Dear Author,

Attached please find a gratis pdf file of your article/note published in Herpetological Review 42(4). You are receiving this pdf at no charge as a benefit of SSAR membership, and it is for your personal use only.

If you wish to order paper reprints or high quality resolution (=print quality) pdfs, you can do so by following the instructions sent to you by email from EzReprint@odysseypress.com. This offer does not apply to Geographic Distribution notes.

Sincerely,

SSAR Publications Office

Notice warning concerning copyright restrictions: The copyright law of the United States (title 17, United States Code) governs the making of copies or other reproductions of copyrighted material such as PDFs. One of these specific conditions is that the copy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes, or later uses, a PDF, copy, or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement. The Society for the Study of Amphibians and Reptiles (SSAR) holds the copyright to this PDF. SSAR authorizes the author to use this PDF to fill reprint requests for private study, scholarship and research purposes. It is a violation of SSAR’s copyright to distribute this PDF via mass emails, or by posting this pdf on any website for download — Except the author’s own personal (not business) website / webpage.
We thank the benefactors of the Saint Mary’s University Science Internship Program. John Lyons of the Wisconsin Department of Natural Resources facilitated the collection of the soft-shells.

PHILIP A. COCHRAN (e-mail: pcohran@smumn.edu) and NATHAN B. PETERSON (e-mail: nbpete08@smumn.edu), Biology Department, Saint Mary’s University of Minnesota, 700 Terrace Heights, Winona, Minnesota 55987, USA.

GOPHERUS AGASSIZII (Desert Tortoise). BURROW COLLAPSE. In the deserts of the southwestern U.S., burrows are utilized by the Desert Tortoise to escape environmental extremes (reviewed by Ernst and Lovich 2009. Turtles of the United States and Canada. 2nd ed. Johns Hopkins Univ. Press, Baltimore, Maryland. 827 pp.). However, the potential for mortality through burrow collapse and entrapment is poorly documented. Nicholson and Humphreys (1981. Proceedings of the Desert Tortoise Council, pp. 163–194) suggested that collapse due to livestock trampling may cause mortality. In addition, Lovich et al. (2011. Chelon. Cons. Biol. 10[1]:124–129) documented a Desert Tortoise that used a steel culvert as a burrow surrogate. The culvert filled completely with sediment following a significant rain event, entombing the animal and ultimately resulting in its death. We note that this mortality was associated with an anthropogenic structure; because tortoises are prodigious diggers, one might hypothesize that they have the ability to dig out of collapsed natural burrows in most situations. Circumstances described here presented us with an opportunity to test this hypothesis.

On 5 January 2011, we observed four occurrences of adult telemetered Desert Tortoises (one male and three females) hibernating in separate burrows that collapsed at our study site on a utility-scale renewable energy wind farm (33.95168 N, 116.667295 W; WGS84) in southern Riverside Co., California, USA. In mid December 2010, winter rainstorms in southern California caused the partial collapse of several burrows distributed throughout the study site (Fig. 1). Wet soil above the mouth of the burrows slumped into the openings blocking the entrance. The lengths of the collapsed segments were not measured relative to total burrow length but each completely occluded the burrow opening. The collapsed burrows were not located near any anthropogenic structures.

One Desert Tortoise, a female (CL = 25 cm, mass = 2950 g), was found (5 January) covered with dirt outside of a collapsed burrow from which she presumably extricated herself. By 5 May 2011, this individual had been relocated five times, producing two clutches of eggs, suggesting normal behavior unaffected by the temporary entombment. The second female (CL = 25 cm, mass = 3100 g) also successfully dug out of her collapsed burrow at some point in early February, and by 6 May 2011, had been relocated three times exhibiting normal behavior. The third female tortoise (CL = 23.3 cm, mass = 2750 g) began excavating her burrow, as observed by one of the authors while peering into a small opening in the dirt, but did not complete the process until early April 2011. By 5 May 2011 she has been relocated three times. By mid-April the last tortoise (male, CL = 32.8, mass = 6275 g) was still inside his collapsed burrow, on the right side of the original opening (from observer’s perspective), apparently unable to extricate himself. A different female tortoise (separate from those above) began excavating into the left side of this male’s burrow (from the outside) but did not complete the process. During the course of the spring the soil surrounding the male dried to an adobe-like consistency. On 14 April 2011, one of the authors used a shovel to remove soil from the top and left side of the male. Even with the body partially exposed, the tortoise was so firmly embedded in the soil that he could not be lifted out without digging away more soil on the right side of the body. The tortoise was completely encased in hard loamy soil with no space for moving the head, limbs, or body, exactly as the tortoise reported by Lovich et al. (op. cit.). It is our opinion that this animal would have remained entombed and would have died if not excavated.

