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Ecology and Morphology of *Chelydra serpentina* in Northwestern Florida

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Abstract - *Chelydra serpentina* (Common Snapping Turtle) is a wide-ranging and often abundant turtle species in the eastern United States, but relatively little is known of its basic ecology in the Southeast. The objective of our study was to examine the ecology and population biology of and describe the morphology of Common Snapping Turtles in northwestern Florida. We intensively sampled five localities in Leon County, FL using traps and hand collection (n = 111), and we also opportunistically collected Common Snapping Turtles as we encountered them through the course of other studies (n = 11). Analysis of seven morphological characters from a subset of individuals indicated that the Common Snapping Turtle in this study is an intergrade between *C. s. serpentina* and *C. s. osceola*. Estimated early growth rates were 20 mm carapace length (CL)/year, and females matured at about 220 mm CL (156 mm PL, approximately 6–8 years). Male Common Snapping Turtles (CL mean = 299 ± 6 mm) were larger than females (CL mean = 270 ± 5 mm), and the overall adult sex ratio was 1:1. Diet consisted primarily of aquatic plants (n = 4). Nesting females were found from early April through mid-May, and clutch size ranged from 5 to 49 eggs (n = 3). Common Snapping Turtle abundance varied over the five sites, but was highest (an average density of 16 individuals/ha) in small suburban ponds with abundant aquatic vegetation, a thick layer of organic sediment, and no alligators. In northwestern Florida, predation by alligators and humans and primary productivity appear to be the factors that influence the distribution and abundance of Common Snapping Turtles.

Introduction

Chelydra serpentina (Linnaeus) (Common Snapping Turtle) is one of the largest and most widely distributed turtles in North America (Ernst et al. 1994). This species occurs in lakes, ponds, streams, and slow-flowing rivers throughout southern Canada and the entire eastern and central United States (Ernst et al. 1994). A disjunct population occurs from Mexico through Central America and northern South America (Ernst and Barbour 1992). Four subspecies are currently recognized, two of which occur in the United States, *C. s. osceola* Stejneger (peninsular Florida) and *C. s. serpentina* (Linnaeus) (remainder of the US/Canadian geographic range), which are distinguished by several morphological characteristics (Ernst et al. 1994, Feuer 1971, Stejneger 1918). Intergradation has been documented between these subspecies in the Okefenokee Swamp area of southern Georgia (Feuer 1971). Recent research suggests that there is no genetic distinction between *C. s. serpentina*

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and *C. s. osceola* (Walker et al. 1998), and use of morphological characteristics may not allow diagnosis to subspecies (Phillips et al. 1996). The Common Snapping Turtle is not currently considered endangered in any part of its range, but threats to the Common Snapping Turtle that may result in local population declines include habitat destruction and alteration, pollution, and harvest (Aresco et al. 2006, Ernst et al. 1994, Gibbons 2003).

Life history and demography of the Common Snapping Turtle are relatively well-studied in some areas in the northern portion of its range, such as the E.S. George Reserve in Michigan (Congdon et al. 1987, 1994) and Algonquin Provincial Park in Ontario (Galbraith and Brooks 1987a, Loncke and Obbard 1977). Demographic research on Common Snapping Turtles in the northern portion of its range indicates that this species has a typical life history of a long-lived, ectothermic vertebrate: slow growth rates, low recruitment, and high adult survivorship (Galbraith and Brooks 1987a, Galbraith et al. 1989, Yntema 1976). This species can reach high abundances in some habitats, but significant variation in density (0–66 adults/ha) and biomass (9–340 kg/ha) of Common Snapping Turtles has been documented in the northern and central portions of its range (Congdon and Gibbons 1989, Froese and Burghardt 1975, Galbraith et al. 1988, Iverson 1982, Iverson et al. 2000, Major 1975). However, no detailed ecological research has been published for Common Snapping Turtles in the southern portion of its North American range. A study at Lake Conway in central Florida found that snapping turtles (n = 21) were most commonly captured in shallow water areas with abundant aquatic vegetation and mud substrates (Bancroft et al. 1983), similar to the preferred habitat reported in other portions of its range (Ernst et al. 1994). As an ectothermic organism, demographic characteristics such as growth rate and age at maturity of Common Snapping Turtles are likely to be strongly influenced by the warmer climate and longer growing season in northern Florida compared to north temperate populations.

