Wildlife. (n.d.). New Jersey Endangered and Threatened Species Field Guide. Retrieved from http://www.conservewildlifenj.org/species/fieldguide/view/Malaclemys terrapin terrapin

DiLeo, K. (2015). Species Status Review of Amphibian and Reptiles. Retrieved from https://www.nj.gov/dep/fgw/ensp/pdf/herp_status_rprt.pdf

Egger, S. (2016). The Northern Diamondback Terrapin (Malaclemys terrapin terrapin) in the Northeast United States: A Regional Conservation Strategy. Retrieved from https://rcngrants.org

Herlands, R., Wood, R., Pritchard, J., Clapp, H., & Furge, N. L. (2004). Diamondback Terrapin (Malaclemys terrapin) Head-Starting Project in Southern New Jersey. Retrieved from https://wetlandsinstitute.org/wpcontent/uploads/2012/12/herlands_et_al_2004.pdf

Muldoon, K. A. (2010). Post-emergence Movement and Overwintering Strategies of Diamondback Terrapin (Malaclemys terrapin) Hatchlings (Master's Thesis). http://www.dtwg.org/Bibliography/Theses/Muldoon%202010.pdf

Project Terrapin. (2018). Diamondback Terrapin Educational Resources. Retrieved from https://www.projectterrapin.org/resources-

References

Roosenburg, W. (2013) Diamondback Terrapin Working Group Meeting, South Carolina.

Rowe, C. L. (2018). Maximum standard metabolic rate corresponds with the salinity of maximum growth in hatchlings of the estuarine northern diamondback terrapin (Malaclemys terrapin terrapin): Implications for habitat conservation. Acta Oecologica, 86, 79-83. doi:10.1016/j.actao.2017.12.005

U.S. Food and Drug Administration. (2016). Pet Turtles: Cute But Commonly Contaminated with Salmonella. Retrieved from https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm048151.htm

Wetlands Institute. (n.d.). Diamondback Terrapins. Retrieved from https://wetlandsinstitute.org/research/diamondback-terrapins/

Wood, R. C., & Herlands, R. (1997). Turtles and Tires: The Impact of Roadkills on Northern Diamondback Terrapin, Malaclemys terrapin terrapin, Populations on the Cape May Peninsula, Southern New Jersey, USA. Proceedings: Conservation, Restoration, and Management of Turtles and Tortoises–An International Conference, 46-53 http://www.dtwg.org/Bibliography/Publications/wood%20