Chelonian Conservation and Biology, 2021, 20(2): 184–199
doi:10.2744/CCB-1488.1

Distribution and Relative Abundance of the Suwannee Alligator Snapping Turtle (*Macrochelys suwanniensis*)

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Abstract. – The Suwannee alligator snapping turtle (*Macrochelys suwanniensis*) was first described in 2014. The species is thought to occur in blackwater and spring-fed streams of sufficient size throughout the Suwannee River drainage, but we have limited detailed information regarding its range. To clarify the distribution of *M. suwanniensis*, we compiled 111 museum, 16 literature, and 40 other credible records and trapped streams throughout the Suwannee drainage in Georgia and Florida, plus 8 streams in the Big Bend region of Florida (total of 1893 trap nights). We documented the first records from the Willacoochee River and Okapilco, Piscola, Warrior, Jones, and Toms creeks in Georgia and from Rocky and Olustee creeks in Florida. Relative abundance based on catch per unit effort (CPUE) varied among streams (0.00–0.50) and sections of the same stream. *Macrochelys suwanniensis* is apparently scarce in the Okefenokee Swamp and in the Suwannee River upstream of White Springs, Florida (none trapped), but it occurs in small blackwater tributaries in this section of the river in both states. In the Suwannee River between White Springs and the estuary, we had a mean CPUE of 0.25, and the highest trapping success in Florida was in downstream reaches of the Suwannee River and in its major tributaries, the Santa Fe and New rivers. The species is widely distributed in Georgia, but relative abundance in most streams appears lower than in Florida. In Georgia, we had the highest trapping success in the Alapaha drainage and in sections of the Little River and Okapilco Creek in the Withlacoochee drainage. In Florida, we failed to trap *Macrochelys* in the purported distribution gap between the Suwannee and Ochlockonee drainages and in the Wacasassa River to the south, indicating that this species is restricted to the Suwannee drainage.

Key Words. – Reptilia; Testudines; Suwannee River drainage; catch per unit effort; conservation status

Thomas et al. (2014) described the Suwannee alligator snapping turtle (*Macrochelys suwanniensis*) as distinct from the western alligator snapping turtle (*Macrochelys temminckii*) based on genetic differentiation and differences in skull and carapace morphology. Description of this new species was supported by a subsequent analysis of cranial shape (Murray et al. 2014), a review of population phylogenetic structure of *Macrochelys*, and an evaluation of morphological and molecular data (Folt and Guyer 2015). *Macrochelys suwanniensis* is most readily distinguished from other *Macrochelys* by a wide and lunate carapacial caudal notch that usually includes the pygal and peripheral pair 11 (Thomas et al. 2014).

The conservation of *Macrochelys* as a whole is of significant concern (Pritchard 1989; Reed et al. 2002) and the US Fish and Wildlife Service (USFWS) was petitioned in 1983 and in 2012 to federally list *M. temminckii*. The USFWS proposed that *M. suwanniensis* be listed as Threatened under the Endangered Species Act (USFWS 2021). Florida prohibited sale of *Macrochelys* in 1972 and limited personal possession to 1 turtle in 1973, effectively ending commercial harvest. Georgia prohibited commercial harvest in 1989 and listed *Macrochelys* as State Threatened in 1992. Florida prohibited all take of *Macrochelys* in 2009 and listed *M. suwanniensis* as State Threatened in November 2018. In a species status assessment for *M. suwanniensis*, the current population size is estimated to be 2000 adults, with 50% confidence that the true size is between 500 and 5000 adults (USFWS 2020).

The distribution of *M. suwanniensis* is apparently restricted to the Suwannee drainage in southern Georgia and northern peninsular Florida, which encompasses an estimated 26,641 km^2 (Nordlie 1990). As recently as 100,000 yrs ago, *Macrochelys* occurred farther south in the Florida peninsula and at sites that currently drain into the St. Johns River (Atlantic drainage), but saltwater inundation during elevated sea levels reduced its range (Ewert et al. 2006). Jensen and Birkhead (2003) unsuccessfully trapped for *Macrochelys* in the St. Mary's River along the Georgia/Florida state line in the Atlantic drainage. The distribution and relative abundance of *M. suwanniensis* in portions of the Suwannee drainage are unknown. Based on observations and limited trapping, Pritchard (1989) claimed *Macrochelys* was rare in the 200,000-ha Okefenokee Swamp and upper Suwannee River, and he speculated that populations may have declined sharply in the Suwannee River since the 1930s due to overharvest. Trapping pressure on *Macrochelys* was intense until approximately 1973 in the upper Suwannee River as far upstream as the entrance to Stephen C. Foster State Park (Pritchard 1989) and populations may not have recovered from past harvest.

The Suwannee River originates as a blackwater stream in the Okefenokee Basin of southeastern Georgia and is fed by blackwater streams, spring-run streams, and springs as it flows approximately 378 km southwesterly toward the Gulf of Mexico in Florida. The Suwannee River has a mean flow of 305 m^3/s (Nordlie 1990) and experiences changes in water chemistry and biological productivity as it flows through Florida (Ceryak et al. 1983), leading the Suwannee River Water Management District to divide the main stem of the river into 6 distinct ecological reaches: Upper River Blackwater (Reach 1), Cody Scarp Transitional (Reach 2), Middle River Calcareous (Reach 3), Lower River Calcareous (Reach 4), Tidal Riverine (Reach 5), and Estuarine (Reach 6; Hornsby et al. 2000). The Santa Fe River is the major Florida tributary of the Suwannee River, and its tributaries include the New River, Olustee Creek, and the Ichetucknee River. The first 2 tributaries are blackwater streams, whereas the Ichetucknee River is a spring-run stream only 9.7 km long. The Santa Fe River begins as a blackwater stream in swamps near Lake Santa Fe and Lake Alto and becomes increasingly spring-fed as it flows 115 km to the Suwannee River. The Santa Fe River disappears underground for about 5 km in River Rise Preserve State Park, approximately 60 km from its origin. Johnston et al. (2015) extensively trapped the Santa Fe River upstream (upper) and downstream (lower) of this land bridge and described how the river changes from a blackwater stream after it receives input from at least 45 artesian springs (Scott et al. 2004), increasing its water clarity, thermal stability, and mineral content. Moler (1996) reported earlier trapping efforts in the Santa Fe drainage.

Jensen and Birkhead (2003) trapped in the Suwannee drainage in Georgia, finding *Macrochelys* in the Alapaha, Little, and Withlacoochee rivers but not in the main stem of the Suwannee River or in Suwannoochee Creek. The Alapaha and Withlacoochee rivers are blackwater with narrow floodplains and sections of these streams flowing through karst terrain disappear underground into sinkholes during periods of low water (Wharton 1978; McConnell and Hacke 1993; Torak et al. 2010; Edwards et al. 2013).

To remedy the lack of knowledge regarding the distribution and relative abundance of *M. suwanniensis* and because of its imperiled status, we compiled existing records and trapped for *Macrochelys* throughout the entire Suwannee drainage plus streams in the Big Bend region of Florida south and north of the Suwannee River. The lack of *Macrochelys* records from streams between the Suwannee and Ochlockonee rivers apparently represents a genuine distributional gap in the range (Allen and Neill 1950), but a few reports exist from some of these streams (Pritchard 1989; Ewert et al. 2006), We used the number of turtles captured per trap night as an index of relative abundance and speculate on reasons for observed differences in relative abundance among streams and sections of streams.

METHODS

We compiled *M. suwanniensis* museum records, literature, and personal communications, as well as catch per unit effort (CPUE) data from a review of this literature, including unpublished reports and our trapping surveys. Museum records were obtained from the American Museum of Natural History (AMNH), Auburn University Museum, Georgia Museum of Natural History (GMNH), Georgia Southern University (GSU), and Florida Museum of Natural History, University of Florida (UF).

From July 2011 through August 2020, we trapped for *M. suwanniensis* using 122-cm-diameter hoop net traps with 6.4-cm mesh. However, 76-cm-diameter hoop net traps with 2.5-cm mesh were used in the Ichetucknee River in Florida because smaller turtle species were the target. Georgia traps were baited with canned sardines and/or chunks of catfish, mullet, and tilapia, while Florida traps were baited with thawed chunks, heads, or fillets of various freshwater or marine fish species. We set traps during the afternoon or evening in water 0.5–2.5 m deep, typically upstream of logjams, large submerged logs, submerged trunks or roots of bald cypress (*Taxodium distichum*), steep vertical or undercut banks, or deep pools associated with outer bends in the river. We sometimes were forced to set traps based solely on suitable water depths, regardless of whether suitable downstream refugia were apparent. Traps were set parallel to the bank with the funnel opening facing downstream and a portion of the upstream end of the trap above water, leaving an air space. In estuarine sites, we usually set paired traps (counted as 1 trap) facing upstream and downstream so that they could effectively trap when the direction of the current reversed due to tides. In Florida, we checked traps the following morning and then moved them to a different section of the river. In Georgia, we checked traps daily but left them in place for up to 3 nights. The number of turtles captured per trap night (TN) is referred to as CPUE.

Downstream of White Springs, Florida, we selected two 5-km stretches in each of 6 ecological reaches of the Suwannee River and trapped them multiple times using 12 traps per session (i.e., 1 night of trapping) for a total of 766 TN. Elsewhere, we did not standardize the number of traps set, number of trapping sessions, or length of stream trapped. Site selection was usually determined by accessibility and some small streams were trapped only once with a few traps. In the Santa Fe drainage, we compiled 504 TN by combining our data with those of Johnston et al. (2015) and eliminating results from smaller traps, except in the Ichetucknee River (Table 1). The only other streams with more than 100 TN were the Alapaha and Suwannee rivers in Georgia (Table 1). We did not trap the Okefenokee Swamp because of the presence of numerous large American alligators (*Alligator mississippiensis*).

