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A Three Year Survey of Aquatic Turtles in a Riverside Pond

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ABSTRACT

The results of a three-year trapping study of a turtle community in a small riverside pond near the Mississippi River in Jersey County, Illinois are reported. Five species were captured (in order of abundance) including the red-eared slider (*Trachemys scripta elegans*), the painted turtle (*Chrysemys picta*), the common musk turtle (*Sternotherus odoratus*), the common snapping turtle (*Chelydra serpentina*), and the spiny softshell (*Apalone spinifera*). We found that catch was affected by gear and time of year. Catches from fyke nets deployed in winter consisted of 68.4% *C. picta*, whereas the catch for baited turtle traps used in spring and fall consisted of 72.7% *T. scripta*. This probably reflects differences in behavior between the two species but it also suggests that trap bias may be an important factor in community studies. We used a recapture percentage index to judge trap bias for baited turtle traps. Catches made with baited turtle traps may have caused a 176% to 370% underestimate of abundance in *C. picta* and *S. odoratus*, respectively. We successfully tested a previously published model for *T. scripta* that predicts plastron length of melanistic males from the plastron length of three-year old females. The value from the model differed from the observed value by only 3.5 mm.

Key words: Turtle communities, trap bias, melanism, *Trachemys scripta, Chrysemys picta, Chelydra serpentina, Sternotherus odoratus*

INTRODUCTION

Studies of aquatic turtle communities are necessary to understand community composition and potential fluctuations in communtiy composition (Gibbons, 1997). Such studies, particularly long-term ones, are difficult and expensive and generally receive little funding support. Nonetheless they are needed to assess the impact of human activities on turtle communities (Smith et al., 2006). In Illinois, relatively few community studies have been reported (Dreslik et al., 2005), and none have been longer than 10 years.

In 1994, studies of aquatic turtle communities in backwater lakes of the Mississippi and Illinois Rivers began in west-central Illinois. Initially these studies were restricted to female nesting and their reproductive output (Tucker et al., 1998a, b; Tucker, 1999), but in 2001, trapping surveys were initiated and continue (Tucker unpublished). The present study involves a small pond created as a borrow pit adjacent to the Mississippi River in southern Jersey County, Illinois. This pond is surrounded by human development (a marina, a golf course, and roadways). Surveys in the pond began in 2003 and concluded in 2005. Here we report these short-term results because the intensity of local human use precluded further study.

We also report the first test of a model for melanism in *Trachemys scripta* elaborated by Tucker et al. (1995). This model was developed from data collected on turtles from large river backwaters and has never been tested on turtles from other habitats. The model transcends sexual identity of the turtles by using data on three-year old females to predict plastron length in melanistic males.

MATERIALS AND METHODS

This study was conducted at a small borrow pond (ca 2 ha) located near the junction of Lockhaven Road and Illinois Route 100 in Jersey County, Illinois. The pond is near the Mississippi River and Piasa Creek but is separated from both by roadways, Illinois Route 100 and Lockhaven Road, respectively. Although emergent aquatic vegetation is present, the pond lacks submersed aquatic vegetation, other than filamentous green algae. Maximum water depth is 2 m, so the pond is permanent and does not normally dry during the summer.

We captured turtles using fyke nets (2003 and 2005) and baited turtle traps (2004). Four fyke nets were set on 20 November 2003 and four fyke nets were also used on 9 December 2005. Gutreuter et al. (1995) described these nets in detail. In 2004, we used six baited turtle traps (Legler, 1960) for a more intensive survey. We baited traps with fish carcasses and checked them daily. We deployed them from 3 May to 27 May (for 16 trap days) and from 15 September to 23 September (for six trap days).

We weighed each turtle with a spring balance to the nearest 10 g and measured plastron length, carapace length, width, and height with calipers to the nearest 1 mm. Sex was determined for specimens that had developed secondary sexual characteristics (Ernst et al., 1994). The few specimens whose sex could not be determined with certainty were classified as female. We marked turtles by drilling holes in the marginal scutes so each turtle had a unique combination of holes.

We tested the melanism model of Tucker et al. (1995) by comparing mean plastron length of three-year old females to mean plastron length of melanistic males. The model is $y = 150.71 + 0.21*x$, where x is the observed mean plastron length for three-year old females and y is the expected mean plastron length for melanistic males. To test the model, the observed mean plastron length for melanistic males is compared to the calculated value from the model. Age for the females was determined by examination of plastron annuli, which are a reasonably accurate estimate of chronological age in young *T. scripta* (Cagle, 1950; Tucker, 2002). Males range in the degree to which melanism is developed (Tucker et al., 1995), but they were only scored as melanistic when they had shell and skin melanism fully developed (stage-2 of Tucker et al., 1995).

