FINAL PERFORMANCE REPORT

Federal Aid Grant No. F22AF03492 (T-128-R-1)

Alligator Snapping Turtle Distribution Survey

Oklahoma Department of Wildlife Conservation

January 1, 2023 – December 31, 2024

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Abstract:

Alligator Snapping Turtles (*Macrochelys temminckii*) have declined across their range, likely due to the combined impacts of high rates of both targeted and incidental harvest, which decimated populations, paired with proliferation of river impoundments that restrict migration and constrain source-sink population dynamics. Although surveys have previously been conducted in the state, those efforts were either conducted many years ago or covered only a fraction of the range in Oklahoma. Our objectives in 2023–24 included conducting surveys that both provided an update for waterways that were previously surveyed and to expand surveys to waterbodies that had not previously been investigated. We surveyed 23 sites distributed across nine major river systems (ranging 3^{rd} to 8^{th} order on the Strahler stream order scale) in the eastern one-third of the state. Trapping was executed using hoop nets baited with frozen fish, chicken, or sardines (in order of frequency), and with few exceptions we expended at least 100 net-nights of effort per system. We identified populations at 15 of the 23 surveyed sites, including three sites where, based on past efforts, the species was thought to be absent. We conducted several bouts of trapping at one site in McIntosh County that was identified as having an especially robust population to determine abundance; using a Cormack-Jolly-Seber open population model, we estimated the surveyed area to support 137 ± 52.72 (mean ± 95% C.I.) individuals, resulting in a calculated density of 37.85 ± 14.56 (mean ± 1 s.d.) individuals/river km and an estimated biomass of 421 kg/km. Our assessment of habitat failed to identify habitat features that strongly predicted species presence, supporting past studies concluding that the species is a habitat generalist. Finally, we report rates of capture of other syntopic turtles and fishes.

Objectives:

1. Ascertain whether or not Alligator Snapping Turtles are present in the creeks and river segments that are surveyed. Where Alligator Snapping Turtles are detected, conduct extended surveys to characterize population size.
2. Characterize the broader community of aquatic turtles, both at sites where Alligator Snapping Turtles are detected and where they are not.

Summary of Progress:

Introduction:

The Alligator Snapping Turtle (*Macrochelys temminckii*) is the largest freshwater turtle in North America and historically occurred throughout river systems that drain into the Gulf of Mexico (Pritchard, 1989). Their distribution ranges from the Florida Panhandle to eastern Texas and extends north to southern Illinois, Missouri, and Kansas (Pritchard, 1989). However, populations appear to be contracting at the periphery of the range, and the species has been nearly extirpated from southeastern Kansas, southwestern Indiana, southern Illinois, and northwestern Kentucky (Rosenbaum et al., 2023). Due to perceived declines, *M. temminckii* was first petitioned to be listed as threatened or endangered under the Endangered Species Act in 1983 but after review, the petition was denied due to a lack of sufficient ecological information for the species on which to base a decision (USFWS, 1984). Currently, the species is proposed to be listed as threatened with species-specific Section 4(d) rules under the Endangered Species Act (USFWS, 2021). Additionally, *M. temminckii* was added to Appendix III of the Conservation on International Trade in Endangered Species (CITES) in 2005 (USFWS, 2005) and was transferred to Appendix II in 2023 such that all international shipments of animals require CITES permits. The Alligator Snapping Turtle is also classified as Vulnerable on the IUCN Red List of Threatened Species (Tortoise and Freshwater Turtle Specialist Group, 1996).

Currently, *M. temminckii* is protected to varying degrees in all states where it occurs. It is listed as a Species of Greatest Conservation Need in Oklahoma (Oklahoma Comprehensive Wildlife Conservation Strategy, 2016) and has been protected in Oklahoma since 1992 by a year-round closed-season designation. Early records of *M. temminckii* in Oklahoma include observations from the Washita River (Wickham, 1922) and the Mountain Fork River (Glass, 1949; Heck, 1998; Towbridge, 1937). The species is limited to the eastern third of Oklahoma due to arid conditions farther west (Thompson et al., 2023). The first formal survey was conducted in the late 1990s and detected *M. temminckii* at 11 of the 67 sites surveyed; however, many of these sites were spatially clustered, suggesting that these eleven sites represented four persisting populations (Riedle et al., 2005). Additionally, this study reported demographic structure of one robust population and observed gaps in the size distribution, including absence of very large adults, that supported the assertion that past harvesting pressure contributed to the species' decline in the state. More recent conservation efforts have included both surveys of previously unsampled locations within the state, resulting in identification of two previously unknown populations (Voves, 2020), and habitat assessments to inform reintroductions of both head-started and translocated turtles (Voves et al. 2023).

Despite multiple studies that were chiefly dedicated to determining the presence/absence of *M. temminckii* in Oklahoma, significant gaps remain in what is known of its distribution. The goal of this Alligator Snapping Turtle survey is to improve the knowledge of the species' distribution in Oklahoma. Periodic surveys of species distributions are crucial for monitoring changes in population trajectories and guiding management efforts.

Approach:

Site Selection.

