Table 2. Carapace length (mm) by scute annuli number of western pond turtles (*Clemmys marmorata*) at Hayfork Creek, California from 1968–73. Means given with standard deviation (SD).

		Carapace Length (mm)	
Annuli Number	*n*	Mean ± SD	Range
0	4	32.73 ± 1.48	30.5 – 33.5
1	10	51.93 ± 4.86	42.5 – 60
2	30	66.55 ± 6.43	55 – 81
3	58	78.14 ± 6.00	66 – 92
4	58	87.51 ± 6.25	73 – 102
5	61	94.75 ± 5.20	83 – 103.5
6	58	102.47 ± 7.01	76 – 114
7	64	107.20 ± 15.82	93 – 126
8	60	116.73 ± 8.37	95 – 126
Males			
9	19	121.24 ± 6.08	111 – 131.5
10	12	129.04 ± 8.58	121 – 145
Females			
9	36	122.31 ± 7.88	110.5 – 139
10	20	129.15 ± 9.30	113.5 – 140.5

but turtle no. 353 from Hayfork Creek only increased carapace length 1 mm in 2 years while still adding 2 annuli (Table 1).

If annuli are deposited each year, body size should progressively and consistently increase with age (i.e., larger turtles have more annuli than smaller turtles). To test this relationship, we compared annuli and measured carapace length of 490 *C. marmorata* from Hayfork Creek, Trinity Co., California. The size of turtles increased steadily with age based on counting annuli (Table 2). This separate data set corroborates that size corresponds to age and annuli in *C. marmorata* up to at least 10 years of age.

Annual deposition of scute rings has been shown for the congeners *Clemmys guttata* (Ernst, 1975) and *C. insculpta* (Harding and Bloomer, 1979; Lovich et al., 1990, Ernst et al., 1994). The maximum number of annuli deposited by congeners is 14–18 for *C. guttata* (Ernst, 1975), 13 for *C. muhlenbergii* (Ernst, 1977), and 15–20 for *C. inscuplta* (Harding and Bloomer, 1979; Farrell and Graham, 1991; Ross et al., 1991). Most of the *C. marmorata* we examined seemed to stop depositing countable scute annuli after 12 to 14 years, but one turtle had 16 countable rings, the maximum number of scute annuli that we have seen for this species. These are the first data indicating that scute rings are deposited essentially annually and that size corresponds to age in juvenile *C. marmorata*.

Acknowledgments. — We thank J.E. Lovich, P.C.H. Pritchard, A.G.J. Rhodin, and G.R. Zug for critically evaluating an earlier draft of this paper. We were helped by a variety of field assistants but especially L.R. Gangle, G.W. Bury, and R.N. Germano.

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Received: 18 November 1997
Reviewed: 3 May 1998
Revised and Accepted: 10 June 1998

Chelonian Conservation and Biology, 1998, 3(1):109–111

Bait Preferences of Southeastern United States Coastal Plain Riverine Turtles: Fish or Fowl?

JOHN B. JENSEN[1]

[1]*Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029 USA [Fax: 912-993-3050; E-mail: john_jensen@mail.dnr.state.ga.us]*

Few studies have been conducted comparing the efficacy of different types of baits for trapping aquatic turtles. Lagler (1943) considered fresh fish and fowl entrails best, but provided no supportive data. Ernst (1965) compared the attractiveness of six different baits (including fresh fish and fowl entrails) to *Chrysemys picta*, *Chelydra serpentina*, and *Sternotherus odoratus*. He concluded that, although fish- and fowl-baited traps captured equal numbers of *C. serpentina* and *S. odoratus*, fowl was far superior to fish for attracting *C. picta*. However, since he ran each of the seven bait trials (including one unbaited control) consecutively, with a week of no trapping between each trial, biases related to seasonality, weather, trap habituation, and trap shyness may have influenced his results. Further, I am aware of no studies comparing bait preferences of riverine turtles of the southeastern United States Coastal Plain.

In conjunction with a status survey of the alligator snapping turtle, *Macroclemys temminckii,* in Georgia, and upon learning of the availability of fresh chicken entrails in quantity from a local processing plant, I developed a study to compare the effectiveness of chicken entrails vs. fresh fish as trap bait for this species and other sympatric turtles. Fresh fish, which I find more difficult to acquire in sufficient amounts, does successfully attract *M. temminckii* (*pers. obs.*; P. Moler, *pers. comm.*; Pritchard, 1989). Though fish was likely used by most former commercial trappers of *M. temminckii*, at least some used chicken successfully and nearly exclusively (P. Moler, *pers. comm.*); commercial harvest is now illegal in most states.