The objective of this study was to collect a range of ecological and population data for Common Snapping Turtles in northwestern Florida. To accomplish this goal, we intensively sampled Common Snapping Turtles at five sites in Leon County, FL, and also collected data on other Common Snapping Turtles we opportunistically collected dead on roads and during the course of other research. Our results provide baseline ecological and population data for this species in the southern portion of its range and allow for comparisons to data from northern populations. We also examined several morphological characters of Common Snapping Turtles that have been used to discriminate subspecies in order to determine whether individuals in northwestern Florida are either intergrades or can be clearly assigned to one subspecies.

Methods

We sampled Common Snapping Turtle populations at five sites in Leon County, FL: McCord Pond, Harriman Pond, Chapman Pond, San Luis

Pond, and Lake Jackson. Our sampling techniques and effort varied across these sites (Table 1) and included trapping, hand-collection, and drift fences. McCord Pond, Harriman Pond, Chapman Pond, and San Luis Pond are small ponds (< 3 ha) located within suburban parks in Tallahassee, FL, and we collected Common Snapping Turtles before and during drawdown and sediment-removal operations at these sites (Aresco and Gunzburger 2004). Prior to sediment removal, the substrate of these ponds was a thick layer of organic sediment that supported an abundance of aquatic macrophytes. Lake Jackson is a large (1620 ha), shallow lake with sand and organic substrate and abundant aquatic macrophytes. Water level is controlled naturally by variation in rainfall and by two sinkholes. During drought conditions, a lowering of the water table causes leakage into the groundwater through the sinkholes and most of the lake bottom dries, an event that has occurred 9 times during the last 100 years, drying on average every 12 years (Wagner 1984).

We collected Common Snapping Turtles using several sampling techniques. At McCord Pond and Chapman Pond, we first used two double-throated 1-m diameter hoop traps baited with sardines that we checked daily. Second, at these sites and at San Luis Pond and Harriman Pond, we surveyed each site daily during the drawdown and sediment removal operations and collected any Common Snapping Turtles we encountered. Turtles were detected and captured in each drying pool by walking transects and moving both hands up and down and from side to side in the shallow water and mud until the entire area was covered several times. Buried turtles of all sizes were easily detected in soft mud by following tracks and, in most cases, observing disturbed mud and/or a small snout-opening at the surface. We collected turtles in this manner from muddy areas surrounding drying pools of water, sediment piles, and from the sediment being actively excavated by machinery (Aresco and Gunzburger 2004). We feel confident that we collected every Common Snapping Turtle present at McCord Pond and Harriman Pond because the entire pond area was subjected to sediment removal, and we were present throughout the entire operation at these sites (Aresco and Gunzburger 2004). Our sampling effort at these sites was correlated with the length of time required for the drydown and sediment-removal process.

Our sampling methods at Lake Jackson differed significantly from the other sites. A large migration of turtles occurred during this study in response to the natural drydown of Lake Jackson in 2000 and the subsequent refilling of the lake in 2001. As Lake Jackson dried, turtles and other herpetofauna emigrated to the west towards Little Lake Jackson, which held water throughout the drought. We collected Common Snapping Turtles migrating between these two lakes at a 700-m drift fence along the road separating these lakes (Aresco 2005). During the drydown in 2000, we also performed regular surveys of the drying lakebed and collected any turtles found in the soft mud of drying pools (Aresco 2005). Since virtually all

Table 1. Variation in density, biomass, and percent composition in the *Chelydra serpentina* (Common Snapping Turtle) community among five sites in Leon County, FL. Sampling effort includes trap hours and visual-encounter surveys (see methods for description of sampling methods at each site). Percent composition is the percent of Common Snapping Turtles in the overall turtle community at each site.