For each turtle capture, we measured median straight-line carapace length (SCL) with Haglof aluminum tree calipers and precloacal tail length (PTL). Turtles were weighed using a Rubbermaid Pelouze 100-kg hanging scale or a Pesola 10-kg hanging scale. These measurements were used to determine age class and sex (Dobie 1971). We marked each turtle individually by drilling holes in marginal scutes (Cagle 1939) and/or by implanting a BioMark passive integrated transponder (PIT) tag into the ventral tail muscle. Most turtles were photographed, and significant records were photo vouchered in herpetology museum collections at GMNH, GSU, and UF. No specimens were collected, but tissue samples were acquired for genetic analyses. We obtained necessary permits and followed guidelines from the Herpetological Animal Care and Use Committee of the American Society of Ichthyologists and Herpetologists in handling and processing turtles.

RESULTS

Distribution. — We compiled 111 museum records, 16 literature records, and 40 records based on credible observations or photographs of *M. suwanniensis* (Appendix 1). Records with imprecise locality data were not mapped for Georgia (Fig. 1) and Florida (Fig. 2), unless they represented the only records for the waterbody. We did not include in Appendix 1 or map every turtle trapped but included at least 1 record from every 5-km river segment trapped. Florida accounted for 110 records and Georgia for 57 records (Appendix 1). Records spanned the period 1912–2020, with 124 records (74.2%) from the past 20 yrs (Appendix 1; Figs. 1 and 2). We trapped 267 turtles in Florida and 54 turtles in Georgia.

We located a *M. suwanniensis* shell (UF 190009) on display at a fish camp on the west side of the Okefenokee Swamp near Fargo, Georgia, that came from a dead adult found in the 1980s by A. Griffis. In December 2019, a large male *M. suwanniensis* was photographed (GMNH 52076) in the Suwannee Canal near the Richard S. Bolt Visitor Center (site of the former Camp Cornelia) in the eastern section of the Okefenokee Swamp National Wildlife Refuge near the confluence of the Suwannee Canal and Cornhouse Creek, a tributary of the St. Mary's River. These findings indicate the species is still present in the Okefenokee Swamp, which we did not trap. We failed to capture *M. suwanniensis* in the Suwannee River in Georgia (Fig. 3) and at 2 sites in Florida upstream of White Springs (Fig. 4). However, B. Johnson photographed an adult *M. suwanniensis* (UF 190014) that he snagged in 2017 while fishing in the Suwannee River at the mouth of Tom's Creek 200 m south of the Georgia line (Fig. 1), which represents our only record from the main stem upstream of White Springs, Florida (Appendix 1).

Macrochelys is found in several tributaries between the Okefenokee Swamp and White Springs, Florida (Table 1; Appendix 1). We trapped 2 adult males in Suwannoochee Creek (10 TN). In 2016, C. Davis photographed an adult *M. suwanniensis* (UF 190012) that was probably nesting on a primitive road adjacent to Jones Creek in Clinch County, Georgia (Fig. 1). We had 5 captures of 4 unique individuals in 11 TN in Tom's Creek in Georgia just north of the Florida line (Fig. 3). We trapped 2 adult females in 6 TN in Rocky Creek (Fig. 4), a small tributary about 6 km south of the Georgia line in Hamilton County. In October 2016, J. Willmott observed 3 large *M. suwanniensis* (UF 189493) together in a shallow pool in Hunter Creek. When we trapped Hunter Creek (3 TN), the water was too shallow for effective trapping or to provide good cover for turtles.

In Georgia, we trapped *M. suwanniensis* in the Alapaha and Withlacoochee rivers and several of their tributaries: the Alapahoochee, New and Willacoochee rivers and Okapilco, Piscola, and Warrior creeks (Table 1; Fig. 3). We vouchered the first record from the Alapaha River in Florida (UF 191014), which was the smallest turtle trapped during our study (105 mm SCL). The farthest upstream record is from Warrior Creek, a tributary of the Little River, near Sylvester, Worth County, Georgia (Fig. 1).

In Florida, we trapped *M. suwanniensis* in all 6 ecological reaches of the Suwannee River, the upper and lower Santa Fe River, and the following tributaries of the Santa Fe River: Olustee Creek and the New and Ichetucknee rivers (Table 1; Fig. 4). The first voucher from Olustee Creek (UF 190977) was a large male (597 mm SCL; 45 kg) that had been trapped 10 yrs earlier 1 km downstream at its confluence with the Santa Fe River. We also vouchered the first specimen (UF 191028) from the New River, but unvouchered records already existed from there (Appendix 1). In 1982, an angler caught a *Macrochelys* in Alligator Lake (about 320 ha) in Lake City,

Table 1. Trapping results from the Suwannee drainage in Georgia and Florida. TN = number of trap nights; CPUE = number of turtles captured per trap night.

Stream	TN	CPUE	Source
Upper Suwannee River			
Suwannee River, Georgia	44	0	Jensen and Birkhead 2003
Suwannee River, Georgia	102	0	Present study
Jones Creek, Georgia	2	0	Present study
Suwannoochee Creek, Georgia	10	0	Jensen and Birkhead 2003
Suwannoochee Creek, Georgia	10	0.20	Present study
Cypress Creek, Georgia	4	0	Present study
Tom's Creek, Georgia	11	0.45	Present study
Rocky Creek, Florida	6	0.33	Present study
Hunter Creek, Florida	3	0	Present study
Suwannee River, N of White Springs, Florida	28	0	Present study
Suwannee River, Reach 1, Florida	124	0.19	Present study
Middle Suwannee River			
Suwannee River, Reach 2, Florida	123	0.29	Present study
Suwannee River, Reach 3, Florida	124	0.24	Present study
Suwannee River, Reach 4, Florida	144	0.38	Present study
Suwannee River, Lafayette/Columbia County, Florida	8	0.25	Moler 1996
Lower Suwannee River			
Suwannee River, Reach 5, Florida	131	0.19	Present study
Suwannee River, Reach 6, Florida	120	0.01	Present study
Suwannee River, Dixie/Gilchrist County, Florida	11	0.27	Moler 1996
Alapaha and Withlacoochee drainages			
Alapaha River, Georgia	49	0.04	Jensen and Birkhead 2003
Alapaha River, Georgia	199	0.15	Present study
Alapaha River, Florida	13	0.15	Present study
Alapahoochee River, Georgia	4	0.25	Present study
Alapahoochee River, Florida	10	0	Present study
Willacoochee River, Georgia	5	0.40	Present study
Withlacoochee River, Georgia	24	0.13	Jensen and Birkhead 2003
Withlacoochee River, Georgia	67	0.06	Present study
Withlacoochee River, Florida	11	0	Present study
New River, Georgia	3	0	Present study
Okapilco Creek, Georgia	4	0	Jensen and Birkhead 2003
Okapilco Creek, Georgia	10	0.30	Present study
Piscola Creek, Georgia	2	0	Jensen and Birkhead 2003
Piscola Creek, Georgia	12	0.17	Present study
Little River, Georgia	34	0.12	Jensen and Birkhead 2003
Little River, Georgia	9	0	Present study
Warrior Creek, Georgia	15	0.33	Present study
Santa Fe drainage			
Upper Santa Fe River	200	0.26	Johnston et al. 2015; present study
Lower Santa Fe River	287	0.12	Johnston et al. 2015; present study
Lower Santa Fe River	22	0.09	Moler 1996
New River	6	0.50	Present study
Ichetucknee River	24	0.08	Johnston et al. 2015; present study
Olustee Creek	17	0.18	Present study
Streams in the Big Bend region			
Steinhatchee River, Florida	12	0	Present study
Fenholloway River, Florida	8	0	Present study
Econfina River, Florida	5	0	Present study
Aucilla River, Florida	34	0	Moler 1996; present study
Wacissa River, Florida	8	0	Present study
St. Marks River, Florida	16	0	Moler 1996; present study
Wakulla River, Florida	7	0	Present study
Wacasassa River, Florida	9	0	Present study

Columbia County (UF 65902), which is closest to the headwaters of Price Creek, a tributary of Olustee Creek.

