



Occurrence of Marine Turtles in the Lower Rio Grande of South Texas (Reptilia, Testudines)

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In conclusion, we suggest that although radio telemetry is probably the most feasible means of studying tropical forest snake activity, it cannot completely overcome the problem of low population densities. A valid analysis of activity range and habitat utilization of most tropical snake species may require more prolonged field work than would be necessary for most temperate forms.

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OCCURRENCE OF MARINE TURTLES IN THE LOWER RIO GRANDE OF SOUTH TEXAS (REPTILIA, TESTUDINES)

Innumerable changes in the biota of the world have occurred as a result of human impact (Detwyler, 1971; W. L. Thomas, 1956). For this reason journals of early naturalists (e.g. Bartram 1971; Bates, 1864; Belt, 1911) have in the past and will undoubtedly continue in the future to be of special interest to modern biologists. Undisturbed biological communities were

commonplace to these early naturalists. Destruction of natural communities occurred so rapidly that these early accounts are the only source of descriptions of the natural flora and fauna of a particular region.

Robert A. F. Penrose was an eminent geologist who was appointed in 1888 to be assistant to E. T. Dumble, the State Geologist of Texas. Much of his geological survey work was accomplished by voyages from the upper reaches of various rivers down to the mouths at the Gulf of Mexico or associated bays. One such trip occurred in May 1889 down the Rio Grande. The downriver voyage began at Eagle Pass and ended at Brownsville. Occasionally Penrose, in letters written at the time and memoirs written later in his life, mentioned biological phenomena which he had observed during these trips.

In a letter dated in May 1889, Penrose wrote the following in reference to the mouth of the Rio Grande (from Fairbanks and Berkey, 1952):

As we approached the mouth of the river, however, the green turtle ["large . . . sometimes three or four feet long"] became very numerous, and we could have collected them in both places. They usually crawled up the sandy shore of the river and laid their eggs there, so that they might hatch in the sun. When they saw us coming down the river in our boat, they made a dash for the water, but there was never any trouble in intercepting them. We collected and consumed the eggs in great quantities and found them very good. They were different from the egg of a chicken or other bird, inasmuch as the shell was soft, like rubber, and they were of such character that a long time was required to boil them sufficiently to harden the albumen.

Unfortunately Penrose collected no individuals for biological specimens. Therefore, identification of these turtles will have to be made from the description given by Penrose.

Four freshwater turtle species are known from the lower Rio Grande Valley of Texas (Conant, 1975; Raun and Gehlbach, 1972): spiny softshell, *Trionyx spiniferus emoryi* (Agassiz); pond slider, *Chrysemys scripta elegans* (Wied); river cooter, *Chrysemys concinna texana* (Baur); and yellow mud turtle, *Kinosternon flavescens flavescens* (Agassiz). The Texas diamond-back terrapin, *Malaclemys terrapin littoralis* Hay, has been reported no farther south than Nueces county (Raun and Gehlbach, 1972) about 200 km north of the mouth of the Rio Grande River. However, none of these turtles could be "green turtle" reported by Penrose, and only *Trionyx* exceeds one foot in length.

No *Trionyx* are known to reach the size of the turtles seen by Penrose. Although larger specimens of various species may have existed in earlier times due to lengthened life spans and/or lack of human pollution, softshells of three to four feet in length are highly unlikely. Because of recent nomenclatural changes, *T. s. emoryi* appears to lack a record length specimen. Lardie (1963) reported a record length of 370 mm (14.6 in.) for a softshell from Parker County, Texas. Latest taxonomic reviews of *T. spiniferus* place this record under another subspecies, *pallidus* (see Webb, 1973). Other subspecies of *spiniferus* have been reported up to thirty inches maximum (Breckenridge, 1957; Stockwell, 1878; True, 1893), but even these large specimens fall below the size of the turtles seen by Penrose.

