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## The Distribution, Habitat Use, Activity, and Status of the Spotted Turtle (*Clemmys guttata*) in Georgia

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**ABSTRACT.** – Conservation of the imperiled spotted turtle (*Clemmys guttata*) at the regional level (i.e., Georgia, USA) will require knowledge of the species historic and contemporary distribution, activity patterns, and habitat preferences. To address these needs, we compiled 170 records of spotted turtles in Georgia from 1892 to 2014, including 89 museum records, 80 records based on credible observations or photos, and 1 literature record. There are recent (1995–2014) records for 79 locations in 31 counties, with 29 of these occurring on 14 conservation lands. Our results demonstrate that the spotted turtle ranges throughout much of the Coastal Plain of Georgia including the Flint River and Withlacoochee River drainages of the Gulf Coastal Plain. Half of the records for which habitat could be classified (62 of 124 records, 50%) were associated with blackwater creek swamps or seepage slope swamps. Remarkably, all but 4 Georgia spotted turtle records with body size data (i.e., 150 of 154; 97%) were based on adult turtles. The majority of Georgia records with the date included were from the late winter–spring (134 of 160 records, 84%, February–May). Likewise, the majority of observations were turtles found on roads (94 of 170 records; 55%), the majority of which (63; 67%) were alive. For the spotted turtle in Georgia, we recommend 1) continued protection and state-listing status, and 2) initiating long-term mark-recapture efforts to estimate population sizes and demographics and evaluate population trends.

**KEY WORDS.** – Reptilia; Testudines; distribution; conservation status.

Owing to its rarity and cryptic habits, the spotted turtle (*Clemmys guttata*, Fig. 1) is among the most poorly known of Georgia's freshwater turtle fauna. There has been very little published information on the life history and ecology of this species in Georgia other than species accounts in regional treatments (e.g., Williamson and Moulis 1979; Buhlmann and Gibbons 1997; Jensen 1999; Akre and Fahey 2008) and brief notes detailing distribution records (Knepton 1956; Folkerts and Skorepa 1967; Berry and Gidden 1973). The most thorough treatment pertaining to the status and distribution of *C. guttata* in Georgia is found in Williamson and Moulis (1994a, 1994b), who compiled and mapped all *C. guttata* records (through 1994) supported by museum specimens.

*Clemmys guttata* is known from a wide array of habitats; generally, wetlands inhabited by the species are characterized by having clear, clean water, aquatic or emergent vegetation, and deep, soft, mucky substrates (Ernst and Lovich 2009). Individuals commonly use upland habitats when moving between wetlands, traveling to or from nesting sites, and during droughts or periods of dormancy (Ward et al. 1976; Litzgus and Brooks 2000; Milam and Melvin 2001). In Georgia, *C. guttata* has been reported from a variety of wetland habitats including ditches, temporary woodland ponds, depression wetlands (i.e., Carolina bays, cypress-gum ponds), blackwater creek

swamps, seepage slope swamps (i.e., bayheads, bay swamps, sphagnum bogs, or pocosins), river swamps, and tidally influenced streams and marshes (Wharton 1978; Williamson and Moulis 1979, 1994c; Jensen 1999). In Georgia and throughout the species range, *C. guttata* prefers shallow water (< 0.5 m in depth), often inhabiting wetlands subject to pronounced seasonal fluctuations in water level.

*Clemmys guttata* has a relatively short active season and is most active in the spring (Ernst and Lovich 2009). The annual peak of activity occurs earlier (March) in the southern part of the species range (South Carolina) than in populations found further north, which may not become active until May (Lovich 1988; Haxton and Berrill 2001; Litzgus and Mosseau 2004). A radiotelemetry study on *C. guttata* conducted at a hardwood swamp in South Carolina revealed that basking activity peaked in late March and early April when turtles aggregated to breed; turtles became inactive by November or December, although individuals occasionally moved or were observed basking on sunny winter days (Litzgus 2003; Litzgus and Mosseau 2004).