Methods. — The study was conducted during late summer 1997 in six stretches of four Gulf Coastal Plain streams within Georgia, USA: Alapaha River, Chattahoochee River, Spring Creek (Decatur County), and Suwannee River (including Suwannoochee Creek). Single opening hoop-traps were employed, consisting of four 4-ft diameter fiberglass hoops supporting 4-in mesh netting. Bait, either fresh chicken entrails or fresh cut fish (including entrails and flesh), was stuffed approximately half-full into 1 liter plastic bottles, which were then topped off with water and frozen. The lid of each bottle was fitted with a clip for attaching the bait to a line within the posterior region of the trap. This positioned the bait in the center of the cylinder, thus preventing turtles from reaching it without entering the trap. Before final setting of each trap, the bait bottle was punctured several times using a knife. The closed end of each trap was tied to a tree, root, or snag on the stream bank with at least some portion above the water, while the open funnel end was oriented downstream and anchored with a weighted line. All traps were nearly parallel with the water flow and positioned so that the hoop at the opening of the trap was resting upright on the stream bottom. This positioning presumably facilitates cumbersome, bottom-walking *M. temminckii* (Ashton and Ashton, 1985) in entering the traps. All traps were placed just upstream from log jams, undercut banks, or other structures assumed to be favored aquatic microhabitats of *M. temminckii*. While setting traps, I endeavored to alternate bait types as I moved upstream or downstream. Colored flagging on nearby snags or limbs was used to indicate bait type.

Thirty-one traps were baited with chicken and 34 with fish. Eight to 14 traps were placed in each stretch of stream depending on habitat and trap-site availability. Traps were set mid-afternoon, left overnight to accommodate the nocturnal activity period of *M. temminckii* (Collins, 1993), and checked and removed early the next morning. Duration of trapping varied from 12–18 hrs among sites, but by less than 2 hrs between traps at the same site. Trapping only took place on days and nights with clear or mostly clear skies and never during turbid water conditions. Water temperature among sites varied by no more than 3ºC (26–29ºC). All captured turtles were identified to species and released.

Results. — Six species of turtles — *M. temminckii, Chelydra serpentina, Pseudemys concinna, Trachemys scripta, Apalone ferox,* and *Apalone spinifera* — were captured; only *M. temminckii* and *T. scripta,* however, were caught in sufficient numbers for statistical evaluation of bait preferences (Table 1). *Macroclemys temminckii* showed an apparent preference for fresh fish ($\chi^2 = 9.96$, df = 1, $p < 0.05$). Conversely, *T. scripta* preferred fresh chicken entrails ($\chi^2 = 9.63$, df = 1, $p < 0.05$). Neither bait successfully attracted more turtles when all six species were combined ($\chi^2 = 1.54$, df = 1, $p < 0.05$). The large mesh netting precluded the capture of any juvenile turtles, other than *Macroclemys* and *Chelydra,* of which no juveniles were caught, and therefore ontogenetic differences in bait preference could not be analyzed.

Discussion. — It is not surprising that both bait types successfully attracted *M. temminckii*, given the species' catholic feeding habits (Sloan et al, 1996). However, the species' apparent preference for fish bait beckons explanation. One hypothesis may be that *M. temminckii* has evolved with fish being a major dietary component, whereas birds are a minor component at best. Indeed, *M. temminckii* is well noted for capturing live fish using its unique tongue lure (Drummond and Gordon, 1979). Therefore, *M. temminckii* may have evolved a greater sensitivity to fish odor. An alternative may relate to the density differences between the two baits. After removing traps, I noticed that unconsumed chicken entrails and their oils floated on the water's surface after discarding, whereas all portions of cut fish quickly sank. As a primarily benthic species, *M. temminckii* is likely to smell water-carried odors trapped in the upper surface of slow-flowing streams only when it surfaces to breathe. Though turbulence may permit some of the chicken entrails'

Table 1. Number of turtles captured in traps using two different baits. C = chicken entrails; F = cut fish; TN = trap-nights.

