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Putative Predation and Scavenging of Two Sea Turtle Species by the American Alligator, *Alligator mississippiensis*, in Coastal Southeastern United States

The food habits of the American Alligator (*Alligator mississippiensis*) are well documented in many freshwater systems (salinity < 5 ppt) throughout its native range (Barr 1997; Delany and Abercrombie 1986; Gabrey 2010; Rice 2004). In marine (salinity > 25 ppt) and estuarine (variable salinity between 5 ppt and 25 ppt) habitats, however, the dietary interactions and food habits of *A. mississippiensis* have received little attention by researchers; limited data exist from Louisiana (Gabrey 2010; McNease and Joanen 1977; Wheatley 2010), Wassaw Island, Georgia (Tamarack 1988, 1993), and Cumberland Island, Georgia (Shoop and Ruckdeschel 1990). To date, no comparative analysis among marine or estuarine populations has been performed. The aforementioned studies indicate that *A. mississippiensis* foraging in marine and estuarine environments consume a variety of prey items including crustaceans (e.g., blue crab, shrimp, crayfish), horseshoe crab, teleost fishes (e.g., mullet, gar, shad, top-minnows), small mammals (e.g., nutria, raccoon, mink), and multiple species of wading birds. Here we report the first accounts of *A. mississippiensis* consuming marine reptiles: Green Sea Turtle (*Chelonia mydas*) and Loggerhead Sea Turtle (*Caretta caretta*).

Observations.—The most recent incident occurred on 25 September 2010 when a sea turtle flipper tag (# TTF-850) was recovered from the stomach of harvested adult male *A. mississippiensis* (total length [TL] = 352 cm, mass = 243 kg). This *A. mississippiensis* was harvested near the mouth of the New River, South Carolina, USA (32.100139°N, 81.088088°W), during a recreational hunt. The flipper tag was subsequently mailed to the Archie Carr Center for Sea Turtle Research (ACCSTR) to report the finding and to collect a returned tag reward.

During a sea turtle nesting survey along South Ponte Vedra Beach, Florida, USA on 17 September 2010 the carapace of a juvenile *Chelonia mydas* (straight carapace length [SCL] = 20.5 cm, straight carapace width [SCW] = 17.3 cm) was found in the sand along the surf (30.07329°N, 81.334190°W, Guana Tolomato Matanzas National Estuarine Research Reserve [GTM-NERR] catalog # 978). No plastron accompanied the carapace.

Eight conical puncture wounds were located laterally along the posterior of the carapace (Fig. 1). The puncture pattern was determined to be bite marks from an adult *A. mississippiensis* (K. Vliet and P. Gignac, pers. comm.). Verification was made chiefly due to the spacing between puncture wounds and the diamond-shaped indentations left when teeth did not fully perforate the bone, typical of crocodilian dentition (P. Gignac, pers. comm.). Given the size and spacing of the puncture wounds in the *C. mydas* carapace, we estimate that the *A. mississippiensis* involved was approximately 2 m TL. Additionally, markings on the turtle carapace indicate that the *A. mississippiensis* adjusted and manipulated the prey item in its mouth in an attempt to break up and swallow the *C. mydas* (Fig. 1).

Four observations of dead *C. caretta* being scavenged by *A. mississippiensis* were made on three separate Georgia barrier islands during ongoing sea turtle nesting surveys sponsored by the Georgia Department of Natural Resources (GADNR) and the U.S. Fish and Wildlife Service (USFWS). The most recent of these observations occurred at 2011 h on 10 May 1999. Caretta Research Project (CRP) personnel found the remains of a moderately decomposed sub-adult *C. caretta* (SCL = 55.0 cm, SCW = 45.9 cm, straight plastron length = 32.3 cm, straight plastron width = 37.9 cm, GADNR biopsy specimen # GA99051001-WASI) on the north end of Wassaw Island, Georgia (31.90395°N, 80.93882°W). CRP personnel pulled the carcass further up the beach toward the dunes so that it would not wash out later that night during high tide. Later that night, at 2300 h, the same personnel encountered a large *A. mississippiensis* (TL 2.7–3.0 m) investigating the aforementioned turtle carcass. The patrol left the *A. mississippiensis* and *C. caretta* carcass at 2330 h. The following day at 1200 h, CRP personnel traveled back the location of the carcass to take photographs of the specimen for GADNR documentation. Upon arrival, they found tracks from an adult *A. mississippiensis* originating at the stranding site and leading westward toward the dunes. The only remaining evidence of the turtle carcass at the stranding site was a depression where the turtle had been placed, two costal scutes, and the right front flipper. Pieces of the decomposing turtle were present along the alligator's route, which was