Relative Abundance. — Based on trapping success, relative abundance is higher in the middle Suwannee River (Reaches 2–4; CPUE = 0.24–0.38; 391 TN) than in the upper (Reach 1; CPUE = 0.19; 124 TN) and lower (Reach 5; CPUE = 0.18; 131 TN) main stem of the river (Table 1; Fig. 4). Relative abundance is very low in the estuary (CPUE = 0.01; 120 TN) and upstream of White Springs in Florida and Georgia (CPUE = 0; 174 TN) (Table 1). However, many variables could have affected trapping success in the estuary, including the wide width of the river and variable tidal flow. Relative abundance is similar in the Suwannee River downstream of White Springs (excluding the estuary; mean CPUE = 0.25; 646 TN) and in the upper Santa Fe River (CPUE = 0.26; 200 TN), but abundance is apparently lower in the lower Santa Fe River (CPUE = 0.09–0.12; 309 TN; Table 1). Overall, relative

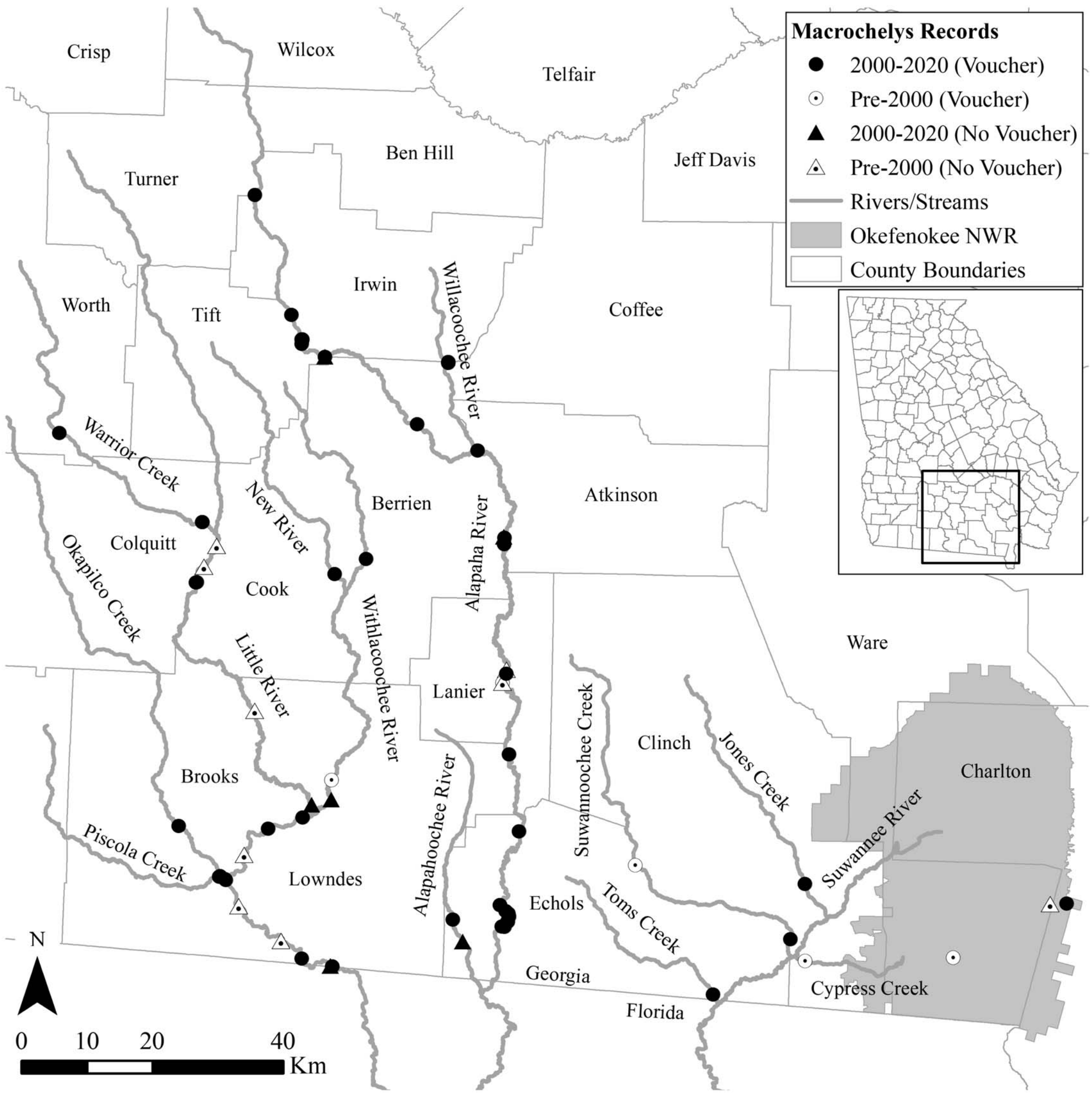

Figure 1. Locations of *Macrochelys suwanniensis* in Georgia before and after 2000.

abundance in tributary streams is apparently lower in Georgia than in Florida. We had sufficient trapping effort in Georgia to conclude that relative abundance is higher in the Alapaha River (CPUE = 0.15; 199 TN) than in the Withlacoochee River (CPUE = 0.06; 67 TN). We could not conclude that some streams lacked *M. suwanniensis* or had a low or high relative abundance because trapping effort was insufficient or conditions were not conducive for successful trapping because of water levels, stream current, poor cover, or other factors.

DISCUSSION

Distribution. — The status of *M. suwanniensis* in the Okefenokee Swamp is poorly known and enigmatic. Various authors (e.g., Wright and Funkhouser 1915; Laerm et al. 1980) listed the alligator snapping turtle as an inhabitant of the Okefenokee Swamp. Pritchard (1989) stated that *Macrochelys* was rare in the Okefenokee Swamp and the upper Suwannee River. Following extensive wildfires in the mid-1950s, the headwaters of the Suwannee River were impounded by an earthen dam, the Suwannee River Sill, in 1960–1962, causing some changes to swamp hydrology and vegetation. The maximum water level of the swamp at the sill during zero outflow conditions has risen 12 cm and extends 60 km into the swamp (Malcolm et al. 1994). The palustrine environment of the sill impoundment differs from the naturally dynamic hydrology of a riparian environment (Yin and Brook 1992; Loftin et al. 2000). Construction of this sill may have caused changes to fish species abundance and composition in the upper Suwannee River (Wharton 1978), but its effects on *M. suwanniensis* populations and movements are unknown. The only museum specimen from the Okefenokee Swamp was a skull collected in 1912 by one of the Cornell University expeditions (AMNH 69731). Carr (1952) provided 2 photographs of a female from the Okefenokee Swamp, which we did not include in Appendix 1 because of imprecise locality information. A photograph of a large

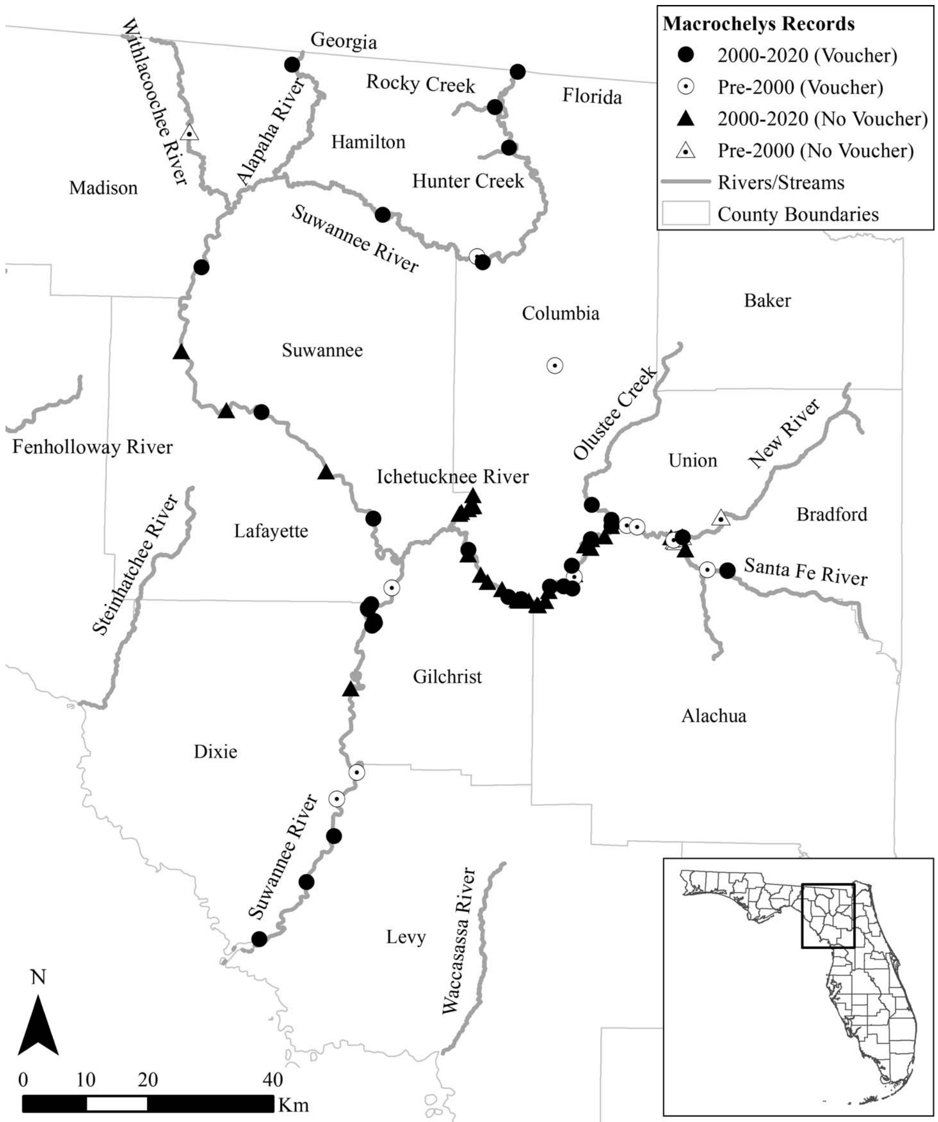

Figure 2. Locations of *Macrochelys suwanniensis* in Florida before and after 2000.

male in 2019 represents only the second voucher specimen from the swamp (Appendix 1), although De Sola and Abrams (1933) mentioned that alligator snapping turtles were "frequently hooked in the old drainage canal (St. Mary-Suwanee Canal) near Camp Cornelia in the Okefinokee." *Macrochelys suwanniensis* apparently does not occur in rivers in the St. Mary's drainage (Allen and Neill 1950; Pritchard 1989; Jensen and Birkhead 2003), but the eastern portion of the Okefenokee Swamp, where Camp Cornelia is located, is in the St. Mary's drainage (Edwards et al. 2013). No streams cross Trail Ridge, a Pleistocene shoreline that forms the eastern boundary of both Okefenokee Swamp and the eastern geographic limit of *M. suwanniensis* (Pritchard 1989).