Additional descriptions reported by Penrose would eliminate *Trionyx* from serious consideration. Penrose reported that the "green turtles" were easily captured; however, the pugnacity of softshells is well-known (e.g. Lardie, 1964). In addition, softshell turtles are quite agile on terrestrial substrates, easily eluding human pursuers (pers. observ.; Cahn, 1937). *Trionyx* eggs have brittle shells (Webb, 1962) in contrast to the soft eggs mentioned by Penrose. Even if one assumes that Penrose may have exaggerated the size of the turtles, reconciliation of egg shell character disparity is not possible.

Eliminating *Trionyx*, the turtles seen by Penrose must have been one of the "marine" turtles which have been present in Texas waters. Four marine turtles have been definitely reported from Texas (Raun and Gehlbach, 1972): Atlantic ridley, *Lepidochelys olivacea kempfi* (Garman); loggerhead, *Caretta caretta caretta* (L.); leatherback, *Dermochelys coriacea coriacea* (L.); Atlantic green, *Chelonia mydas mydas* (L.). The hawksbill, *Eretmochelys imbricata imbricata* (L.), has not been reported from Texas, according to Raun and Gehlbach (1972), and Strecker (1915) said it was "apparently rare" in the Gulf of Mexico. Brown (1950) knew of no

TABLE 1. Characteristics of Known Marine Turtles of Texas which Favor or Disfavor Identification of Turtles seen by Penrose.

Turtle	Favoring	Disfavoring
Atlantic ridley, <i>Lepidochelys olivacea</i>	recent nesting records on Padre Island; large rookery in Tamaulipas	small turtle; record is 27-5/8 inches
Loggerhead, <i>Caretta caretta</i>	very abundant on Texas coast; known to travel up rivers; carapace may be olive	size reported by Penrose is very small for loggerhead
Leatherback, <i>Dermochelys coriacea</i>	1	large turtle, rare in Texas; not green
Atlantic green, <i>Chelonia mydas</i>	carapace may be olive; size reported by Penrose fits breeding age; very common (at least in past) in Texas; nests presently on Mexican Gulf Coast; has placid disposition.	no nesting reports from Texas

¹No characteristics are known which favor the leatherback.

1966). Factors which favor or disfavor the identification of Penrose's turtles as one of the four remaining species are summarized in Table 1.

Atlantic ridley *Lepidochelys olivacea kempfi* (Garman).—This species is relatively rare on the Texas coast at present. Although ridleys are common in the Atlantic and in the Gulf of Mexico, breeding of this turtle was unknown (see Carr and Caldwell, 1958) until quite recently when the most unusual mass breeding of any turtles in the world, an *arribada*, was discovered on the Gulf Coast of Tamaulipas, Mexico (Carr, 1963; Carr and Caldwell, 1958; Hildebrand, 1963). Almost the entire breeding of the species occurs in a short stretch of beach (40,000 turtles in a single day along about one mile of beach). Egg laying occurs in the daylight hours. Cases of isolated breeding are known from northern Padre Island, Texas, southward to Veracruz. These areas may represent previous *arribada* sites. Natural breeding has been reported from Padre Island, Texas, as late as 1950 (Werler, 1951). Recent attempts have been made to re-establish viable populations on southern Padre Island (see Breuer, 1971). Subsequent cases of breeding on southern Padre Island have been reported; these may represent females which hatched from eggs transplanted to Padre Island.

Occurrence of massive breeding by the ridley within 300 kilometers of the Rio Grande would certainly indicate that Penrose's turtles could be of this species. The ridley has been considered a rare species along the Texas coast (Brown, 1950; Strecker, 1915), but the occurrence of an *arribada* since extinct at the Rio Grande is certainly possible. Penrose does not state that the turtles were laying eggs in the daytime but one would assume that his party would be traveling down the river only during daylight hours (observations of turtles may have been made during the evening at landfall). Daytime egg laying is unique to the Atlantic ridley among marine turtles. Despite all these similarities, the record known length of the Atlantic ridley is only 74.9 cm (29.5 in.) as reported by Conant (1975). This length falls quite short of the three to four foot length of the turtles seen by Penrose.

