A Survey Of The Reptiles And Amphibians Of Kickapoo State Park And The Middle Fork State Fish And Wildlife Area (MFSFWA)

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INTRODUCTION

Reptiles and amphibians are two of the most endangered taxa worldwide from factors including habitat loss and degradation, disease and parasitism, introduced invasive species, environmental pollution, unsustainable use, and global climate change (Gibbons et al 2000). In the United States, federal listing is available for species that are endangered or threatened with extinction throughout all or a significant portion of their range. Few species, however, qualify for such measures. Sustaining populations throughout a species range and on the edge of its range is essential however, for maintaining genetic, behavioral, and morphological diversity. Thus, the value of State management for nationally common but locally rare species is tremendously important.

For a species to be managed appropriately, however, baseline data including population numbers, distribution, size, and structure (sex, age, etc.) is essential. Both Blanding's turtles (*Emydoidea blandingii)* and four-toed salamanders (*Hemidactylium scutatum)* are listed as Threatened in Illinois, primarily because Illinois is on the edge of their range, and because of their reliance on specific habitats that have been widely impacted by habitat degradation (Phillips et al. 1999).

STUDY SITES AND PREVIOUS SURVEYS

Kickapoo State Park was purchased in 1939, this park was one of the first parks created on strip-mined land. It encompasses 2,842 acres and includes 22 deep water ponds ranging in size from 0.2 acres to 57 acres, totaling 221 acres of open water (IDNR website).

The Middle Fork State Fish and Wildlife Area land was purchased by the state in the late 1960's for a water supply and recreation reservoir. It became a State Fish and Wildlife Area in 1978, and officially the Middle Fork State Fish and Wildlife Area in 1986. The area consists of 2,700 acres of grass, forest and cropland. It is bordered by Kennekuk Cove County Park and by Illinois Power Company's Vermilion Station. It is also connected to Kickapoo State Park by the Middle Fork River (about 10 miles downstream) (IDNR website).

Both Blanding's turtles and four-toed salamanders have been reported to occur in Middle Fork State Fish and Wildlife Area (MFSFWA) and possibly occur in Kickapoo State Park in Vermilion County, Illinois. Blanding's turtles and four-toed salamanders were first observed at MFSFWA in 1990. In 1995, INHS scientists surveyed MFSFWA to document whether these two species still existed at the reserve. No Blanding's turtles were trapped or observed and only one gravid female four-toed salamander was encountered. In 1996, one additional Blanding's turtle was observed and since the 1995 survey, numerous (100+) four-toed salamanders have been encountered at MFSFWA, however, quantitative data used to estimate abundance is lacking (Phillips, personal communication). No surveys have been conducted at Kickapoo State Park for Blanding's turtles. In the last decade, no Blanding's turtles have been encountered, and it is

questionable whether a population still exists at these parks. It was important that the status of these populations be investigated and monitored so that management decisions at MFSFWA and Kickapoo State Park can include these species.

OBJECTIVES

1) Survey for Blanding's turtles at the park and wildlife area,
2) Establish baseline population data on four-toed salamanders and Blanding's turtles
3) Collect blood samples from all turtles for future health and genetic analyses
4) Compile a species list for all amphibians and reptiles encountered in these areas.

MATERIALS AND METHODS

SPECIES LIFE HISTORIES

Emydoidea blandingii

Populations can be found from southwestern Quebec and southern Ontario west to Minnesota and central Nebraska and south to central Illinois. Large populations can be found in the Great Lakes region (Ernst et al. 1994; Harding 1997). In Illinois, since 2000, individuals or populations have been found or re-verified from 15 counties including: Bureau, Carrol, Cook, DuPage, Henderson, Iroquois, Kane, Kankakee, La Salle, Lake, Lee, McHenry, Ogle, Whiteside, and Will. Records exist (all but four were pre-1980 records), however, where turtles were vouchered, sighted, or photographed from 15 additional counties including: Cass, Champaign, Coles, Cumberland, Grundy, Henry, Jasper, Jo Davies, Mason, McLean, Morgan, Peoria, Rock Island, Vermilion, and Winnebago (Illinois Natural Heritage Database; Phillips et al. 1999).

This medium sized turtle prefers productive, eutrophic habitats with organic bottoms and abundant vegetation (Ernst et al. 1994) and is found inhabiting quite marshes, swamps, shallow weedy ponds, prairie wetlands, wet sedge meadows, and shallow vegetated portions of lakes (Ernst et al. 1994; Harding 1997, Phillips et al. 1999). They are primarily carnivorous, eating crayfish and other invertebrates, but also ingest plant material (Ernst et al. 1994; Banning et al. unpublished data; Phillips et al. 1999).

They are also a long-lived species with the oldest known individuals to be over 70 years old (Brecke and Moriarty 1989, Congdon unpublished data). Reproduction does not begin until the mid-teens with females depositing only one clutch of 3 to 22 eggs per year. Mature females do not always nest each year. Because this species is slow-

maturing, juvenile as well as adult survivorship must remain high to ensure species survival (Congdon et al. 1993).

These turtles are active during the daylight. In northern Illinois, turtles are first seen in late March when water temperatures reach 19C, but may be active at lower temperatures, and can be captured using baited hoop traps (Rowe and Moll 1991, Banning et al. 2006).

Hemidactylium scutatum

Populations can be found from Nova Scotia to northern Minnesota, and south to the Gulf of Mexico. Its range is discontinuous in the southern and Midwestern states where only small isolated patches occur (Lanoo 1998). In Illinois, since 2000, individuals or populations have been found or re-verified from seven counties including: Jo Davies, Knox, La Salle, Lawrence, Ogle, Rock Island, and Vermilion. Vouchered specimens exist, however (all but one were pre-1980 records) , from five additional counties including: Cook, Jersey, Lake, McDonough, and Will (Illinois Natural Heritage Database; Phillips et al. 1999).