Like Jensen and Birkhead (2003), we failed to trap *M. suwanniensis* in the Suwannee River upstream of White Springs. However, we documented turtles in 5 tributaries in this section of the river: Jones, Suwannoochee, Tom's, Rocky, and Hunter creeks. We trapped *M. suwanniensis* in Suwannoochee Creek, where Jensen and Birkhead (2003) were unsuccessful but A. Redmond, a commercial trapper, reported the species was "fairly common" (Pritchard 1989). These tributaries are fringed by mixed pine–oak forest communities and offer cooler water temperatures than the river main stem. The narrower width of tributaries may help turtles locate traps, increasing the likelihood of our catching them.

Macrochelys populations are present in the Alapaha drainage in Georgia and Florida, including its tributaries, the Alapahoochee and Willacoochee rivers (Table 1; Fig. 1). Dozens of deep, natural swamp lakes pockmark the channel of the Alapaha River and would appear to offer prime habitat for *M. suwanniensis*, which has been documented from swamp lakes in the Alapaha River Wildlife Management Area. In Georgia, the Withlacoochee River and a large tributary, the Little River, have *M. suwanniensis* (Pritchard 1989; Jensen and Birkhead 2003). We failed to trap turtles in the Little River (Table 1; Fig. 3)

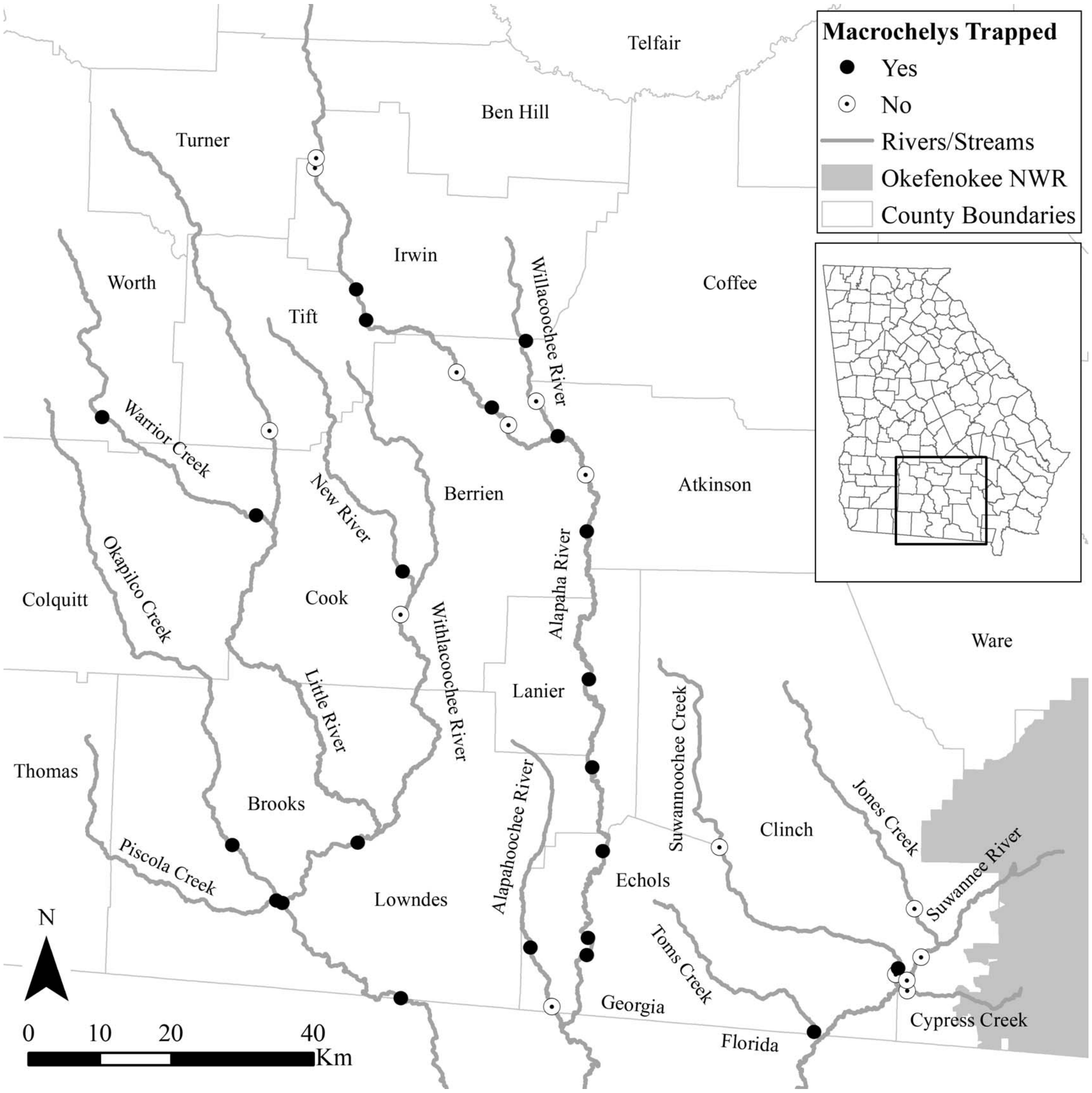

Figure 3. Locations of trapping sites (2011–2020) in Georgia and success in catching *Macrochelys suwanniensis*.

but located observations and 1 museum voucher (GMNH 52117) from 2 sites in the past 5 yrs. Based on conversations with A. Redmond, Pritchard (1989) reported that intense commercial trapping occurred in the late 1960s and early 1970s in the Little River and that the Withlacoochee River was "trapped out" by 1982. Populations have at least partially recovered from past harvest in these 2 rivers (Table 1). We trapped *M. suwanniensis* in 2 smaller Georgia tributaries of the Withlacoochee River, Okapilco and Piscola creeks (Fig. 3), where Jensen and Birkhead (2003) were unsuccessful (Table 1). Three *M. suwanniensis* were caught by D. Winterton in the Withlacoochee River in northeastern Madison County, Florida (Pritchard 1989), and we trapped 2 *M. suwanniensis* in this river just north of the Georgia state line (Table 1; Fig. 3).

Johnston et al. (2015) trapped extensively in the Santa Fe River downstream of its confluence with the New River, but the distribution of *M. suwanniensis* farther upstream is unknown. We trapped the species in its 2 major tributaries, the New River and Olustee Creek, near their confluence with the Santa Fe River (Fig. 2). Turtles have been reported (Pritchard 1989), trapped (Johnston et al. 2015), and observed nesting along the Ichetucknee River, and nests have been found along Cow Creek, a tributary of the Santa Fe River in Gilchrist County (Jackson and Thomas 2018). The species is occasionally also found in springs and sinkhole lakes in the Santa Fe drainage (Johnston et al. 2015).

Voucher specimens are lacking from the 7 streams between the Suwannee and Ochlockonee drainages (Fig. 2), but reports exist from this purported distributional gap. Five of these streams begin as blackwater streams, but the Wakulla and Wacissa rivers originate at first-magnitude springs. The mouths of the Steinhatchee and Suwannee rivers are separated by about 50 km, whereas the mouths of the Ochlockonee River, which is inhabited by a different *Macrochelys* species, and the St. Marks River are separated by about 14 km. Pritchard (1989) reported 2 *Macrochelys* sightings from the Wacissa River and 1

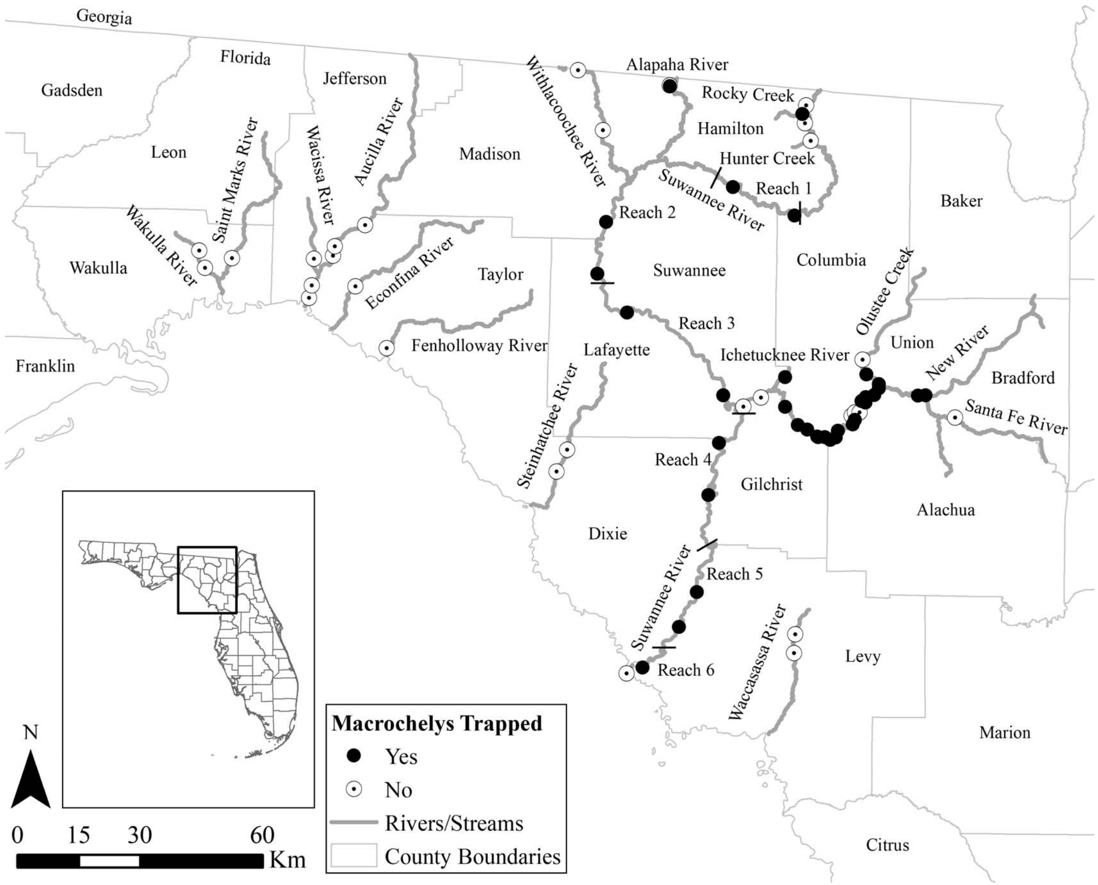

Figure 4. Locations of trapping sites (2011–2020) in Florida, locations of ecological reaches of the Suwannee River, and success in catching *Macrochelys suwanniensis*.