*Clemmys guttata* appears on the International Union for Conservation of Nature (IUCN 2013) Red List as Endangered. This species was recently petitioned for federal listing as Threatened, the petitioners stating that "Its overall



**Figure 1.** An adult female spotted turtle (*Clemmys guttata*) from southern Georgia, USA. Photo by Dirk J. Stevenson.

range has contracted with most remaining populations declining and suffering from isolation” (Giese et al. 2012). Ongoing threats cited in the petition include habitat loss, invasive plant species, collection for the pet trade, and vehicle mortality (see Ernst and Lovich 2009 for other causes of decline). *Clemmys guttata* is currently state-listed in Georgia as Unusual, a designation for “A species that has special or unique features that entitle it to special consideration to ensure its continued survival”; this listing status protects it from collection on public and private lands (Georgia Department of Natural Resources, *pers. comm.*, June 2015).

We recognized that the information available in Williamson and Moulis (1994a, 1994b, 1994c) was outdated, prompting the current study. The goal of our study was to compile all *C. guttata* records and observations for Georgia to allow a better understanding of the habitat requirements, life history, historic and current distribution, and conservation status of this poorly known species. The information generated by this effort is currently needed by herpetologists and natural resources managers in Georgia so that they may 1) consider this species when prioritizing conservation and land acquisition goals, 2) prepare habitat management plans for protected lands that support *C. guttata* populations, 3) identify population strongholds, as well as sites and regions where future field inventories are merited, and 4) locate reference sites for long-term population monitoring.

## METHODS

We compiled *C. guttata* records for Georgia through 30 June 2014 from several sources: 1) museum records, 2) literature records, 3) observations obtained from the Georgia Department of Natural Resources’ Biotics Database, 4) our personal observations, and 5) a September 2013 survey soliciting observations from herpetologists and natural resource personnel working in Georgia. Museum collections queried by this study include the American Museum of Natural History (AMNH), Auburn University (AUM), Charleston Museum (CHM), Georgia Museum of Natural History (GMNH), Georgia Southern University (GSU), Georgia Southwestern State University (GSWSU), Georgia State University, Florida Museum of Natural History (FMNH), Piedmont College, United States National Museum (USNM), and Valdosta State University (VSU). A number of other major museum collections had been queried as recently as 1994 (Williamson and Moulis 1994a, 1994b).

We measured straight-line carapace length (SCL) to the nearest 0.1 cm and assigned sex to specimens using characteristics given by Ernst and Lovich (2009). Means are reported with standard deviations (SD). Records with size data were classified as adult (SCL  $\geq$  8.0 cm), juvenile (SCL = 4.0–7.9 cm), or hatchling (SCL  $\leq$  3.9 cm; Ernst and Lovich 2009). We estimated the size class of some specimens from photographs.

We classified habitat at *C. guttata* sites using 2 state-specific publications that describe the natural communities of Georgia (Wharton 1978; Edwards et al. 2013). From site visits, interviews with the observers, or review of aerial imagery, we classified habitat type for each record as 1 of 7 habitat categories.

1) *Blackwater Creek Swamps/Seepage Slope Swamps*. — Often referred to colloquially as “branches”, blackwater creek swamps are broadleaf tree and shrub communities (with over half of the woody plants composed of evergreen species) along small, tannin-stained streams; Edwards et al. (2013) synonymized this community with “Small Stream Floodplain Forest”. Seepage slope swamps (alternative names include bay swamps, shrub bogs, or pocosins), seepage-influenced wetlands underlain by deposits of peat, are typically located at the base of xeric sandhills; dominant canopy species include sweet bay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), and tulip poplar (*Liriodendron tulipifera*). (Note: Because seepage slope swamps are closely associated with, and typically grade into or are situated near, the origins of blackwater creek swamps, we combined these into a single habitat designation.)

2) *River Swamps*. — These alluvial wetlands occur in the floodplains of rivers and larger streams and are typically forested with bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), and Ogeechee lime (*Nyssa ogeche*). This classification includes “Cypress-Tupelo River Swamp” and “Bottomland Hardwood” communities per Edwards et al. (2013).