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indicated by tracks leading into the dunes. The parts included three scutes (with epibiota still attached), five ribs, two hyoplastra, the upper and lower tomia, marginal, and pygal bones, horse-shoe crab claws (presumably stomach contents from the turtle), and portions of the esophagus with visible papillae. Turtle parts and alligator tracks led directly to an alligator hole located on the eastern edge of Beach Pond (31.90500°N, 80.94000°W) approximately 150 m away from where the stranded carcass had originally been placed.

Researchers on other Georgia barrier islands have observed three similar instances of sea turtle scavenging. An *A. mississippiensis* was seen scavenging a *C. caretta* carcass on Blackbeard Island (31.46732°N, 81.21866°W) in 1998 (D. Keineth, pers. comm.). Additionally, two instances occurred on Little St. Simons Island (31.26932°N, 81.30078°W) in 1995 and 1996, in which *A. mississippiensis* were observed carrying decomposing *C. caretta* carcasses down the beach to freshwater wetlands located behind the dunes (M. Robinson, pers. comm.).

Discussion.—Two other crocodilian species have been reported to consume sea turtles. *Crocodylus porosus* (Estuarine Crocodile) on Crab Island, Queensland, have been observed patrolling beaches to capture nesting *Natator depressus* (Flatback Sea Turtle) and *Lepidochelys olivacea* (Olive Ridley Sea Turtle) as female turtles search for suitable locations to dig nests and oviposit (Limpus et al. 1983; Sutherland and Sutherland 2003). It was estimated that during sea turtle nesting season *C. porosus* will consume a minimum of one adult turtle per week in this location (Sutherland and Sutherland 2003). Additional records of *N. depressus* predation by *C. porosus* are reported from Papua New Guinea (Hirth et al. 1993). In Costa Rica, *Crocodylus acutus* (American Crocodile) were recorded consuming nine adult *L. olivacea* (Ortiz et al. 1997) following nesting events.

In freshwater systems, *A. mississippiensis* have been documented to prey upon several freshwater turtle species within the genera *Apalone*, *Deirochelys*, *Kinosternon*, *Pseudemys*, *Sternotherus*, and *Trachemys* (Barr 1997; Delany and Abercrombie 1986; Gabrey 2010; McNease and Joanen 1977; Wolfe et al. 1987). In three Florida lakes, Delany and Abercrombie (1986) found turtles to be the most common prey type recovered from the stomachs of adult male alligators greater than 3.0 m total length. With regard to the information reported here, only two of the six observations potentially represent predation of marine turtles; the other four most certainly represent scavenging of dead turtle carcasses by *A. mississippiensis*.

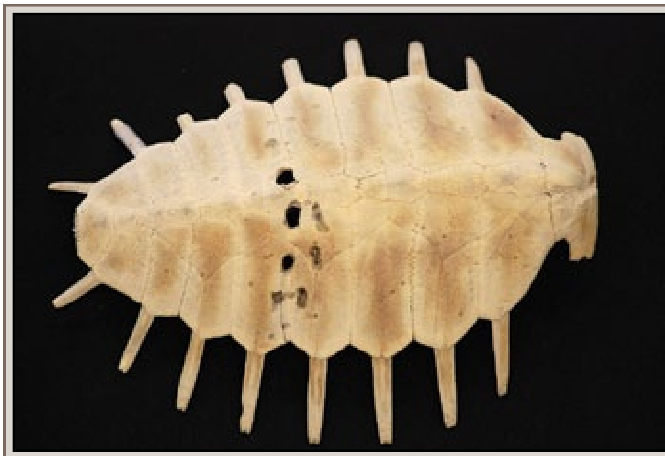

Fig. 1. Photograph of the carapace of a *Chelonia mydas* with bite marks identified as those of an *Alligator mississippiensis* measuring ca. 2 m TL.