sighting from Wakulla Springs. Florida Natural Areas Inventory records include a photograph in the *Woods and Water* newspaper of a specimen reportedly from the 111-km-long Aucilla River in 2000, a large dead adult from the St. Marks River in 1992, and a live specimen observed in the Wakulla River in 1980. Moler (1996) provides anecdotal reports of 1 additional specimen each from the St. Marks and Wakulla rivers but failed to trap *Macrochelys* in the Aucilla and St. Marks rivers. We did not map any of these observations because the lack of voucher specimens prevents identification to species. We conclude that *Macrochelys* populations are probably not established in these streams, despite the presence of suitable habitat. Some of these reports are credible, and turtles may occasionally wander in from the Ochlockonee River, the nearest river with an established *Macrochelys* population. *Macrochelys* has been observed in brackish Ochlockonee Bay (Pritchard 1989). Alternatively, turtles found in these streams could represent released pets. We are aware of *Macrochelys* that have been found outside their native range in Georgia (Fulton County) and in Florida: DeSoto, Duval, Hillsborough, Lee (UF 191797), Marion (AMNH 125696, KU 61844), Miami-Dade, Nassau, Orange (UF 166530), and Volusia counties.

Macrochelys suwanniensis is currently distributed widely throughout southcentral Georgia in medium- to large-sized streams (Fig. 1), with our surveys documenting a number of new county records and minor range extensions (Stevenson et al. 2021). We found evidence that the species occurs in every major creek in the Suwannee drainage in Florida. We documented the first records from the New and Willacoochee rivers and Okapilco, Piscola, Warrior, Jones, and Toms creeks in Georgia and from Rocky and Olustee creeks in Florida.

Relative Abundance. — *Macrochelys suwanniensis* abundance is apparently low in the Okefenokee Swamp and the upper Suwannee River north of White Springs, Florida (Pritchard 1989; Jensen and Birkhead 2003), and we failed to find the species during 130 TN in this section of the river but trapped it in several small tributaries. *Macrochelys* may have always been scarce in the upper Suwannee River (Jensen and Birkhead 2003) or populations may not have recovered from past harvest. Its low abundance in the main stem may be due to low pH and scarcity of potential prey (Jensen and Birkhead 2003). Mussels and snails, important food items in the diet of *M. temminckii* in Louisiana drainages (Elsey 2006), are absent from the upper Suwannee River (Williams et al. 2014).

In the Suwannee River, relative abundance is highest in the middle reaches, where increasing amounts of water from the Floridan Aquifer change the acidic, blackwater stream to a clear, slightly colored, alkaline stream with higher biological productivity (Hornsby et al. 2000). The paucity of *Macrochelys* in the estuary (Table 1) may be due to reduced available habitat or avoidance of water with higher salinities; the only capture was near the mouth of a small tributary (Fig. 4) that presumably had lower salinity. Adult *Macrochelys* are sometimes found in brackish-water habitats (Jackson and Ross 1971), but movements into salt water are extremely rare (Pritchard 1989; Ewert et al. 2006).

Based on CPUE, *M. suwanniensis* appears to be relatively abundant in some of the small tributaries off the upper Suwannee River, but this might be an artifact of turtles being more trappable in narrower streams. Another factor affecting this abundance metric is the number of trap nights; the capture of just 1 turtle can result in a high CPUE if trapping effort is low. Excluding trap nights in the estuary, our CPUE downstream of White Springs in the Suwannee River was 0.25, which we consider to be a baseline for medium- and large-sized streams such as the Alapaha, Withlacoochee, and Santa Fe rivers. In comparison, recent trapping for *M. temminckii* in 29 streams of all sizes in the Florida panhandle between the Sopchoppy and Perdido rivers, excluding the Choctawhatchee drainage (documented to have depauperate *Macrochelys* populations), yielded a CPUE of 0.30 in 586 TN (Enge et al. 2019). Multiple trapping sessions in three 5-km sections of the Ochlockonee, Apalachicola, and Choctawhatchee rivers in Florida yielded CPUEs of 0.53 (98 TN), 0.36 (107 N), and 0.01 (103 TN), respectively (Mays et al. 2015). Trapping for *M. temminckii* in Georgia by Jensen and Birkhead (2003) yielded a mean CPUE of 0.20, but the CPUE was 0.45 in several streams in the Apalachicola drainage. Our CPUE in several Georgia streams would probably have been higher if we had not left traps for more than 1 night, because most turtles were trapped the first night.

Relative abundance of *M. suwanniensis* in Georgia is relatively low. Sufficient trapping has been conducted in the Alapaha and Withlacoochee rivers to provide meaningful results. Interestingly, we had higher CPUE than Jensen and Birkhead (2003) in the Alapaha River, but this trend was reversed in the Withlacoochee River (Table 1). Heavy harvest apparently did not occur in most streams inhabited by *M. suwanniensis,* unlike many rivers in the Southeast, but harvest occurred in Georgia in the Little, Withlacoochee, and upper Suwannee rivers and Suwannoochee Creek (Pritchard 1989). These streams have low abundance of *M. suwanniensis* (Table 1), possibly indicating slow population recovery from past harvest. Because of long generation times and low reproductive rates of *Macrochelys* (Tucker and Sloan 1997; Reed et al. 2002; Holcomb and Carr 2013), depleted populations may take a long time to recover (King et al. 2016). Exceptionally large turtles (45–57 kg; old adult males) are present in the Suwannee and Santa Fe rivers in Florida (Enge et al. 2014; Johnston et al. 2015), which were probably never intensively harvested commercially. Although we did not analyze demographic data, we trapped juveniles (105–325 mm SCL) in Okapilco, Olustee, Tom's, and Warrior creeks and in the Alapaha, Santa Fe, Suwannee, and Withlacoochee rivers, indicating population recruitment is occurring in both states and in all drainages. We had recent reports of juveniles from the Alapahoochee and Little rivers in Georgia. Because *Macrochelys* does not attain sexual maturity until 11–22 yrs old (Dobie 1971; Tucker and Sloan 1997; Johnston et al. 2012), juveniles should be detected in those streams with substantial trapping effort, although different microhabitat use and foraging strategies may make juveniles less susceptible to trapping than adults.

Macrochelys is relatively abundant in the Santa Fe River (Johnston et al. 2015) and its major blackwater tributaries, the New River and Olustee Creek (Table 1). Based on CPUE, the Suwannee River downstream of White Springs and the upper Santa Fe have similar abundance, but abundance is apparently lower in the lower Santa Fe River (Table 1). The species is less abundant in the short, spring-run Ichetucknee River (Johnston et al. 2015). During a 4-yr study in the upper Santa Fe River and New River, S. Santhuff claimed that he consistently had a CPUE of 0.30–0.60 (Moler 1996). Johnston et al. (2015) had a much lower CPUE in the upper Santa Fe River, but it was over twice as high as in the lower Santa Fe River (Table 1). We had a CPUE of 0.50 in the New River (Table 1), but this result should be interpreted cautiously because we had only 6 TN.

Threats. — Although harvest of *M. suwanniensis* is now illegal, anthropogenic mortality continues from harvest for food or pets, accidental ingestion of fishing tackle, and boat strikes (Ewert et al. 2006; USFWS 2020). Thirty-six percent of 11 radiographed *Macrochelys* in the Santa Fe River and 12% of 25 turtles in the Suwannee River in Florida had hooks lodged in their upper gastrointestinal tracts (Enge et al. 2014). Turtles are susceptible to getting caught by trotlines and bush hooks (i.e., limb lines) set for catfish or by recreational anglers (Enge et al. 2014). The monofilament or gel-spun fishing line attached to a hook can cause severe digestive blockage, and ingested hooks can perforate the digestive tract lining, resulting in injury and potentially death. *Macrochelys* individuals occasionally drown from entanglement in fishing line, particularly unattended bush hooks or trotlines (Mays et al. 2015). We had 3 reports of anglers in Georgia catching *M. suwanniensis* while fishing during the day, and 2 marked turtles in the Suwannee River in Florida were caught by anglers fishing for catfish at night from the riverbank. Based on published life-history data, mortality of adult *Macrochelys* from ingested hooks is sufficient to cause population declines (Steen and Robinson 2017). *Macrochelys* populations are susceptible to declines from anthropogenic mortality and are slow to recover because of low recruitment, slow growth, and long generation time (Iverson 1991; Congdon et al. 1994; Folt et al. 2016).

