Diet Selection in Three Emydid Turtle Species

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Introduction

Turtles of the genera *Trachemys*, *Pseudemys*, and *Chrysemys* are extremely common in southeastern Virginia and can make up a significant portion of the vertebrate biomass in freshwater systems (Congdon et al. 1986). One of the more abundant species is *Trachemys scripta*, commonly referred to as the Slider Turtle (Mitchell 1994). *T. scripta* is typically the most abundant species when present (Bury 1979). The success of *Trachemys scripta* may be, in part, due to its feeding ecology. *T. scripta* is omnivorous with a generalist diet (Ernst et al. 1994). It is best described as extremely opportunistic, utilizing a wide range of food including many different species of algae and vascular plants, invertebrates, fish, and all life stages of frogs (Ernst and Barbour 1972; Parmenter and Avery 1990; Ernst et al. 1994).

Chrysemys picta (the Painted Turtle) is another omnivorous turtle that is abundant throughout Virginia and is the most frequently observed basking turtle in Virginia (Mitchell 1994). This turtle is known to eat a wide variety of algae and vascular plant material, invertebrates and frogs (Ernst and Barbour 1972; MacCulloch and Secoy 1983; Ernst et al. 1994).

Pseudemys rubriventris (The Red-Bellied Cooter) inhabits many freshwater ecosystems in southeastern Virginia. Adult turtles are mainly herbivorous, however *P. rubriventris* has been known to consume animal material on occasion (Ernst et al. 1994). Although algae and vascular plants compose most of their documented diet, these turtles are also known to consume snails, crayfish, and tadpoles (Ernst et al. 1994).

Considering the documented overlap in diet, it is possible that *Trachemys scripta*, *Pseudemys rubriventris*, and *Chrysemys picta* are utilizing the same resources and thus participating in competitive interactions. Moreover, large populations of turtles could potentially have an impact on prey species. Since all three turtle species described above are known to consume amphibian larvae (Ernst et al. 1994), the combined effects of these turtles could substantially lower amphibian recruitment. The goal of this study was to determine if there is niche overlap in the diets of *Trachemys scripta*, *Pseudemys rubriventris*, and *Chrysemys picta* and establish if any of the turtle species would select amphibian larvae as a diet item.

Methods

All turtles were collected from Waller Mill Lake located in Waller Mill Park, Williamsburg, Virginia. The turtles were captured using hoop nets baited with sardines in oil and bananas. Hoop nets were secured using 1.8-meter plastic garden stakes and were only partially submerged to prevent the drowning of captured turtles. The nets were checked and reset daily. The carapace length (cm) and mass (kg) of all turtles were recorded using calipers and a spring scale. The turtles were marked using fingernail polish to ensure that the same individual was not used in feeding trials more than once. Adult turtles belonging to the species *Trachemys scripta*, *Pseudemys rubriventris*, and *Chrysemys picta* were transported back to the lab for feeding trials. No juveniles were collected for the feeding trials to prevent sampling bias as juvenile *T. scripta* and *C. picta* are known to be mainly carnivorous with a shift to an omnivorous diet as they reach maturity (Congdon et al. 1992; Bouchard and Bjorndal 2006). Turtles belonging to all other species were returned to the lake. Collection occurred at various areas around the lake and took place from 17 June 2012 through 8 September 2012.

The feeding trials were conducted using methods adapted from Koch (2010). Turtles were held in plastic swimming pools covered in 2.5 cm (1 in.) hex-shaped poultry netting to deter predators prior to feeding trials. Landscaping stones were provided for basking sites and a portion of the pool was covered with a tarp for shade.

Feeding trials were conducted in 62 L (66 qt.) clear, plastic storage containers. The feeding trial containers were set up in the same manner describe above. Six containers were set up so numerous trials could occur simultaneously. One turtle was placed in each container for a fasting period of 24 hours.

After the fasting period, each turtle was offered the control diet item along with one experimental diet item. The vascular plant, *Sagittaria*, served as the control item, as it is a known diet item of all three turtle species and vascular plant material was shown to constitute the majority of the diet of all three turtle species in a previously conducted study (Demnicki 2007). The experimental diet items were *Chara* (algae) and *Lithobates* tadpoles (up to 5 cm in length). During trials in which they were included, a single, live tadpole was offered. The diet items were left for a period of four hours. After the four-hour time period, the containers were checked to see if the turtles had consumed the control item, the experimental item, both items or neither item and that information was recorded.

The turtles were fasted for another 24-hour period and a second trial was conducted with the control and the other experimental diet item. After the feeding trials were completed on each turtle, the turtles were returned to the lake and released at the location from which they were captured. If the turtle(s) could not be immediately returned to the lake, they were held in a separate pool fitted in the manner described above until such time that they could be returned.

After all feeding trials were completed; the data were compiled for each species and analyzed using the Fisher Exact Probability Test to determine if there was a significant difference in the preference for different food items for each species.

Results

The results of the feeding trials are shown in Table 1. *Trachemys scripta* and *Chrysemys picta* exhibited no dietary preferences during feeding trials ($p = 0.096$ and $p = 0.999$) accepting equally *Sagittaria*, *Chara*, and *Lithobates* tadpoles. However, *Pseudemys rubriventris* demonstrated a dietary preference for *Sagittaria* ($p = 0.0358$).