Because of the conditions under which the natural burrows collapsed, the survival of the three female tortoises contrasts with the impending mortality of the male observed in this study. This is likely due to the fact that the females were not entombed in burrows oriented so as to allow the sun to bake the collapsed soil. When entombed under these conditions it appears that some tortoises may be unable to free themselves. Given the digging prowess of Desert Tortoises we hypothesize that this is not a frequent cause of mortality. However, temporary entrapment may result in physiological stress or late egress that translates into a delayed or complete loss of opportunity for early spring feeding and reproduction.

Support for our field studies is provided by the California Energy Commission (CEC). This study has been conducted under permits with the U.S. Fish and Wildlife Service and California Department of Fish and Game. This work was approved by Northern Arizona University’s Institute for Animal Care and Use Committee (IACUC). E. Nowak and C. Drost provided useful comments on earlier versions of this manuscript.

CELAB L. LOUGHRAN (e-mail: cloughran@usgs.gov), JOSHUA R. ENNEN (e-mail: jennen@usgs.gov), and JEFFREY E. LOVICH (e-mail: jeffrey.lovich@usgs.gov), U.S. Geological Survey, Southwest Biological Science Center, c/o Northern Arizona University, Applied Research & Development Bldg., Suite 150, P.O. Box 5614, Flagstaff, Arizona 86011, USA.

Graptemys Flavimaculata (Yellow-blotched Map Turtle). UNIQUE AERIAL BASKING BEHAVIORS. The genus Graptemys (Emydidae) is the most diverse genus of North American turtles, with most species occurring within river systems that drain into the Gulf of Mexico (Lindeman, in press. The Map Turtle and Saw-back Atlas: Ecology, Evolution, Distribution, and Conservation of the Genus Graptemys). One of these species, G. flavimaculata, is...
a small species endemic to the Pascagoula River system of southeastern Mississippi, USA (Selman and Qualls 2009. Herpetol. Cons. Biol. 4:171–184). This species is most commonly observed basking aerially, with high basking densities associated with river bends and associated emergent deadwood snags that provide basking platforms (Lindeman 1999. Biol. Cons. 88:33–42). I report on two unique basking behaviors observed in G. flavimaculata (Leaf River, Forrest Co., Mississippi): 1) extensive shuttling on/off basking structures, and 2) head dipping into the water. To the best of my knowledge, neither of these behaviors have been reported in this species, with the first rarely reported in other species and the second reported for only one other turtle species, Trachemys scripta scripta (Auth 1975. Bull. Florida State Mus., Biol. Sci. 20:1–45.).

On 20 June 2007, a female G. flavimaculata was observed shuttling on and off the same log eight times (1343–1511 h) for a total basking time of 74 minutes out of 88 total minutes (Table 1); unfortunately no data loggers were deployed at this time to collect temperature data. On 10 September 2007, a juvenile female shuttled eight times on and off different branches and tangles (0857 and 1400 h), for a total basking time of 163 minutes out of 303 total minutes. Lastly, a male individual was noted on 8 April 2008 to shuttle 9 times between a log and floating log (0939 and 1305 h), for a total time of 147 minutes out of 206 total minutes. Observations 2 and 3 had temperature data associated with behaviors (Table 1).

Basking turtles were also observed on multiple occasions head dipping in the water before submerging. This behavior was observed twice on 17 July 2007 with two different individuals (one male, one female). Before they returned to the water, both individuals dipped only their heads under the water surface. The male did this twice at 1020 h and then returned to the water following 141 minutes of basking; the female did this once for approximately 15–20 sec before submerging after basking for 138 minutes. During the week prior to these observations, the Leaf River basin received several inches of rain causing water levels to be abnormally high and water temperatures to be unseasonably cool for July. Another observation of this behavior was made on 7 May 2008 when a male G. flavimaculata submerged the anterior portion of his body while his hindlimbs were clinging to the basking structure. During the 1–1.5 minutes exhibiting this behavior, he raised his head out of the water twice and then submerged. Environmental temperatures for all three observations are described in Table 1.