Loggerhead *Caretta caretta caretta* (L.).—Strecker (1915) reported that the loggerhead was "said to be abundant from Galveston southward." Brown (1950) reported this species was "apparently our most abundant sea turtle, at least in the vicinity of Port Isabel, *Caretta caretta* is often taken in the bays and seen in the Gulf." Brown (1950) felt that this species is much more common in Texas than indicated by records; scientific records are scarce because of the large size of this species and its value as food. Ernst and Barbour (1972) report that the loggerhead nests on the Gulf Coast (no indication that it does or does not nest in Texas) from April to August with a peak in June.

specimens from Texas but believed its range included "probably coastal Texas." Apparently no specimens are known from Texas. Recently, however, R. A. Thomas (1976) listed *E. imbricata* as occurring in Texas "... on the basis of reports of coastal sightings by several persons." At any rate, this species is extremely rare in Texas and should not be considered as a viable possible choice for the turtles seen by Penrose. The only known nesting of the hawksbill in the continental United States was observed near Juno, Florida, in August 1959; in the Caribbean the principal nesting months are May and June (Carr, Hirth and Ogden,

Leatherback *Dermochelys coriacea coriacea* (L.).—Raun and Gehlback (1972) record this species from three coastal Texas counties all well north of the Rio Grande. Few reports exist of this species in Texas waters; Strecker (1915) did not list this species for the state. Leary (1957) reported approximately one hundred leatherbacks along a thirty mile line north from Port Aransas on 17 December 1956. The individuals were approximately seventy meters from the surfline. No nests were observed because of ensuing inclement weather. Unreported nesting beaches of this species could easily exist in this area as St. Joseph and Matagorda Islands are not accessible by the public. However, breeding of this species is only known from April to July in various populations from Florida to Costa Rica (Carr, 1952; Carr and Ogren, 1959). The report by Leary (1957) was probably a feeding aggregation as turtles were observed to be most numerous in association with cabbagehead jellyfishes, *Stomolophus meleagis* L. Agassiz.

Atlantic green *Chelonia mydas mydas* (L.).—This species was so common in the past that a thriving turtle cannery existed at Indianola on the Texas coast about 320 kilometers north of the Rio Grande. Few specimens from Texas exist in scientific collections, but an extraordinary number were caught for human consumption (Brown, 1950). Reed (1941) reported that the green was formerly very common in Texas waters. Apparently no nesting records are known from Texas. In fact, Carr and Caldwell (1956) reported that the only known rookeries of American *Chelonia* populations at present are off the coast of Quintana Roo (Yucatan), Mexico; Tortugero, Costa Rica; and Aves Island in the eastern Caribbean. Numerous American rookeries have been totally destroyed (Bustard, 1972). Although Florida has always been reported to have been densely populated by green turtles, the first verified nesting observations on the North American coast did not occur until the late 1950's (Carr and Ingle, 1959). Carr (1952) reported that, to his knowledge, no green turtle nests had been seen on the Florida coast since the early part of the twentieth century. The last regular occurrence apparently occurred in the 1890's. Audubon (1926) reported on the Florida green turtle population of the early nineteenth century. Ehrhart (1975) recently reported nesting greens on Merritt Island, Florida, some 160 kilometers north of the previous northernmost record. Green turtle females nest in two or three year cycles although some turtles have four year cycles. Heavy nesting results when individuals nest at a single time (Carr and Carr, 1970). Bellairs (1970) reports that green turtle females usually go ashore to lay eggs in late evening. Thus, Penrose and his companions could have observed this species breeding after they made landfall to camp for the night. Ernst and Barbour (1972) report that breeding occurs from March to October with greatest activity in May (time of Penrose's observation) and June. A three-to-four-foot long Atlantic Green would be fair-sized to large. Possibly the green turtle once bred at the Rio Grande and has since been extirpated.