We defined systems in this study as larger rivers that may receive inputs from multiple tributaries, and those tributaries that we surveyed were defined as sites. To protect sensitive populations, we assigned a letter code to each system and a number code to sites within each system. We focused our survey efforts on systems in eastern Oklahoma that were within the known historic range of the species and these included: 1) sites that had previously been trapped where *M. temminckii* were detected, 2) sites that had previously been surveyed but where *M. temminckii* were not detected despite presence of apparently suitable habitat, and 3) sites where the habitat appeared suitable but had not been previously surveyed, often due to limited accessibility (Riedle et al., 2005; Voves, 2020). We surveyed sites from 27 May–25 June and 25 August–15 October in 2023, and 22 May–24 June and September 1-8 in 2024. We conducted surveys at 23 sites on nine river systems. In 2023, we surveyed sites associated with the Canadian, Verdigris, Neosho, Arkansas, Little, Illinois, Kiamichi, and Blue Rivers. In 2024, we surveyed sites associated with the Red, Canadian, and Verdigris rivers. Because our initial effort there in May 2023 produced the highest detection rate of any of the sites that we surveyed, Site A2 was surveyed in four bouts for the purpose of estimating its population size. After the initial survey, we resurveyed this site in September and October 2023 and again in June 2024.

Turtle Surveys.

In 2023 we trapped exclusively using 3-ringed 0.9-m hoops nets with 2.5-cm mesh. In 2024, we supplemented those traps with additional net styles to expand the size range of the turtles that we could detect, including 1.2-m diameter double-throated hoop nets to target larger animals and 38-cm diameter spring traps to target shallower areas where small turtles may occur. We baited traps with frozen fish that were supplied to us by the USFWS's Oklahoma Fish and Wildlife Conservation Office whenever possible, and all fish used as bait were harvested as components of other research efforts by that office (Tishomingo, Oklahoma) and were not collected specifically to serve as turtle bait. On occasions when frozen fish were unavailable, we instead baited traps with chicken, canned sardines, or both. Nets were set in the afternoon and then checked the following morning. Traps were set at locations where structures were available on which to secure the nets to prevent total submersion, and suitable structures typically included fallen trees, stumps, and the roots of trees near the shoreline. Temperature data loggers (iButton model DS1922L, Maxim Integrated Products, San Jose, California, USA) were deployed upon arrival at a site and removed at the conclusion of trapping bouts. Two data loggers were deployed: one for surface water temperatures and another for temperatures below the thermocline, when one was present.

We endeavored to distribute traps randomly among the suitable trap set locations that were available at each survey site. After placing the traps at suitable locations on the first day of surveying a system, we then continued documenting additional locations with a goal of cataloging a total of 100 suitable locations. On subsequent days of trapping, we then selected a random subset of the identified locations to deploy the next traps (Anthony, 2013). At some survey sites, suitable locations for deploying nets were very limited, and in these instances randomizing trap locations was not feasible and we instead saturated the site with traps.

Alligator Snapping Turtle Detection (**Objective 1**).

To decrease the likelihood of failing to detect populations of *M. temminckii*, we conducted at least 100 net-nights (NN) (1 net-night= 1 net set overnight) of trapping effort in each river system, a degree of effort that has been demonstrated to reduce the risk of failing to detect the target species in water bodies where it in fact occurs (Ligon et al., 2019, Voves, 2020). We also avoided trapping during seasons characterized by extreme temperatures, including July and early August, as well as cold winter months. During extreme temperatures, *M. temminckii* tend to move into deeper water, likely contributing to reduced detectability (Riedle et al., 2006).

We determined the demographic status (e.g., juvenile of undetermined sex, adult female, adult male) and recorded a suite of morphological measurements of each captured turtle. Every *M. temminckii* was injected with a passive integrate transponder (PIT) tag and a blood sample was collected from the dorsal coccygeal vein and stored in lysis buffer for potential future genetic studies. Each individual also was scanned with a hand-held metal detector to check for ingested fishing hooks.

Lastly, we assessed the habitat quality of each site surveyed. To do this, we followed the methods of assessing habitat that are described in a habitat suitability model that was developed for *M. temminckii* (Voves et al., 2023). We assessed aquatic habitat to characterize where individuals are likely to spend time as well as the adjacent riparian habitat that serves an important role in providing nesting and incubation habitat.

Population Estimate (**Objective 1**).

Because a site in McIntosh County initially produced a very high capture rate, we conducted four discrete survey bouts to generate sufficient capture-mark-recapture data to estimate the size of the resident population. We used the Cormack-Jolly-Seber model to estimate the population at site A2 (Baillargeon and Rivest, 2007).

The Aquatic Turtle Community (**Objective 2**).

We characterized the broader community of aquatic turtles, both at sites where Alligator Snapping Turtles were detected and where they were not, by recording and measuring all other turtles that were detected incidentally. We scanned every turtle for metal, regardless of species, to assess the potential impacts of recreational fishing on the broader turtle community.

Results and Discussion:

Alligator Snapping Turtle Detection (**Objective 1).**

Across all of the surveyed sites, we conducted 1,542 net-nights (NN) of trapping effort and captured 168 *M. temminckii* (143 unique individuals plus 26 recaptures). We detected *M. temminckii* at 15 of 23 sites surveyed (Table 1; Figure 1), including one site where we captured both reintroduced and wild *M. temminckii*. These captures included 42 females, 34 males, to adults of undetermined sex, and 65 juveniles of undetermined sex. Consistent with previous studies and reflecting the species' strong sexual size dimorphism, the average size of males was greater than females (Table 2; Figure 2). One site experienced significant flooding (unexpected due to mild weather forecast) that drowned six *M. temminckii* despite the inclusion of floatation materials that were added to all traps (traps were overwhelmed by the extreme increase in water depth); those deceased turtles are included in the total numbers of captures, but upon recovery of the carcasses the sex of two animals could not be determined.