	No. of individuals captured											
	M. temminckii		*C. serpentina*		*T. scripta*		*P. concinna*		*A. ferox*		*A. spinifera*	
Stream	C	F	C	F	C	F	C	F	C	F	C	F
Suwannee River (C = 8 TN, F = 6 TN)	0	0	0	0	0	1	0	0	2	1	0	0
Alapaha River (C = 5 TN, F = 6 TN)	0	0	0	0	12	6	0	0	2	5	1	0
Spring Creek (C = 8 TN, F = 12 TN)	5	7	1	4	3	8	0	0	0	0	1	5
Chattahoochee River (C = 10 TN, F = 10 TN)	1	6	0	0	52	24	3	2	0	0	0	2
TOTALS	6	13	1	4	67	39	3	2	4	6	2	7

odor to reach deeper water, the possible lack of a continuous odor trail may hinder the ability of *M. temminckii* to locate the source. Other predominantly benthic turtles, such as *Sternotherus minor* and *Chelydra serpentina*, may be similarly affected. Though the sample size was too low for statistical analysis, this point is reinforced by the capture of four of the five *C. serpentina* in traps baited with fish. Unfortunately, the relatively large mesh size used precluded capture of *Sternotherus*.

Trachemys scripta, also considered an opportunistic omnivore (Ernst et al., 1994), was decidedly more attracted by chicken than fish. Basking occupies a great deal of the daily activity cycle of *T. scripta* (Auth, 1975), which therefore involves more frequent exposure to the upper, rather than lower, water column. It may be possible that *T. scripta* is more likely than *M. temminckii* to smell near-surface odors than those submerged below.

Cagle and Chaney (1950) stated, and later Frazer et al. (1990) demonstrated that the mere presence of an individual turtle in a trap may attract other conspecifics. This attraction may have biased the capture data for *T. scripta*, but not likely for *M. temminckii*. Two particular traps, baited with chicken, captured 19 and 14 *T. scripta*, respectively. Seven *T. scripta* per trap was the next highest concentration. If the turtles from those two traps were eliminated from the analysis (due to possible influence from the presence of other turtles), no significant bait preference would have been revealed for *T. scripta*. Two traps containing four *M. temminckii* each represented the only multiple captures of this species. Since one of these traps was baited with fish and the other with chicken, it is unlikely that bias associated with attractiveness to other conspecifics influenced the analysis.

The interest in capturing aquatic turtles for survey and inventory, rather than simply for subsistence or commercialization, has made studies such as this important. Increasing the odds of capturing a larger percentage of a particular species' population increases the accuracy of distributional and demographic surveys, but care must be taken that new and improved capture techniques are not utilized to the detriment of turtle populations.

Acknowledgments. — I thank Lee Andrews, Paul Moler, and Jim Ozier for trapping assistance. Personnel with Georgia DNR's Fisheries Section provided fish. Chris Poplaski helped prepare fish for bait. A special thanks is extended to Cagle's Inc. for supplying chicken entrails. Georgia DNR law enforcement officers provided information on boat launch sites and stream conditions. Kathy Gault graciously assisted me with the statistical analysis. The manuscript was much improved by Dale Jackson, who provided editorial suggestions.

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Received: 11 January 1998
Reviewed: 3 May 1998
Revised and Accepted: 20 May 1998

Chelonian Conservation and Biology, 1998, 3(1):111–112

Sexual Dimorphism of Neonate Eastern Spiny Softshells, *Apalone spinifera spinifera*

TERRY E. GRAHAM[1] AND CYNTHIA B. COBB[1]

[1]*Department of Biology, Worcester State College, Worcester, Massachusetts 01602 USA [E-mail: tgraham@worc.mass.edu]*

Sexual dimorphism in the carapacial pattern of adult eastern spiny softshells (*Apalone spinifera spinifera*) is well known (Webb, 1962; Ernst et al., 1994). Males have clear paravertebral spots with dark bordering rings and females lack clear spots. The development of obvious sexual pattern differences in headstarted juvenile softshells has been reported by Graham (1991) at a carapace length (CL) of as little as 52 mm.

On 14 August 1997 a clutch of 19 softshell eggs was discovered on a sandbar in the Lamoille River, Chittenden County, Vermont, USA, and removed to the laboratory for incubation. Seventeen eggs hatched on 9 September and the neonates ranged in CL from 39.0 to 41.7 mm ($\bar{x} = 40.2$). We carefully examined each hatchling under a 7X dissecting microscope. Two patterns in the appearance of the anterior paravertebral spots were noted. In the first pattern, the spots were bordered by a distinct dark ring, as in adult males (Fig. 1A), and in the second pattern, the spots had either an indistinct or absent ring as in adult females (Fig. 1B). These