This small salamander prefers boggy pools or spring-fed ravines in undisturbed or mature deciduous forests, but has been found in secondary forests and soggy soils below dams of man-made lakes. Adults are terrestrial and can be found in moist rotten logs and under leaf litter. They feed on a variety of arthropods (Pfingsten and Downs 1989; Phillips et al. 1999).

Adults mate in autumn and females lay 20-60 eggs between April-May. Females select nesting sites a few inches above water. Throughout much of their range, females primarily nest within mats of sphagnum moss or leaves, within logs, under rocks (Pfingsten and Downs 1989), however, in Vermilion county, females were found to nest primarily in grass tussocks growing in shallow water (Herman and Phillips, personal observation). Females are often found attending the nests and eggs hatch within two months and larvae wriggle into the surrounding water (Pfingsten and Downs 1989; Phillips et al. 1999).

These salamanders can best be found by conducting hand searches between April-May for males and females in the upland forest, and for nesting females above shallow water (Phillips, personal communication).

SURVEY TECHNIQUES

Turtles

Turtles were trapped using baited hoop traps from 6 June to 22 September 2005 at Kickapoo State Park and from 6-12 June 2006 at MFSFWA. Traps were approximately 18” diameter, placed along the shoreline in shallow water so that at least 4 inches of the

trap was above water, and checked daily to prevent accidental drowning. A GPS location was taken along the shore where traps were placed.

Other methods such as visual spot searches or timed visual encounter surveys can also be used to identify the turtle species present in an area. Visual spot searches were conducted daily at all ponds that were being trapped. Ponds were approached cautiously so that basking turtles were not disturbed, and the species encountered were identified visually, often with binoculars. The number of each species encountered visually was not recorded because we felt that those estimations would be biased assessments of the true turtle abundance in ponds, due to the facts that 1) ponds differed in the cover provided (influencing the ability of the researcher to approach the ponds unnoticed), 2) there are discrepancies in the wariness and tolerance of turtle species to approaching threats (impacting what turtle species you might commonly see), 3) ponds differed in the amount of available basking habitat, 4) long-term marking of turtles to prevent visual re-sampling (ex: paint on carapace) is difficult because turtles shed their scutes, and 4) the high volume of recreational visitors that could influence the number of turtles basking within a ponds and among ponds (due to differences in visitor use of ponds). For these reasons, we only recorded what species were encountered during visual surveys.

Timed visual encounter surveys were also conducted between 15 April to 12 June 2006 MFSFWA. Researchers would walk the perimeter of the marsh in the shallow waters, searching the vegetation for turtles. This method has been very successful during the spring to locate Blanding's turtles (Banning et al. 2006). The total amount of time spent searching was recorded.

Upon capture, we measured straight-line plastron length (PL) and carapace length (CL) to the nearest mm, weighed turtles to the nearest gram, and gave each turtle a unique notch on their marginal scutes (Cagle, 1939). The sex of each turtle was identified using secondary sexual characters like elongated foreclaws and preanal tail lengths. Reproductive stage was determined using PL (Ernst et al. 1994) (Table 1).

A health assessment was taken from each turtle captured. First, all turtles were physically examined for injuries including missing appendages and eyes, and fractured shells. Second, the turtles were examined for leeches, and the number of leeches on each turtle was recorded. A sample of leeches were removed from each turtle for identification by Mark Wetzel at the Illinois Natural History Survey and deposited into the Annelida Collection. Finally, a blood sample was taken from the subcarapacial sinus (Fisher 2003) and placed in lithium heparinized Capiject tubes. The volume of blood taken did not exceed 0.1 mL per 100 g body weight (Moon and Hernandez 2001). Blood was stored on ice until return to the laboratory. Turtles were then released at the site of capture.

Upon return to the laboratory, a blood smear was created from the heparinized blood to check from hemoparasites. Blood was then centrifuged for 5 minutes and the plasma was decanted. Plasma and some red blood cells were then and stored at -80°C for future hormone and genetic analyses.

For parasite descriptions, prevalence is defined as the percentage of hosts infected with at least one parasite and intensity is the average number of parasites per infected host (Bush et al. 1997).

Salamanders

Timed visual encounter surveys were conducted at MFSFWA between 9 April and 16 May 2006. We were unable to survey salamanders during the 2005 season because funding was not available until after the nesting season. Surveys targeted the areas around "Hemi Pond" (40.2390 °N, 87.7857 °W)"Sweetflag Marsh" (40.2390°N, 87.7861°W) because these are the areas known to have robust four-toed salamander densities (Herman and Phillips). Leaf litter and logs were checked for salamanders, as were grass tussocks within the ponds where female salamanders are known to nest. The total number of salamanders by species was recorded. We determined the sex of four-toed salamanders only by visually examining the abdomen to determine if it was swollen with eggs. All four-toed salamanders were toe clipped to indicate previous encounter and a GPS location was taken.

RESULTS

TURTLES

Trapping and Survey Analyses

Overall Survey Data

Ten sites were surveyed from Kickapoo State Park and MFSFWA. A total of 2979 trap hours (124 trap days) of effort yielded 92 turtles including: 1 *Apalone spinifera*, 12 *Chelydra serpeninta*, 40 *Chrysemys picta*, and 39 *Trachemys scripta*. One *C. picta* and one *T. scripta* from Kickapoo State Park were recaptures. No *Emydoidea blandingii* were found at either site (Tables 2 & 3).