Discussion.—Of the marine turtles known from Texas, only one species, leatherback, would appear to be a very unlikely possibility. Reports are rare along Texas for this most open-water-adapted species.

Unfortunately, Penrose gave a very limited description of the turtles. Some of the information given by Penrose does not eliminate any of the species; e.g. egg shell texture. Penrose reports that eggs of these turtles were "soft"; eggs of all marine turtles fit this description (Pope, 1939; Werler, 1951). The turtles are simply referred to as "the green turtle." This description is of little help as the Atlantic green is usually brown; the term green refers to the color of its fat. The Atlantic green may be olive, however, as may the ridley. The size reported by Penrose (largest up to three and four feet) is of limited value. The leatherback and loggerhead attain much larger sizes although breeding loggerheads of that size would not be unusual. An Atlantic green of this size would be large but nowhere near the record (about five feet—Conant, 1975). The ridley is quite a bit smaller than the length reported by Penrose; however, much larger turtles could have existed prior to extensive human exploitation as reported for the Atlantic green (Carr, 1952). Ease of capture of the turtles by Penrose and his party may indicate that the turtle encountered by this group was the Atlantic green. Pritchard (1967) reports that both the ridley and the loggerhead are highly "aggressive" and "bad-tempered" while the green has a "placid disposition." Barbour (1945) reported that the ridley was "more active than any of the other [marine turtle] species."

The really striking part of Penrose's report is that these turtles were breeding on the banks of the Rio Grande River. Marine turtles generally nest on open beaches (Carr, 1952; Ernst and Barbour, 1972); in fact, records of nests in riparian areas are rare. Audubon (1926) reported that the green turtles entered bays and rivers of southern Florida in April. Carr (1952) believed these turtles entered short spring-fed creeks to feed on aquatic plants such as *Vallisneria* and *Sagittaria*. However, Babcock (1919) reported that green turtles were known to deposit eggs on "uninhabited banks of certain rivers"; original source of this report is not given. Babcock (1919) also reported that loggerheads sometimes traveled several miles up rivers.

Certainly, at least some of the marine turtles are able to enter and remain in freshwater. However, in saltwater these marine turtles are unable to maintain a positive water balance; an orbital "salt gland" is predominant in the role of Na^+ and K^+ excretion in the green turtle (Holmes and McBean, 1964). In freshwater, the green turtle suffers a net loss of sodium. The salt gland becomes non-functional; some sodium may be extracted from the external medium but substantial sodium is lost through the cloaca (Kooistra and Evans, 1976). The loggerhead, on the other hand, is able to reduce its sodium loss to such an extent that survival in freshwater is possible for twenty days even though no sodium is extracted from the external medium. Apparently no data exist for other species of marine turtles.

The lower part of the Rio Grande contains water of variable salinity. Manatees were common in the lower Rio Grande before predation pressures in Mexico reduced populations to very low levels (Gunter, 1941). During the extreme drought of the 1950's numerous marine fishes were collected in the lowermost Rio Grande (Robinson, 1959). Marine turtles are known to withstand freshwaters; therefore, the existence of a marine turtle in the lower Rio Grande is not unbelievable.

Unfortunately, no positive identification of the turtles seen by Penrose can be made. However, by reviewing the points for and against the various possibilities (see Table 1), I believe that they most likely were Atlantic green turtles, *Chelonia mydas mydas* (L.). Breeding of this species in a riparian habitat is unusual, but has been reported, admittedly unverified. The area around Brownsville was sparsely populated in the late 1880's; heavy settlement did not occur until the first quarter of the twentieth century. Few biologists spent long periods of time in the area, although numerous workers did collect in the area. The green turtle has distinctly cyclical reproductive habits. Even such a dramatic event as a mass turtle breeding phenomenon could have escaped the notice of biologists.

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