

several weeks after hatching. Egg and hatchling measurements are reported in Table 1. The JC twins had moderate dome asymmetries in their carapaces and were joined by remnants of a single shared yolk (Fig. 1). The MI twins possessed strongly deformed shells. The JC twin egg, but not the MI twin egg, was substantially heavier than the average of the remaining eggs in the clutch and at the site (Table 1). In both cases, the twins were smaller than average hatchlings (Table 1). Both came from larger than average clutches, as might be expected if twinning were random (Tucker and Janzen 1997, *op. cit.*).

We genotyped each twin tortoise at 9 variable microsatellite loci (Gopo D011, Gopo B104, Gopo-12, Gopo D004, GP81, Gopo-02, Gopo D107, GP61, Gopo B011). In each case, twins possessed identical genotypes at all 9 loci, while 462 sibling pairs at a study site in south-central Florida had identical genotypes at an average of  $3.8 \pm 1.6$  SD of these loci (KJL, unpubl. data). This strongly indicates that both pairs of twins were genetically identical and thus monozygotic, rather than dizygotic (fraternal), twins.

All methods were approved by the Institutional Animal Care and Use Committee of Georgia Southern University (#I19007) and conducted under scientific collecting permits LSSC-18-00023C (FL) and 119068420 (GA).

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**GRAPTEMYS PSEUDOGEOGRAPHICA KOHNII** (Mississippi Map Turtle). **REPRODUCTIVE BEHAVIOR.** The courtship of *Graptemys pseudogeographica* has been documented during the months of April, October, and November (Lindeman 2013. The Map Turtle and Sawback Atlas: Ecology, Evolution, Distribution, and Conservation. University of Oklahoma Press, Norman, Oklahoma. 460 pp.). Herein, we present an earlier month for courtship behavior for the subspecies *G. p. kohnii*.

In the Trinity River in Arlington, Texas, USA (32.78440°N, 97.08896°W) on 7 March 2021 at 0852 h we observed an adult female *G. p. kohnii* swimming near the shore of the river with her head above the surface. The water was ca. 0.6–1 m deep. An adult male was observed below the surface and directly under her chin. Each time she submerged her head, the male extended and arched his forelimbs parallel to her head with his wrist and foreclaws alongside her tympanum. Although intromission was not witnessed, the exhibited behaviors indicated that this was a courtship attempt. The day was sunny, and the air temperature was 14.4°C. Water temperature was not recorded. This is the earliest documented reproductive behavior for wild *G. p. kohnii*.

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**MACROCHELYS TEMMINCKII** (Alligator Snapping Turtle). **DIET.** On 8 October 2020 a deceased and decomposing adult female *Macrochelys temminckii* was found in Cottonwood Creek in Grand Prairie, Texas, USA (32.72656°N, 97.01437°W), recovered, and accessioned into the Texas Turtles Specimen Collection (TTSC 9). Prior to skeletonization, examination of the

turtle's stomach contents revealed the shell of a Zebra Mussel (*Dreissena polymorpha*). *Macrochelys temminckii* is known to consume Asian freshwater clams (*Corbicula* spp.) and mussels (Unionidae; Allen and Neil 1950. Spec. Publ. Ross Allen's Reptile Institute. 4:1–15). This is the first documentation of a zebra mussel in the diet of *M. temminckii*. Fragments comprising two unionid mussels were also recovered. Given the propensity for *Dreissena polymorpha* to attach to mussels in the family Unionidae (Baker and Hornbach 2008. Am. Midl. Nat. 160:20–28) it is possible that the unionid was carrying the *Dreissena* when it was ingested. Salvage of the specimen was performed under Texas Parks and Wildlife Scientific Research Permit SPR-0620-082.