Kickapoo State Park

Turtles were trapped from nine ponds totaling 2191 trap hours (91.3 trap days) of effort (Tables 2 & 3). A total of 83 turtles were captured including: 1 *A. spinifera*, 8 *C. serpentina*, 35 *C. picta*, and 39 *T. scripta* (Tables 2 & 3). Overall, we captured *A. spinifera* at a rate of one per 2191 hrs., *C. serpentina* at a rate of one per 273.8 hrs., *C. picta* at a rate of one per 62.6 hrs., and *T. scripta* at a rate of one per 56.2 hrs.

Visual spot searches identified basking *C. picta*, and/or *T. scripta* from most lakes surveyed (Table 4). Information on each turtle captured including ID, location, sex, reproductive stage, and injuries can be found in Table 5. A summary of turtle demographics and morphometrics can be found in Table 6.

MFSFWA

A total of 788 trap hours (33 trap days) at the Main Marsh yielded 9 turtles: 4 *C. serpentina*, and 5 *C. picta* (Tables 2 & 3). Overall, we captured *C. serpentina* at a rate of one per 197 hrs., and *C. picta* at a rate of one per 157.6 hrs.

A total of 215 minutes (3.6 hours) of timed visual encounter surveys yielded only *C. serpentina* and *C. picta*, as did spot searches (Table 4). Information on each turtle captured including ID, location, sex, reproductive stage, and injuries can be found in Table 5. A summary of turtle demographics and morphometrics can be found in Table 6.

Health Analyses

Two species of leeches were recovered from turtles: *Placobdella parasitica*, and *Placobdella ornata*. The prevalence and intensity of leeches by pond and by turtle species can be found in Tables 7 and 8, respectively. Both species are known to occur historically in Illinois (Wetzel 1992; Wetzel 2006).

Only hemoparasites of the genus *Hemogregarina* were found. The prevalence and intensity of *Hemogregarina* sp. by pond and by turtle species can be found in Tables 9 and 10, respectively.

SALAMANDERS

A total of 510 search minutes (8.5 hours) at MFSFWA yielded a total of 26 salamanders: 1 *Ambystoma texanum*, 2 *Eurycea cirrigera*, 13, *H. scutatum* (individuals or nests), and 10 *Plethodon cinereus* (Table 11 & 12). Of the *H. scutatum* found 3 were males, 4 were females on nests, 2 were juveniles, and 4 were unguarded nests (no female) (Table 11). Nests were found no earlier than April 29th (Table 11). It took an average of 40 minutes to find one *H. scutatum* individual/nest.

SPECIES LIST OF AMPHIBIANS AND REPTILES

A species list from Kickapoo State Park can be found in Table 13.
A species list from MFSFWA can be found in Table 13.

DISCUSSION

TURTLES

Trapping Effort and Species Composition

Four species of turtles were captured between Kickapoo State Park and MFSFWA. Although not encountered, the common map turtle (*Graptemys geographica*), the common musk turtle (*Sternotherus odoratus*), and the smooth softshell (*Apalone mutica*) have been reported from Vermilion County. Both *A. mutica* and *G. geographica* are riverine species (Ernst et al. 1994), and it is unlikely that either would permanently settle in the reserve ponds. It is possible that *S. odoratus* utilizes these sites but was not detected.

Apalone spinifera had the lowest turtle species composition (number of one species/total number of turtles) and composed only 1.1% of all turtles captured at Kickapoo State Park and MFSFWA. This species composition figure is comparable, however, to that described from Jacob, Illinois (1% of all species), but much less than the 16% reported from Elkville, Illinois (Cagle 1942), and much greater than that found in Lockport, Illinois (0.18%; Dreslik et al. 2005). Other studies have seen much variation in the composition of *A. spinifera* in ponds throughout Illinois (Readel and Phillips, unpublished data), and in Louisiana (Cagle and Chaney 1950). The number of trap hours taken to capture one *A. spinifera* was double the average from 57 sites in central and southern Illinois (Readel et al. in review).

Chelydra serpentina had the second lowest turtle species composition (13.3% of total turtles captured) at the sites trapped. This composition is similar to that found when multiple populations were averaged in southern and central Illinois (Cagle 1942; Readel et al. in review), and in Louisiana (Cagle and Chaney 1950), but lower than that found in Lockport, Illinois (23%; Dreslik et al. 2005). Additionally, it took only half the number of trap hours to capture one *C. serpentina* at Kickapoo State Park and MFSFWA compared to a large-scale survey of 57 sites conducted throughout central and southern Illinois (Readel et al, in review). This species appeared particularly abundant at MFSFWA (44% of all species captured). The species composition at this particular reserve may actually be higher than observed because numerous traps were damaged (large holes ripped in them) allowing occupants to escape, and the damage was most likely from *C. serpentina.*

Chrysemys picta had the highest turtle species composition (43.3% of total turtles captured), and is often reported as the most abundant turtle in suitable ponds within its range (Ernst et al. 1994; Dreslik et al. 2005; Ernst 1971 “c”). The number of trap hours taken to capture one *C. picta* at Kickapoo State Park and MFSFWA was one-third the effort required for a large-scale survey conducted in central and southern Illinois (Readel et al. submitted)

Trachemys scripta had the second highest turtle composition (42.2% of total turtles) at

these sites. Like *C. picta* it is generally one of the most abundant turtle species in most of its natural range (Ernst et al. 1994). The species composition at these reserves were lower, however, than other studies conducted in Louisiana (Cagle 1950), and Kentucky (Ernst and Barbour 1972).

