

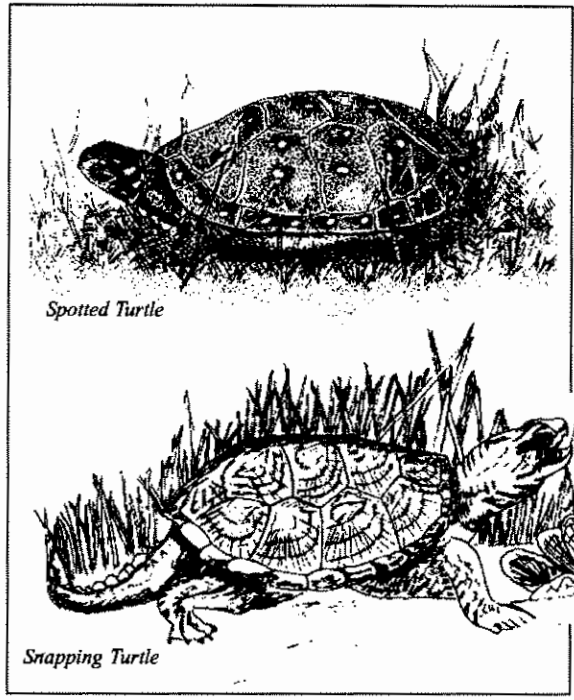
MARSH 7 TURTLES

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ABSTRACT

There is a variety of wetland habitat suitable for marsh turtles in the Delaware Estuary. Among the dozens of species of turtles identified in the region (Roddy 1928, Conant 1951, Conant and Collins 1991), this chapter will highlight only four that are representative of different habitat types: the

common snapping turtle (*Chelydra serpentina*), eastern mud turtle (*Kinosternon subrubrum subrubrum*), spotted turtle (*Clemmys guttata*), and red-bellied turtle (*Pseudemys rubriventris*). The common snapping turtle, the largest species in the estuary, is found in ponds with muddy bottoms, or streams with overhanging banks. The eastern mud turtle is semi-aquatic, tolerates brackish water, and often wanders far from water. Spotted turtles are also semi-aquatic, traveling overland between wetlands, which can be bogs, slow-moving streams, marshes, hardwood swamps, drainage ditches, or vegetated ponds. Red-bellied turtles are a deep-water species, seeking rivers, marshes, ponds, and axbows as habitat. They also frequent brackish water at the mouths of rivers. Turtles are scavengers of carrion, and their eggs and young are prey for many estuarine species. Degradation of habitat, over-collecting for the pet market, and man-made hazardous conditions all contribute to the observed decline of turtle populations. Retention of permanent lakes or ponds, as well as marshy, slow-moving stream corridors and small vernal or temporary ponds that remain flooded on a seasonal basis will provide the food and other resources required by the various turtle species.



Spotted Turtle

Snapping Turtle

INTRODUCTION

Turtles (Chelonians) are reptiles that have evolved with characteristics similar to those of the creatures that were on Earth with the dinosaurs. Unlike most of the reptilian life forms at the end of the Mesozoic era, their characteristics persisted and present-day turtles are essentially the same creatures they were then.

Although the Delaware Estuary lies within the close vicinity of heavily populated areas, there are open grassy marshes, hardwood swamp floodplain forests, and tidal bays and inlets that provide a rich array of wetland habitats for marsh turtles. In fact, turtles are closely associated with the various habitat types in the estuary ecosystem.

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Of the four reptilian orders known to exist on Earth today, turtles are by far the most popular. Some are kept as pets, some are trapped or hunted for human consumption, while others are important as scavengers and carrion eaters on the marsh floor. All turtles play an important role in the food chain of the Delaware Estuary's ecosystem. They are top predators within their habitat niche, and in turn are preyed upon by large fish, birds, and mammals (Ernst and Barbour 1972).