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**MALACLEMYS TERRAPIN LITTORALIS** (Texas Diamond-backed Terrapin). **MALOCCLUSION (PROGNATHISM).** In turtles, malocclusions are deformations that result in imperfect position of the beak when the jaws are closed. Though more common in captive individuals, malocclusions have been observed in embryos of wild freshwater and marine species, including *Chelydra serpentina* (Snapping Turtle), *Chrysemys picta* (Painted Turtle), *Caretta caretta* (Loggerhead Sea Turtle), and *Chelonia mydas* (Green Sea Turtle; Kaska et al. 2000. In Abreu-Grobis et al. [compilers], Proceedings of the 18<sup>th</sup> International Sea Turtle Symposium, pp. 271–272. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Miami, Florida). In wild populations, malocclusions are reported at lower rates in adults compared to hatchlings and juveniles (Bell et al. 2006. Environ. Poll. 142:457–465). Specifically, prognathism, or development of an underbite, can be observed in individuals where portions of the beak become overgrown (Innis 2008. In Proceedings of the North American Veterinary

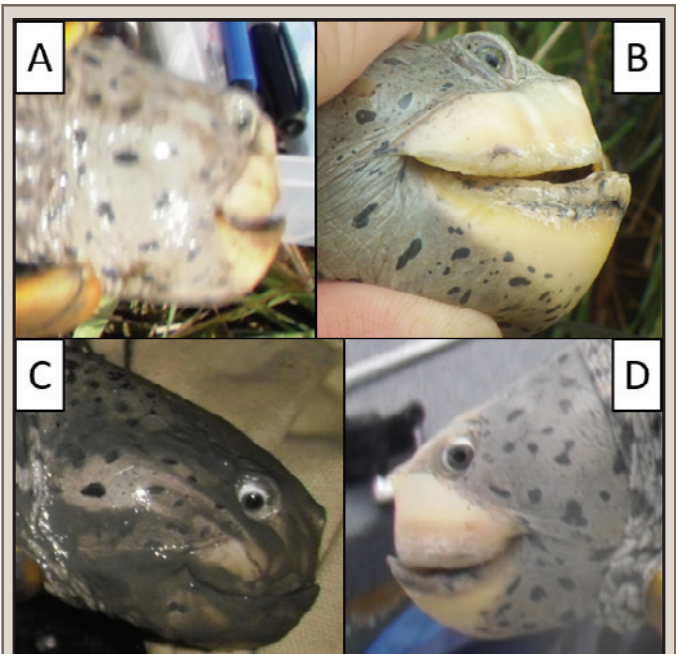


FIG. 1. Prognathism in wild caught adult female *Malaclemys terrapin littoralis*: A) *M. t. littoralis* N229 on 21 April 2010; B) *M. t. littoralis* N229 on 3 October 2021; C) *M. t. littoralis* N604 on 1 July 2011; D) *M. t. littoralis* N604 on 8 August 2012.

Conference, Orlando, Florida, 2008, Vol. 22, pp. 1780–1782). Documentation of malocclusions, specifically prognathism, in adult chelonians is rare, with most records relegated to conference proceedings or clinical reports. To the authors' knowledge, this report represents the first documentation of malocclusion and prognathism in adult females from a wild population of *Malaclemys terrapin littoralis*.

As part of an ongoing long-term monitoring program established in 2008, two adult female Diamond-backed Terrapins exhibiting prognathism have been captured multiple times ( ). Turtle N229 was first captured on 21 April 2010 (190 mm SCL, 47 mm head width). She was believed to be a full-grown adult at the time of this initial capture. On 3 October 2021, turtle N229 was recaptured (194 mm SCL, 49 mm head width) and exhibited little growth in the 4183 d between capture events (4 mm total). Another adult female, N604, was originally captured on 1 July 2011 (184 mm SCL, 47 mm head width). This turtle was recaptured on 8 August 2012 (185 mm SCL, 48 mm head width) and 23 October 2013 (185 mm SCL, 49 mm head width), though she has not been captured again since 2013. All capture events occurred during routine, random transect surveys of an insular population at South Deer Island, Galveston, Texas, USA (29.27108°N, 94.91085°W; WGS 84). To date, over 1000 individuals have been captured and marked in this ongoing program. Except for these two individuals, no records of malocclusions in adult males or other adult females have been observed.