3) *Depressional Wetlands*. — These isolated, temporary or semi-permanent wetlands are often forested with scattered pond cypress (*Taxodium ascendens*), swamp black gum (*Nyssa sylvatica* var. *biflora*), or both and include depression marshes, Carolina bays, cypress-gum ponds, and limesink ponds.

4) *Swamps*. — We used this classification for all forested and freshwater wetlands, including disturbed ecosystems, that could not be readily assigned to categories 1, 2, or 3 above.

5) *Ditches*. — These are linear wetlands of anthropogenic origin (usually along road margins; Fig. 2).

6) *Tidal Wetlands*. — These are coastal wetland communities that are tidally influenced, with slightly brackish water).

7) *Unknown*. — For records represented by specimens found on roads we classified the habitat type of the nearest wetland located within ~ 200 m of the record’s location; if we could not locate a wetland, we classified the record’s habitat as unknown.

## RESULTS

We compiled 170 *C. guttata* records for Georgia including 89 museum records, 80 records based on credible observations or photos, and 1 literature record (Knepton 1956; Fig. 3). These records included collec-



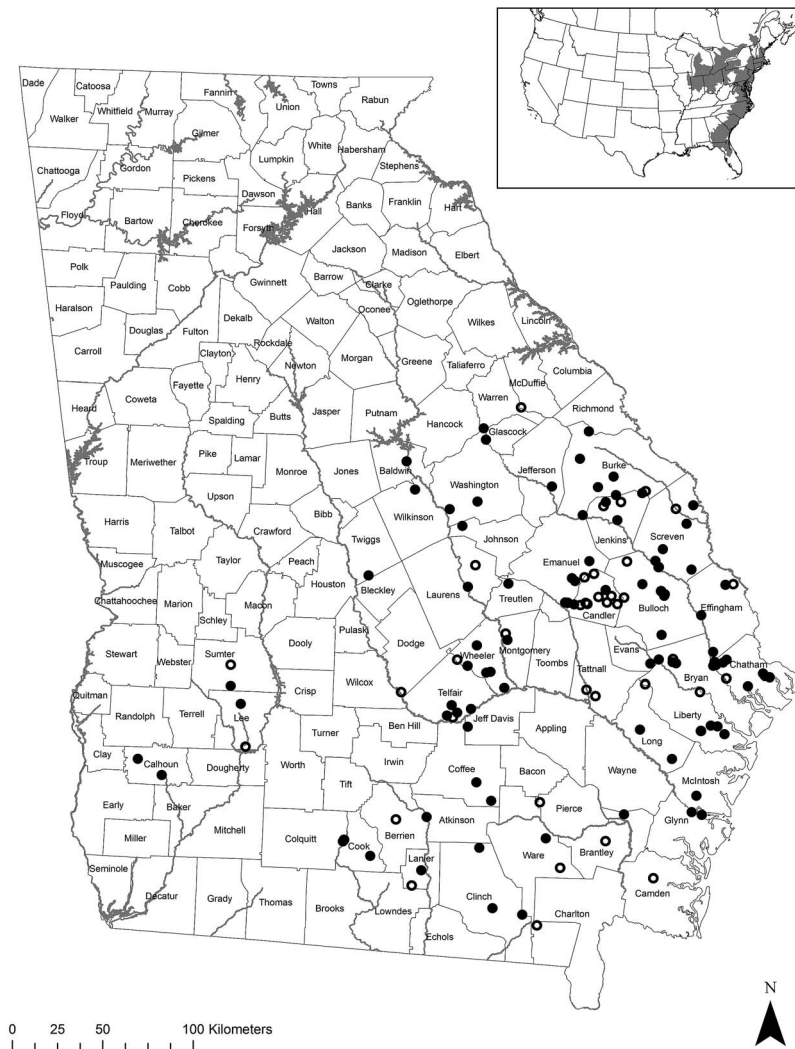
**Figure 2.** A blackwater ditch habitat in southern Georgia inhabited by spotted turtles (*Clemmys guttata*). Note logs utilized by basking individuals. Ditch is ~ 3 m wide. Photo by Dirk J. Stevenson.

tions or observations of 72 males, 35 females, and 63 turtles for which sex was not determined.