GEOGRAPHIC RANGE

Although the Delaware Estuary lies within the close vicinity of such densely populated cities as Trenton, New Jersey; Philadelphia, Pennsylvania; and Newark, Delaware, many vast and unpolluted natural marshlands remain. Open grassy marshes, hardwood swamp floodplain forests, and tidal bays and inlets provide a rich array of habitats for plants and wildlife in general, and turtles in particular (Delaware, New Jersey, and Pennsylvania Natural Heritage Programs 1994).

The snapping turtle occurs in southern Canada to the Gulf of Mexico. In the East, they are found along the Atlantic Coast and west to the Rocky Mountains. There also is a Florida subspecies (Conant and Collins 1991). In the estuary, snapping turtles are widespread and occur in deep water marshes, especially in more remote, vegetated areas; they may sometimes enter brackish water. They are also present in streams and any type of permanent impoundment such as lakes.

The eastern mud turtle has a rather wide range in the eastern United States from southwestern Connecticut, Long Island, and Staten Island to the Gulf Coast of Florida; it also ranges into Kentucky, southern Indiana, and Illinois (Conant and

Collins 1991). This species occurs along the coastal plain in Delaware in all three counties (Arndt 1993). In New Jersey it is more common in the southern areas of the coastal Pine Barrens and tidal marshes, especially in Atlantic, Cape May, and Cumberland Counties (Zappalorti 1976). Mud turtles are known from marshy areas along the Maurice River and its tributaries, especially around Mauricetown, Dorchester, Heislerville, Dividing Creek, Hansey Creek, Turkey Point Road, Fortescue Creek, and Cedar Creek (Zappalorti 1992a). In Pennsylvania, the species is known only from Bucks, Delaware, and Philadelphia Counties, in the southeastern portion of the Commonwealth (McCoy 1985).

The spotted turtle occurs from southern Maine to northeastern Illinois, southward in the eastern United States to central Florida, with isolated colonies in southern Quebec and Ontario, central Illinois, southwestern North Carolina, and adjacent South Carolina. Spotted turtles are known from Commercial, Downe, Lawrence, and Maurice River Townships in New Jersey. They also occur in northwestern Vermont (Conant and Collins 1991). Historically, spotted turtles were distributed regularly throughout the estuary, but their numbers have been reduced significantly in Delaware, New Jersey, and Pennsylvania. They now occur in suitable unpolluted freshwater wetlands away from highly populated areas.

The range of the red-bellied or "king" turtle in the United States shows an isolated colony in Plymouth County, Massachusetts (Babcock 1916, 1917, 1937; Graham 1971a; Amaral 1993), which occurs discontinuously from southern New Jersey along the coastal plain south to North Carolina, and west to West Virginia (Conant and Collins 1991). In the Delaware Estuary, "red-bellies" are

known to occur in suitable waterways, lakes, and marshes throughout most of Delaware. In New Jersey they are found from Middlesex County (in the central portion of the state) southward to Cape May and Cumberland Counties along the Delaware Bayshore (Zappalorti 1976, 1992). In Pennsylvania, the red-bellied turtle is currently restricted to a few isolated colonies in the Delaware drainages of Bucks, Philadelphia, and Delaware Counties, and the Potomac drainage. It occurs in Manor and Silver Lakes in Bucks County, and in the Tinicum marshes and Darby Creek in Philadelphia and adjacent Delaware County. Red-bellied turtles may also occur in the Springton Reservoir in Delaware County (Conant 1951, Conant and Collins 1991). J. D. Groves, former Curator of Reptiles at the Philadelphia Zoological Garden, has observed these colonies for several years and feels that none probably contain more than 30 individuals. Records from the Potomac drainage are based on a specimen captured (and subsequently released) at Fannettsburg Dam on the West Branch of Conococheague Creek, Franklin County, and specimens from near Fairfield, Adams County (McCoy 1985). In New Jersey, "red-bellies" are known from several locations in Upper Dennis, Middle, and Lower Townships in Cape May County. In Cumberland County they are found in Clark's Pond in Fairfield Township, Whitehead Ponds in Commercial Township, and at Cedarville Ponds in Lawrence Township (Zappalorti 1992b).