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**PANGSHURA SMITHII PALLIDIPES (Pale-footed Roofed Turtle).** **DIET.** *Pangshura smithii pallidipes* is a geoemydid turtle that occurs in northern India and Nepal, including Bardiya National Park in western Nepal (Kästle et al. 2013. Field Guide to Amphibians and Reptiles of Nepal, Arco-Nepal e.V., München, Germany. 397 pp.). It is omnivorous and feeds on water insects, aquatic plants, fruits, tadpoles, frogs, fish, and meat in captivity (Schleich and Kästle 2002. Amphibians and Reptiles of Nepal: Biology, Systematics, Field Guide, A.R.G. Gantner Verlag K.G., Germany. 540 pp.). *Pangshura smithii* (Brown Roofed Turtle) is documented to feed on nine



FIG. 1. *Pangshura smithii pallidipes* feeding on *Imperata cylindrica* at the Turtle Conservation Center, Bardiya National Park Office, Bardiya, Nepal.

plant genera: *Typha*, *Desmostachya*, *Cyperus*, *Nasturtium*, *Saccharum*, *Potamogeton*, *Cynodon*, *Amaranthus*, and *Polygonum* (Auffenberg and Khan 1991. Hamadryad 16:25–29). Here, I report on *P. smithii pallidipes* feeding on *Imperata cylindrica* (Cogongrass).

At 1400 h on 31 October 2021, at the Turtle Conservation Center (28.45344°N, 81.24133°E; WGS 84; 157 m elev.) at Bardiya National Park Office, Thakurdwara, Bardiya, I observed a *P. smithii pallidipes* feeding on *I. cylindrica*. The turtle bit off pieces of the leaves (both fresh and old) of *I. cylindrica* on land and carried them into the water to swallow them (Fig. 1). This feeding process was repeated several times for 5 min. To the best of my knowledge, this is the first report of *P. smithii pallidipes* feeding on *I. cylindrica*.

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**PSEUDEMYIS CONCINNA (River Cooter) and TRACHEMYS SCRIPTA ELEGANS (Red-eared Slider).** **CLEANING SYMBIOSIS.** Cleaning symbiosis occurs when one organism, a cleaner, feeds on the body surface of another organism, resulting in the removal of ectoparasites, epiphytes, scales, mucus, or dead skin (Losey et al. 1994. Copeia 1994:684–690; Krawchuk et al. 1997. Can. Field-Nat. 111:315–317). Cleaning symbiosis can occur between individuals of the same (intraspecific) or different (interspecific) species (Losey 1987. Symbiosis 4:229–258). Cleaning symbiosis is infrequently reported among turtles and the adaptive significance of this behavior remains poorly understood (Sazima et al. 2004. Cybium 28:47–53; Haralson and Pearson 2020. Herpetol. Rev. 51:312–313). In most cases of cleaning symbiosis involving turtles, fish are reported to remove epiphytic algae and ectoparasites (e.g., barnacles) from turtles (Losey et al. 1994, *op. cit.*; Sazima et al. 2004, *op. cit.*; Donini et al. 2020. Herpetol. Rev. 51:538), although on occasion, intra- and interspecific interactions among turtles have been observed in which one individual removes algae and/or ectoparasites from another (Meshaka 1988. Herpetol. Rev. 19:88; Meshaka and Deyrup 1999. Herpetol. Rev. 30:95; Krawchuk et al. 1997, *op. cit.*; Haralson and Pearson 2020, *op. cit.*). We here report multiple observations of cleaning symbiosis (intra- and interspecific removal of epiphytic algae) involving *P. concinna* and *T. scripta elegans* inhabiting an urban stream.

Our observations were made along a 1.8 km stretch of Wards Creek bounded by bridges at College Drive (upstream) and Interstate Highway 12 (downstream) in Baton Rouge, East Baton Rouge Parish, Louisiana, USA. Wards Creek drains a largely urban watershed, and as such is subject to rapid and highly variable fluctuations in water levels following rainfall events (see also Walsh et al. 2005. J. North Amer. Benthological Soc. 24:706–723 for characteristics of urban streams). Normal water depth in this stretch of Wards Creek is  $\leq 1$  m, although deeper pools (to 2 m) are present in several places. Turbidity is minimal except after rainfall events, facilitating observations of turtle behavior. In most places, the creek is shaded by overhanging hardwood trees, although a 0.4 km stretch immediately upstream from Interstate Highway 12 is characterized by dense herbaceous annual vegetation (primarily *Ambrosia trifida*). We used Nikon Monarch binoculars (8 × 42) to observe behavioral interactions among turtles.

Our first observation of cleaning symbiosis occurred from