Seven of our survey sites had been previously surveyed. These previous surveys had detected *M. temminckii* at four the sites, while the absence of *M. temminckii* at the other three sites (A4, C1, and C2) and had been used to infer that the species had been extirpated from those sites in the past. However, during the current series of surveys, we succeeded in detecting the species at all three of the sites where the species was presumed to be extirpated (Table 3) (Riedle et al., 2005; Voves, 2020). This suggests that the earlier survey efforts had been insufficient (too few net nights) to detect *M. temminckii;* that they had been conducted during suboptimal conditions (e.g. periods of high temperatures) that could have affected capture rates, or at times when the population size was lower.

Habitat suitability scores ranged 10.10–22.64, indicating that sites spanned a wide range of quality from poor to excellent, with the majority categorized as 'good' based upon recommended classifications (Table 4) (Voves et al., 2023). Interestingly, we found only a weak correlation between the HSI score and CPUE (cor = 0.411, df = 19, $p = 0.064$), indicating that habitat quality is often a poor predictor of the presence of this species.

We discovered nine individual turtles of four species with hooks either ingested or externally embedded (Table 5). Five turtles had ingested fishing hooks, requiring removal by Tulsa Zoo staff veterinarians, while four others had hooks externally embedded, which we successfully removed on site. These nine turtles included four *M. temminckii,* three *Trachemys scripta,* one *Chelydra serpentina,* and one *Graptemys ouachitensis*.

Our findings demonstrate that populations of *M. temminckii* may be more numerous than previously appreciated but is rare or has been extirpated in some sites. Many factors may account for this variability, but a potentially important one may be differences in site accessibility. Remote and difficult-to-access locations, such as those within system I, may have been exposed to lower rates of intentional and unintentional take by humans (both historically and recently) simply due to low availability of publicly accessible boat ramps amid large tracts of private lands.

We also found that two important factors that potentially increased our detection rates over those of previous studies were that we conducted more intensive surveys (i.e., more NN) in each system (Figure 3) and avoided trapping during the hottest summer months (Figure 4). These adjustments to our survey protocol likely contribute to our high rate of success detecting populations at sites where the species had previously been declared extirpated.

Sites with nearby docks and easy access were more likely to be impacted by limb lines and jug lines, posing substantial risks to the turtle community. These also were the locations where we encountered turtles with fishing hooks, either ingested or externally embedded, underscoring the potential effects of fishing activities on turtle populations in these areas.

Population Estimate (**Objective 1**).

The first survey at the McIntosh County site was conducted on 27–28 May 2023, and yielded 20 individuals from 20 nets (CPUE = 1.00). During the second period, 28 September–1 October 2023, 39 unique *M. temminckii* were captured within 78 NN (CPUE = 0.50), 11 of which were recaptures from the first trapping effort. In the third trapping period 12–15 October 2023, we captured 18 individuals comprised of 9 new and 9 recaptures in 106 NN of effort (CPUE = 0.17). Finally, 21–24 June 2024, yielded 10 unique individuals, including 5 recaptures in 100 NN (CPUE = 0.10). Based upon these data, we estimated the population to be 137.3 (95% CI: 84.6–190) individuals within the survey reach. This site supported an impressively robust population despite having readily accessible public access points. However, despite this easy accessibility we did not observe high rates of fishing activity, possibly because of its close proximity to more popular fishing areas. We speculate that this dense population may be the result of a historical population that occupied System A then became displaced into small tributaries when the river was dammed in 1964 to create a reservoir. Our repeated surveys at this site also illustrate the inherent variability that may occur in capture rates at different times of the year within a single site and a known population.

The Aquatic Turtle and Fish Communities (**Objective 2**).

We captured 3,112 turtles representing 10 species including *M. temminckii,* Red-eared Sliders (*Trachemys scripta*), Ouachita Map Turtles (*Graptemys ouachitensis*), False Map Turtles (*Graptemys pseudogeographica*), Common Snapping Turtles (*Chelydra serpentina*), Spiny Softshell Turtles (*Apalone spinifera*), Smooth Softshell Turtles (*Apalone mutica*), Eastern River Cooters (*Pseudemys concinna*), Razorback Musk Turtles (*Sternotherus carinatus*)*,* and Common Musk Turtles (*Sternotherus odoratus*). System F had the lowest diversity with four species and system I had the highest with 10 species (Tables 6, 7). We propose that biodiversity observed in a turtle community is a useful indicator of that water body's overall ecological health and suitability for aquatic vertebrates in general, and beta diversity is informative in assessing the relative condition of different river systems.

Bait type has been identified as an important factor is drawing turtles into traps (Anthony 2013). We chiefly used frozen fish of various species that had been captured in unrelated studies and provided to us by the USFWS's Oklahoma Fish and Wildlife Conservation Office in Tishomingo, Oklahoma. On occasions when frozen fish was unavailable, we instead used frozen chicken and/or canned sardines. As expected, turtle captures varied across the variety of baits used (Tables 8, 9).

Finally, we captured a range of fish as incidental bycatch during our survey efforts. Species detected and the number captured varied across the rivers that we surveyed (Tables 10, 11).

Table 1. County, total *M. temminckii* captured, total net nights, and capture rate (number of *M. temminckii* per total net nights) for each site survey in 2023–24. Capture rate is reported as total captures, and when recaptures occurred the number of unique individuals is reported parenthetically. At site C2, 20 of the captured turtles were captive-bred turtles released by Tishomingo Fish Hatchery while 3 were naturally occurring wild animals.

