

# A Natural History of the Diamondback Terrapin

by BOB COOK

It was mid-afternoon as a friend and I worked our way around the West Pond of Jamaica Bay Wildlife Refuge. Birding was typically slow for late June. The northbound warbler waves and shorebirds had already passed through, and things were beginning to settle down to just the summer residents — breeding birds and biting insects. Passing through a section of trail bounded high on each side by thickets of bayberry, we came to a more open habitat and encountered a small group of visitors standing quietly at the trail's edge and attentively staring at the ground nearby.

A diamondback terrapin was in the process of nesting. She had already laid her eggs and was in the last stages of covering the nest, pulling forward large scoops of sand with her powerful, webbed hind feet. The sand was placed into the nest hole and packed down with her feet. This process was repeated until the original grade of the flat, sandy spot had been restored. When finished she walked off towards the salt marsh. All that remained as sign of the nest was a small disturbed area five inches in diameter. It was tough enough to pick out then, and in a few days the spot would be indiscernable.

Such encounters with diamondback terrapin (*Malaclemys terrapin*) have become more common in recent years, at least in the northeast. The terrapin, a turtle of the coast, inhabits salt marshes and mangrove swamps from Cape Cod south to the

Florida Keys, and up along the Gulf coast to south Texas. There are seven subspecies of terrapin, a fact not altogether surprising when one considers its distribution, a narrow line running along a north-south climatic gradient over 1300 miles long. The subspecies most familiar to me is the northern diamondback terrapin (subspecies *terrapin*), which ranges from Cape Cod to Cape Hatteras.

The "return" of the diamondback terrapin has occurred slowly, after a period of intense exploitation led to its decline and commercial extinction. Highly esteemed for its flavor, in the late 1900's the terrapin was considered an essential of any champagne dinner, and large scale harvest began. In Maryland in 1891 more than 89,000 pounds were sold at 25 cents per pound. As the harvest continued, the population fell, as did subsequent harvests. True to laws of supply and demand the price rose, particularly since high-living gourmets were willing to pay top dollar. By 1920 the price in Maryland was up to \$1.22, but the population had declined to the point that only 823 pounds were harvested. The irony of this fashionable period in the terrapin's history is that in earlier times it was so abundant that eighteenth century tidewater slaves once struck for relief from a diet too heavy in terrapin.

The decline of wild terrapins was foreseen by some, and in 1902 the U.S. Bureau of Fisheries and the State of North Carolina began experiments in the "farming" of terrapins as a way of producing marketable turtles and restoring wild populations. Most of this took place in Beaufort, North Carolina, and involved a hybrid of two subspecies, *terrapin*, the Chesapeake, now northern diamondback

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defined down south, these events tend to be spread out over a greater period of time than for northern populations.

At Merritt Island, Florida, the Florida east coast terrapin (*requesta*) becomes active by mid-February and mates from late March to late April. In Jamaica Bay, terrapins first become apparent in mid-May. With experience (about five minutes) you can easily spot their heads bobbing above the water's surface on warm, calm days at high tide. Binoculars help. On one 400 yard stretch of shore I once counted 160 heads in late May; presumably the turtles were basking in the afternoon sun. Female heads are larger than male.

The diamondback terrapin is a striking example of sexual dimorphism. Adult females grow to nine inches in carapace length, while six inches is very large for a male. This undoubtedly hastened diamondback decline years ago, since the harvest focused on females.

In New York, if you look closely in late May - early June, you can observe terrapins mating. The male approaches a female floating at the surface from behind and nudges her cloacal region with his snout. If she remains still, the male mounts and copulation occurs immediately while both float at the surface. The male (identified by his small head) can be seen close behind and above the larger female. All this takes place quickly, the approach phase lasting 30 to 60 seconds and copulation only one to two minutes. This explains why one has to look long and hard to actually catch them in the act. How many times and with how many males a female mates is not well known. In all probability some mate a number of times, though on the other hand, females can store sperm and lay fertile eggs a couple of years after mating.

