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Continued Monitoring of the River Cooter in Southeastern Gallatin County, Illinois

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INTRODUCTION

Studies detailing the life history and ecology of an organism are necessary for the formulation of conservation strategies. Such studies are often difficult to conduct with because they are relatively long-lived compared to most organisms. Currently there are only a few turtle ecology/life history studies exceeding six years. Thus, much of the conservation and management strategies based on these studies lack crucial information on the long-term fluctuations in demographic vital rates and population size. In 1994 I began research on the river cooter (*Pseudemys concinna*) in southeastern Illinois. Initial studies were directed at the distribution of the species in an effort to gain a better handle on their status in the sate. During these initial studies nine populations were discovered in Galaltin and White counties along the Ohio and Wabash rivers (Dreslik, 1998, Dreslik and Moll 1994, 1996). During this initial survey one site selected for studies that would focus on the ecology and life history of this endangered species (Round Pond, Gallatin County).

Research at Round Pond has answered many key ecological questions of both a conservation and scientific nature. These studies included diet, conservation, spatial biology, and demographics. At Round Pond, *P. concinna* was found to be an active forager and predominantly feed on aquatic algae (Dreslik 1994, 1996a, 1997, 1999). From a conservation standpoint it appears that its food resources would be abundant and thus warrants little concern at this time. Over the last decade several studies have focused on population demographics and life history (Dreslik 1996, 1997, Dreslik and Moll 1996, Dreslik and Warner 2002). Sex ratios appear to be in equality for most years and juvenile represent a fairly high proportion of the turtles captured (Dreslik, 1996, 1997, Dreslik and Moll, 1996). These studies have found the population to appear stable but these were all point estimates thus lacking a temporal component. For conservation purposes the population appears is healthy. Much work has focused on the growth of the species (Dreslik, 1996, 1997, Dreslik and Moll, 1996, Dreslik and Warner 2002). It was found that male and female growth rates do not differ but females grow to larger sizes than males (Dreslik 1996a,1997, Dreslik and Moll, 1996). Also, based on growth it appears that *P. concinna* has delayed sexual maturity, males would mature between 8 to 15 years and females between 13 – 24 years (Dreslik 1996 a,b, 1997). Finally, there is significant variation in the growth rates of cohorts with some maturing faster than others (Dreslik and Warner, 2002).

Studies focusing on the summer movement of turtle revealed that over-time, an individual would continually expand it home range to nearly the size of the lake (Dreslik *et al.* 2001, Dreslik *et al.* 2002). Also, at least one individual made an inter-populational movement to nearby Long Pond during the monitoring period (Dreslik *et al.* 2001, Dreslik *et al.* 2002). This data suggests that over-time there may be more movements between populations in the region than once expected and the entire region may be acting as a single large metatpopulation (Dreslik, 1996, 1998, Dreslik and Moll 1996, Dreslik *et al.* 2001, Dreslik *et al.* 2002).

Threats to the population do exists. They have been identified as both intrinsic and extrinsic factors (Dreslik 1998, Dreslik and Moll 1996). Intrinsic factors include demographic and genetic instability (Dreslik 1998, Dreslik and Moll 1996). Initially estimated as a small population of ca.150 individuals (Drelik, 1997), *P. concinna* at round Pond could face the problems of demographic sotchasticity. Because of this long-term monitoring was initiated to examine the temporal trend in population size. From 1994-2003, I have captured, marked, and monitored over 150 individual river cooters, *P. concinna*, from Round Pond, Gallatin Co., IL. By continuing the monitoring of the marked population long-term trends in demographic vital rates, population size and even population structure can be determined to assess this state endangered species. The objective of my study was to continue monitoring marked and new individuals in the population and assess the mark recapture data for temporal trend in populations size, structure, sex and juvenile to adult ratios, and growth rates.

MATERIALS AND METHODS

Turtles were trapped using unbaited fyke nets, baited hoop traps, trammel nets, dip nets and by hand. Traps were checked once - twice daily. All captured turtles were: weighed (with pull spring scales and/or electronic balances), sexed (using secondary sexual characteristics), aged by annuli counts on the left pectoral scute, and new individuals and marked (Cagle, 1939). The following morphological characteristics were measured using metric calipers: carapace length (CL), carapace width (CW), shell height (SH), plastral length (PL), length of the left pectoral scute at the seam (LPECT) and all annuli on the left pectoral scute. We tested to see if size structure differed between years of surveys using Chi-square tests. We calculated population sizes using the Schumacher-Eschmeyer regression method and tracked the trend in population size using linear regression. Individuals were placed into cohorts and we modeled their growth rates modeled using nonlinear regression.