Site	County	Number of Captures	Net Nights	Capture Rate (Turtles/Net Night)
System A		**111(86)**	**493**	**0.225**
Site A1	McIntosh	0	4	0.000
Site A2	McIntosh	103(78)	304	0.338
Site A3	McIntosh	1	100	0.010
Site A4	Pittsburg	7	82	0.085
System B		**2**	**138**	**0.014**
Site B1	Wagoner	0	19	0.000
Site B2	Wagoner	0	42	0.000
Site B3	Wagoner	0	19	0.000
Site B4	Rogers	2	58	0.035
System C		**29**	**150**	**0.193**
Site C1	Mayes	4	33	0.121
Site C2	Mayes	23	34	0.676
Site C3	Wagoner	2	83	0.024
System D		**3**	**74**	**0.041**
Site D1	Muskogee	3	40	0.075
Site D2	Muskogee	0	34	0.000
System E		**1**	**100**	**0.010**
Site E1	McCurtain	1	26	0.038
Site E2	McCurtain	0	74	0.000
System F	Sequoyah	**0**	**100**	**0.000**
System G		**8**	**242**	**0.033**
Site G1	Choctaw	2	102	0.078
Site G2	Choctaw	3	120	0.025
Site G3	Choctaw	3	20	0.150
System H	Bryan	**0**	71	**0.000**
System I		**14(13) (6*)**	**86**	**0.233**
Site I1	Choctaw	0	15	0.000
Site I2	Choctaw	6	31	0.194
Site I3	McCurtain	8(7) (6*)	40	0.350
Site I6	Choctaw	4	49	0.082

**M. temminckii* that perished in nets during an extreme flooding event.

Table 2. Summary of morphological measurements of Alligator Snapping Turtles (*M. temminckii*) pooled across all river systems surveyed in 2023–24. Values presented at mean ± 1 s.d.

Metric	Males	n*	Females	n*	Juveniles	n**
Midline Carapace Length (mm)	437.6 ± 83.8	34	379.0 ± 41.1	42	229.4 ± 48.1	70
Carapace Width (mm)	363.7 ± 66.0	34	328.7 ± 33.6	42	201.0 ± 51.5	70
Plastron Length (mm)	326.5 ± 58.2	34	290.4 ± 37.6	41	174.6 ± 35.9	70
Pre-Cloacal Length (mm)	134.5 ± 47.4	31	81.5 ± 16.3	41	55.3 ± 15.1	70
Full Tail Length (mm)	428.8 ± 68.9	31	373.1 ± 46.2	41	246.0 ± 61.7	70
Mass (kg)	19.48 ± 11.18	31	13.76 ± 4.43	41	3.51 ± 1.92	70

* Metrics that were calculated from smaller samples sizes due to incomplete morphometrics from 3 males and 1 female that perished in nets during an unforeseen flood event.
** Some juveniles captured in 2023 were measured again when recaptured in 2024.

Table 3. Rates of capture of Alligator Snapping Turtles (*Macrochelys temminckii)* at sites or in river systems that were surveyed in two or more surveys. Past surveys were conducted in 1997–98 (Riedle et al., 2005) and 2018 (Voves et al., 2023).

Location	**1997–99**	**2018**	**Present Study**
A2	0.620 (07-22-1999)	-	0.338 (05-28-2023)
G	0.060 (07-16-1997)	-	0.033 (09-05-2023)
C	0.000 (06-13-1998)	0.000 (07-14-2018)	0.193 (06-11-2023)
B	0.000 (07-16-1998)	-	0.014 (06-16-2024)
A3	0.000 (07-01-1997)	0.000 (06-13-2018)	0.010 (05-31-2023)
C5	0.000 (05-29-1997)	0.024 (06-02-2018)	-
C4	0.000 (08-10-1998)	0.130 (06-24-2018)	-

Table 4. The habitat suitability index model scores for each site surveyed along with the results from Voves (2023) survey. Suitability scores were categorized as Poor (< 11), Fair (11–15), Good (16–21), and Excellent (≥ 22).

Site	*M. temminckii* Status	CPUE	Channel Score	Bank Score	Anthropogenic Score	HIS Score	Suitability Ranking
C2	Present	0.68	7.52	6.66	4.16	18.34	Good
C1	Present	0.12	7.24	7.00	4.26	18.50	Good
C3	Present	0.02	2.08	3.70	4.32	10.10	Poor
B4	Present	0.04	5.52	8.58	5.00	19.10	Good
G3	Present	0.15	1.86	5.16	6.06	13.08	Good
G1	Present	0.08	3.10	6.20	5.00	14.30	Fair
G2	Present	0.03	7.60	7.56	3.96	19.12	Good
D1	Present	0.08	4.70	7.42	3.50	15.62	Good
A4	Present	0.09	6.04	7.16	5.00	18.20	Good
A3	Present	0.01	6.52	7.62	4.94	19.08	Good
I3	Present	0.35	9.26	7.74	5.64	22.64	Excellent
I2	Present	0.19	4.96	7.96	4.82	17.74	Good
A2	Present	0.34	6.90	6.94	6.00	19.84	Good
E	Present	0.01	6.58	6.50	5.92	19.00	Good
B2	Absent	0.00	4.16	6.80	4.84	15.80	Good
B1	Absent	0.00	1.36	5.78	5.70	12.84	Fair
B3	Absent	0.00	3.98	4.48	5.82	14.28	Fair
H	Absent	0.00	6.74	6.18	5.69	18.61	Good
D2	Absent	0.00	2.58	5.00	6.00	13.58	Fair
F	Absent	0.00	5.66	5.60	4.94	16.20	Good
I1	Absent	0.00	4.88	3.30	4.26	12.44	Fair

Table 5. Metal was detected in turtles using a handheld metal detector. Species codes are MATE (*M. temminckii),* CHSE (*C. serpentina),* TRSC (*T. scripta),* and GROU (*G. ouachitensis*).

