Terrestrial Burrowing in Nesting Softshell Turtles (*Apalone mutica* and *A. spinifera*)

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Photographs by the senior author.

After nesting, female Softshells have been observed to burrow for variable distances under the sand surface in close proximity to the just-completed nest. We describe terrestrial burrowing behavior in *Apalone mutica* and *A. spinifera* from Kansas, Arkansas, and Louisiana and discuss possible reasons for the behavior.

Most nesting freshwater turtles minimize their time spent terrestrially, leaving the water to nest and returning immediately following nesting (Burke et al. 1994). Exceptions to this include some turtles that migrate long distances to nest (e.g., *Emydoidea blandingi*; Rowe and Moll 1991) and species that bury themselves after nesting (e.g., *Kinosternon flavescens* and *K. subrubrum*; Iverson 1990, Burke et al. 1994). Putative reasons for burrowing in *Kinosternon* include nest attendance/defense and awaiting conditions that would reduce stress or increase survival during the turtles' return to water (Iverson 1990, Burke et al. 1994).

Fig. 1. Male *Apalone spinifera* (top) and male *A. mutica* (bottom).

Fig. 2. Softshell habitat on sandbars of the Kaw River in Kansas (top) and nesting habitat along the White River in Arkansas (bottom).

North American Softshells (*Apalone* spp.; Fig. 1) are well known for their characteristic behavior of burrowing into sand and other soft substrates under water (Webb 1962, Graham and Graham 1991); however, little is known regarding their propensity to burrow terrestrially after nesting. We have observed shallow terrestrial "troughs" in association with nesting crawls of *A. mutica* and *A. spinifera* on sandbars that result from females crawling just underneath the surface of the sand and resurfacing some dis-

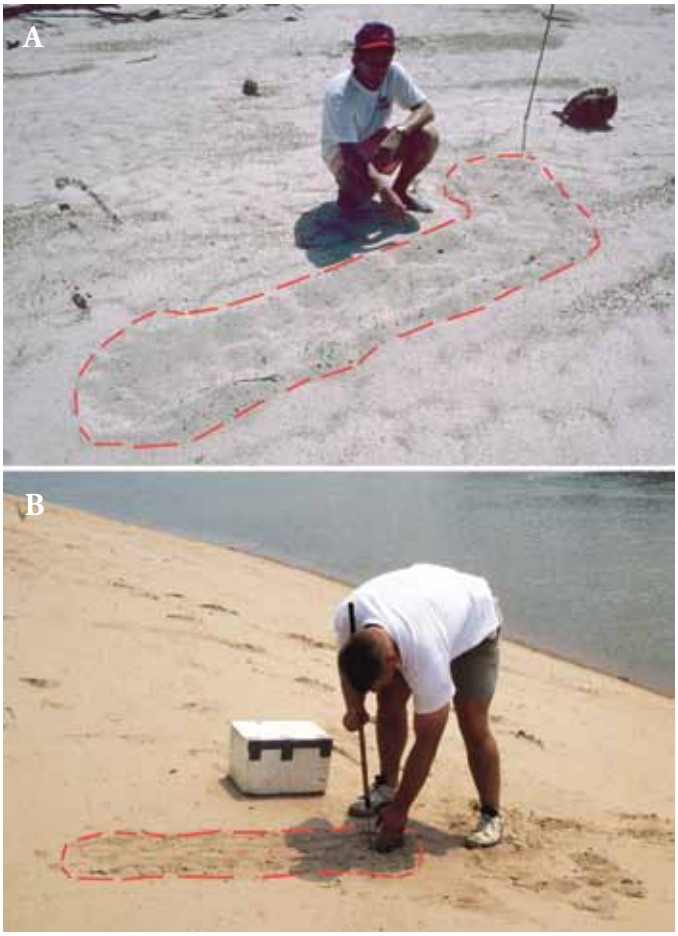

Fig. 3. (A) A curved trough (dashed outline) of *Apalone spinifera* on the Comite River in Louisiana. (B) A straight trough (dashed outline) of *A. mutica* on the White River in Arkansas. The researcher is probing to find the exact location of the nest.

tance away. We also have observed the process of trough excavation in one *A. mutica*.

Collectively, we have observed a total of 8 troughs of *A. mutica* on sandbars of the Kansas River in Kansas (Plummer 1976, unpubl. data, 7 troughs of *A. mutica* on the White River in Arkansas (Plummer, unpubl. data), and 7 troughs of *A. spinifera* and 4 unidentified *Apalone* troughs on the Comite River in Louisiana (Doody 1995). Troughs varied in length from 0.5–4.0 m (mean 2.2 ± 1.24 m SD in Louisiana) and about 20–30 cm in width. Troughs (Fig. 3) varied in shape from straight to curved to sinuous to figure-eight shaped. One trough that appeared to be made by one female *A. mutica* consisted of three separate segments in close proximity, each approximately 2–3 m in length.