Records spanned the period 1892–2014, with 80 records (47%) documented from 2000 to 2014 (Fig. 4). There were records for all months of the year except December (Fig. 5). Twenty-seven records were classified as “month unknown” due to insufficient data; 17 of these records were observations or collections made during “spring”.

All but 4 records (150 of 154, 97%) for which size data were available were based on adult-sized turtles. The remaining 4 records were of juveniles, with no records of hatchlings. Size was unknown for 16 records. We measured 39 *C. guttata*, all of which were adults ( $n = 34$  preserved museum specimens;  $n = 5$  live turtles). Male SCL averaged  $10.2 \pm 0.59$  cm (range, 9.1–11.2 cm;  $n = 25$ ). Female SCL averaged  $9.8 \pm 0.82$  cm (range, 8.6–11.2 cm;  $n = 14$ ).

There were 46 records that lacked habitat information and could not be classified as to habitat type. We classified 62 records (50% of the total number of records for which habitat could be classified) as being from blackwater creek swamp/seepage slope swamp habitats (Fig. 6), with most of the remainder from swamp (25 records), river swamp (14 records), and ditch (14 records) habitats.



**Figure 3.** Distribution of the spotted turtle, *Clemmys guttata*, in Georgia. Solid symbols represent museum records and records supported by photographs (deposited with the Georgia Department of Natural Resources Biotics Database). Open symbols signify records based on personal observations by the authors and credible reports (unsupported by photos or specimens) from herpetologists, biologists, and others familiar with the species.

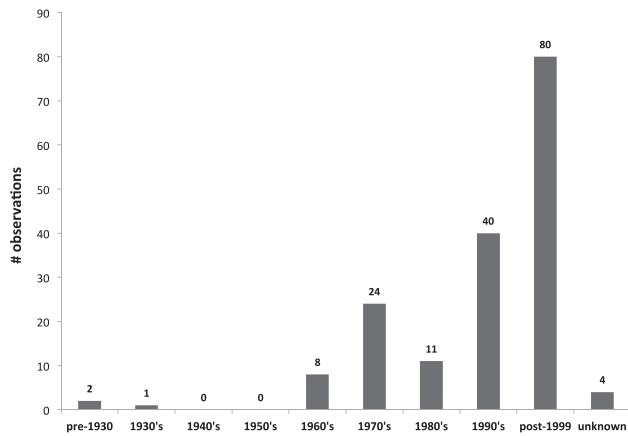
Records for which accompanying behavioral information was available at the time of collection or observation included 94 turtles found crossing roads, 30 turtles basking within wetlands, 14 turtles found swimming in shallow water, and 2 turtles captured in pitfall traps placed at the margins of isolated wetlands. Of the records represented by turtles found on roads, 63 were found alive and 31 were found dead; 47 were male turtles, 14 were female, and 33 were individuals for whom sex was not determined.

## DISCUSSION

*Distribution.* — An earlier, comprehensive review of *C. guttata* in Georgia mapped 42 spotted turtle records from 40 sites located in 26 counties (Williamson and Moulis 1994a, 1994b). Herein we compiled an additional 128 Georgia records for the species based on museum specimens, literature records, credible sightings reported

to us, and records in the Georgia Department of Natural Resources Biotics Database; these included records/observations for ~ 70 additional sites and 18 additional counties.