Date Pulled	Time Pulled	Site	Net Number	Species	PIT code	Sex	CL (mm)	MPL (mm)	Mass (g)	Pre-cloacal (mm)	Tail (mm)	Carapace Width (mm)	Comments
10/1/2023	11:10	A2	2M61	MATE	982091062771816	M	564	407	44000	199	535	368	hook fragment under the surface of the skin (removed by vet)
9/2/2023	9:23	G3	SC8	MATE	982091062771817	M	523	354	31000	223	512	448	Hook on the top of head with string still attached (removed on site)
10/13/2023	N/A	A2	N/A	MATE	982091062771800	F	405	319	17000	93	443	366	Hook in the back of mouth, visible when mouth was open (removed by vet)
9/29/2023	11:44	A2	2M21	MATE	982091062771813	F	322	241	8000	69	369	275	Hook in the throat (removed by vet)
6/20/2024	1:15	I1	Limb Line	CHSE		F	285	-	6000	-	-	-	Was caught by an illegal limb line (removed on site)
6/14/2023	11:07	C3	F17	TRSC		F	228	-	1400	-	-	-	Hook was detected with the metal detector near pectoral scutes (removed by vet)
6/23/2024	9:09	A2	4M22	TRSC		F	208	-	1100	-	-	-	Metal object in the stomach (seemed to be a fishing weight)
8/25/2023	10:48	G1	R27	TRSC		F	207	-	1350	-	-	-	Hook in throat (removed by vet)
6/14/2023	9:52	C3	F31	GROU		F	202	-	1050	-	-	-	Hook in the side of the jaw (removed on site)

Table 6. Species richness and evenness of turtle communities within each surveyed system.*

Location	Turtle Species Richness	Turtle Species Evenness
Canadian River	8	0.365
Verdigris River	7	0.325
Neosho River	8	0.343
Arkansas River	6	0.250
Illinois River	4	0.195
Little River	6	0.030
Kiamichi River	7	0.167
Blue River	6	0.164
Red River	9	0.134

* *Apalone mutica* was not included in this analysis because < 5 individuals were trapped across all sites.

Table 7. Composition of turtle communities (presence/absence) in all systems surveyed in Oklahoma. MATE = *Macrochelys temminckii*; TRSC = *Trachemys scripta*; GROU = *Graptemys ouachitensis*; CHSE = *Chelydra serpentina*; APSP = *Apalone spinifera*; APMU = *Apalone mutica*; PSCO = *Pseudemys concinna*; GRPS = *Graptemys pseudogeographica*; STCA = *Sternotherus carinatus*; STOD = *Sternotherus odoratus*.

Species	Verdigris River	Neosho River	Arkansas River	Canadian River	Illinois River	Blue River	Kiamichi River	Lower Red River	Little River
MATE	X	X	X	X			X	X	X
TRSC	X	X	X	X	X	X	X	X	X
GROU	X	X		X	X	X		X	X
GRPS		X	X	X		X	X	X	
CHSE	X	X		X				X	
APSP	X	X	X	X		X	X	X	X
APMU		X		X				X	
PSCO	X	X	X	X	X	X	X	X	X
STCA							X	X	X
STOD	X	X	X	X	X	X	X	X	

Table 8. Baits used in different river systems in eastern Oklahoma while conducting trapping surveys for Alligator Snapping Turtles (*M. temminckii*) in 2023–24.

Bait	**Arkansas River**	**Verdigris River**	**Blue River**	**Eufaula Lake**	**Illinois River**	**Kiamichi River**	**Little River**	**Neosho River**	**Red River**	**Total**
Striped Bass (*Moron saxatilis*)	34	111	0	207	54	0	80	93	30	**609**
Chicken Drumstick	0	0	19	66	0	147	0	37	0	**269**
Carp Sucker (*Carpiodes carpio*)	13	4	0	103	30	0	5	0	6	**161**
Silver Carp (*Hypophthalmichthys molitrix*)	7	20	11	11	11	39	0	9	7	**115**
Bighead Carp (*Hypophthalmichthys nobilis*)	0	0	0	59	0	0	0	0	0	**59**
Spotted Bass (*Micropterus nigricans*)	0	0	0	1	0	47	0	0	0	**48**
Bigmouth Buffalo (*Ictiobus cyprinellus*)	18	0	0	14	0	0	0	1	13	**46**
Grass Carp (*Ctenopharyngodon idella*)	2	4	0	6	0	9	0	8	5	**34**
Common Carp (*Cyprinus carpio*)	0	0	0	24	0	0	0	0	9	**33**
Channel Catfish (*Ictalurus punctatus*)	0	0	0	0	5	0	13	0	5	**23**
Sardines	0	0	0	0	0	0	0	0	11	**11**
Blue Catfish (*Ictalurus furcatus*)	0	0	0	5	0	0	1	2	0	**8**
White Crappie (*Pomoxis annularis*)	0	0	0	0	0	0	0	1	0	**1**

Table 9. Distribution of turtles captured using different types of bait in 0.9-m diameter hoop traps in eastern Oklahoma in 2023–24.

