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PREDATION BY RACCOONS ON DIAMONDBACK TERRAPINS, *MALACLEMYS TERRAPIN TEQUESTA*

Observations of predation on adult turtles are rare. Such predation has been reported for only a few species, including *Chrysemys picta* (Ernst, 1974; Wilbur, 1975), *Chrysemys scripta* (Minickly, 1966), *Clemmys guttata* (Ernst, 1976), *Graptemys pulchra* (Shealy, 1976), *Terrapene ornata* (Metcalf and Metcalf, 1979), *Gopherus polyphemus* (Causey and Cude, 1978), and *Malaclemys terrapin rhizophorarum* (Godley, 1978). No data are currently available concerning predation on adult Florida east coast terrapins, *M. t. tequesta*. This report documents the first known case of predation on adults of that species.

On 19 June, 1977, I observed a raccoon (*Procyon lotor*) attacking an adult female *M. t. tequesta* along a dike road at the Merritt Island National Wildlife Refuge, located in Brevard County, Florida. The raccoon had already broken the turtle's neck, and severed the left hind limb before I approached the area. Upon dissection I found that the raccoon had "gutted" the turtle, by opening a small hole where the hind leg had been severed, and reaching in to pull out all internal organs. Metcalf and Metcalf (1979) have reported that predators mutilated a *T. ornata* in a similar manner.

The discovery of numerous freshly-killed *Malaclemys* (N = 24) along a .5 km section of dike in 1977-1978 indicates that such predation is not uncommon at Merritt Island. Although the actual predation on these individuals was not observed, the following evidence strongly suggests that raccoons were responsible for their deaths. First, all the dead individuals found were surrounded by raccoon tracks, and showed body damage similar to that noted above. Second, despite the fact that the dikes the turtles were found on were surveyed daily during the course of a study on the nesting habits of *Malaclemys* (Seigel, MS), I found no evidence that the turtles died of natural causes (e.g. overheating or desiccation), nor that other predators were involved. The only other likely predators

on *Malaclemys* at Merritt Island are the bobcat and the river otter, neither of which was ever seen on the study area.

Adult females accounted for the majority (86%) of individuals found dead. In contrast, Wilbur (1975) reported that both sexes of *Chrysemys picta* were equally susceptible to raccoon predation. Females were more susceptible to predation in this study because the nesting season (late April-early July) represents the only period of significant overland activity for *Malaclemys* at Merritt Island. Although dikes were surveyed year-round, evidence of predation was found only during the nesting season.

The impact of raccoon predation on *Malaclemys* populations is not yet clear. Preliminary population estimates (Seigel, unpublished) indicate that at least 10% of the adult female population at the study site were killed by raccoons in 1977-1978. Numerous old, decomposed *Malaclemys* shells found along the sides of the dike suggest that the predation there has occurred for a number of years, and that the population there has been subjected to severe predation pressure for some period of time. Wilbur (1975) found that a *Chrysemys picta* population was greatly reduced by raccoon predation, and that the predation caused a decrease in mean generation time.

I suggest that the predation pressure on *Malaclemys* at Merritt Island is peculiar to that area, and may represent a phenomenon of only recent development for the following reasons. First, if raccoon predation on *Malaclemys* is common, it is difficult to explain why such a conspicuous phenomenon has not been previously reported. Second, there is indirect evidence to indicate that man-made changes in the Merritt Island habitat may have led to the predation currently seen. In 1958, a series of mosquito control dikes were built on the refuge, destroying most of the salt marsh in the area. Local residents claim that the raccoon population increased sharply at this time. This increase, coupled with an invasion of new dike habitats by raccoons as feeding areas, probably led to increased contact between raccoons and *Malaclemys* when the latter began to use the dikes as nesting areas (Seigel, MS). Thus, rather than being a normal part of raccoon feeding habits, raccoon predation on *Malaclemys* only began when conditions led to increased contact between the two species.

These observations, coupled with those of Wilbur (1975) suggest that while predation on adult turtles is rare, the barriers preventing such predation may be easily disturbed by man-made changes in habitat. Large reductions in population size, and even eradication of some local populations may result from such disturbances, since turtles are poorly adapted to severe mortality at a life stage when survivorship is generally very high. This is especially true for the present study, since most of the predation is on reproducing females, the most biologically important part of the population.

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AGGRESSIVE BEHAVIOR IN THE WOOD TURTLE, *CLEMMYS INSCULPTA*

Aggression between captive turtles has been reported among phylogenetically diverse species. These include: sea turtles (*Chelonia mydas* and *Eretmochelys imbricata*; Spoczynska, 1971; and Parrish, 1958, respectively), box turtles (*Terrapene carolina*; Boice, 1970), and wood turtles (*Clemmys insculpta*; Dinkins, 1954; Harless, 1970). However, a number of studies indicate that aggression had never been observed in natural populations of turtles whose conspecifics had behaved aggressively in captivity. Examples include: the softshell turtle (*Trionyx spinifer pallidus*; Lardie, 1964), the aquatic box turtle (*Terrapene coahuila*; Brown, 1974) and the painted turtle (*Chrysemys picta*; Ernst, 1971).

Aggression has been related to courtship behavior in box turtles (Ewing, 1935), tortoises (*Gopherus berlandieri*; Weaver, 1970), and sea turtles (*Chelonia mydas*; Booth & Peters, 1972). Space limitations have also been hypothesized as precipitants of aggression. An example of this is limitation of basking sites in Pacific pond turtles (*Clemmys marmorata*; Bury & Wolfheim, 1973). Other observations of aggression have been reported for which causes were not postulated. These include intraspecific encounters between loggerhead musk turtles (*Sternotherus minor*; Jackson, 1969), box turtles (Latham, 1917), and desert tortoises (*Gopherus agassizi*; Woodbury & Hardy, 1948).

I report two instances of aggression between adult male wood turtles in the Rondout Valley of central New York State. They took place on land and were observed from approximately 1.5 m.

The first encounter took place on 14 Aug. 1977. Both turtles had been radio tracked in their home ranges for 28 days prior to the encounter. T1 was radio tracked for 19 days following the encounter. T2 was radio tracked for 37 days following the encounter. The incident took place during a period when T1 was moderately active. He had moved an average minimum distance of 15.25 m per day for the preceding four days (range 6.5 to 35 m per day). T2 had been very active during the same period. He had moved an average minimum distance of 35.63 m per day (range 10.5 to 80.5 m per day). During the encounter ambient temperature was 27.8 C, relative humidity was 83% and the sun was completely overcast. The combat took place in aspen woods with sparse herbaceous vegetation.

Turtles had been weighed and measured earlier in the season. T1 measured 18.8 cm in carapace length and weighed 980 g. T2 measured 18.6 cm in carapace length and weighed 905 g. T1 was clearly the aggressor and T2 was clearly the submissive recipient in this encounter. This is unlike Dinkins' (1954) observation of combat in captive wood turtles in which both males were equally aggressive.

Observations were begun at 1235 hours Eastern Daylight Time. When turtles were discovered, the forelegs of T1 were resting on the bridge of the carapace of T2; the animals were