			Sampling	Number collected			Density		Biomass	Percent
Locality	Area (ha)	Sampling dates	effort (hr)	Juv	M	F	total	(#/ha)	(kg/ha)	composition
McCord Pond	2.0	1 Aug 1999–Mar 2000	1182	9	25	30	64	32	128	18.0%
Harriman Pond	0.5	1 Oct 2000–30 Oct 2000	154	2	5	4	11	22	69.5	10.0%
San Luis Pond	2.2	13 Mar 2004–24 Apr 2004	102	1	10	5	16	7.3	32.0	na
Chapman Pond	1.0	1 Jul 2003–30 Jul 2003, 16 Sept 2003–27 Sept 2003	1476	1	1	1	3	3.0	11.0	3.5%
Lake Jackson	405.0	22 Feb 2000–1 Nov 2005	6204	9	4	4	17	0.04	0.07	0.2%

Table 2. Variation in morphological features associated with subspecies distinction (Ernst et al. 1994, Feuer 1971, Stejneger 1918) of *Chelydra serpentina serpentina* and *Chelydra serpentina osceola* from a population at McCord Pond, Tallahassee, Leon County, FL (n = 35).

	Subspecies description		McCord Pond, northwest Florida	
Character	*C. s. osceola*	*C. s. serpentina*	Mean ± SD (range)	% with *C. s. osceola* trait
Width 3rd vertebral/total length of vertebrals	> 0.33	< 0.33	0.32 ± 0.02 (0.30–0.37)	12%
Plastral forelobe length/carapace length	> 0.4	< 0.4	0.40 ± 0.02 (0.36–0.47)	66%
Width 3rd vertebral/ height 2nd pleural	> 0.9	< 0.9	0.88 ± 0.06 (0.78–1.07)	31%
Number of pairs of chin barbels	Two	One		9%
Prominence of lateral caudal tubercules	Moderate	Well-developed		11%
Dorsal keel knobs	Center of scute	Rear of scute		0%
Neck tubercles	Long, pointed	Round, wart-like		*

*100% of individuals had moderately pointed (intermediate) neck tubercules.

individuals of all turtle species were migrating overland west from the north part of the drying Lake Jackson in 2000, we were able to estimate absolute abundance and population structure of each species, including Common Snapping Turtles.

In addition to the five sites in which we intensively sampled Common Snapping Turtle populations, we also opportunistically collected Common Snapping Turtles at other localities in Leon County, FL as we encountered them dead on roads (DOR) or during other research projects (Aresco and James 2005).

For each Common Snapping Turtle collected, we recorded maximum carapace length (CL) and plastron length (PL) in mm, weight (g), and sex. We used secondary sex characteristics including tail size and location of cloacal opening (Ernst et al. 1994) to determine sex of individuals larger than the minimum size at maturity for females, which we confirmed through dissection of a gravid DOR female that measured 225 mm CL, 162 mm PL. We did not confirm size at maturity of male Common Snapping Turtles through dissection, so we classified individuals less than 220 mm CL as juveniles. It is possible that males mature at a larger size than females, and individuals greater than 220-mm CL with male secondary sex characteristics are subadult males. We counted lines of arrested growth (LAGs) for those Common Snapping Turtles with clearly visible LAGs on the 2nd pleural scute (n = 21). We did not verify that LAGs are deposited annually using mark-recapture of known-age animals, thus the age estimates based on counts of LAGs may be inaccurate (Galbraith and Brooks 1987b). We measured seven morphological characters from a subsample of 35 Common Snapping Turtles from McCord Pond to identify subspecies (Table 2). We collected clutch-size data from three Common Snapping Turtles: we dissected one female found DOR and we radiographed two females hand-collected on land. We obtained diet data by collecting fecal samples from two Common Snapping Turtles and dissecting the stomach of two others (one that became entangled and drowned in a trap at McCord Pond and one found DOR). In some cases, we were unable to measure or sex turtles due to time constraints or degradation of specimens collected DOR; thus, not all data were collected from each individual. We also counted individuals of all other species of turtles captured during our sampling at all five sites except San Luis Pond.