STATUS AND TRENDS

The Natural Heritage Programs of Delaware, New Jersey, and Pennsylvania rank the snapping turtle as a "common" or "stable" species ("S5"). Because of its economic value to the food industry, the snapper is trapped commercially for human consumption, and has been declared a game spe-

cies by New Jersey officials in order to control the numbers taken.

The mud turtle is listed as "common" or "stable" (S5) in Delaware and New Jersey, but it is considered an endangered species (S1) in Pennsylvania (Delaware, New Jersey, and Pennsylvania Natural Heritage Programs 1994). The eastern mud turtle is presently afforded protection as an endangered species under the Pennsylvania Fish Law (Section 251.1). It is illegal to catch, take, kill, or possess this turtle unless authorized by the Pennsylvania Fish Commission.

Both the Delaware and New Jersey Natural Heritage Programs list the red-bellied turtle as a "common" or "stable" species (S5), but in Pennsylvania, it is considered "endangered" (S1) due to its limited distribution within the three Delaware Bayshore Counties.

In spite of their wide distribution, spotted turtle populations continue to decline throughout their range, especially in Delaware and portions of New Jersey, because of draining or filling of marshy wetlands, and overcollecting (Lovich 1985, Heckscher 1994). The spotted turtle is now officially listed as "rare" or "uncommon" (S3) by the Delaware Department of Natural Resources, Natural Heritage Program (Heckscher 1994). The Natural Heritage Programs of Pennsylvania and New Jersey classify this turtle as a "declining" species and list it as common or stable.

LIFE HISTORY

Marsh turtles can evade detection as they move about within their wetland habitat. Inherently shy and secretive, there are only two times in their life history when they may be conspicuous: when bask-

ing on shore or on log snags, and when females come out of the water to deposit their eggs in an open, sunny situation that is free from flooding. (As egg layers, the females must select a suitable nesting site that will ensure the right combination of heat from the sun and soil humidity to incubate the eggs.)

The more detailed life histories of the four target species will be discussed in turn.

Snapping Turtle. The common snapper is the largest species of freshwater turtle within the estuary. (The alligator snapping turtle, *Macrolemys temminckii*, is the largest freshwater turtle in the United States.) Although the shell of the snapping turtle measures only about 3.75 centimeters (1.5 inches) long when it emerges from the egg, snappers attain an average shell length of 25-37.5 centimeters (10-15 inches) as adults, and have been known to grow considerably larger. Conant and Collins (1991) state that the record size of snappers is a shell length of 46 centimeters (18.5 inches) and a weight of 16 kilograms (35 pounds); however, other investigators have recorded turtles with a carapace length of 48 centimeters (19 inches) and a weight of 27 kilograms (60 pounds) (Zappalorti 1976). Ernst and Barbour (1972) claimed that adults can weigh more than 34 kilograms (75 pounds), and that males generally achieve larger sizes than females.

The carapace is large, well-formed, and heavily serrated. The upper shell of young individuals is extremely rough, with three low keels extending along the back. With age, these "knobs" disappear, and old individuals have a smooth carapace. The fleshy underparts and limbs are largely exposed. The tail is very long, with a conspicuous "saw-toothed" dorsal crest. The head is also large, with the eyes located close to the snout.

The snapping turtle's mating season is usually April and early May. Egg-laying may occur anytime from late May through mid-July, but the peak nesting season is June in the Delaware Estuary. When a gravid female is ready to lay eggs, she will seek a suitable nesting site (Congdon et al. 1987). The female lays between 12 and 75 eggs (Ernst and Barbour 1972) that hatch from 50 to 125 days later, depending upon temperature, humidity, and other environmental factors. Hatchling snappers emerge from the eggs from mid-August to early October.

In most cases, snapping turtles are bottom baskers, but they occasionally climb out of the water to bask when infested with blood-sucking leeches. (They rid themselves of these parasites by completely drying out in the warm sun, which causes the leeches to drop off.)

Eastern Mud Turtle. These small turtles reach sexual maturity at a carapacial length of about 7.5 or 10 centimeters (3 or 4 inches), but Conant and Collins (1991) give a record size of 12 centimeters (4.9 inches).