Following the discovery of a flipper tag in the stomach of an adult *A. mississippiensis* on 25 September 2010, ACCSTR personnel found the tag had originally been applied to the right front flipper of a *Caretta caretta* that had been reared in captivity by the National Marine Fisheries Service Lab in Galveston, Texas, during 2005–2006. The turtle was used in the testing of turtle excluder devices and subsequently released off Sebastian Inlet State Park in Brevard County, Florida, on 6 July 2006. The last measurements taken in 2006 (SCL = 43.4 cm, SCW = 35.5 cm, mass = 10.63 kg) indicate that the turtle may have been >70 cm SCL in 2010 (P. Eliazar, ACCSTR, pers. comm.). At this size the *C. caretta* would have been far too large for an adult *A. mississippiensis* to consume whole (Erickson et al. 2003). Therefore, three plausible explanations exist for the presence of the flipper tag in the stomach of the harvested *A. mississippiensis*: 1) the alligator consumed the right flipper of the live turtle; 2) the alligator scavenged portions of the turtle after it had died; or 3) the alligator consumed the flipper tag after it had already fallen off the turtle. The type of flipper tag attached to this particular turtle (i.e., inconel metal) can remain attached for up to 5 or more years (P. Eliazar, pers. comm.) and it is highly resistant to corrosion. Thus, it is most likely that the flipper was removed from a live or stranded turtle and that the appendage was digested by the *A. mississippiensis*, leaving only the indigestible tag behind.

The second observation of potential predation was the finding of a *C. mydas* carapace on 17 September 2010. At the estimated size of 2 m TL, the alligator responsible for the bite wounds could not have swallowed the turtle whole. It is possible that the *A. mississippiensis* consumed the plastron, viscera, head, and appendages and then abandoned the remainder of the carcass, as these portions were missing from the turtle. We were unable to determine if the *C. mydas* was captured alive and killed by the *A. mississippiensis* or if the turtle was found stranded dead.

We speculate that one of two scenarios accounts for the *C. mydas* carapace on the beach. More probable, an adult *A. mississippiensis* crossed the 100–250 m of beach scrub habitat and FL-A1A from Guana Lake within the Guana Wildlife Management Area (GWMA) to access the beach shoreline. Guana Lake, a 10 mile long man-made impoundment (30.074216°N, 81.337261°W), is home to a large resident *A. mississippiensis* population as indicated from ongoing mark-recapture and GPS telemetry studies (J. Nifong, unpubl. data). Although rarely reported, *A. mississippiensis* have been observed on multiple occasions traversing FL-A1A and roaming in the surf along South Ponte Vedra Beach (J. Ellenberger, pers. comm.). Alternatively, the predation event could have taken place within the Intracoastal Waterway and the turtle remains subsequently carried out to sea through the nearby St. Augustine Inlet.

For sea turtle species that return to nesting beaches along the southeastern coast of the United States, peak nesting occurs in summer from June–August (S. Eastman, pers. comm.). Many of these nesting beaches are located within the home ranges of *A. mississippiensis* which occupy dune swales and coastal freshwater wetlands. *Alligator mississippiensis* using these coastal habitats regularly travel to estuarine and marine habitats in search of prey (Tamarack 1988), some spending as much as 87% of their time in fully marine waters as determined from GPS telemetry studies (J. Nifong, unpubl. data). During nesting season it is likely that *A. mississippiensis* encounter adult sea turtles along nesting beaches in shallow water or on-shore, providing the opportunity for capture. In deeper open water, adult sea turtles would most likely evade capture by *A. mississippiensis*. Furthermore, a number of estuaries along this coast serve as nursery grounds for juvenile sea turtles such as *C. mydas* (S. Eastman, pers. comm.). Given that *A. mississippiensis* use the same habitat for foraging, it is possible that *A. mississippiensis* encounter juvenile sea turtles in these nursery areas while in search of prey. Although the observations reported here are widely separated both geographically and temporally (i.e., 15 years) we believe the predation of sea turtles by *A. mississippiensis* may occur regularly yet remain undetected in most cases.

Sea turtle strandings are often used to estimate the annual mortality of sea turtle species in the United States, even though two studies have questioned the practice (Shoop et al. 1998; Shoop et al. 1999). Because many factors influence the likelihood of a dead sea turtle washing ashore, the possibility exists that strandings represent only a fraction of the overall annual mortality actually occurring in near-shore waters. Additionally, because *A. mississippiensis* may removed a small percentage of beached turtles via scavenging, researchers are potentially underestimating the true number of dead turtles washing ashore, especially in coastal habitats supporting high alligator densities. More information is needed to determine the frequency of these scavenging events before we can accurately assess the effect of *A. mississippiensis* scavenging on the real number of dead turtles washing ashore annually along the southeastern Atlantic and Gulf coasts.

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