Early accounts of mating in *centralis* claimed it occurred at night whereas my observations indicate late morning and afternoon. Much of terrapin activity is determined by temperature, and it is interesting that mating of *requesta* at Merritt Island was observed in water only

above 76 degrees F. In Jamaica Bay, the northern diamondbacks are mating in water temperatures in the mid-60's. Typical of widely distributed species of poikilotherms (cold blooded animals), northern populations not only begin their annual activities later in the season than their southern counterparts, but are also able to function at lower temperatures. Otherwise it would never become warm enough for a long enough period of time to complete an annual cycle.

The nesting season follows mating. This is when most of us encounter terrapins, since they are up on land. Actually it's just the females; I have never encountered a male on dry land nor have I read of anyone else doing so. This is the most extensively studied aspect of terrapin biology.

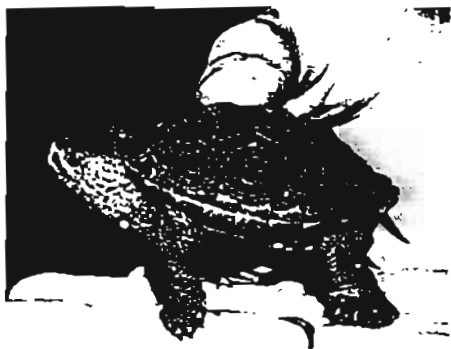
At Merritt Island, most nesting occurs during May and June. At Brigantine, New Jersey, in the most thoroughly studied terrapin population I know of, nesting of *terrapin* occurs from the second week of June into the third week of July. We see pretty much the same in Jamaica Bay *terrapin*, though we have some records for the first week of June.

Since these activities are temperature dependent, there is much year-to-year variation within a population in both timing and length of the nesting season. On top of this is variation between populations and subspecies due to climate and resultant differences in life history strategies. In general theory, temperate species lay large clutches of small eggs in well defined seasons whereas tropical species lay small clutches of large eggs continuously, rather than in a well defined season.

The diamondback terrapin exhibits a north-south gradient in these population characteristics. For instance, while the *requesta* at Merritt Island have a defined nesting season averaging 55 days, the *terrapin* of Brigantine have an average nesting season of 38 days, and the Jamaica Bay season averages 34 days. The farther north, the more things are compressed

nesting and hatching. I've concluded that Jamaica Bay *terrapin* lay only a single clutch. This seems corroborated by clutch size, averaging 14.5 eggs and ranging from 11 to 18. These are the largest clutch sizes I'm aware of, but it wouldn't be surprising to find that clutch sizes average higher on Cape Cod.

By all accounts, large females lay large clutches. Honors for egg production go to the terrapin farm hybrids. Some laid five clutches per year, producing an annual average of 35 eggs. With all that food and no chance to burn it off, their energy goes into egg production. It's unlikely this occurs in wild populations.



*Juvenile terrapin.*

For most turtles, incubation and hatching are vulnerable periods. Eggs that survive flooding and wind-erosion still have to escape predators, such as the fox, raccoon, gulls, and crows observed in the Brigantine study. Predator destruction accounted for half the eggs laid one year and nearly three-quarters the next. However, this may be extreme. The Merritt Island population, which seems to lead in the bizarre department, apparently experiences little predation on eggs, but has raccoons with a taste for adult females. In 1980 at least 10 percent of them were killed by raccoons in two nesting seasons. This seems to be a recent phenomenon resulting from a human-induced increase in raccoons. Such mortality at this life

stage is unusual for turtles, and it's unlikely that populations can sustain such losses without a major decline.

Jamaica Bay has seen some human alterations favor terrapins. Most nest on dredge spoil deposited earlier this century, usually on islands. Urbanization in New York City is so intense that fox are gone, and the raccoons present in the City's large, natural parks are unable to colonize the human-created uplands of Jamaica Bay. With the major predators extirpated, hatching success is high, 93 percent based on eight nests we've followed.