Visual spot searches were an easy and useful approach to identifying species presence in a pond. This technique is only useful for species that commonly bask or for sites that contain numerous basking sites. For instance, using visual spot searches we were able to identify the presence of *C. picta* and *T. scripta* in 2 ponds (out of 10 sampled) each where trapping was unsuccessful in capturing these species. This technique, however, was unsuccessful in identifying the presence of *C. serpentina*, a species that rarely aerially basks (Ernst et al. 1994).

Although some species (*C. picta* especially) appeared to have skewed sex ratios, we did not feel comfortable making any statistical inferences at this time due the small sample sizes and because short-term fluctuations of sex ratios can occur (Ernst et al. 1994). Immature individuals of all species (except *A. spinifera*) were found at Kickapoo State Park suggesting that all species are experiencing successful recruitment. Additionally, one female painted turtle was found nesting along Peelman Pond in Kickapoo State Park. No immature individuals were captured at MFSFWA, however, but due to the low sample size, we are unable to make any inferences about recruitment.

Health analyses

Health analyses of the turtles in both Kickapoo State Park and MFSFWA revealed that few individual turtles suffered from physical injuries. Only 6% and 8% *C. picta* and *T. scripta*, respectively, from Kickapoo State Park suffered from shell damage that was likely caused from large mowers or automobiles. Road mortality can greatly impact populations causing skewed sex ratios and decreased population sizes (Aresco 2005). Although the number of individuals that have likely sustained sub-lethal shell damage from either automobiles or mowers is low, they appear to have an impact on at least some of the population. It is unknown how many turtles are killed each year by automobiles at Kickapoo. During this study, we saw only one *A. spinifera* road mortality. The low speed limits at Kickapoo State Park may limit the impact that roads and road mortality have on these populations. No turtles from MFSWA had physical injuries and no roads are in close proximity to the Main Marsh.

Hematophagus leeches are among the most common parasites of aquatic reptiles and amphibians including freshwater turtles (Sawyer, 1986; Watermolen, 1996; Light and Siddall, 1999), and can cause bacterial and fungal infections and anemia in their hosts (Frye, 1991; Mader, 1996). Leeches are also vectors for hemoparasites including *Haemograegarina* sp. (Mann, 1962; Telford, 1984; Siddall and Desser, 2001) and *Trypanosma* sp. (Mann, 1962; Telford, 1984), and can transmit these parasites between turtles, both intra- and interspecifically (Telford, 1984; Barnard and Upton, 1994; Siddall and Desser, 2001). While hemoparasites are not considered to be pathogenic (Telford, 1984; de Campos Brites and Rantin, 2004) they may affect host fitness (Oppliger et al.,

1996; Sorci et al., 1996; Oppliger and Clobert, 1997).

Two species of hematophagus leeches were identified from turtles: *Placobdella parasitica* and *Placobdella ornata*. *Placobdella* species are primarily turtle generalists (Sawyer, 1986). Feeding behaviors differ among leech species and *P. parasitica* is more likely to remain on turtle hosts after feeding than *P. ornata* and *P. multilineata* (Sawyer, 1986). One study determined that 90% of *P. parasitica* individuals found in ponds were attached to turtle hosts, compared to only 1% of *P. ornata* (Maloney and Chandler, 1976). This behavior might have accounted for the higher proportion *P. parasitica* on turtles both in this study and in others (MacCulloch, 1981; Brookes et al., 1990; Ryan and Lambert, 2005).

The average prevalence and intensity of leeches on turtles in the different ponds varied, however, some of this variation might have been due to the different turtle species present in the ponds. *C. serpentina* had the highest prevalence and intensity of leeches in this study and this has also been reported in other studies (McAuliffe, 1977; Dodd, 1988; Brooks et al., 1990). The close proximity of bottom-dwelling species (like *C. serpentina*) with the substrate, where leeches reside, might increase the susceptibility of leech parasitism (Ryan and Lambert 2005, Readel et al. submitted). Overall, hundreds of samples are often required to make statistical inferences on parasite loads (Bush et al. 1997), therefore we do not know what the true leech loads are within each species or site.

Overall, 23% of all turtles had hemoparasite infections. The prevalence and intensity of hemoparasite infection in turtles appeared to differ among sites, however, and among species, although the true parasite loads are difficult to calculate with this small of sample size (Bush et al. 1997). Although some *C. serpentina* had high hemoparasite infections, most turtles had very low infections. It is unknown what fitness consequences low and high hemoparasite infections have on their turtle hosts.

SALAMANDERS

Four species of salamander were found at MFSFWA. Two other species of salamander, the spotted salamander (*Ambystoma maculatum*), and the marbled salamander (*Ambystoma opacum*) are also known to occur here (Herman, field notes).

Although only 13 *H. scutatum* individuals or nests were recovered from MFSFWA, the time it took to locate an individual (40 minutes for this study) was much shorter than previous surveys at Collison Marsh. In 2001, a general herpetofaunal survey was conducted at Collison that yielded 20 *H. scutatum* over 3023 search hours, resulting in one *H. scutatum* being found every 151 minutes. The discrepancy in these time recoveries might be due to the fact that 1) the 2001 survey targeted a much larger area surrounding Collison Marsh, whereas this study targeted known areas of high *H. scutatum* density, and 2) the 2001 study was conducted throughout the year, whereas this study was conducted during the peak of female nesting. When the search efforts between

April and May of 2001 and 2005 are compared, the time it takes to find a *H. scutatum* is much more similar (40 minutes for 2005 and 103 minutes for 2005).