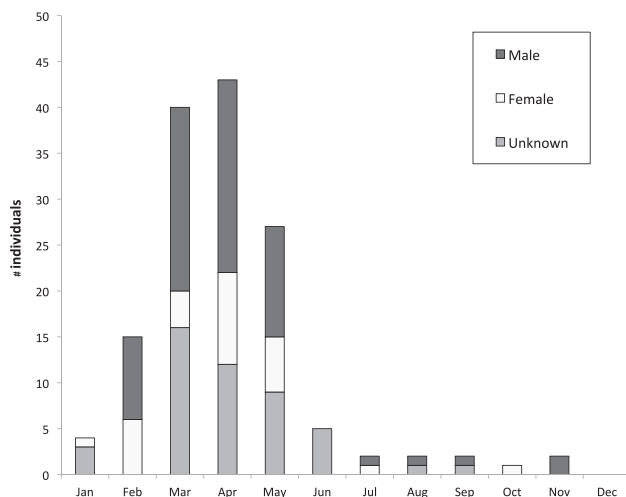
Our results show that *C. guttata* ranges throughout much of the Coastal Plain of Georgia (Fig. 3). A majority of historic and recent records are from the lower and middle Atlantic Coastal Plain, north of the Altamaha River, which may be a population stronghold for the species in Georgia. Additionally, there are multiple records 1) for the upper Coastal Plain of southeastern Georgia at or near the Fall Line, 2) adjacent to the Atlantic coast, and 3) within the Flint River and Withlacoochee River drainages of the Gulf Coastal Plain. The species is apparently absent from both the Fall Line Sandhills and the upper Coastal Plain regions of southwestern Georgia. Remarkably, *C. guttata* has not been documented from the Okefenokee Swamp in southeastern Georgia.



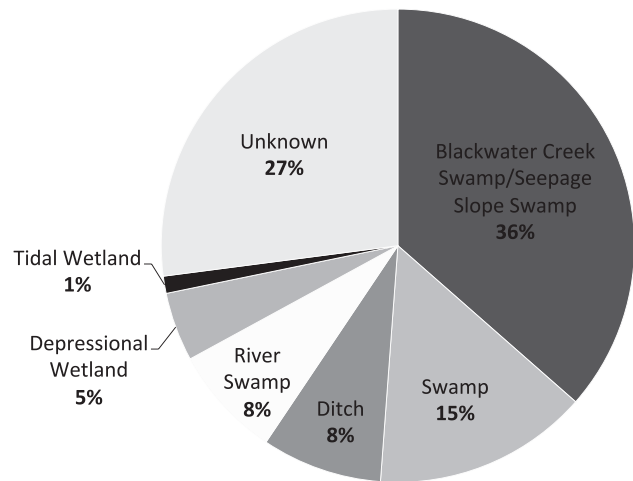
**Figure 4.** Spotted turtle (*C. guttata*) records for Georgia, by decade.

**Habitat.** — Our classification of habitat types should be interpreted cautiously in that we were unable to visit some known localities and some records are from disturbed sites. Nonetheless, given the limitations of our data, Georgia populations of *C. guttata* are most often associated with blackwater creek swamps or seepage slope swamps, connected wetland habitat types. However, it would be inaccurate to describe the spotted turtle as specialized or highly habitat-specific in Georgia, given that several other types of lentic or slow-moving water habitats (e.g., river swamps, depressional ponds, ditches) are utilized. In the Coastal Plain of South Carolina, some evidence suggests that turtles may be selecting a specific water depth (< 0.5 m) as opposed to a particular habitat type, per se (Litzgus and Brooks 2000).

Despite intensive field surveys since ca. 1975, only 2 *C. guttata* have been captured in depressional wetland habitats (cypress-gum ponds) on a large, protected tract—Fort Stewart, Georgia (Williamson and Moulis 1979, 1994a, 1994c; Stevenson 1999). Many of these wetlands (ca. 1200 occur on-site) are embedded in well-managed,



**Figure 5.** Spotted turtle (*C. guttata*) records for Georgia, by month and sex.



**Figure 6.** Spotted turtle (*C. guttata*) habitat types for Georgia, based on  $n = 170$  records.

frequently burned longleaf pine (*Pinus palustris*)–wiregrass (*Aristida stricta*) flatwoods and sandhills, are situated close to blackwater creek swamps, and support a high species richness of amphibians and reptiles (Williamson and Moulis 1979; Stevenson 1999). The rarity of *C. guttata* here may be due to the ephemeral nature of the wetlands (most dry annually and remain dry for extended periods during drought events), to the solid-bottomed, litter-poor substrates (an artifact of soil characteristics and regular prescribed fire) typical of these ponds, or to both.