Because not all turtle species respond similarly to traps (Ream and Ream, 1966), we used a percent recapture index to empirically compare our trap efficiency among species. This index is R = [(T-I)/I]*100. Where R = recapture percentage, T = total captures for the species, and I = initial captures. The assumption is that if they are equally likely to be recaptured, they are equally likely to be caught initially. The index is sufficient for our preliminary study because it provides an estimate of trap bias. However, we have no measure of any bias in initial captures.

RESULTS

We captured 400 individuals of five species 977 times from 2003 to 2005 (Table 1). The red-eared slider (*Trachemys scripta elegans*) was the most frequently caught (Table 1) and had the highest recapture index. The recapture index for *T. scripta* was two to three times higher than for *Chrysemys picta*, *Sternotherus odoratus*, or *Chelydra serpentina*. We estimated turtle biomass to be at least 142 kg/ha (Table 1).

Fyke nets were used in winter trapping in 2003 and 2005, whereas baited turtle traps were used during the activity season in spring and fall of 2004. Both gears gave different impressions of the turtle community. More *C. picta* were caught in fyke nets and more *T. scripta* were caught in baited turtle traps (Table 2). In the fyke nets, *C. picta* made up 68.4% and *T. scripta* made up 15.7%, whereas in the turtle traps *T. scripta* made up 72.7% and *C. picta* made up 14.3% of the captures.

The sex ratio of species with multiple captures (omitting *Apalone spinifera* because we caught only a single female) approached 1:1 except for *Sternotherus odoratus*. Sex ratio was male skewed in *S. odoratus* with 71% of the turtles caught being males. Female *T. scripta* and *C. picta* females had longer carapaces than males (Table 3), and male *C. serpentina* had longer carapaces than females (Table 3). Means for all turtles on initial capture are given in Table 4.

We caught 29 stage-2 melanistic male *T. scripta*. These males had plastrons ranging from 164 mm to 211 mm (mean = 181.9 mm). The six females that were in their third season of growth averaged 131.7 mm in plastron length. The predicted melanistic male plastron length based on the model is 178.4 mm, which differed by 3.5 mm from the observed value.

DISCUSSION

In the region we studied, there are about 10 species of aquatic turtles that occur in aquatic habitats (Table 5, Ernst et al., 1994; Phillips et al., 1999; Tucker et al., 2001; Dreslik and Phillips, 2005). We found half of these in our small riverside pond. Typically these turtles associate in lacustrine habitats and none are riverine specialists (see Dreslik and Phillips, 2005, for a detailed classification), except for *Apalone spinifera* (Table 5). This is a remarkable finding given that our sampling was so limited. Generally our level of sampling was sufficient to detect only the most common species (Dreslik et al., 2005). Because riverine habitats such as the Mississippi River and Piasa Creek are in close proximity to our site, more extended sampling might have recovered more of the river turtles. Nonetheless, our results conform to turtle community that would be predicted from other analyses (Dreslik and Phillips, 2005).

Our captures using fyke nets and baited turtle traps differed remarkably, supporting the suggestion by Dreslik et al. (2005) that multiple gears should be employed when sampling turtle communities. These two gears function differently. Fyke nets have 15 m long leads that set perpendicular to the shore and that allows the net to work passively (Gutreuter et al., 1995). Turtles that swim into the lead are caught when they try to swim around the obstacle. Turtle traps use bait to attract turtles to the trap and require an effort by the turtle to get caught. However, the different turtle species caught could also be due to the use of fyke nets during the winter. Our data may reflect a difference in *T. scripta* and *C. picta* move during winter.

However, the fyke net sets may give a more representative sample because they are passive and do not require a behavioral response to work. Trap bias may be considerable as suggested by variation in our recapture percentage. *Trachemys scripta* was certainly the turtle most often recaptured and if the other three common turtles had the same recapture rates as *T. scripta*, we should have caught 137 *C. picta*, 141 *S. odoratus*, and 29 *C. serpentina*. If these values are substituted for those actually observed (Table 6), it is clear that the dominance of sliders in the population may be an artifact of the ways turtles respond to baits and traps. For instance, trap bias may have resulted in a 176% underestimate of *C. picta* abundance and an even more remarkable 370% underestimate for *S. odoratus*. Such potential bias compromises results of studies using raw trapping data (e.g., Dreslik et al., 2005; Dreslik and Phillips, 2005, and the studies they review). Our study is the only effort we know of that attempts to quantify trap bias for a turtle community.

Our findings for the first test of the model to predict the plastron length for melanistic males are noteworthy. This model was developed from data based on *T. scripta* caught in large backwater habitats of the Illinois and Mississippi Rivers (Tucker et al., 1995). Considering our small sample of females of the correct age (N = 6), the deviation of only 3.5 mm seems minimal. This suggests that this model may be applicable in other habitats in this region. It also suggests that the relationship between melanistic male size and age specific growth rates by female *T. scripta* first reported by Lovich et al. (1990) has considerable predictive power.