Female *H. scutatum* nestsed between April 29 and May 15 in 2005. In total, we recovered 7 nests. Nests were not marked because recreational hikers visit this area and we did not want to alert the public to the position of these nests. It is possible that up to two of the nests were recounted. There may be tremendous yearly variation in the number of nesting females because in previous years, nests could be found in almost all grass tussocks in Sweetflag Marsh resulting in 50-100 nests (Phillips, personal communication). Other studies have reported variation in the number of oviposting females. In Virginia, the number of ovipositing females fluctuated between 15 and 177, and in a second pond it fluctuated between 15 and 91 (unpublished data found on HYPERLINK "http://www.AmphibiaWeb" www.AmphibiaWeb).

Two juvenile *H. scutatum* were found in the upland forest under logs. Juveniles are rarely found at this site (Phillips, personal communications) and their presence demonstrates that some recruitment is occurring at MFSFWA.

Overall, we are unable to create a population estimate with so few initial captures and with no recaptures of individuals. *H. scutatum*, however, was the most abundant salamander species found in this area (50% of all salamanders found).

CONCLUSIONS

A breeding population of *H. scutatum* is present at MFSFWA and the presence of juveniles indicate that at least some individuals are likely making it to adulthood. Fluctuations in the number of ovipositing females, however, make it difficult to determine a population estimate. A multi-year survey would give a much better estimate.

Although no *Emydoidea blandingii* were found at Kickapoo State Park and MFSFWA, it is possible that a population still exists. Due to the interconnectedness and breadth of possible habitats in the area, a small population of Blanding's turtles could be persisting. Trapping of individuals is feasible at Kickapoo State Park but was extremely difficult at MFSFWA. Not only did the landscape features make trap transport difficult, the high density of *C. serpentina* in the Main Marsh led to many destroyed traps. Finally, hand searches were made nearly useless in May due to a major duckweed bloom that obliterated water visibility making it impossible to see turtles just below the water surface. Additional surveys should be undertaken to determine if Blanding's are present in the parks.

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Table 1. The average size at sexual maturity for each turtle species (Ernst et al. 1994).

Species	Male Size at Maturity (PL in mm)	Female Size at Maturity (PL in mm)
Apalone spinifera	90	200
Chrysemys picta	90	120
Chelydra serpentina	145	145
Sternotherus odoratus	60	80
Trachemys scripta	90	200

Table 2. Trap location, dates, and number of each turtle species captured at Kickapoo State Park and MFSFWA.

Location	Northing	Westing	Set	Removed	Trap Hours	Trap Days	*A. spinfiera*	*C. serpentina*	*C. picta*	*T. scripta*
Kickapoo State Park										
High Lake	40.13379	87.72973								
			6/6/05	6/13/05	213.5	8.9	---	1	1	10
			6/27/05	6/29/05	46.8	1.9	---	1	---	---
			7/15/05	7/20/05	190.0	7.9	---	---	3	2
			9/16/05	9/17/05	22.5	0.9	---	---	2	---
				Total	**472.8**	**19.7**	**0**	**2**	**6**	**12**
Inland Sea	40.1486	87.7378								
			9/18/05	9/22/05	189.0	7.9	1	---	1	4
				Total	**189.0**	**7.9**	**1**	**0**	**1**	**4**
Little Deep	40.1313	87.7246								
			7/15/05	7/19/05	100.0	4.2	---	---	---	---
				Total	**100.0**	**4.2**	**0**	**0**	**0**	**0**
Little Hook	40.15274	87.7441								
			6/13/05	6/19/05	147.0	6.1	---	3	3	---
			6/27/05	7/1/05	187.5	7.8	---	---	5	3
			7/15/05	7/19/05	99.0	4.1	---	---	4	---
			9/16/05	9/22/05	140.0	5.8	---	---	---	---
				Total	**573.5**	**23.9**	**0**	**3**	**12**	**3**
Peelman	40.12397	87.73241								
			6/13/05	6/21/05	166.5	6.9	---	1	2	8
			6/27/05	7/1/05	187.5	7.8	---	---	3	7
			7/15/05	7/20/05	242.0	10.1	---	---	---	1
				Total	**596.0**	**24.8**	**0**	**1**	**5**	**16**

Table 2 (cont.). Trap location, dates, and number of each turtle species captured at Kickapoo State Park and MFSFWA.

Location	Northing	Westing	Set	Removed	Trap Hours	Trap Days	*A. spinfiera*	*C. serpentina*	*C. picta*	*T. scripta*
Kickapoo State Park										
Possum	40.151	87.7381								
			9/16/05	9/22/06	140.0	5.8	---	---	10	4
				Total	**140.0**	**5.8**	**0**	**0**	**10**	**4**
Silt Basin	40.1339	87.7271								
			6/13/05	6/14/05	24.0	1.0	---	---	---	---
				Total	**24.0**	**1.0**	**0**	**0**	**0**	**0**
Sportsmans	40.15202	87.73855								
			6/13/05	6/14/05	23.5	1.0	---	---	1	---
			9/16/05	9/18/05	48.8	2.0	---	---	---	---
				Total	**72.3**	**3.0**	**0**	**0**	**1**	**0**
Unnamed Slough	40.12226	87.73669								
			6/17/06	6/18/06	23.5	1.0	---	2	---	---
				Total	**23.5**	**1.0**	**0**	**2**	**0**	**0**
MFSFWA										
Main Marsh	40.2393	87.782	6/6/06	6/12/06	788.0	32.8	0	4	5	0
				Total	**788.0**	**32.8**	**0**	**4**	**5**	**0**

Table 3. Trap locations, total trap hours, and total number of each turtle species captured.