Bait	# of Turtles Caught	% of Turtles Caught
Striped Bass (*Moron saxatilis*)	1407	49.5
River Carpsucker (*Carpiodes carpio*)	351	12.4
Chicken Drumstick	339	11.9
Silver Carp (*Hypophthalmichthys molitrix*)	259	9.1
Bigmouth Buffalo (*Ictiobus cyprinellus*)	187	6.6
Common Carp (*Cyprinus carpio*)	59	2.1
Grass Carp (*Ctenopharyngodon idella*)	57	2.0
Bighead Carp (*Hypophthalmichthys nobilis*)	47	1.7
Largemouth Bass (*Micropterus nigricans*)	45	1.6
Channel Catfish (*Ictalurus punctatus*)	16	0.6
Blue Catfish (*Ictalurus furcatus*)	13	0.5
White Crappie (*Pomoxis annularis*)	8	0.3
Sardines	2	0.1

Table 10. List of fishes recorded as bycatch in Oklahoma rivers while conducting trapping surveys for Alligator Snapping Turtles (*Macrochelys temminckii*) in 2023–24.

Species	**Eufaula Lake**	**Verdigris River**	**Neosho River**	**Arkansas River**	**Illinois River**	**Little River**	**Kiamichi River**	**Blue River**	**Red River**
Shortnose Gar (*Lepisosteus platostomus*)	18	4	0	0	0	0	4	0	1
White Crappie (*Pomoxis annularis*)	77	6	5	2	1	0	7	3	0
Bluegill (*Lepomis macrochirus*)	97	24	27	31	19	7	73	22	19
Longear Sunfish (*Lepomis megalotis*)	30	21	3	16	11	1	13	1	16
Longnose Gar (*Lepisosteus osseus*)	4	0	0	0	0	0	1	0	2
Blue Catfish (*Ictalurus furcatus*)	4	0	3	1	0	6	3	1	0
Spotted Gar (*Lepisosteus occulatus*)	7	3	5	1	0	0	2	4	2
Warmouth (*Lepomis gulosus*)	1	1	1	0	0	0	2	0	0
Channel Catfish (*Ictalurus punctatus*)	29	23	2	0	0	1	5	2	6
Bigmouth Buffalo (*Ictiobus cyprinellus*)	1	0	6	0	0	0	2	0	0
Smallmouth Bass (*Micropterus dolomieu*)	2	0	0	1	1	0	0	0	0
Green Sunfish (*Lepomis cyanellus*)	1	0	0	2	0	0	2	0	0
Black Crappie (*Pomoxis nigromaculatus*)	12	0	3	2	0	0	8	0	2
Redear Sunfish (*Lepomis microlophus*)	2	0	0	1	1	0	0	0	2
Flathead Catfish (*Pylodictis olivaris*)	0	0	0	0	1	0	1	2	1
Black Bullhead (*Ameiurus natalis*)	0	0	0	0	0	2	0	0	2
Least Sunfish (*Lepomis humilis*)	0	0	0	0	0	1	0	0	0
Golden Redhorse (*Moxostoma erythrurum*)	0	0	0	0	0	2	0	0	0
Quillback (*Carpiodes cyprinus*)	0	0	0	0	0	0	1	0	0
Alligator Gar (*Atractosteus spatula*)	0	0	0	0	0	0	1	0	2

Table 11. Species richness and evenness for fish caught while conducting surveys for Alligator Snapping Turtles (*M. temminckii*) in Oklahoma in 2023–24.

Location	**Species Richness**	**Species Evenness**
Eufaula Lake	14	0.696
Verdigris River	7	0.806
Neosho River	9	0.772
Arkansas River	9	0.603
Illinois River	6	0.617
Little River	7	0.842
Kiamichi River	15	1.039
Blue River	7	0.658
Red River	11	0.766