We attempted to return Common Snapping Turtles collected during this research to their original collection location when possible. For San Luis Pond, we held all Common Snapping Turtles (n = 16) in large cattle tanks at the Florida State University greenhouse facility for two months during the sediment-removal project. These turtles were released back to San Luis Pond after the project was completed. At Lake Jackson, we returned all Common Snapping Turtles captured back to Little Lake Jackson, which retained water throughout the course of this study. At our three remaining study sites, we were unable to return the turtles we collected to their original pond for several reasons. At all three sites, the sediment removal operations resulted in poor habitat quality immediately after completion, with little organic sediment or aquatic vegetation remaining (Aresco and Gunzburger 2004). At McCord Pond, the extended duration of the sediment removal operation (nine months) and the large number of Common Snapping Turtles collected (n = 64) made holding turtles in cattle tanks an unviable option. Thus, from McCord Pond, we moved all Common Snapping Turtles collected to Lake Iamonia, Lake Overstreet, and Lake Hall, three large nearby lakes with similar habitat characteristics to McCord Pond prior to sediment removal. At Harriman Pond and Chapman Pond, we moved all Common Snapping Turtles collected to McCord Pond in an effort to reestablish this population, as the habitat quality had improved over time through growth of macrophytes and sediment deposition.

Results

Morphological characters and subspecies classification

A sample of 35 Common Snapping Turtles from McCord Pond shared characteristics of both *C. s. serpentina* and *C. s. osceola*, suggesting that the population consisted of intergrades of characters used to separate these subspecies (Table 2). The proportion of Common Snapping Turtles with *osceola*-like traits varied across traits from 0 to 66% (Table 2). Most traits could be classified into one of the two subspecies, but for neck tubercles, all individuals had an intermediate morphology with moderately pointed tubercles. An examination of variation in plastral forelobe length/carapace length to third vertebral width/second pleural height showed considerable overlap in these characters between *C. s. serpentina* and this population from northwestern Florida, but little overlap with *C. s. osceola* (Aresco et al. 2006).

Population and community structure

Abundance and density of Common Snapping Turtles varied over the five sites in Leon County, FL from a low of 0.04/ha at Lake Jackson to a high of 32/ha at McCord Pond (Table 1). Biomass of Common Snapping Turtles ranged from 128 kg/ha at McCord Pond to 0.07 kg/ha at Lake Jackson (Table 1). Common Snapping Turtles were very abundant at ponds in suburban parks; at these four sites, average density was 16/ha and average biomass was 60 kg/ha (Table 1). Sex ratio of adult males:adult females was not significantly different from 1:1 at McCord Pond, our highest density site (28 males:25 females; $\chi^2 = 0.08$, df = 1, p = 0.78), and from all five sites pooled (41 males:45 females; $\chi^2 = 0.1$, df = 1, p = 0.75). The abundance of Common Snapping Turtles relative to other turtle species varied strongly across the five sites. Common Snapping Turtles represented only 0.2% of the turtle community at Lake Jackson, whereas it represented 18% of the turtle community at the much smaller McCord Pond (Table 1). Other turtle species found syntopically with Common Snapping Turtles included *Trachemys scripta* (Schoepff) (Yellow-bellied

Slider), *Pseudemys floridana* (LeConte) (Florida Cooter), *Sternotherus odoratus* (Latreille) (Stinkpot), *S. minor* (Agassiz) (Loggerhead Musk Turtle), *Kinosternon subrubrum* (Lacepède) (Mud Turtle), and *Apalone ferox* (Schneider) (Florida Softshell).