Groundwater withdrawal and water pollution pose potential threats to *M. suwanniensis*. Water levels in the Floridan Aquifer have declined in northern Florida over the past 70 yrs because of groundwater extraction for human use and reduced groundwater recharge due to surface drainage alterations (Knight 2015). Most of the 197 springs identified in the Suwannee River basin are located between Suwannee Springs and Ellaville in Florida. Reduced input from springs can decrease water levels and clarity and reduce biological productivity, potentially affecting turtle populations. In the Santa Fe River, the total density of all turtle species combined appeared to be 3 to 4 times greater in the spring-influenced reach than in the blackwater reach (Johnston et al. 2016). The area around the Suwannee River is sparsely populated, and the predominant land uses are agriculture and silviculture (Raulston et al. 1998). However, there is a potential of chemical pollution by pulp mills and waste products from cities and agricultural activities along tributaries in Georgia. For example, the City of Valdosta had major sewage spills of suspended solids into the Withlacoochee River from its wastewater treatment plant in March, July, and August 2013 (Enge et al. 2014). Although groundwater quality tends to be good in Florida, the middle reaches of the Suwannee River are increasingly being impacted by nutrients, particularly nitrates and nitrites, because of groundwater contamination from croplands, poultry farms, dairies, and septic tanks (Raulston et al. 1998; Knight 2015). Elevated nitrate concentrations can cause mortality of insects, larval fishes, and anurans (Kincheloe et al. 1979; Camargo and Ward 1995; Hecnar 1995), which are potential prey for *Macrochelys*, and possibly affect habitat suitability by increasing growth of filamentous macroalgae (Stevenson et al. 2007) and invasive hydrilla (*Hydrilla verticillata*; Kennedy et al. 2009).

Although forests bordering streams in the Suwannee drainage are mostly intact, residents often remove logs and fallen trees along the bank that obstruct boat traffic (Enge et al. 2014). In 2000, the State of Florida initiated a program to allow permitted removal of deadhead logs, which are submerged pine and cypress timber cut by axes up until the early 20th century (Kaeser and Litts 2008). From 2000 to 2008, more than 16,000 logs were removed from rivers, but this is likely a conservative estimate (Kaeser and Litts 2008). Deadhead logging is permitted in Florida in all of the Withlacoochee River, the farthest downstream portion of the Santa Fe River, and the Suwannee River from White Springs downstream to Fanning Springs. A logger reported locating several places on the Suwannee River with hundreds of logs (McFarland 2016). Removal of any woody debris from the Suwannee River and its tributaries could have a negative impact on *Macrochelys*, because woody debris may provide primary refugia during low-water periods and concentrate prey items (Enge et al. 2014).

In the species status assessment for *M. suwanniensis*, future conditions and viability of the species was projected in 50 yrs using a female-only, stage-structured matrix population model (USFWS 2020). Based on the current state of knowledge, *M. suwanniensis* populations are predicted to decline in abundance and range, but the current state of knowledge is full of uncertainty (USFWS 2020). This assessment would be strengthened with additional studies on population delineations, abundance and occupancy, variation in demographic rates across the range of the species, the impacts of threats on demography, and prevalence of threats across the landscape (USFWS 2020). Our findings were incorporated in this species status assessment. Population models based on our trapping data downstream of White Springs in the Suwannee River indicate a slightly decreasing or stable population (T.M.T., unpubl. data, 2021). Because of our trapping results, land-use patterns, and coverage of protected lands along the Suwannee and Santa Fe rivers, we are more optimistic regarding the future of *M. suwanniensis* populations in Florida than in Georgia. We believe that populations in Georgia are faring the best in the Alapaha drainage and in sections of the Little River and Okapilco Creek in the Withlacoochee drainage. Populations in Georgia streams that experienced commercial harvest in the past (Pritchard 1989) may continue to recover. Additional surveys of the Okefenokee Swamp and tributary streams of the upper Suwannee River in Georgia, most of which are difficult to access, are needed to better determine the status of populations at these sites. Our trapping results provide baseline data from which future population trends can be determined.

Acknowledgments

For information, lodging, or logistical assistance, we thank staff at Stephen C. Foster State Park and Paradise Public Fishing Area; Abigail Abouhamdan, Matt Elliott, and Dusty Exum (Georgia Department of Natural Resources); Sara Aicher and Chip Campbell (Okefenokee National Wildlife Refuge); Andrew Gude (Lower Suwannee National Wildlife Refuge); and Amy Thompson and Bobby Toothaker (Florida State Parks). Private landowners who allowed access were Heather Brasell, John Cox, Corey Davis (Superior Pine), Marvin Dickey, Grant Harvey (Langdale Company), Bryant Johnson, Russell Rigdon, and Will Wingate. Nikki Castleberry (Georgia Museum of Natural History), Lance McBrayer (Georgia Southern University), Kenneth Krysko, and Coleman Sheehy III (Florida Museum of Natural History) answered questions and accessioned voucher specimens. For help with field surveys, we are grateful to Jacob Barrett, Jonathon Bolton, Tyler Brock, Chris Coppola, Andy Day, Tucker Ennis, Matthew Fedler, Jeremy Geiger, Chad Harrison, Daniel Parker, Dustin Piontek, Bronc Rice, Nick Schiltz, David Steen, Eric Suarez, and Mark Robertson. Jonathan Mays and David Steen provided helpful comments on the manuscript. A 2018–2019 survey of the Suwannee drainage in Georgia was funded by the Southeastern Association of Fish and Wildlife Agencies. A 2011–2013 survey of the Suwannee River in Florida was funded by a Conserve Wildlife Tag Grant from the Wildlife Foundation of Florida. No specific permission was required for trapping by staff of the Florida Fish and Wildlife Conservation Commission (FWC), which is the permitting agency, but scientific collection permits were obtained from FWC by G.R.J. (WX04230 and LSSC-10-00039 [A-E]) and from the Georgia Department of Natural Resources by D.J.S. and The Orianne Society (339315608, 29-WJH-16-21, 029, 115579244, and 353660973).

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Received: 4 December 2020
Revised and Accepted: 18 March 2021
Published Online: 20 October 2021
Handling Editor: Peter V. Lindeman

Appendix 1. Data for *Macrochelys suwanniensis* records. UF = Florida Museum of Natural History, University of Florida; GMNH = Georgia Museum of Natural History; GA DNR = Georgia Department of Natural Resources; GSU = Georgia Southern University; AMNH = American Museum of Natural History; AUM = Auburn University Museum.