Extensive shuttling behavior exhibited by G. flavimaculata has not been previously reported. Presumably this behavior allows basking individuals to thermoregulate on a fine scale, as the temperature data indicate that optimal body temperatures appear to fall within a relatively narrow window between the water [WT] and ambient air [AT]/log temperatures [LT]. During the two observations with associated temperature data, WT and AT were initially similar, but log temperature was higher than WT. By the end of the observations, both AT and LT increased considerably and were warmer than WT. A study with a similar species, Graptemys geographica (Bulté and Blouin-Demers 2010. Oecologia 162:313–322), found that individuals operated within a fairly narrow range of body temperatures throughout the day and individuals could raise their body temperatures well above water temperatures, thus playing a critical role in thermoregulation. Further, the three observations occurred across most of the active season of this species (April, June, September) and with different sizes/sexes, thus indicating that this behavior is not limited to a particular season and/or sex.

To the best of my knowledge, head dipping behavior has only been described in one study with T. s. scripta (Auth 1975, op. cit.) with little discussion of the behavior. From these observations, head dipping appears to be either 1) a thermal “test” of the water temperature prior to submergence, or 2) a method to gain olfactory cues of the nearby environment (i.e., detect conspecifics, predators, prey items). However, it is unclear if “water testing” is a better explanation than olfaction due to the inability to determine underwater conditions (i.e., presence of a predator). “Water testing” could be plausible as cooler WT relative AT or LT was documented, but one might expect this to occur more often due

<table>
<thead>
<tr>
<th>Date, sex of individual (shuttling [S], head-dipping [HD])</th>
<th>Initial emergence time (in minutes)</th>
<th>Initial final WT (°C)</th>
<th>Initial final AT (°C)</th>
<th>Initial final LT (°C)</th>
<th>Basking duration for each time individual emerged (in minutes)</th>
<th>Final submergence time (in minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 June 2007, female (S)</td>
<td>1343</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>17 13 10 8 5 7 8 6</td>
<td>1511</td>
</tr>
<tr>
<td>10 Sept 2007, juv female (S)</td>
<td>0857</td>
<td>26.9–29.4</td>
<td>26.6–32.2</td>
<td>28–33.6</td>
<td>80 9 52 19 8 8 29 31</td>
<td>1400</td>
</tr>
<tr>
<td>8 April 2008, male (S)</td>
<td>0939</td>
<td>20.1–24.4</td>
<td>19.0–26.2</td>
<td>22.5–32.4</td>
<td>3 2 17 9 39 2 1 2 72</td>
<td>1305</td>
</tr>
<tr>
<td>17 July 2007, male (HD)</td>
<td>n/a</td>
<td>24.7</td>
<td>28.3</td>
<td>31.4</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>17 July 2007, female (HD)</td>
<td>n/a</td>
<td>26.5</td>
<td>27.1</td>
<td>27.7</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>7 May 2008, male (HD)</td>
<td>n/a</td>
<td>24.7</td>
<td>27</td>
<td>30</td>
<td>n/a</td>
<td></td>
</tr>
</tbody>
</table>
Podocnemis expansa (Giant South American River Turtle).

Nesting Range Expansion. Podocnemis expansa is gregarious during nesting; even today, beaches are found in the Brazilian Amazon where hundreds of females might lay their eggs in a single night. The high consumption of this turtle's meat and eggs, as well as the ease with which it is captured, especially during nesting periods, has contributed to the decline in populations throughout its entire range and to extirpation in some places. Despite conservation and enforcement efforts, the species has been classified by the IUCN SSC FTTG as Critically Endangered (October 2010) (www.iucnredlist.org). Areas with high concentrations are well known, but regions at the limits of its range, where there are few individuals, are not yet completely known, partly due to difficult access and the extensive area where the species occurs.