Growth rates and size relationships

The size distribution of Common Snapping Turtles at these sites was dominated by large adults, with a few juveniles to indicate low levels of recruitment (Table 1, Fig. 1). Adults outnumbered juveniles at all sites except Lake Jackson (Table 1). Estimated early growth (1–6 years) of Common Snapping Turtles in Leon County, FL was variable among individuals and ranged from 20–30 mm CL/year (Fig. 2). Based on estimated age using LAGs and the minimum size at maturity for females (based on one dissected DOR individual), we estimate that females matured at about 6–8 years (Fig. 1, Fig. 2). Male Common Snapping Turtles (CL mean = 299 ± 6 mm, PL mean = 216 ± 5 mm, n = 38) were larger than females (CL mean = 270 ± 5 mm, PL mean = 200 ± 4 mm, n = 43) in this study (t-test for CL: t = -3.81, df = 80, P < 0.001; Fig. 1).

Reproductive ecology

We recorded clutch size for three female Common Snapping Turtles collected while nesting from 4 April through 16 May (Table 3). Clutch size ranged from 5–49 eggs. In addition, a Common Snapping Turtle was observed nesting on 28 Mar 1996 at Wakulla Springs State Park, Wakulla

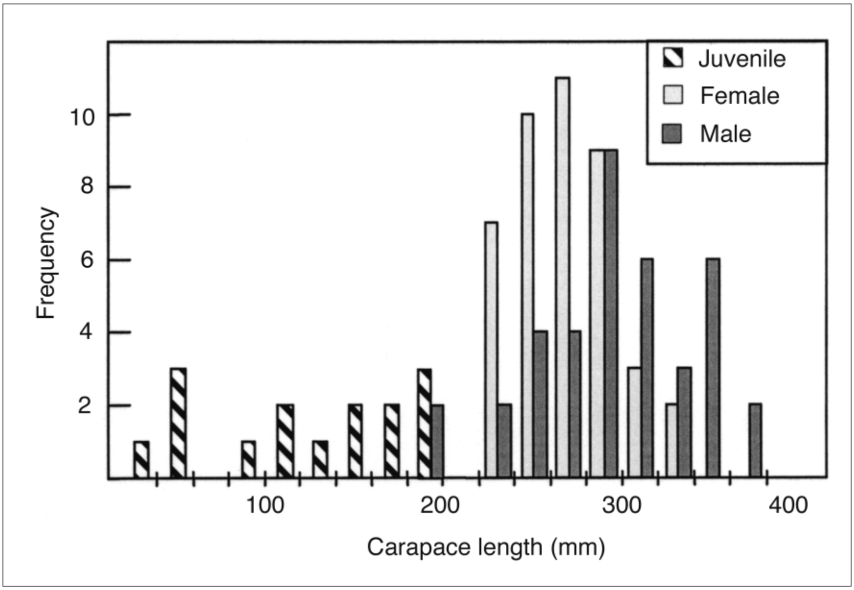

Figure 1. Size distribution of *Chelydra serpentina* (Common Snapping Turtles) collected from five sites (McCord Pond Harriman Pond, San Luis Pond, Chapman Pond, and Lake Jackson) in Leon County, FL.

County, FL, just south of Leon County (Scott Savery, Wakulla Springs State Park, Crawfordville, FL, pers. comm.). Thus, we infer that the nesting season of Common Snapping Turtles in Leon County begins in late March/ early April and probably continues at least through late May.

Diet

The diet of four Common Snapping Turtles collected in Leon County consisted of predominantly aquatic plants, with one aquatic insect (Table 4). We found no evidence of consumption of fish or other vertebrates by Common Snapping Turtles.