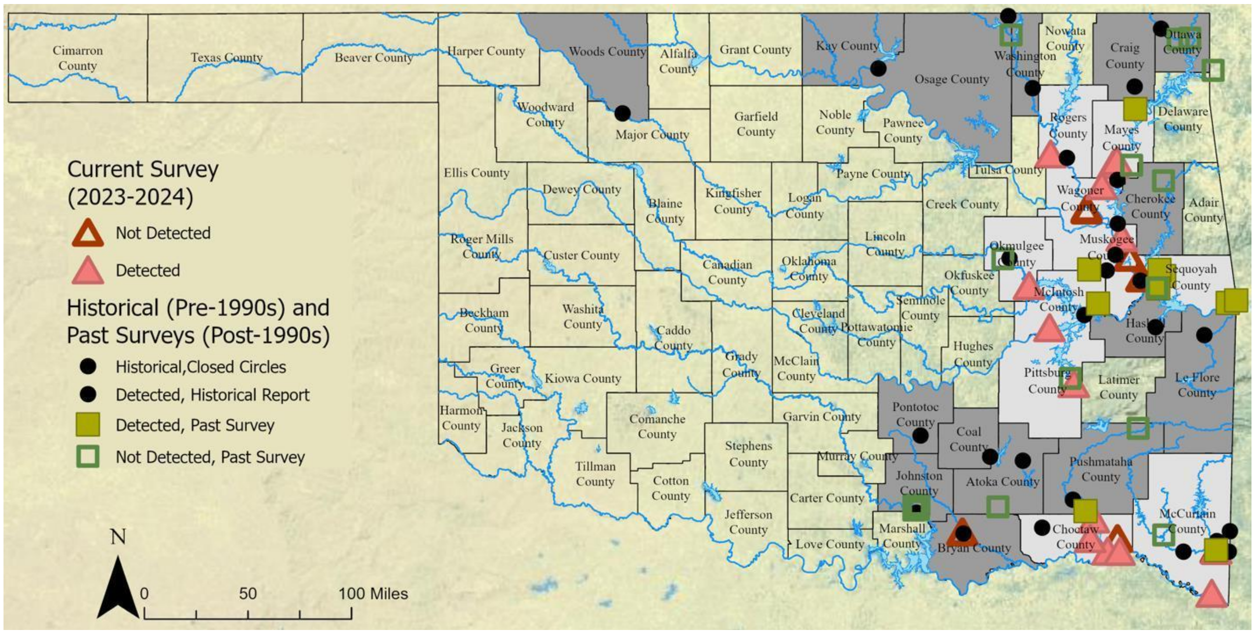

Figure 1. Detection of *M. temminckii* across all sites that were surveyed (present = filled orange point, absent = open orange point), for past surveys (present = filled grey point, past survey absent = empty grey point), historical record captures (black filled points). All locality points were jittered to mask precise locations.

Figure 2. The midline carapace length (mm) of *M. temminckii* separated by sex/age class for each site. Light orange represents juveniles, medium orange is females, and dark orange indicates males. Adults start to diverge from juveniles around the 330 mm length and males begin to diverge from females at 340–360mm.

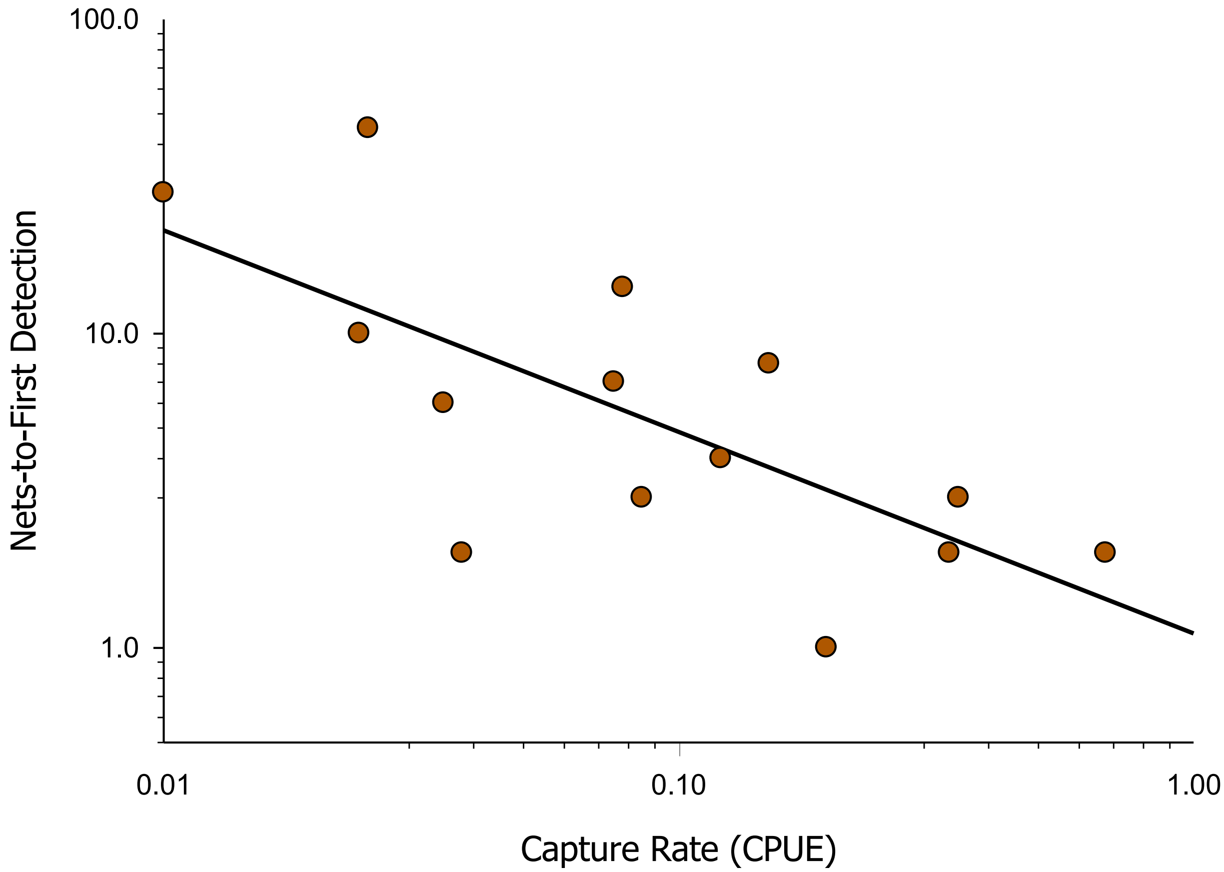

Figure 3. Number of nets to first capture relative to captures per unit effort. Note that both x and y-axes use a logarithmic scale.