RESULTS AND DISCUSSION

Population Structure. – The composite size frequency histogram reveals that there may have been a large pulse of reproduction because there are a large number of individuals at about 150 mm PL (Figure 1). Also, there are a large number of younger/smaller individuals present in the population suggesting healthy recruitment (Figure 1). Pairwise groupings of size structures revealed there were no significant differences in the structure between 1194-1995 and the following pairs 1996-1997 (D = 0.50, p = 0.111), and 2002-2004 (D = 0.30, p = 0.675). The year pairs of 1996-1997 and 1998-1999 (D = 0.50, p = 0.111), and 1998-1999 and 2002-2004 (D = 0.30, p = 0.675) also did not significantly differ. Thus, the population appears to have achieved a stable age distribution because the proportions of individuals in each size class are not differing over time.

Sex Ratios. – The overall sex ratio for the population was 1.4F:1M and was biased toward females (χ^2 = 5.09, p = 0.024). The overall sex ratio did not show any temporal trend (r^2 = 0.02, p = 0.749). Also the total operational sex ratio (adults only) was 0.78F:1M and also did not differ significantly from equality (χ^2 = 2.65, p = 0.103). Only in 2002 were adult sex ratios biased because we captured no adult females (Table1; Figure 2). Finally, the operational sex ratio did not show a temporal trend (r^2 = 0.05, p = 0.593). Although there were some fluctuations in sex ratios, in only one instance was a bias detected in any given year (Table 1).

Thus, the difference observed in the overall sex ratio toward females signifies that there are most likely more immature females in the populations than expected but this difference is only present when all years are pooled. A bias toward females is more favorable than a male bias because females are ultimately what dictate population growth and recruitment rates.

Juvenile to Adult Ratios. – Most years more immature individuals significantly more in 1994, 1998, and 2002 (Table 1; Figure 2). Because turtles are long-lived this bias may reflect an accumulation of several successive years of successful recruitment. The overall adult to immature ratio of 0.63A:1I was also significantly biased toward immature individuals (χ^2 = 14.52, $p < 0.001$). A bias such as this signifies successful recruitment is occurring in the population. The overall adult to immature ratio showed no temporal trend ($r^2 = 0.002$, p = 0.925).

Population Size.– I based estimates on one years samples to reduce biases and overall we met the assumption of population closure required by the Schumacher-Eschmeyer model (Figure 3). This is because the slope of the regression line in figure three is significant and the y-intercept does not significantly differ from zero (see Dreslik 1997 for a detailed treatment of the models). Over the last decade the *P. concinna* population at Round Pond is increasing slowly ($F_{1,6}$= 8.79, $p = 0.025$, $r^2 = 0.59$, slope = 15.3). This translates to a rate of approximately fifteen individuals per year. Since 1994, estimates have doubled (Table 2; Figure 4). However in some years the confidence intervals are wide suggesting that open population models should be explored. If simply the first and last estimates are considered, the population size of *P. concinna* at Round Pond is increasing and because there were no differences in the population structure, sex ratios, or adult to juvenile ratios, this increase is occurring across all sizes, sexes, and stages.

Cohort Specific Growth.– For the growth analyses we only used the first and last capture to reduce pseudoreplication. There was a wide variation in growth rates with females ranging from 0.056 – 0.094 and males ranging from 0.109 – 0.188 (Table 3). Thus it appears males grew at faster rates (Table 3, Figures 5, 6). Individuals from the 2002-2004 cohorts may have escaped capture with fyke nets either because of differential habitat use in juveniles or biases inherent in the size of the fyke nets we used. Individuals from these cohorts are still at small sizes and may easily evade capture. Although 15 cohorts were represented for females, and 8 for males, our sample sizes are small and results should be considered preliminary;, however these number represent five additional cohorts having data for females and three for males compared to the previous study (Dreslik and Warner, 2002). Thus, continued monitoring does allow for greater representation of some cohorts that had smaller sample sizes in 2001. Further monitoring in 2006 will hopefully increase the sample size for cohorts with smaller representation and potentially estimate growth rates for individuals in the 2002 and 2003 cohorts.

A previous study for Round Pond reported a growth rate of 0.087 for females and 0.136 for males (Dreslik 1997a). When considering the mean growth rate of all cohorts our results are similar to those previously reported for Round Pond, however we have the ability to look at yearly effects. This is important because ectotherms are tied to the environment from physiological and resource aspects. This in turn forms a causative chain to body size and ultimately to reproductive output.

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