Terrestrial movement

Subadult and adult males and females (independent of nesting movements) were observed moving overland in pine flatwoods in the Apalachicola National Forest, Liberty County, FL, between permanent water in swamps and ephemeral cypress dome ponds (M.J. Aresco and J.G. Palis, unpubl. data). At Lake Jackson, two juveniles (40 mm CL) were found

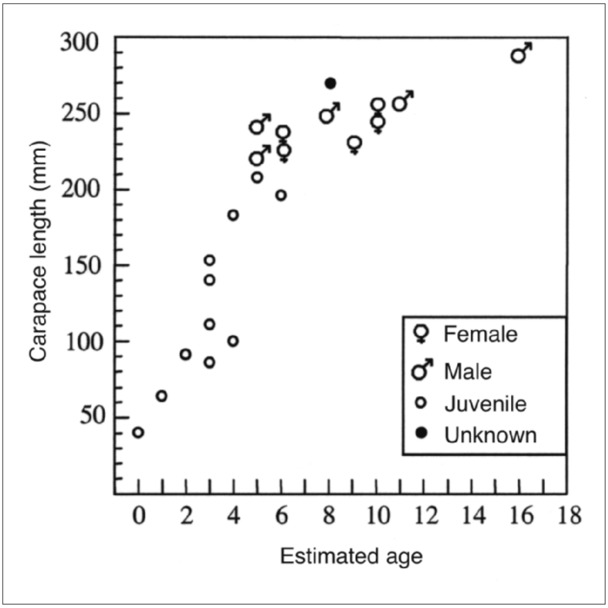

Figure 2. Relationship of estimated age and size (CL) of *Chelydra serpenti-na* (Common Snapping Turtles) (n = 21) in Leon County, FL. Age was estimated using counts of lines of arrested growth (LAG) on the 2nd pleural scute and included only those turtles with complete sets of clearly visible LAGs.

Table 3. Clutch size for three *Chelydra serpentina* (Common Snapping Turtles) collected in Leon County, FL. Lines of arrested growth (LAG) were not visible on the two larger females.

		Female				
Date	Locality	CL (mm)	Weight (g)	LAG	Clutch size	Method
4 Apr 2002 (DOR)	San Luis Pond	225	1920	6	5	Dissection
28 Apr 2003	Lake Jackson	285	4850	-	34	X-ray
16 May 2003	Goose Pond	387	9750	-	49	X-ray

at the drift fence moving directly towards Little Lake Jackson after apparently migrating at least 0.5 km from the nearest remaining pool on the lake bottom during the final days of drying. A large male (346 mm CL) migrated from a drying pool at Lake Jackson on 20 April 2000 to Little Lake Jackson and was captured migrating back to Lake Jackson on 15 March 2001 as the lake refilled. During the dry-down of Lake Jackson, under severe drought conditions, two Common Snapping Turtles, a 140 mm CL juvenile and 268 mm CL adult, were found dead on the dry lake bottom, both probably killed by raccoons.

Discussion

Common Snapping Turtles in this study in Leon County, FL were classified as intergrades because for the first 3 characteristics in Table 2, the individuals in this population are almost exactly equal to the dividing value for the two subspecies. In addition, the fact that there is significant variation in the proportion of individuals with traits characteristic of *C. s. osceola* (0–11%, Table 2) suggests that there are not two different morphotypes present in the population, but rather a mix of morphology consistent with hybridization. Further research, including analysis of additional portions of the genome, is needed to clarify the subspecific relationships.

Abundance of Common Snapping Turtles varied considerably over the five sites sampled in this study in Leon County, FL. Abundance was highest in small (< 3 ha) suburban ponds and much lower in the one large lake (1620 ha) (Table 1). It is unlikely that this is due to variation in sampling effort, as the site with the highest sampling effort had the lowest density. This result is supported by a separate study of turtle communities in northwestern Florida that included a survey of 14 additional lakes (4–2330 ha) in Leon County (Aresco and James 2005). In that study, Common Snapping Turtles were caught in hoop traps at only 2 sites (McCord Pond and Chapman Pond) and

Table 4. Diet of four *C. serpentina* collected in Leon County, FL.