Location	Trap Hours	Trap Days	*A. spinifera*	*C. serpentina*	*C. picta*	*T. scripta*	Total No. Captured
Kickapoo State Park							
High Lake	472.8	19.7	---	2	6	12	20
Inland Sea	189.0	7.9	1	---	1	4	6
Little Deep Pond	100.0	4.2	---	---	---	---	0
Little Hook Lake	573.5	23.9	---	3	12	3	18
Peelman Pond	596.0	24.8	---	1	5	16	22
Possum Pond	140.0	5.8	---	---	10	4	14
Silt Basin	24.0	1.0	---	---	---	---	0
Sportsmans Lake	72.3	3.0	---	---	1	---	1
Unnamed Slough	23.5	1.0	---	2	---	---	2
Total	**2191.0**	**91.3**	**1**	**8**	**35**	**39**	**83**
MFSFWA							
Main Marsh	788.0	32.8	---	4	5	---	9
Total	**788.0**	**32.8**	**0**	**4**	**5**	**0**	**9**
Grand Total	**2979.0**	**124.1**	**1**	**12**	**40**	**39**	**92**

Table 4. Turtle species identified using visual spot searches and trapping at each location.

Location	*A. spinifera*	*C. serpentina*	*C. picta*	*T. scripta*
Kickapoo State Park				
High Lake		---	**XX**	**XX**
Inland Sea	---			
Little Deep Pond				**X**
Little Hook Lake		---	**XX**	**XX**
Peelman Pond		---	**XX**	**XX**
Possum Pond			**XX**	**XX**
Silt Basin			**X**	
Sportsmans Lake			**XX**	**X**
Unnamed Slough		---	**X**	
MFSFWA				
Middle Fork		**XX**	**XX**	

---	Trapping only
X	Visual only
XX	Visual + Trapping

Table 5. Identification, location, sex, stage, morphometrics, and injuries for each turtle captured.

Species	ID	Location	Date of Capture	Sex	Stage	Wt (g)	CL	PL	Injury	Injury Type
A. spinifera										
	---	Kickapoo-Inland Sea	9/19/05	Female	Mature	970	215	160	No	
C. serpentina	10L	Kickapoo-High	6/7/05	Unknown	Immature	---	215	140	No	
	---	Kickapoo-High	6/28/05	Unknown	Mature	---	232	166	No	
	10R	Kickapoo-Little Hook	6/14/05	Female	Mature	---	260	187	No	
	12L	Kickapoo-Little Hook	6/14/05	Unknown	Immature	---	252	108	No	
	11L	Kickapoo-Little Hook	6/14/05	Unknown	Immature	703	145	109	No	
	9L	Kickapoo-Peelman	6/21/05	Unknown	Immature	219	103	72	No	
	10R	Kickapoo-Slough	6/18/05	Unknown	Immature	101	77	54	No	
	12L	Kickapoo-Slough	6/18/05	Unknown	Immature	624	146	104	No	
C. picta										
	2L-2R	Kickapoo-High	6/7/05	Female	Mature	601	166	157	No	
	9L-10L	Kickapoo-High	7/16/05	Male	Mature	207	118	111	No	
	2L-8L	Kickapoo-High	9/17/05	Male	Mature	247	128	117	Yes	Shell
	1L-12L	Kickapoo-High	7/19/05	Male	Mature	280	138	126	No	
	3L-8L	Kickapoo-High	9/17/05	Male	Mature	306	142	130	No	
	2L-9L	Kickapoo-High	7/18/05	Unknown	Immature	109	86	82	No	
	1L-8L	Kickapoo-Inland Sea	9/19/05	Male	Mature	342	149	135	No	
	2L-11R	Kickapoo-Little Hook	7/17/05	Female	Immature	145	103	95	No	
	9L-11L	Kickapoo-Little Hook	6/29/05	Female	Immature	162	105	99	No	
	2L-3L	Kickapoo-Little Hook	6/14/05	Female	Mature	453	150	140	No	
	9L-12L	Kickapoo-Little Hook	7/16/05	Female	Mature	486	155	140	No	
	8L-12L	Kickapoo-Little Hook	6/29/05	Male	Immature	122	95	87	No	
	8L-9R	Kickapoo-Little Hook	6/14/05	Male	Mature	148	100	91	No	

Table 5 (cont.). Identification, location, sex, stage, morphometrics, and injuries for each turtle captured.