Their carapace is smooth, low, and unkeeled, with no distinctive pattern or markings. The head is well-proportioned with a strongly hooked snout. A pair of barbels is present in the chin, with a second, smaller pair on the neck. Their limbs are stout and muscular, with webbing on each foot. Females have short stubby tails whereas males have longer thicker tails that end with a terminal nail. The carapace is usually some shade of brown, but individuals may vary from dark yellow and orange to maroon and even black. The plastron is usually yellowish-brown, and their limbs, neck, and fleshy underparts are brownish-gray.

In mid-June, females lay eggs in fields or on the grassy shoulders of paved roads that pass through their marshy habitat. Adult females usually lay three to six small, white eggs in shallow nest chambers that they dig with their front and hind feet. Hatchling mud turtles are about the size of a dime when the eggs hatch in mid-September.

The eastern mud turtle is primarily aquatic, but will venture into terrestrial situations in the morning or early evening. During periods of severe drought, this turtle will burrow into the mud bottom of a dried-up pool and aestivate until rains replenish the water. During winter the species hibernates, usually in an aquatic situation, but it may move to areas away from the water and dig a burrow or retreat under logs in stump holes or in deep, matted pockets of vegetation and humus (Ernst and Barbour 1972, Zappalorti 1976).

Spotted Turtle. This turtle's hatchlings are small, elongated, and lack distinctive spotting, although spotting will become more evident in adults, as their name implies. The hatchlings measure about 2.5 to 3 centimeters (6 to 8 inches) and have soft shells. As their common name implies, the adults have spots that gradually become more pronounced as they age. This small turtle may attain a shell length of 12.5 centimeters (5 inches). The smooth carapace, legs, and head are black and spotted with yellow; scales on the unhinged black plastron are edged with yellow or cream. Some individuals have large bright orange or yellow spots behind the eyes, while others may lack spots on the carapace altogether. The average specimen has about 100 yellow or white spots scattered about the upper shell (Carr 1952).

Spotted turtles emerge from hibernation in late March and become active in early April. They eat

the tadpoles of wood frogs (*Rana sylvatica*), chorus frogs (*Pseudacris triseriata kalmi*), and spring peepers (*Pseudacris crucifer*) that have accumulated in vernal ponds in spring. Courtship and mating occur in early spring in the northern part of its range. The flask-shaped nests are made either on dry open land or in sedge grass tussocks of *Carex* sedge. Three to five elliptical white eggs with soft leathery shells are deposited in nests, which are then covered over well. Incubation requires 70-80 days; hatching occurs in August.

They are at home on land as well as in streams and commonly bask on logs or on the stream edge. They are quite conspicuous in spring, but become more secretive in summer and fall, perhaps because the vegetation provides more cover and because the water has warmed up and they spend less time basking. Their black shell also helps absorb heat in the shallow water, further reducing the need to bask. Because most vernal ponds dry up by mid-summer, spotted turtles resort to more permanent waterways or aestivate under matted vegetation until fall rains once again flood their habitat. Spotted turtles feed on insects, other aquatic invertebrates, and occasionally vegetation.

Red-Bellied Turtle. This large basking turtle averages 25-31 centimeters (10-12 inches) in carapace length as adults. Aside from the snapping turtle, "red-bellies" are the largest freshwater turtle in the Delaware Estuary (Graham 1978, 1981, 1982, 1984, 1991, and 1992). Coloration and pattern are highly variable, but in general, the carapace is mahogany to black, with light chestnut to reddish vertical bars on the upper shell. The name *rubriventris* is from the Latin words, *rubidus*, for reddish, and *venter* for belly, referring to the reddish plastron (Graham 1991, Amaral 1993).