State: county	Site	River drainage	Latitude, longitude	Year	Source
Georgia: Atkinson	Alapaha River, S of Willacoochee	Alapaha	31.22251°N, 83.05013°W	2018	UF 187357 (present study)
Georgia: Atkinson	Alapaha River, S of Willacoochee	Alapaha	31.23155°N, 83.05027°W	2019	Present study
Georgia: Berrien	Alapaha River, US 82	Alapaha	31.38628°N, 83.19375°W	2020	UF 191136 (present study)
Georgia: Berrien	Alapaha River, near Willacoochee River	Alapaha	31.35141°N, 83.09570°W	2016	UF 178389 (present study)
Georgia: Berrien	Withlacoochee River, SR 76	Withlacoochee	31.19868°N, 83.27138°W	2020	GMNH 52116
Georgia: Brooks	Little River, Lawson Mill Pond Road	Little	30.98566°N, 83.44426°W	1998	Jensen and Birkhead (2003)
Georgia: Brooks	Withlacoochee River, Nankin-Clyattville Road	Withlacoochee	30.66904°N, 83.39463°W	1997	Jensen and Birkhead (2003)
Georgia: Brooks	Piscola Creek, SW of Quitman	Withlacoochee	30.75574°N, 83.49542°W	2018	UF 187359 (present study)
Georgia: Brooks	Okapilco Creek, near Withlacoochee River	Withlacoochee	30.75286°N, 83.48647°W	2018	UF 187360 (present study)
Georgia: Brooks	Withlacoochee River, near Okapilco Creek	Withlacoochee	30.75165°N, 83.48476°W	ca. 2015	GA DNR Biotics Program
Georgia: Brooks	Okapilco Creek, SR 333	Withlacoochee	30.82468°N, 83.56214°W	2019	UF 190008 (present study)
Georgia: Brooks	Little River, N of SR 133	Withlacoochee	30.85765°N, 83.35055°W	ca. 2016	GA DNR Biotics Program
Georgia: Brooks	Withlacoochee River, W of SR 31	Withlacoochee	30.64539°N, 83.36092°W	2016	UF 178991
Georgia: Brooks	Withlacoochee River, SW of Troupville	Withlacoochee	30.83989°N, 83.36434°W	2018	GSU 26451 (present study)
Georgia: Brooks	Withlacoochee River, SW of Troupville	Withlacoochee	30.82344°N, 83.41900°W	2018	GSU 26452 (present study)
Georgia: Charlton	Okefenokee Swamp, Camp Cornelia Landing	Suwannee/ St. Mary's	30.73771°N, 82.14139°W	2019	GMNH 52076
Georgia: Clinch	Cypress Creek, US 441	Suwannee	30.65425°N, 82.55799°W	ca. 1985	UF 190009
Georgia: Clinch	Jones Creek, 8.6 km N of Fargo	Suwannee	30.76031°N, 82.56027°W	2016	UF 190012
Georgia: Clinch	Suwannoochee Creek, S of SR 187	Suwannee	30.78265°N, 82.83154°W	ca. 1997	UF 191135 (present study)
Georgia: Clinch	Suwannoochee Creek, SR 94	Suwannee	30.68438°N, 82.58195°W	2020	UF 191137 (present study)
Georgia: Coffee	Willacoochee River, SR 158	Alapaha	31.47123°N, 83.14569°W	2019	UF 190007 (present study)
Georgia: Colquitt	Warrior Creek, Vicker's Bridge Road	Little	31.24434°N, 83.53547°W	2018	UF 187358 (present study)
Georgia: Cook	Little River, N of Reed-Bingham State Park	Little	31.18282°N, 83.53093°W	1998	Jensen and Birkhead (2003)
Georgia: Cook	Little River, Roundtree Bridge Road	Little	31.21212°N, 83.51147°W	1999	Jensen and Birkhead (2003)
Georgia: Cook	Little River, Reed-Bingham State Park	Little	31.16149°N, 83.54186°W	2020	GMNH 52117
Georgia: Cook	New River, SR 76	Withlacoochee	31.17686°N, 83.32123°W	2020	UF 191134 (present study)
Georgia: Echols	Alapahoochee River, Frank J. Culpepper Road	Alapaha	30.67330°N, 83.10477°W	2007	GA DNR Biotics Program
Georgia: Echols	Alapahoochee River, SR 376	Alapaha	30.70346°N, 83.12118°W	2019	UF 190010 (present study)
Georgia: Echols	Alapaha River, Statenville	Alapaha	30.70226°N, 83.03385°W	2019	GSU 52075 (present study)
Georgia: Echols	Alapaha River, Howell Road	Alapaha	30.82666°N, 83.01832°W	2020	UF 191133 (present study)
Georgia: Echols	Alapaha River, S of SR 94	Alapaha	30.69480°N, 83.04276°W	2018	UF 178389 (present study)
Georgia: Echols	Alapaha River, S of SR 94	Alapaha	30.69477°N, 83.03848°W	2019	GSU 26459 (present study)
Georgia: Echols	Alapaha River, S of SR 94	Alapaha	30.69573°N, 83.04024°W	2019	GSU 26461 (present study)
Georgia: Echols	Alapaha River, S of SR 94	Alapaha	30.70176°N, 83.03350°W	2018	GSU 26454 (present study)
Georgia: Echols	Alapaha River, N of SR 94	Alapaha	30.70895°N, 83.03141°W	2019	GSU 26455 (present study)
Georgia: Echols	Alapaha River, N of SR 94	Alapaha	30.72443°N, 83.04655°W	2019	GSU 26456 (present study)
Georgia: Echols	Alapaha River, N of SR 94	Alapaha	30.72443°N, 83.04655°W	2019	GSU 26457 (present study)
Georgia: Echols	Alapaha River, N of SR 94	Alapaha	30.71622°N, 83.03732°W	2019	GSU 26458 (present study)
Georgia: Echols	Alapaha River, N of SR 94	Alapaha	30.71312°N, 83.03270°W	2019	GSU 26460 (present study)
Georgia: Echols	Tom's Creek, Woodpecker Route	Suwannee	30.60593°N, 82.70422°W	2019	UF 190013 (present study)
Georgia: Irwin	Alapaha River Wildlife Management Area	Alapaha	31.49834°N, 83.38187°W	2016	UF 178161 (present study)
Georgia: Irwin	Willacoochee River, SR 158	Alapaha	31.47242°N, 83.14566°W	2019	Present study
Georgia: Lanier	Alapaha River, N of SR 37	Alapaha	31.04951°N, 83.04275°W	1997	Jensen and Birkhead (2003)
Georgia: Lanier	Alapaha River, S of SR 37	Alapaha	31.03127°N, 83.04880°W	1997	GMNH 36536
Georgia: Lanier	Alapaha River, S of SR 37	Alapaha	31.04409°N, 83.04318°W	2016	UF 179160 (present study)

Appendix 1. Continued.

State: county	Site	River drainage	Latitude, longitude	Year	Source
Georgia: Lanier	Alapaha River, N of US 84	Alapaha	30.93258°N, 83.03616°W	2020	UF 191132 (present study)
Georgia: Lowndes	Withlacoochee River, W of Knights Ferry Landing	Withlacoochee	30.71575°N, 83.46296°W	1997	Jensen and Birkhead (2003)
Georgia: Lowndes	Withlacoochee River, S of US 84	Withlacoochee	30.78669°N, 83.45642°W	1997	Jensen and Birkhead (2003)
Georgia: Lowndes	Joree Millpond, Jerry Jones Road	Withlacoochee	30.86562°N, 83.31909°W	2000	GA DNR Biotics Program
Georgia: Lowndes	Withlacoochee River, SR 31	Withlacoochee	30.63564°N, 83.31239°W	2019	UF 190011 (present study)
Georgia: Tift	Alapaha River, Ferry Lake Road	Alapaha	31.47685°N, 83.34404°W	2019	GMNH 52055
Georgia: Tift	Alapaha River, US 319	Alapaha	31.53291°N, 83.39953°W	2019	GMNH 36536 (present study)
Georgia: Turner	Alapaha River, S of SR 107	Alapaha	31.69733°N, 83.46304°W	2011	GSU 18993
Georgia: Ware	Okefenokee Swamp	Suwannee	30.66150°N, 82.32160°W	1912	AMNH 69731
Georgia: Ware	Okefenokee Swamp, Suwannee Canal near Camp Cornelia	Suwannee/ St. Mary's	30.73670°N, 82.16780°W	ca. 1933	De Sola and Abrams (1933)
Georgia: Worth	Warrior Creek, Sumner Road South	Little	31.36278°N, 83.76844°W	2019	UF 190015 (present study)
Florida: Alachua	Poe Spring	Santa Fe	29.82500°N, 82.64900°W	2010	Johnston et al. (2015)
Florida: Alachua	Hornsby Spring Run	Santa Fe	29.85000°N, 82.59300°W	2017	UF 190225
Florida: Alachua	Santa Fe River, US 41	Santa Fe	29.85299°N, 82.60758°W	ca. 2010	UF 155553
Florida: Alachua	Santa Fe River, between US 441 & River Rise	Santa Fe	29.86067°N, 82.59469°W	ca. 2015	Present study
Florida: Alachua	Santa Fe River, River Rise Preserve State Park	Santa Fe	29.86640°N, 82.59050°W	1997	UF 165793
Florida: Alachua	Santa Fe River, River Rise Preserve State Park	Santa Fe	29.87049°N, 82.58968°W	ca. 2015	Present study
Florida: Alachua	Santa Fe River, CR 235	Santa Fe	29.87860°N, 82.33640°W	1979	UF 65903
Florida: Alachua	Santa Fe River, CR 231	Santa Fe	29.87872°N, 82.33619°W	2003	UF 166146
Florida: Alachua	Santa Fe River, SE of Worthington Springs	Santa Fe	29.90835°N, 82.40611°W	2006	Florida Natural Areas Inventory
Florida: Alachua	Santa Fe River, Oleno State Park at Paraner's Branch Sink	Santa Fe	29.90902°N, 82.56352°W	ca. 2015	Present study
Florida: Alachua	Santa Fe River, Oleno State Park near river sink	Santa Fe	29.91230°N, 82.57338°W	ca. 2015	Present study
Florida: Alachua	Santa Fe River, Oleno State Park at Ogden Pond	Santa Fe	29.91347°N, 82.57133°W	ca. 2015	Present study
Florida: Alachua	Santa Fe River, E of SR 121	Santa Fe	29.91971°N, 82.42201°W	1993	P.E.M. (*pers. obs.*)
Florida: Alachua	Santa Fe River, W of SR 121	Santa Fe	29.92087°N, 82.42443°W	1993	P.E.M. (*pers. obs.*)
Florida: Alachua	Santa Fe River, Oleno State Park near Bible Camp Road	Santa Fe	29.92138°N, 82.56268°W	ca. 2015	Present study
Florida: Alachua	Santa Fe River, W of I-75	Santa Fe	29.92160°N, 82.56340°W	2006	UF 165801
Florida: Alachua	Santa Fe River, near New River	Santa Fe	29.92294°N, 82.41838°W	1993	P.E.M. (*pers. obs.*)
Florida: Alachua	Santa Fe River, Bible Camp Road	Santa Fe	29.92584°N, 82.54104°W	ca. 2015	Present study
Florida: Alachua	Santa Fe River, E of CR 241	Santa Fe	29.94000°N, 82.48700°W	1962	UF 22267
Florida: Alachua	Santa Fe River, E of CR 241	Santa Fe	29.94000°N, 82.48700°W	1992	UF 84653
Florida: Alachua	Santa Fe River, near Olustee Creek	Santa Fe	29.94084°N, 82.52978°W	ca. 2015	Present study
Florida: Alachua	Santa Fe River, E of CR 241	Santa Fe	29.94230°N, 82.50409°W	1980	UF 48437
Florida: Alachua	Suwannee River, High Springs	Suwannee	29.85214°N, 82.63062°W	2009	UF 156982, 156985
Florida: Alachua	Suwannee River, High Springs	Suwannee	29.85214°N, 82.63062°W	2012	UF 156986 (present study)
Florida: Bradford	Santa Fe River, W of Brooker	Santa Fe	29.87938°N, 82.36948°W	1980	UF 49967
Florida: Bradford	Santa Fe River, near New River	Santa Fe	29.92245°N, 82.41582°W	1993	P.E.M. (*pers. obs.*)
Florida: Bradford	Santa Fe River, S of Worthington Springs	Santa Fe	29.92314°N, 82.41897°W	1992	UF 93476–7
Florida: Bradford	New River, W of SR 18	Santa Fe	29.92619°N, 82.41121°W	2020	UF 191028 (present study)
Florida: Columbia	Alligator Lake, Lake City		30.17200°N, 82.62757°W	1982	UF 65902
Florida: Columbia	Santa Fe River, near Poe Spring	Santa Fe	29.82565°N, 82.65105°W	ca. 2015	Present study
Florida: Columbia	Santa Fe River, SW of US 27	Santa Fe	29.83117°N, 82.63756°W	ca. 2015	Present study
Florida: Columbia	Santa Fe River, W of Rum Island	Santa Fe	29.83284°N, 82.68415°W	ca. 2015	Present study
Florida: Columbia	Santa Fe River, Rum Island	Santa Fe	29.83357°N, 82.67762°W	2009	UF 156980–1, 156983–4, 15688–92

Appendix 1. Continued.