Most nesting crawls of *A. mutica* and *A. spinifera* did not exhibit troughs (72 of 77; 93.5% nests of *A. mutica* and 198 of 209; 94.7% nests of *A. spinifera*). However, 5 of 8 (63%) troughs contained nests in Kansas and 11 of 15 (73%) troughs contained nests in Louisiana. Troughs were found only during the nesting season (late May–mid July for both species). Except for basking, this period is generally the only time the highly aquatic softshells are found in terrestrial situations (Webb 1962). We have found both pre- and post-nesting adult females (Fig. 4) burrowed typically at the exit end of the trough, but we have not found hatchlings, juveniles, adult males, or subadult females in troughs. Nests may occur anywhere in the trough, but usually were toward one end, most often at the entrance (Fig. 3B).

Few literature references address nesting troughs or their function. Harper (1926) noted that nesting softshells (probably *A. ferox*) sometimes burrowed before returning to water. *Apalone* spp. generally nest on open sandbars on sunny days (Webb 1962, Plummer 1976, Doody 1995), when extended exposure to high temperatures could presumably be lethal. One hypothesis for the function of troughs is that mothers burrow to temporarily escape high surface temperatures and await optimal conditions for return to water. This behavior is similar to that of Mud Turtles (*Kinosternon*), which nest long distances from their aquatic habitats (Burke et al. 1994).

Alternatively, burrowing turtles may exhibit cryptic behavior in response to disturbance or predation risk. In support, one *A. mutica* burrowed terrestrially after being disturbed by MVP while she was nesting. Burrowing by *Apalone* is common in aquatic situations (Graham and Graham 1991). For example, when approached from some distance, individual turtles will readily bury themselves under the sand in shallow water (Graham and Graham 1991; JSD, pers. obs.; MVP, pers. obs.).

Another possible function is that nesting turtles bury themselves to more closely assess the suitability of substrate characteristics such as temperature. However, only 5% of 68 *A. spinifera* nests in one study were associated with the behavior (Doody 1995). Finally, mothers may simply respond to a physical constraint. Extended hot weather conditions or coarse-grained sand may render surface sand not cohesive, causing the sand to cave in on itself when a turtle attempts to excavate a chamber (Doody et al. 2004; Fig. 5) or when hatchlings try to emerge from the nest chamber (Mortimer 1990; Fig. 6). As a consequence, the closely related Pig-nosed Turtle (*Carettochelys insculpta*) may nest at lower elevations on sandbars due to the friable sand at higher elevations (Doody et al. 2004); however, lower elevations increase the risk of flood mortality. By burrowing, softshell

Fig. 4. Female Softshells, such as this *Apalone spinifera* from Gin Creek, Arkansas, can be quite large.

mothers could excavate a nest in cohesive sand by removing the uppermost loose sand. This putative behavior is perhaps a simpler version of body-pitting displayed by sea turtles and the Amazonian Giant River Turtle, *Podocnemis expansa* (Schauble et al. 2006, Vogt 2008). Body-pitting may aid turtles attempting to nest on sandbars that have a layer of loose, dry sand. In support of this hypothesis, *Apalone* nests associated with troughs were deeper than those without troughs (Doody 1995).

Although we have generated hypotheses for the unusual "troughing" behavior exhibited by softshells, current evidence does not allow us to favor any particular one. Focal observations of nesting turtles would be particularly useful but difficult given the relatively low frequency of the behavior. Accordingly, the thermoregulation hypothesis would be difficult to test. However, the other two hypotheses may be more easily testable. First, mock predators or some other disturbance could be introduced to nesting turtles to test the predation risk hypothesis. Second, the cohesive sand hypothesis could be addressed by attempting to excavate an artificial nest chamber next to the trough. Failure to create a chamber would lend support to this idea (Doody et al. 2004).

Acknowledgments

After informing Henry Fitch about the unusual behavior of a nesting female *Apalone mutica* that MVP had observed on the Kansas River during the 1973 nesting season, Henry said, "You ought to look into that." Well Henry, here it is — thanks for the suggestion.

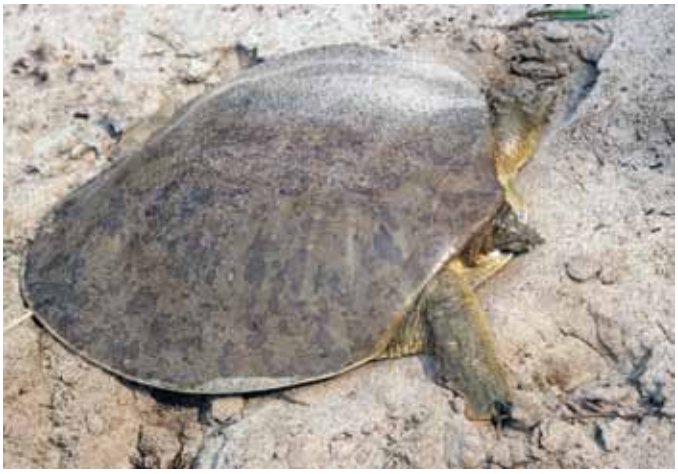

Fig 5. A female *Apalone mutica* excavating a nest along the White River, Arkansas.

Fig. 6. Hatchling *Apalone mutica* ready to emerge from a nest (the top 5 cm of sand has been brushed back) along the Comite River, Louisiana.

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