The front of the upper jaw has a terminal notch flanked on each side by a distinct maxillary cusp. The presence of maxillary cusps distinguishes the red-belly group from other large basking turtles, including the Florida red-bellied turtle (*P. nelsoni*) and the Alabama red-bellied turtle (*P. alabamensis*). Hatchlings average about 3.2 centimeters (1.3 inches) in length (the range is 2.6-4.1 centimeters) and are greenish in coloration. They become darker with age. Sexual maturity is probably reached in eight to 15 years in females and sooner in males (Amaral 1993). Males have long, thick tails with the vent beyond the carapacial margin, elongated foreclaws, and flatter shells. Females grow slightly larger and have more domed carapaces (Iverson and Graham 1990).

Adult females excavate their nest chambers on road shoulders or sandy beaches above gravel ponds or lakes. An average of 12 eggs (range 5-17) are deposited in each nest (Haskell 1993). Incubation takes 73-80 days at 25°C (77°F) (Graham 1971b). Red-bellied turtles often share their wetland habitat with the more common eastern painted turtle, *Chrysemys picta*, the only native Delaware Estuary turtle that it resembles. The painted turtle, however, is smaller, has a smooth posterior margin on its carapace, and two large yellow marks on each side of the head (McCoy 1985, Conant and Collins 1991, Amaral 1993).

Current data gathered from wild specimens suggest that aquatic vegetation is the primary food for all age classes, although crayfish are often eaten (Graham 1969, 1981). The turtles are often seen basking on logs or snags in unpolluted waterbodies. In Cape May and Cumberland Counties, New Jersey, they use wet sand ponds quite frequently and prefer ponds and lakes with thick mats of aquatic vegetation. "Red-bellies" are ac-

tive from late March to October throughout the Delaware Estuary's freshwater marshes. During the winter they rest on the bottoms of ponds or rivers under the ice in a state of relative inactivity known as brumation (hibernation).

ECOLOGICAL/ECONOMIC ROLE

Turtles serve as scavengers and carrion eaters on the marsh floor, thereby playing an important role in the food chain of the Delaware Estuary. They not only serve as top predators within their niche, but their eggs, hatchlings, and juveniles, whose shells are soft and poorly developed, are preyed upon by fish, birds, and mammals (Zappalorti 1976).

Of the four reptilian orders known to exist today, the Chelonians (turtles) are the most popular with people. They are kept as pets, and trapped or hunted for human consumption. "Snapper" soup and stew, for example, are served in many area restaurants and their popularity has led to the decline of large turtles in the Delaware Estuary.

HABITAT REQUIREMENTS

The turtles discussed in this chapter occupy two types of marshes within the Delaware Estuary: (1) the freshwater swamp or marsh, which connects to inland stream or river corridors that eventually empty into the brackish tidal areas; edge vegetation usually consists of trees, shrubs, and grasses that are tolerant of seasonal flooding and wet conditions for extended periods; and (2) the coastal salt marsh associated with the mouths of streams and rivers, where freshwater and seawater mix; typical salt marshes consist of zones of tidal brackish water where an array of plants and animals is alternately flooded by seawater and exposed to air

by the rise and fall of the tide (Niering 1965). Individual preferences of the four target species are discussed next.

Snapping Turtle. Snapping turtles show a preference for ponds with muddy bottoms, or streams with overhanging banks. They have often been found in muskrat runways or tunnels under the muskrat lodge (Carr 1952, Zappalorti 1976).

Eastern Mud Turtle. This is a semi-aquatic turtle that often wanders overland far from water. The species selects shallow, vegetated habitats such as ponds, wet borrow pits, ditches, and canals. Individuals are frequently observed occupying muskrat lodges. This turtle has a high tolerance for brackish water and is often found in tidal marshes or on offshore islands (Iverson 1972). This is a wandering species that seems to show a preference for shallow water such as roadside ditches, marshes, small temporary ponds, wet meadows, and brackish tidal waters. In New Jersey, mud turtles are found in wet borrow pits. Individuals often wander across roads in early morning or late afternoon in search of food or an alternative body of water. They are known to occasionally overwinter in uplands (Bennett 1972).

