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Diamondback terrapin (*Malaclemys terrapin terrapin*) research and conservation project on the Atlantic coast of Southern New Jersey, USA

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Of the roughly 300 known species of living turtles in the world, diamondback terrapins are the only ones exclusively adapted to life in the brackish (= variably salty) waters of coastal salt marshes. Terrapins have a very odd geographic distribution, extending along the Atlantic coast of the United States from the northern tip of Cape Cod down to the southernmost tip of Florida (= Key West National Wildlife Refuge) and then around the Gulf coast to somewhere near the Texas/Mexico border. This linear range is several thousand miles long but never more than a few miles wide, and extends from the north temperate zone of North America (where terrapins hibernate during the winter) down to the subtropics (where they aestivate, or become inactive, in the summer). This makes them one of the only animals in the world that hibernate in one part of their range and aestivate in another part of it.

Terrapins play an important ecological role in salt marsh ecosystems. Terrapin eggs, hatchlings, and juveniles are heavily preyed upon by a wide range of predators including foxes, raccoons, skunks, crows, gulls, bald eagles, crabs and large fish. The relatively few terrapins that survive to adulthood, however, are at the top of the salt marsh food web and may help keep populations of other animals, such as marsh grass-grazing snails, from growing destructively large.

The Atlantic coast of southern New Jersey is characterized by coastal barrier beach islands that lie between the Atlantic Ocean and the *Spartina*-dominated salt marshes in which development of coastal barrier beach islands, terrapins nested on barrier island sand dunes. However, most of this natural habitat has been leveled to create nearly continuous resort communities along the Jersey shore. Consequently,

female terrapins have had to find a suitable alternative location to lay their eggs. Today, sadly, most of the readily available nesting sites for terrapins in southern New Jersey are the shoulders of heavily trafficked roads crossing and adjacent to salt marshes. To make matters worse, terrapin nesting season (late May through mid-July) coincides with New Jersey's peak tourist season. The result is that an appalling number of nesting females are killed by motor vehicles each year.

Nearly all terrapin roadkills are adult females looking for a place above the high tide line to dig a nest and lay their eggs. Female terrapins can continue to reproduce over a span of three to four decades. When a motor vehicle runs over and artificially removes an adult female terrapin from the population, it takes a long time to replace her. The inevitable consequence is that the mounting numbers of adult female terrapins killed by vehicular traffic are contributing to a decline in the size of the overall terrapin population.

During terrapin nesting season, scientists, student researchers, and volunteers of The Wetlands Institute (www.wetlandsinstitute.org) monitor a 38-mile transect of salt marsh road. Since terrapins nest with equal enthusiasm both during the day and night, road patrols occur around the clock to help nesting female terrapins cross roads safely. Injured terrapins are brought back to the lab for rehabilitation. If the injuries sustained are severe, terrapins are taken to a local veterinarian for medical attention.

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Dead female terrapins struck by motor vehicles are also taken back to the lab so that any potentially viable eggs can be retrieved from the female's carcass in a procedure called an "eggectomy." These eggs are placed in containers bedded with vermiculite and incubated at The Wetlands Institute and Richard Stockton College of New Jersey. After seven to eight weeks, tiny hatchlings emerge from many of these "orphan" eggs.

Over the past twenty two nesting seasons, an average of 500 nesting female terrapins per year were killed on the salt marsh roads of our 38-mile transect. During the 2011 terrapin nesting season, we recorded 482 female terrapin roadkills. We removed 1065 outwardly undamaged and potentially viable eggs from those roadkills. Of the 1065 rescued eggs, 516 successfully hatched, which is remarkable considering that the eggs had endured the impact of being hit by a moving vehicle (average female terrapin straight-line plastron length = 15.4 cm).

Like most other turtles, terrapins are characterized by temperature-dependant sex determination (= TSD), which means eggs will develop into male or female hatchlings depending on the temperature at which the egg develop. We incubate all rescued eggs at temperatures that will yield female hatchlings in an effort to, at least partially, replace the female terrapins that are killed on roads.

Newborn hatchling terrapins are held in captivity for approximately ten months. The hatchlings typically will grow from 2.5 cm to a length of approximately 8 cm. This process is called "head-starting." The 8 cm long hatchlings are about the size of a three or four-year-old wild terrapin. At this size, the head-starters are relatively predator-proof and will have a better chance of surviving than if they were released into the salt marsh as soon as they hatch. Head-started terrapins are usually released by school children and members of the general public which often generates media publicity and helps us spread awareness about terrapin conservation.

Another way scientists at The Wetlands Institute mitigate the terrapin roadkill problem, is to install terrapin barrier fences. Preliminary experiments demonstrated that roadside fencing might be an effective means of preventing nest-seeking female terrapins from wandering onto the heavily-trafficked summertime roads.

Ongoing research suggests that terrapin barrier fences significantly reduce the number of terrapin road kills (up to 85% reduction in some road mortality hot-spots). Their widespread use in appropriate places can save hundreds of terrapin lives every nesting season. Furthermore, terrapin-free roads are much safer for people to drive on. The amount of unexpected braking and sudden swerving to avoid hitting terrapins in the road is greatly reduced. Collaboration between volunteers, governmental agencies, local businesses, and the Wetlands Institute has resulted in over eight miles of terrapin barrier fences being installed since 2005. The role the Wetlands Institute plays is to encourage concerned citizens, as well as private and public agencies, to become involved. Our commitment is to help individuals and organizations with technical advice, access to our long-term road kill data, and even fence building materials in some cases. We continue to investigate new designs for cost-effective terrapin barrier fences and share this information with interested parties.

For more information about our programs, visit our websites www.wetlandsinstitute.org and www.terrapinconservation.org. In addition, the Diamondback Terrapin Working Group (www.dtwg.org) is an organization whose members include scientists, staff at federal and state conservation agencies, and private citizens all concerned with protection of terrapins throughout their entire range.