Date	Locality	CL (mm)	Weight (g)	Sex	Sample type	Diet item	Percent
5 Jul 2003	Chapman Pond	310	5700	M	Fecal	*Spirodela polyrhiza* (L.) (duckweed)	95%
						Nelumbo lutea (Willd.) (American lotus)	5%
28 Jul 2003	Bradford Road Pond	282	4450	F	Stomach	*Utricularia* sp. (L.) (bladderwort)	100%
8 Aug 1999	McCord Pond	369	9000	M	Stomach	*Colocasia esculenta* (L.) (wild taro)	100%
9 Oct 2003	Waverly Pond	249	2800	M	Fecal	*Lethocerus americanus* (Leidy) (giant water bug)	< 1%
						Panicum sp. (L.) (maidencane grass)	1%
						Nitella sp. (Agardh) (stonewort)	99%

were not trapped at any large lakes (> 4 ha) (Aresco and James 2005). Other studies have also demonstrated that Common Snapping Turtles can be very abundant in small ponds and wetlands, ranging from 61 individuals/ha in a 0.4-ha pond (Major 1975) to 59 individuals/ha at a 0.8-ha pond (Froese and Burghardt 1975). Population density of Common Snapping Turtles was correlated with primary productivity across two populations in Ontario (Galbraith et al. 1988). In Leon County, FL, Aresco and James (2005) found that overall turtle abundance was highest in lakes with high periphyton productivity, a mud/organic substrate, and no alligators; however, their sample size of Common Snapping Turtles was too low to allow for analysis of specific habitat correlates to abundance of this species.

Size at maturity of Common Snapping Turtles was similar between our study in northwestern Florida and that in north temperate populations (Christiansen and Burken 1979, Mosiman and Bider 1960, White and Murphy 1973). Growth rates are typically greater in turtles at lower latitudes with a corresponding reduction in age at maturity. We estimated that female Common Snapping Turtles in our study matured at six to eight years, which was similar to a population in Iowa (six or more years; Christiansen and Burken 1979), whereas they require twice that in Michigan (17–20 years; Congdon et al. 1987) and Ontario (11–16 years; Galbraith et al. 1989). Clearly, both the length of the growing season and productivity as it relates to quantity and quality of food resources influences variation in growth rates and age-at-maturity of Common Snapping Turtles.

In northwestern Florida, Common Snapping Turtles apparently reaches its highest abundance in small ponds without alligators and with abundant aquatic vegetation and deep organic sediment (Aresco and Gunzburger 2004, Aresco and James 2005). Similarly, in the St. Croix River in Minnesota and Wisconsin, abundances of Common Snapping Turtles, *Chrysemys picta* (Schneider) (Painted Turtle), and *Graptemys geographica* (LeSueur) (Northern Map Turtle) were associated with muck substrates (Wright et al. 1999). In southeastern lakes, survival of Common Snapping Turtle juveniles may be increased by a muck substrate, which provides a refuge from alligator predation. During extremes in temperature in shallow ponds, turtles may also benefit from a soft, deep, mud/muck bottom into which they can bury into during aestivation or winter dormancy. A muck substrate also provides optimal microhabitat for diet items of Common Snapping Turtles such as macroinvertebrates, macrophytes, and macroalgae. Although our analysis of gut contents suggested that Common Snapping Turtles is primarily herbivorous, this analysis was limited to four individuals, and the diet of Common Snapping Turtles is known to be highly variable across individuals within and among populations (Alexander 1943, Lagler 1943). Trophic position of Common Snapping Turtles at Lake Jackson based on stable isotope analysis was 3.5, which reflects a more carnivorous diet at that site (Aresco and James 2005). This result may also indicate inefficient digestion and assimilation of plant material.