Spotted Turtle. Spotted turtles are small semi-aquatic turtles that are widely distributed in suitable wetland habitats. They generally inhabit shallow bodies of water such as marshes, hardwood swamps, vernal and permanent vegetated ponds, and freshwater drainage ditches. Old cranberry bogs and slow-moving streams are also important habitats available to this species in the Delaware Estuary. In spring, they spend hours basking on tussock sedge (*Carex stricta*), muddy embankments, and logs in order to raise (thermoregulate) their body tempera-

tures. Unlike the more aquatic deep-water turtles, *Clemmys guttata* is not averse to traveling overland from one vernal pond to the next in search of food and possibly, a mate.

Red-Bellied (King) Turtle. Throughout its range, this turtle is usually found in relatively deep water bodies; low gradient rivers; and marshes, ponds, and oxbows of the associated floodplain. Barnacles are occasionally found attached to its shell, indicating it frequents brackish waters near the mouths of rivers (Arndt 1975). It requires a soft bottom to the waterbody, as well as the availability of basking sites. Common aquatic plants, the staples of its diet, must be present.

SPECIAL PROBLEMS

A variety of factors have been identified that may have contributed to the observed general decline of turtles, including mammal predation, ecological succession, over-collecting for the pet-trade, and man-made hazards (Zappalorti 1976, Lovich, 1985). Raccoons (*Procyon lotor*) are known to be efficient predators of spotted turtles (Ernst 1976). While several mammalian species such as foxes, skunks, shrews, and weasels are known to eat and destroy turtle eggs, hatchlings, juveniles, and adults, the raccoon is probably the most aggressive in its pursuit of Chelonians. Raccoons are also on the increase in the Northeast, and have learned to raid trash dumpsters and garbage cans as an alternative food source.

Loss of habitat is significant throughout portions of the Delaware Estuary, especially in industrialized cities like Camden, Trenton, Philadelphia, Newark, and Wilmington. The draining, filling, and polluting of wetland habitats have narrowed the areas remaining for wildlife, particularly the turtles.

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MANAGEMENT CONSIDERATIONS

A diversity of turtle habitats is required and must be preserved. There are various types of freshwater wetlands, with different vegetational zones and with and without tree canopies. Most are associated with river or stream floodplains, but others are located in isolated situations away from permanent bodies of water. The latter types may only become connected during high-water periods such as rainstorm events, end-of-winter thaw, and/or heavy spring rain.

Permanent lakes or ponds, either natural or human-made, provide aquatic habitat for turtles that prefer or select deep water. Marshy, slow-moving stream corridors offer wet conditions for turtles that like soft, muddy places in which to burrow and forage. Also important are small vernal or temporary ponds that remain flooded on a seasonal basis, but provide a wealth of food resources that can be exploited by the more terrestrial species of turtles that are not averse to walking over dry land to reach these ephemeral pools (Zappalorti 1976 and 1992a).

Although snapping turtles are widespread in Delaware, Pennsylvania, and New Jersey in most types of wetland habitat, their economic value to the food industry has led to a decline of breeding-size adults. This has prompted New Jersey's Division of Fish, Game and Wildlife to regard this turtle as a game animal and the species is now regulated. Professional trappers who take more than three "snappers" a day must apply for a special license. Those who only take one or two turtles, occasionally, do not require a permit. Snapping turtles may be taken year-round, except during their breeding period; no turtles may be taken from May 1 to June 15 to protect gravid females prior to the egg-laying season (Gibbs 1993).

RECOMMENDATIONS

Human activities can be reduced or managed in important turtle habitats to avoid conflicts with the Chelonians. Road mortality could be greatly reduced by posting "turtle crossing" signs in known migration areas. Additionally, culverts or tunnels can be constructed under busy roadways that provide passageways for the turtles. Fencing and/or retaining walls should be used to herd the turtles into the culverts or tunnels. More important, public education aimed at fishermen, boaters, and sportsmen would help reduce accidental deaths to turtles, especially by drowning in crab or fish traps.

Predator control and protection of nesting areas would help increase egg-hatching success. Management plans for critical turtle habitat and the turtles themselves should be developed by qualified herpetologists, especially in areas where rare, threatened, or endangered turtle species are known to occur within the Delaware Estuary.

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