Table 1. Number of times turtles consumed diet items during laboratory feeding trials. Numbers in parentheses represent sample size. (*) indicates a significant difference ($p < 0.05$) using Fisher Exact Probability Test.

Feeding Trial Selections	*Trachemys scripta* (8)	*Pseudemys rubriventris* (11)*	*Chrysemys picta* (6)
Sagittaria* vs. *Chara			
Sagittaria only	3	3	4
Chara only	0	0	0
Neither item	5	3	1
Both items	0	5	1
***Sagittaria* vs. *Lithobates* tadpole**			
Sagittaria only	1	7	4
Tadpole only	2	0	0
Neither item	2	4	0
Both items	3	0	2

Discussion

Trachemys scripta and *Chrysemys picta* were found to exhibit no dietary preferences when offered a variety of items they are known to consume. However, *Pseudemys rubriventris* exhibited a preference for plant material. This result is reasonable as *T. scripta* and *C. picta* are classified as omnivorous and *P. rubriventris* is mainly herbivorous. While *T. scripta* and *C. picta* exhibited no statistically significant preference in diet, they consumed *Sagittaria*, a vascular plant, more often when compared to other diet items. This is consistent with results from a previous study of wild turtles conducted at Lake Maury, Newport News, Virginia (Demnicki 2007). Vascular plant material was found in the fecal samples of 77% of female and 83% of male *T. scripta*, making up the vast majority of the volume of the samples (Demnicki 2007). Likewise, vascular plant material was found in 100% of the fecal samples from male and female

C. picta, making up almost 100% of the volume (Demnicki 2007). In addition, studies show that populations of *T. scripta* in Tennessee, Florida and Louisiana have mainly a plant-based diet (Marchand 1942; Cagle 1950).

While *Trachemys scripta* and *Chrysemys picta* appear to have a diet that consists mainly of vascular plant material in lakes of the Southeast, they do not in other areas of the United States. Populations of *T. scripta* in Illinois were found to consume equal amounts of plant and animal material (Smith 1961). This result is consistent with other populations of *T. scripta* in Illinois (Dreslik 1999). *Chrysemys picta* in high-elevation habitats in Colorado had a diet that was dominated by aquatic snails (*Lymnaeidae* and *Succineidae*) along with damselflies (*Odonata*) and caddisflies (*Trichoptera*) (Cooley et al. 2003). Knight and Gibbons (1968) studying Michigan populations of *C. picta* in a polluted river found that the turtle's diet was about 75% animal matter. In the Pacific Northwest, two populations of *C. picta* had a diet that consisted of a significant amount of insect larvae and amphipods (Lindeman 1996). Similarly, MacCulloch and Secoy (1983) found that *C. picta* in Saskatchewan had a carnivorous diet that likely resulted in the populations having both larger body sizes and larger clutches.

The herbivorous diet of *Pseudemys rubriventris* at Waller Mill Lake is consistent with most of the published literature on *Pseudemys* diet. Fecal analysis of turtles at Lake Maury, Newport News, Virginia found the diet of *Pseudemys* was 100% herbivorous with vascular plant material being the major diet item (Demnicki 2007). While *P. rubriventris* is known to consume algae, *Chara* (a filamentous algae) did not appear to be a preferred diet item of the Waller Mill turtle population, only being consumed a total of six times during feeding trials. *Chara* was only consumed along with *Sagittaria* and never by itself.

While vascular plants appear to be the major component of their diets, *Trachemys scripta* and *Chrysemys picta*, both omnivorous species, consumed *Lithobates* tadpoles during feeding trials. Omnivorous turtles are considered opportunistic predators and typically consume amphibians when encountered (Toledo et al. 2007). Since the biomass of turtles in freshwater habitats is usually quite large, the effect of predation on amphibians could potentially be substantial (Congdon et al. 1986). Hecnar and M'Closkey (1997) found that amphibian species richness was significantly reduced in ponds that also supported populations of predatory fish when compared to ponds that had non-predatory fish species or no fish at all. In addition, Gregoire and Gunzburger (2008) found that even fish species with a small body size could have a negative effect on amphibian populations. It is reasonable to suppose that populations of turtles that consume amphibian larvae could result in a similar outcome. For example, it appears that the introduction of the non-native *Trachemys scripta elegans* has had a significant negative impact on amphibian populations throughout Europe (Polo-Cavia et al. 2010).

Despite these observations, certain factors seem to impact the level of turtle predation observed. In laboratory experiments, Feder (1983) found that movements like swimming and surfacing to breathe attract the attention of *Chrysemys picta* and increase the rate of predation on *Lithobates* tadpoles. Along with attractive movements, turtles tend toward predation on larger tadpoles (Gomez-Mestre and Keller 2003). There also appears to be a difference in the degree of palatability among species of amphibian larvae, which impacts whether or not a turtle will consume the tadpole (Gomez-Mestre and Keller 2003). However, Koch (2010) found that during feeding trials *C. picta* did not exhibit a preference when offered larvae from five species of amphibian belonging to different genera, including a salamander (*Ambystoma mavortium*).

In conclusion, the omnivorous *Trachemys scripta* and *Chrysemys picta* exhibited no dietary preference, while the herbivorous *Pseudemys rubriventris* preferentially consumed plant material during this study.

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