Species	ID	Location	Date of Capture	Sex	Stage	Wt (g)	CL	PL	Injury	Injury Type
C. picta (cont.)	1L-12L	Kickapoo-Little Hook	6/29/05	Male	Mature	131	103	95	No	
	1L-11R	Kickapoo-Little Hook	6/29/05	Male	Mature	156	109	102	No	
	3L-10R	Kickapoo-Little Hook	6/14/05	Male	Mature	214	114	109	No	
	3L-2R	Kickapoo-Little Hook	7/16/05	Male	Mature		130	122	No	
	1L-3R	Kickapoo-Little Hook	6/29/05	Unknown	Immature	80	84	80	No	
	1L-1R	Kickapoo-Peelman	6/20/05	Female	Mature	457	153	140	Yes	Shell
	8L-3R	Kickapoo-Peelman	7/1/05	Male	Mature	228	127	115	No	
	3L-3R	Kickapoo-Peelman	6/30/05	Male	Mature	242	121	116	No	
	3L-8R	Kickapoo-Peelman	6/28/05	Male	Mature	350	149	135	No	
	2L-1R	Kickapoo-Peelman	6/20/05	Unknown	Immature	72	75	72	No	
	3L-11R	Kickapoo-Possum	9/17/05	Female	Mature	579	171	161	No	
	2L-10R	Kickapoo-Possum	9/19/05	Male	Mature	167	116	108	No	
	3L-1R	Kickapoo-Possum	9/17/05	Male	Mature	205	118	111	No	
	3L-9R	Kickapoo-Possum	9/17/05	Male	Mature	211	120	112	No	
	8L-8R	Kickapoo-Possum	9/17/05	Male	Mature	227	126	117	No	
	2L-12R	Kickapoo-Possum	9/17/05	Male	Mature	245	132	120	No	
	8L-11R	Kickapoo-Possum	9/17/05	Male	Mature	300	140	123	No	
	8L-10L	Kickapoo-Possum	9/17/05	Male	Mature	307	137	126	No	
	8L-9L	Kickapoo-Possum	9/17/05	Male	Mature	354	144	127	No	
	10L-11L	Kickapoo-Possum	9/17/05	Male	Mature	310	137	130	No	
	2L-3R	Kickapoo-Sportsman	6/14/05	Female	Mature	557	164	150	No	
T. scripta	2R	Kickapoo-High	6/6/05	Unknown	Immature	81	90	74	No	
	1R	Kickapoo-High	6/7/05	Female	Immature	119	95	91	No	
	1L-11L	Kickapoo-High	6/8/05	Female	Immature	202	112	104	No	
	1L-10L	Kickapoo-High	6/8/05	Female	Immature	374	138	130	No	
	1L-2L	Kickapoo-High	6/7/05	Female	Immature	599	165	154	No	

Table 5 (cont.). Identification, location, sex, stage, morphometrics, and injuries from each turtle captured.

Species	ID	Location	Date of Capture	Sex	Stage	Wt (g)	CL	PL	Injury	Injury Type
T. scripta (cont.)										
	1R-12R	Kickapoo-High	6/11/05	Female	Mature	1538	234	222	No	
	1L-3L	Kickapoo-High	6/7/05	Female	Mature	1616	233	222	No	
	13L	Kickapoo-High	6/7/05	Female	Mature	2381	262	244	Yes	Shell
	2L-8R	Kickapoo-High	7/19/05	Male	Mature	171	104	99	No	
	1L-9L	Kickapoo-High	6/8/05	Male	Mature	456	162	146	No	
	3R	Kickapoo-High	6/7/05	Unknown	Immature	101	86	81	No	
	9L-2R	Kickapoo-Inland Sea	9/22/05	Female	Mature	1615	221	207	No	
	8L-12R	Kickapoo-Inland Sea	9/21/05	Female	Mature	1750	240	220	No	
	9L-3R	Kickapoo-Inland Sea	6/10/06	Female	Mature	1886	240	229	No	
	9L-1R	Kickapoo-Inland Sea	9/22/05	Male	Mature	243	123	118	No	
	8L-11L	Kickapoo-Little Hook	6/29/05	Male	Mature	154	103	97	No	
	8L-10L	Kickapoo-Little Hook	6/29/05	Male	Mature	527	163	155	No	
	8L-11L	Kickapoo-Little Hook	6/28/05	Male	Mature	690	177	167	No	
	2L-10L	Kickapoo-Peelman	6/14/05	Female	Immature	136	100	93	No	
	1L-10R	Kickapoo-Peelman	7/1/05	Female	Immature	238	120	113	No	
	2L-11L	Kickapoo-Peelman	6/14/05	Female	Immature	654	172	167	No	
	10L-12L	Kickapoo-Peelman	6/30/05	Female	Immature	793	176	174	No	
	2L-12L	Kickapoo-Peelman	6/20/05	Female	Mature	1398	227	214	No	
	11L-12L	Kickapoo-Peelman	6/30/05	Female	Mature	1634	235	217	No	
	1L-9R	Kickapoo-Peelman	7/1/05	Female	Mature	1386	231	218	No	
	3L-12L	Kickapoo-Peelman	6/20/05	Male	Immature	105	88	83	No	
	3L-9L	Kickapoo-Peelman	6/20/05	Male	Mature	548	167	156	No	
	1L-8R	Kickapoo-Peelman	7/1/05	Male	Mature	613	169	160	No	
	---	Kickapoo-Peelman	6/29/05	Unknown	Immature	32	57	52	No	
	---	Kickapoo-Peelman	6/29/05	Unknown	Immature	31	57	53	No	
	2L-9R	Kickapoo-Peelman	7/19/05	Unknown	Immature	51	71	67	No	

Table 5 (cont.). Identification, location, sex, stage, morphometrics, and injuries for each turtle captured.

Species	ID	Location	Date of Capture	Sex	Stage	Wt (g)	CL	PL	Injury	Injury Type
T. scripta (cont.)										
	3L-10L	Kickapoo-Peelman	6/20/05	Unknown	Immature	58	72	67	No	
	3L-11L	Kickapoo-Peelman	6/20/05	Unknown	Immature	97	86	81	No	
	8L-1R	Kickapoo-Possum	9/17/05	Female	Immature	1302	213	198	Yes	Shell
	3L-12R	Kickapoo-Possum	9/17/05	Female	Mature	1284	210	200	No	
	8L-10R	Kickapoo-Possum	9/19/05	Male	Mature	336	143	133	No	
	8L-2R	Kickapoo-Possum	9/17/05	Male	Mature	550	169	157	No	
	1L-2R	Kickpoo-Peelman	6/30/05	Unknown	Immature	116	92	85	Yes	Shell
C. serpentina										
	12R	MFSFWA-Main	6/8/06	Male	Mature	---	270	196	No	
	11L	MFSFWA-Main	6/9/06	Female	Mature	---	234	166	No	
	12R	MFSFWA-Main	6/9/06	Male	Mature	---	357	247	No	
	12L-12R	MFSFWA-Main	6/10/06	Female	Mature	---	226	200	No	
C. picta										
	2R	MFSFWA-Main	6/10/05	Male	Mature	382	140	127	No	
	2R-9L	MFSFWA-Main	6/10/06	Female	Mature	518	161	152	No	
	1L	MFSFWA-Main	6/7/06	Female	Mature	590	167	154	No	
	1R	MFSFWA-Main	6/9/06	Female	Mature	606	166	151	No	
	2L	MFSFWA-Main	6/12/06	Female	Mature	740	178	170	No	

Table 6. Sex, stage, average morphometrics and injuries for each turtle species captured. One *T. scripta* and one *C. picta* were recaptures and not included in this table.