This study demonstrates the importance of small wetlands to Common Snapping Turtle populations. The four small ponds in our study (McCord Pond, Harriman Pond, San Luis Pond, and Chapman Pond) were once natural ponds that have been modified over the last two decades to serve as stormwater retention ponds in city parks (Aresco and Gunzburger 2004). Populations of Common Snapping Turtles in suburban ponds in such parks have been protected from human harvest for several decades. This may be why large individuals, which were presumably old adults, dominated the size distribution in the ponds in this study compared to a large lake that is subjected to intense fishing, including trotlines, and also potential harvest of turtles (Michael Hill, Florida Fish and Wildlife Conservation Commission, Tallahassee, FL, pers. comm.). Intensive muck-removal operations, where entire wetlands are drained and dredged to deepen ponds for stormwater, can extirpate Common Snapping Turtle populations (Aresco and Gunzburger 2004). Demographic and life-history traits of Common Snapping Turtles, including long generation times and naturally high rates of egg and juvenile mortality, limit their annual recruitment (Congdon et al. 1994). They may not be able to compensate for sudden or chronic losses of large numbers of breeding adults, and even small increases in annual mortality rates of mature females (< 10% increase) can lead to long-term declines with little or no population recovery possible (Brooks et al. 1991, Congdon et al. 1994). Although the Common Snapping Turtle is an excellent overland disperser, habitat fragmentation such as roads and development may limit the ability of Common Snapping Turtles to recolonize ponds, especially with increasing distance to the nearest unaltered wetland (Gibbs and Shriver 2002). In addition, habitat alteration resulting from sediment-removal operations probably reduces the likelihood of population recovery even if some individuals recolonize the pond. Large-scale sediment-removal operations leave ponds with a hard, graded sand substrate devoid of any organic material. Therefore, the conservation of small, vegetated wetlands in suburban and natural areas should be a priority for the conservation of Common Snapping Turtles in Florida.

The level of harvest of Common Snapping Turtles in Florida is unknown because the Florida Fish and Wildlife Conservation Commission (FFWCC) does not require permits or reporting for turtles harvested for personal consumption. In addition, most commercial turtle harvest (65–85%) goes unreported (Enge 1993). Collection for the pet trade apparently focuses on hatchlings raised from eggs from wild-caught females (Kevin Enge, FFWCC, Quincy, FL, pers. comm.). Local turtle trappers in north Florida often capture Common Snapping Turtles on trotlines, set lines, and bush hooks, both intentionally and as bycatch while trapping fish and Florida Softshell Turtles. According to trappers, snapping turtle meat is kept for personal consumption or sold locally. In the 1980s–1990s, baited trotlines set to catch Florida softshells were prevalent on Lake Jackson, Leon County, FL (Michael Hill, FFWCC, Tallahassee, FL, pers. comm.).

Although Common Snapping Turtles may naturally be less abundant in large lakes, long-term exploitation of Common Snapping Turtles as bycatch to Florida softshell harvest may at least partially explain the very low density of this species at Lake Jackson compared to nearby ponds, which have relatively high densities of Common Snapping Turtles but no harvest pressure. Therefore, although levels of unreported harvest for personal consumption or local sales may be relatively low, some Common Snapping Turtles populations may be adversely affected if population densities are naturally low and the same populations are exploited over time. Even low levels of harvest of adult Common Snapping Turtles may result in dramatic population declines (Congdon et al. 1994). Recent concerns that increases in harvest of turtles for Asian markets may lead to population declines have prompted some states to regulate or ban harvest of Common Snapping Turtles. Harvest bans in some states may lead to an increase in harvest pressure in states without regulations. Further research on Common Snapping Turtles should be conducted throughout the southern portion of its range in order to establish baseline demographic rates and evaluate population trends in order to better predict the effects of harvest.

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