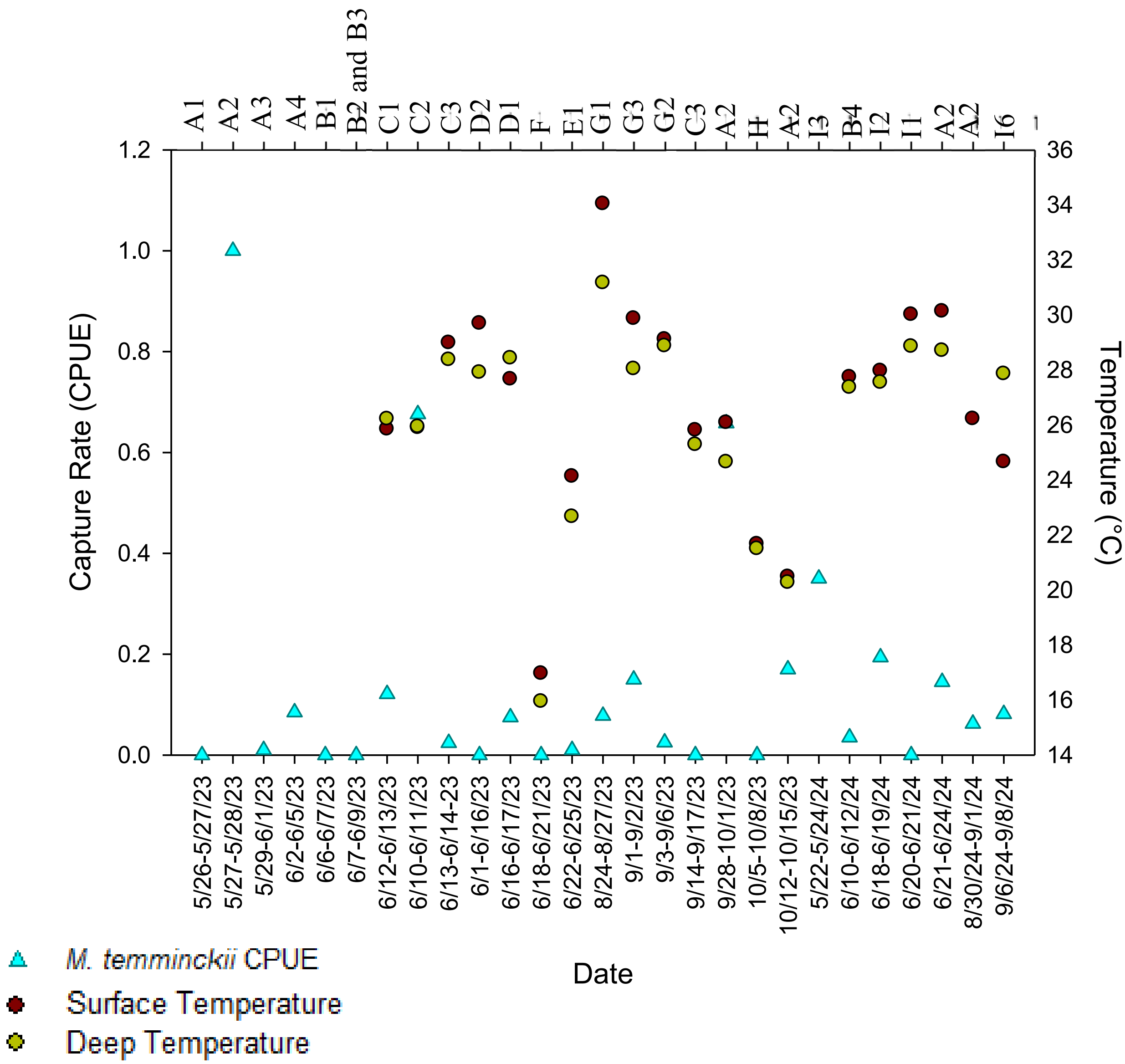

Figure 4. Capture rates, deep (red circles) and surface (yellow circles) water temperatures for each date the nets were at a site. As well as the CPUE (blue triangles) for each survey. Temperature data are missing for some trapping bouts due to theft and loss of data loggers in a flood.

Recommendations:

1. Reassessing the status of *M. temminckii* in Oklahoma has filled several gaps in the known distribution of the species by identifying populations in areas where it was previously believed to be either historically absent or extirpated prior to the 1980s. That many sites where the species was detected failed to identify obviously robust populations supports past assertions that *M. temminckii* experienced substantial declines in the past from which they are slow to recover and suggest that conservation actions such as population reintroductions and augmentations remain a valuable tool in aid of conservation of this ecologically impactful species (Blasky 2024).
2. Continued distribution surveys seem likely to reveal yet more locations where *M. temminckii* persist, and population surveys are recommended for tracking changes in population size and demographics. A list of potential survey locations for future work includes Holly Creek and the Glover River in the Little River system; Dog Creek and Panther Creek in the Verdigris River system; Sardis Reservoir in the Kiamichi River system; Coal and Gaines creeks in the Canadian River system; coves surrounding Fort Gibson Reservoir; and Island Bayou, Whitegrass Creek, and Goodwater Creek in the Lower Red River system.
3. Conservation actions should focus on identifying and addressing the primary causes of decline, which may have occurred decades earlier, in order to give ex-situ methods, like head-start/reintroduction programs, the highest chance for success (Moll and Moll, 2004).
4. Community outreach to anglers may prove useful by providing education about the risks to aquatic wildlife from passive fishing techniques, such as the deployment of trot lines and limb lines, and best practices for minimizing potential impacts, especially to turtles.
5. One important factor to consider when implementing conservation methods is human accessibility, as it can significantly influence the effectiveness and sustainability of conservation efforts and the populations they support.

Significant Deviations:

There were no significant deviations from the grants objectives, geographic scope, or proposed approaches. We conducted surveys at a subset of the proposed sites, and knew from the beginning that some sites would have to be omitting from the survey schedule due to logistical (access), time, and other constraints.

Equipment:

No equipment was purchased using grant funds.

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