Species	Total Captured	Sex (M.F.Unknown)	Stage (Mature.Immature)	Average Weight	Average CL	Average PL	% with Injury	Injury Types
Kickapoo State Park								
A. spinifera	1	0.1.0	1	970	215	160	0	
C. serpentina	8	0.1.7	2.6	N/A	179	118	0	
C. picta	34	23.8.3	28.6	273	127	117	6	Shell
T. scripta	38	11.19.8	20.18	681	153	143	8	Shell
MFSFWA								
C. serpentina	4	2.2	4.0	N/A	272	202	0	
C. picta	5	1.4	5.0	567	162	151	0	

Table 7. Prevalence and intensity of leechs on turtles from each location.

Location	No. Turtles	No. with Leeches	Prevalence	Intensity	Leech Species Identified
Kickapoo State Park					
High Lake	19	1	5.3	2	*Placobdella* sp.
Inland Sea	6	0	0	0	---
Little Hook Lake	17	1	5.8	1	**Placobdella parasitica**
Peelman Pond	22	2	9.1	1	**Placobdella parasitica**
Possum Pond	14	0	0	0	---
Sportsmans Lake	1	0	0	0	---
Unnamed Slough	2	1	50	9	**Placobdella ornata**
MFSFWA					
Main Marsh	9	6	66.7	10	Not yet Identified
Total	**90**	**11**	**12.2**	**7**	***Placobdella parasitica, Placobdella ornata***

Table 8. Prevalence and intensity of leechs on each turtle species.

Species	No. Turtles	No. Turtles with Leeches	Prevalence	Intensity	Leech Species Identified
A. spinifera	1	0	0.0	---	---
C. serpentina	12	5	41.7	13	*Placobdella ornata*
C. picta	39	5	12.8	1.4	*Placobdella* sp., *Placobdella ornata*
T. scripta	38	1	2.6	1	*Placobdella parasitica*

Table 9. Average prevalence and intensity of *Hemogregarina* sp. in turtles from each location.

Location	No. Turtles	No. with Hemoparasites	Prevalence	Intensity
Kickapoo State Park				
High Lake	11	2	18.2	9.5
Inland Sea	5	2	40	3
Little Hook Lake	10	4	40	2.5
Peelman Pond	12	0	0	---
Possum Pond	0	2	14.3	2.5
Unnamed Slough	1	0	0	---
Total	**39**	**10**	**23.3**	**4**

Table 10. Average prevalence and intensity of *Hemogregarina* sp. in each turtle species.

Species	No. turtles	No. with Hemoparasites	Prevalence (%)	Intensity
A. spinifera	1	0	0.0	---
C. serpentina	5	1	20.0	18
C. picta	25	5	20.0	2
T. scripta	23	4	17.4	3

Table 12. Search effort and salamander encounters at MFSFWA.

Date	Effort Time (min)	*A. texanum*	*E. cirrigera*	*H. scutatum*	*P. cinereus*
4/9/06	120	1	1	2	3
4/11/06	30	---	1	1	---
4/15/06	30	---	---	---	2
4/23/06	140	---	---	2	2
4/29/06	60	---	---	2	---
5/7/06	55	---	---	1	---
5/16/05	75	---	---	5	3
Total	**510**	**1**	**2**	**13**	**10**

Table 13. Reptile and amphibian species encountered in this study (*), and in 2001 (Herman and Phillips).

MFSFWA		**Kickapoo State Park**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
*Acris crepitans**	Cricket Frog	*Apalone spinifera**	Spiny Softshell T
Ambystoma maculatum	Spotted Salamander	*Acris crepitans**	Cricket Frog
Ambystoma opacum	Marbled Salamander	*Chelydra serpentina**	Snapping Turtle
*Ambystoma texanum**	Smallmouth Salamander	*Chrysemys picta**	Painted Turtle
Bufo fowleri	Fowlers Toad	*Nerodia sipedon**	Northern Watersn
*Chelydra serpentina**	Snapping Turtle	*Rana clamitans**	Green Frog
*Chrysemys picta**	Painted Turtle	*Trachemys scripta**	Slider Turtle
Coluber constrictor	Black Racer		
Diadophus punctatus	Ringneck Snake		
Elaphe obsoleta	Rat Snake		
Elaphe vulpina	Fox Snake		
Eurycea cirrigera	Two-lined Salamander		
*Hemidactylium scutatum**	Four-toed Salamander		
*Hyla versicolor**	Gray Treefrog		
Nerodia sipedon	Northern Watersnake		
*Plethodon cinereus**	Redback Salamander		
Pseudacris crucifer	Spring Peeper		
Pseudacris triseriata	Western Chorus Frog		
Rana catesbiana	Bullfrog		
*Rana clamitans**	Green Frog		
Storeria dekayi	Brown Snake		
*Terrapene carolina**	Eastern Box Turtle		
Thamnophis sirtalis	Common Garter Snake		