Similarly intriguing, *C. guttata* is apparently absent or at least very rare from the vast forested swamps and oxbows within the floodplain of the Altamaha River, a major Atlantic Coastal Plain drainage (Stevenson and Stackhouse 2012). Scouring of the Altamaha floodplain by regular flooding—and the associated removal of organic substrates—may be a factor limiting the occurrence of *C. guttata* here and possibly in the floodplains of other alluvial river systems (Stevenson and Stackhouse 2012).

**Activity.** — The late winter–spring activity pulse suggested by this study appears to be the norm for *C. guttata* in the southeastern United States. For Georgia, 75.0% (120 of 160 records) of the compiled records are from March to May. Levels of activity for this period, as measured by frequency of records, are similar for other southeastern states: Florida, 67% (Meylan 2006); North Carolina, 73% (Palmer and Braswell 1995); Virginia, 72% (Mitchell 1994). Also similar to our study, a significant number of Florida records are of adult males found crossing roads between March and June, a time when males may travel extensively in search of females (Meylan 2006). Our observation dates for *C. guttata* found basking ranged from 15 January to 11 June. At Francis Beidler Forest in southeastern South Carolina, *C. guttata* emerge from a short winter quiescence (of ca. 2 mo) around late February and begin to bask by March;

basking activity peaks in late March and early April, at which time turtles aggregate to breed (Litzgus 2003, Litzgus and Mousseau 2004). *Clemmys guttata* may become inactive or dormant for extended periods during summer and fall (Ward et al. 1976; Joyal et al. 2001), which likely explains the paucity of Georgia records for these seasons.

*Status and Conservation in Georgia.* — Recent (1995–present) Georgia *C. guttata* records are available for 79 sites in 31 counties, including records for 14 conservation lands (public lands, nature preserves, and tracts under conservation easement). The significantly higher number of records for the periods 1990–1999 and 2000–2014 (compared with earlier decades) are almost certainly an artifact of increased reporting (e.g., our call for observations via the 2013 questionnaire produced some records) and field surveys by the authors, and thus are not indicative of population growth or range expansion. Despite its IUCN Red List status as Endangered, *C. guttata* is currently state-listed in only 1 state (Georgia) of the 5 southeastern-most states in which it occurs (Florida, Georgia, North Carolina, South Carolina, Virginia). The state listing for Georgia relates, in part, to the species potential vulnerability from over-collection and poaching, as *C. guttata* is highly desired by turtle hobbyists and herpetoculturists. Georgia does not have a recent history of being a major source for the illicit pet trade in the species (J.B.J., *pers. obs.*).

Even though the records reported herein indicate that the species remains widespread in the state, we support continued protection and state-listing status for *C. guttata* because of current threats facing the species and because our limited information suggests that *C. guttata* populations in Georgia are locally distributed and that population sizes may be small. A recent status review supported continued protection and state-listing status as Rare (Stevenson 2014). Serious declines in turtle populations of K-selected species like *C. guttata* may go unnoticed because adult turtles can live many decades after the onset of recruitment problems, thereby masking local extinctions (Klemens 2000).

Unfortunately, no long-term population studies of this species have been conducted in Georgia. The spring aggregations of *C. guttata* and their pronounced activity at this time allow them to be observable. We recommend focused surveys targeting this species and, more importantly, initiation of long-term mark–recapture efforts at sites throughout the species Georgia range. During March and April, known historical sites and other potential wetland habitats should be surveyed for *C. guttata* using a combination of wading surveys, binocular surveys, and possibly trapping (Litzgus and Mousseau 2004; this study). All turtles captured should be measured, sexed, weighed, and uniquely marked. As individual turtles exhibit fidelity to aggregation sites, long-term survivorship can be monitored by annual surveys of these sites (Litzgus and Brooks 2000; Litzgus and Mousseau 2004).

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