Another interesting finding is the roughly equal male to female sex ratio in *C. serpentina*. Considerable unpublished data developed by JKT at other Illinois sites in Jersey and Calhoun counties, suggest that sites close to roads generally have strongly male-biased sex ratios. This is thought to reflect removal of females for consumption by local inhabitants and loss of females to road kills. Consequently, we restricted our analysis to sexually mature turtles, those with a carapace length greater than 200 mm (Ernst et al., 1994). We collected only eight sexually mature turtles. Of these, six (75%) were males and two (25%) were females. This ratio is more consistent with others found for other sites along roadways in unpublished studies. Interestingly, we identified 4 of 5 immature turtles as females and only one small turtle as a male. This could reflect the difficulty of using the only known sexing method (see Ernst et al., 1994) on small turtles.

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Table 1. Turtles caught in a riverside pond in Jersey County, Illinois.

Species	Initial captures (percent females)	Percent of fauna	Recaptures N	R	Biomass (kg)
Trachemys scripta	270 (42.6)	67.5	471	174	197
Chrysemys picta	78 (50.0)	19.5	77	99	31
Sternotherus odoratus	38 (29.0)	9.5	18	47	10
Chelydra serpentina	13 (46.2)	3.3	10	77	43
Apalone spinifera	1 (100)	0.2	1	100	3
Total	400		577		284

R = recapture percentage.

Table 2. Initial captures of turtles in fyke nets and baited turtle traps.

Species	Fyke	Percent	Baited	Percent
Trachemys scripta	6	15.7	264	72.7
Chrysemys picta	26	68.4	52	14.3
Sternotherus odoratus	5	13.2	33	9.1
Chelydra serpentina	1	2.7	12	3.3
Apalone spinifera	0		1	0.6
Total	38		363	

Fyke net captures made in 2003 and 2005; baited turtle trap captures made in 2004; recaptures are excluded.

Table 3. Sexual dimorphism in carapace length in four species of turtles caught in a riverside pond in west-central Illinois compared using Kruskal-Wallis test.

Species	Mean carapace length		Chi square	*P*	df
	Male	Female			
T. scripta	136	179	47.55	0.0001	1
S. odoratus	112	103	1.13	0.2875	1
C. picta	133	142	6.70	0.0096	1
S. serpentina	255	155	5.89	0.0152	1

Table 4. Descriptive statistics for measures of size for five species of turtles caught in a riverside pond in west-central Illinois.

Species	Plastron length	Carapace length	Carapace witdh	Carapace height	Mass (g)	N
T. scripta	143 (48.6) 58-237	155 (52.3) 62-253	120 (35.6) 56-1290	58 (18.9) 26-100	731 (592) 43-2700	270
C. picta	128 (25.6) 72-180	138 (26.7) 79-191	101 (16.7) 65-137	47 (8.8) 27-67	393 (170) 100-940	78
S. odoratus	78 (12.5) 17-90	109 (17.5) 24-128	73 (10.3) 20-83	43 (6.4) 13-54	256 (79.4) 3.1-410	38
C. serpentina	158 (57.0) 63-234	209 (81.6) 80-322	179 (69.2) 72-287	88 (33.4) 36-129	3274 (2665) 150-8275	13
A. spinifera	230	313	230	83	3398	1

Measures of length, width, and height are in mm; mass is in g. Recaptures are excluded. Mean (standard deviation) is given on top line; range (maximum and minimum) is given below.

Table 5. Species of aquatic turtles known to occur in west-central Illinois and their preferred habitats compiled from Ernst et al., 1994 and Dreslik and Phillips, 2005.

Species	This study	Preferred habitat
Common snapping turtle (*Chelydra serpentina*)	yes	pond/river
Smooth Softshell (*Apalone mutica*)		river
Spiny softshell (*Apalone spinifera*)	yes	river
Common musk turtle (*Sternotherus odoratus*)	yes	pond/river
Painted turtle (*Chrysemys picta*)	yes	pond/river
Red-eared slider (*Trachemys scripta elegans*)	yes	pond/river
Cooter (*Pseudemys concinna*)		river
Common map turtle (*Graptemys geographica*)		river
False map turtle (*Graptemys pseudogeographica*)		river
Ouachita map turtle (*Graptemys ouachitensis*)		river

Table 6. Use of recapture percentage index to normalize number of turtles of four species given recapture percentages equal to that calculated for *Trachemys scripta* for other three species.

Species	Unadjusted		Adjusted for recapture	
	Total	%	Total	%
T. scripta	270	67.7	270	46.8
C. picta	78	19.5	137	23.7
S. odoratus	38	9.5	141	24.4
C. serpentina	13	3.3	29	5.1
Total	399		577	