Eggs that survive predation hatch after incubation periods averaging 66 days at Merritt Island, 76 days at Brigantine, and 81 days in Jamaica Bay. This is all temperature dependent, and differences in nest depth and microclimate result in tremendous variation. I suspect that clutches laid at either end of the season take longer to hatch than those laid in the middle, but this would require a large sample size and heavy-duty statistics to filter out the effects of all the other factors.

In New Jersey, complete hatching takes up to four days (average two) and top eggs hatch first. Unlike sea turtles, emergence of terrapin hatchlings is not simultaneous, and some take up to nine days (average 2.5) to leave the nest. Temperature is the main determinant, and nearly all emergence takes place during the day. Here is another vulnerable period. Raccoons ate 25 percent of the Brigantine hatchlings before they emerged. Those that do emerge are preyed on by gulls and night herons, so the usual behavior (determined by tracks) is to head for cover and hide. Burger's scarcity of daytime observations implies that they wait until night to complete the trip to water.

The hatchling *terrapin* of Jamaica Bay emerge in late summer - early fall or next spring. We see recent hatchlings (identified by the egg tooth) from September to mid-November. They're found in the daytime, usually on a trail. Since I haven't looked at night, I don't know if the daytimers are running for cover or really

between salt marsh and nesting dunes, forcing gravid females to cross the road. On Long Island, New York, peak nesting season coincides with heavy beach traffic (including July 4th), and many turtles never make it. On one stretch of road, several miles long, 100-200 females are run over every year; estimates are that 1000 are killed yearly in New Jersey.

Crab pots also catch terrapins. Drownings are widespread. In one case, even with daily pot checks, 10 percent of the trapped terrapins drowned. During April and May of 1982, 17,385 terrapins drowned in the traps of 743 South Carolina crabbers. The commercial demand for terrapins may also be on the rise, prompting crabbers and fishermen to keep animals they once released. In New York City, an estimated 10,000 terrapins a year, mostly from the Carolinas and Delmarva, are sold in the market.

Data on terrapin sales, harvest, and population estimates are scarce, so it is difficult to make a long-term prognosis

for the species. Certainly, concern for the terrapin is mounting. Four states now completely protect them, while others manage the terrapin fishery with size limits and seasons. Some have no restrictions. New York State recently held hearings on the diamondback terrapin and is considering upgrading it from unprotected to game status which would tend to limit the harvest and sale.

The diamondback terrapin survived the first great assault on its numbers largely because its habitat remained intact. Unfortunately this is no longer the case and, with continued habitat loss and human-induced mortality, it is unlikely they can sustain another period of commercial exploitation. Every state needs to assess its terrapin status and determine if adequate measures exist for ensuring their survival into the 21st century. It is only with premeditated protection that terrapins will continue to be a part of the estuarine ecosystem and be around to cross our path on those early summer afternoons.

## Federal Concerns For Sea Turtles

by ANTHONY L. PACHECO

It is comforting to know that government authority extends to sea turtles through the Endangered Species Act of 1973. The first Endangered Species Act, passed in 1969, specified prohibitions on the importation of species listed as endangered. As amended, this federal law now makes it a violation to "harass, harm, pursue, hunt, shoot, wound, kill, capture, or collect endangered species." Additionally, the law "provides for acquisition and protection of turtle nesting habitat, establishment of marine sanctuaries for turtle protection and funding of

sea turtle research and protection through grant-in-aid to the states." At the moment hawksbill, leatherback, and Kemp's ridley are listed as endangered, the green turtle is listed as endangered in Florida and threatened throughout the rest of its range, and the loggerhead is listed as threatened.

Sea turtle research and management in the southeastern U.S. is carried on principally by NOAA's National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service, networking with the fishing industry, states, academia, and other federal agencies. Research and management activities have been re-directed to meet congressional mandates which reflect needs for information on sea turtles. Managers need to know causes of death, both natural and man-induced,

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