In the Lower Xingu River there are known nesting sites for *P. expansa*, most notably on Embaubal beach (2.6784°S, 52.0186°W), in Senador José Porfírio (Pará state), but information is still lacking on the species’ occurrence throughout this hydrographic basin. Here we report the first occurrence of *P. expansa* in the Upper Xingu River, although regional studies have indicated that this area is a potential habitat for the species (Pritchard and Trebbau 1984. The Turtles of Venezuela. Society for the Study of Amphibians and Reptiles, Caracas. 403 pp.). In 2010 we recorded and monitored the temperature of two *P. expansa* nests in the Xingu Indigenous Park (11.9346°S, 53.5298°W). These were the only nests found on the sandy beaches that are formed during the river’s dry season throughout a monitored area of 13 km where Podocnemis unifilis frequently nests, and Phrynops geoffroanus do so less often. Nesting of *P. unifilis* in this area has been monitored since 2006, but it was only in 2010 that *P. expansa* nests were seen. Podocnemis expansa nesting occurred when the water level reached its lowest point, which is standard for this species.

We used data loggers (buttons Maxim DSG1921G) to monitor the temperature throughout incubation, at 60-minute intervals. For the two nests, incubation lasted 65 and 78 days and the thermo-sensitive-period temperature (in the second third of the incubation period) was 29.4 ± 0.86°C (range = 28–31°C) and 28.7 ± 1.01°C (range = 26.5–32°C), respectively. These incubation temperatures and durations are compatible with the production of males (Lubiana and Ferreira Júnior 2009. Zoologia 26:527–533). Hatching success was 57% in one nest with 101 eggs and 52% in the other nest with 73 eggs. No predation attempts were recorded for the nests.

On 29 October 2010, a female was captured by one of the Indians while fishing with a hook and line near the same beach where the two nests were found. This female had a straight carapace length of 33.6 cm, straight carapace width of 25.5 cm, plastron length of 28.1 cm, plastron width of 19.8 cm and weight of 3.38 kg. Tissue was collected from this individual for comparative genetic analysis with individuals from other regions in the future. The Indians confirmed that they do occasionally capture *P. expansa* when fishing. During the same incubation period in 2010 our group also saw *P. expansa* tracks on at least two other beaches in the area.

Reports from indigenous people suggest that *P. expansa* was introduced in the 1960s, when the Xingu Indigenous Park was created, by its founders and some indigenous people. These animals came from populations on the Ilha do Bananal, in the Araguaia River, in São Felix do Araguaia (Mato Grosso state). The animals were released at about 20 km upstream from the site where we observed the nests. Their introduction had been to provide an additional food source, mainly because the Indians of that region very much appreciate the meat and eggs of *P. unifilis*. In the 1980s a new release of young *P. expansa* took place in rivers in the Upper Xingu. This time the individuals were from Rio das Mortes (Mato Grosso) (Vera Lúcia Ferreira Luz, Environmental Analyst, Head of RAN/ICMBio, pers. comm.). On both occasions the translocation of animals was carried out without considering the species’ ecological needs and without approval from the relevant environmental entities. There are various signs that the information about the introduction of the species may be reliable: the apparent rarity of *P. expansa* in the region; the lack of knowledge among the indigenous peoples of the nests and nesting sites; few reports of adult individuals being captured; scant knowledge of the capture techniques used for the species; the fact that this species is not part of the traditional indigenous diet (while *P. unifilis*, common in the area, is an important food item); and the absence of this species in local myths and rites.

Knowledge of all nesting sites is important for the establishment of the species’ range, especially in regions that have been only lightly affected by agricultural inroads and intensive fishing. The report of *P. expansa* in the Xingu Indigenous Park is important because of the large changes foreseen with the damming of the Xingu River to generate energy. Hydroelectric plants are planned upstream and downstream of this recorded site, and it is vital that the feeding and nesting areas of the species are known, to study the possible effects on their ecology caused by the change in the river's hydric regime. The genetic diversity of these individuals should be compared with that of turtles from other areas (principally in populations from the Lower Xingu and Araguaia River Basin). This will lead to a better understanding of the evolutionary dynamic of the species in the reported site and of its diversity distribution within this area at the limit of its range.

This work was licensed by RAN/IBAMA (Process SISBIO Number: 16226-4, Emitted: 14/07/2010) and sponsored by Projeto Petrobras Ambiental (Contract 6000.0053598.09.2).