State: county	Site	River drainage	Latitude, longitude	Year	Source
Florida: Columbia	Santa Fe River, NE of US 27	Santa Fe	29.84588°N, 82.63189°W	ca. 2015	Present study
Florida: Columbia	Santa Fe River, NW of Ginnie Springs	Santa Fe	29.84742°N, 82.70939°W	ca. 2015	Present study
Florida: Columbia	Santa Fe River, River Rise Preserve State Park	Santa Fe	29.88270°N, 82.59460°W	2012	UF 190178
Florida: Columbia	Wilson Springs	Santa Fe	29.90378°N, 82.76643°W	2009	UF 155563
Florida: Columbia	Wilson Springs	Santa Fe	29.90378°N, 82.76643°W	2012	UF 155562
Florida: Columbia	Santa Fe River, near Olustee Creek	Santa Fe	29.94090°N, 82.52990°W	2001	UF 165800
Florida: Columbia	Ichetucknee River, N of US 27	Santa Fe	29.95550°N, 82.78180°W	2010	Johnston et al. (2015)
Florida: Columbia	Ichetucknee River, N of US 27	Santa Fe	29.95800°N, 82.77900°W	2011	Johnston et al. (2015)
Florida: Columbia	Ichetucknee River, NE of midpoint launch	Santa Fe	29.96243°N, 82.76766°W	ca. 2015	Present study
Florida: Columbia	Ichetucknee River, Ichetucknee Springs State Park	Santa Fe	29.96700°N, 82.75900°W	2001	Jackson and Thomas (2018)
Florida: Columbia	Ichetucknee River, S of CR 238	Santa Fe	29.98300°N, 82.76000°W	2014	Present study
Florida: Dixie	Suwannee River, 3.3 km E of Suwannee	Suwannee	29.33550°N, 83.10150°W	2012	UF 191096 (present study)
Florida: Dixie	Suwannee River, S of Old Town	Suwannee	29.54010°N, 82.97790°W	1996	UF 165792
Florida: Dixie	Suwannee River, S of CR 340	Suwannee	29.79320°N, 82.92278°W	2012	UF 169570 (present study)
Florida: Dixie	Suwannee River, N of CR 340	Suwannee	29.81700°N, 82.93192°W	2011	UF 169561 (present study)
Florida: Dixie	Suwannee River, N of CR 340	Suwannee	29.81705°N, 82.93154°W	2012	UF 169564 (present study)
Florida: Dixie	Suwannee River, N of CR 340	Suwannee	29.82103°N, 82.92797°W	2012	UF 169565 (present study)
Florida: Dixie	Suwannee River, N of CR 340	Suwannee	29.82278°N, 82.92612°W	2011	UF 169560 (present study)
Florida: Gilchrist	Gilchrist Blue Springs	Santa Fe	29.83097°N, 82.68182°W	ca. 2015	Present study
Florida: Gilchrist	Gilchrist Blue Springs	Santa Fe	29.83100°N, 82.68100°W	2010	Johnston et al. (2015)
Florida: Gilchrist	Santa Fe River, E of Rum Island	Santa Fe	29.83139°N, 82.66493°W	ca. 2015	Present study
Florida: Gilchrist	Santa Fe River, W of Ginnie Springs	Santa Fe	29.83648°N, 82.69892°W	2009	UF 155551–2
Florida: Gilchrist	Santa Fe River, E of SR 47	Santa Fe	29.85747°N, 82.73364°W	ca. 2015	Present study
Florida: Gilchrist	Santa Fe River, W of SR 47	Santa Fe	29.86800°N, -82.74500°W	2015	Jackson and Thomas (2018)
Florida: Gilchrist	Santa Fe River, S of Wilson Springs	Santa Fe	29.89693°N, 82.76661°W	ca. 2015	Present study
Florida: Gilchrist	Suwannee River, Sun Springs (Reach 4)	Suwannee	29.70024°N, 82.95734°W	2012	Present study
Florida: Gilchrist	Suwannee River, S of CR 340	Suwannee	29.79172°N, 82.92405°W	2012	UF 169567 (present study)
Florida: Gilchrist	Suwannee River, S of CR 340	Suwannee	29.79357°N, 82.92147°W	2012	UF 169569 (present study)
Florida: Gilchrist	Suwannee River, CR 340	Suwannee	29.79602°N, 82.91961°W	2012	UF 169568 (present study)
Florida: Gilchrist	Suwannee River, N of CR 340	Suwannee	29.79844°N, 82.92035°W	2012	UF 174467 (present study)
Florida: Gilchrist	Suwannee River, N of CR 340	Suwannee	29.81564°N, 82.93143°W	2012	UF 169563 (present study)
Florida: Hamilton	Alapaha River, N of CR 150	Alapaha	30.60115°N, 83.07365°W	2020	UF 191014 (present study)
Florida: Hamilton	Suwannee River, US 41	Suwannee	30.31967°N, 82.75016°W	2020	UF 191033 (present study)
Florida: Hamilton	Suwannee River, CR 136	Suwannee	30.32789°N, 82.75975°W	1973	AUM 23113
Florida: Hamilton	Suwannee River, 2 km E of US 129	Suwannee	30.38618°N, 82.91767°W	2011	UF 191032 (present study)
Florida: Hamilton	Hunter Creek	Suwannee	30.48609°N, 82.70912°W	2016	UF 189493
Florida: Hamilton	Rocky Creek, CR 135	Suwannee	30.54430°N, 82.73362°W	2019	UF 189678 (present study)
Florida: Hamilton	Suwannee River, Tom’s Creek	Suwannee	30.59616°N, 82.69655°W	2017	UF 190014 (present study)
Florida: Lafayette	Fletcher Spring	Suwannee	29.84672°N, 82.89256°W	1961	UF 12693–5 (present study)
Florida: Lafayette	Suwannee River, Branford (Reach 3)	Suwannee	29.92010°N, 82.92430°W	2012	Present study
Florida: Lafayette	Suwannee River, NW of Branford	Suwannee	30.01348°N, 83.00440°W	2006	Florida Natural Areas Inventory
Florida: Lafayette	Suwannee River, Mayo (Reach 3)	Suwannee	30.09929°N, 83.17182°W	2012	Present study
Florida: Lafayette	Suwannee River, Dowling Park lower (Reach 2)	Suwannee	30.18341°N, 83.24879°W	2012	Present study
Florida: Levy	Suwannee River, N of Fowler’s Bluff	Suwannee	29.41938°N, 83.02554°W	2020	UF 191095 (present study)
Florida: Levy	Suwannee River, Manatee Springs State Park	Suwannee	29.48645°N, 82.98104°W	2012	UF 169566
Florida: Levy	Suwannee River, SW of Fanning Springs	Suwannee	29.57930°N, 82.94520°W	1996	UF 103694–6
Florida: Madison	Suwannee River, N of Dowling Park	Suwannee	30.30538°N, 83.21807°W	2012	UF 174466 (present study)

Appendix 1. Continued.

State: county	Site	River drainage	Latitude, longitude	Year	Source
Florida: Madison	Withlacoochee River, N of SR 6	Withlacoochee	30.50110°N, 83.24240°W	1983	Pritchard (1989)
Florida: Suwannee	Ichetucknee River, Mill Pond Spring	Santa Fe	29.96643°N, 82.76179°W	2020	J.D. Mays (photo)
Florida: Suwannee	Suwannee River, S of Branford	Suwannee	29.94647°N, 82.92495°W	2012	UF 169562 (present study)
Florida: Suwannee	Suwannee River, NE of Mayo	Suwannee	30.09754°N, 83.11397°W	2016	UF 190179
Florida: Suwannee	Unknown location (inaccurate coordinates)	Suwannee	30.15356°N, 82.96482°W	1923	UF 57967
Florida: Union	Santa Fe River, SR 121	Santa Fe	29.92182°N, 82.42602°W	1994	UF 89890–1
Florida: Union	Santa Fe River, SR 121	Santa Fe	29.92186°N, 82.42601°W	1995	UF 115413
Florida: Union	Santa Fe River, SR 121	Santa Fe	29.92574°N, 82.43026°W	ca. 2015	Present study
Florida: Union	New River, W of SR 18	Santa Fe	29.92601°N, 82.41269°W	1993	P.E.M. (*pers. obs.*)
Florida: Union	New River, E of SR 18	Santa Fe	29.92688°N, 82.40946°W	1993	P.E.M. (*pers. obs.*)
Florida: Union	New River, W of SR 18	Santa Fe	29.92710°N, 82.41180°W	1993	P.E.M. (photo)
Florida: Union	New River, E of CR 231	Santa Fe	29.95600°N, 82.34800°W	1996	Jackson and Thomas (2018)
Florida: Union	Olustee Creek, SR 18	Santa Fe	29.95015°N, 82.53009°W	2020	UF 190977 (present study)
Florida: Union	Olustee Creek, Brown Road	Santa Fe	29.97149°N, 82.56290°W	2020	UF 190989 (present study)