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Diet Content and Overlap of Six Species of Turtle Among the Wabash River

Lori Pierce

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Diet Content and Overlap of Six Species

of Turtle Among the Wabash River

(TITLE)

BY

Lori Pierce

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ABSTRACT

A community of six species of turtles from the Wabash River and its backwaters was studied to determine diet composition of each species and amount of dietary overlap among species. Species studied included: Trionyx muticus, Trionyx spiniferus, and Graptemys ouachitensis in the river; Trachemys scripta and Chrysemys picta in both the river and backwaters; and Chelydra serpentina in the backwaters only.

Trionyx muticus, T. spiniferus, and G. ouachitensis all belong to a guild that specializes on aquatic insects. The highest diet overlap (69.6%) was between the two softshells, T. muticus and T. spiniferus. Coexistence is possible because T. spiniferus are rare and there is some indication that they are feeding in different microhabitats, with T. spiniferus utilizing the bottom of the river and T. muticus feeding in the water column. Moderate overlap occurred between T. muticus and G. ouachitensis, but 58% of the diet differed.

Trachemys scripta are able to coexist with the other riverine species because they belong to a different guild. This species is highly herbivorous (93%) in the river, more so than in the sloughs (69%). Turtles occurring in the river had more diet overlap with T. scripta occurring in sloughs than with those in the riverine habitat. This could be due to niche

partitioning in the river to reduce competition.

The remaining species encountered showed little diet overlap with any other turtle. *Chelydra serpentina* were piscivorous, while *Chrysemys picta* were omnivorous.

Turtle species of this community are able to coexist by feeding on different food items, foraging in different areas, and by occurring in small numbers.

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TABLE OF CONTENTS

INTRODUCTION

Although there have been numerous studies on the diet of turtles, there have been relatively few concerning diet overlap between sympatric turtle species. Berry (1975) documented that *Sternotherus minor*, when sympatric with *S. odoratus*, became more generalized in its food habits. Vogt (1981) studied three sympatric *Graptemys* and found coexistence possible because one species specialized on molluscs while the other two species were omnivores feeding in different microhabitats. Food partitioning among tropical chelonians has also been studied (Moll, 1990; Vogt and Guzman Guzman, 1988).

Diet overlap studies are of importance because they provide an indication of how related species are able to coexist. According to the principle of competitive exclusion, no two species can occupy the same niche indefinitely, for one species will be competitively superior and will ultimately replace the less competitive species (Gause, 1934, in Grant, 1977). In order to coexist, species may have to partition the niche to reduce competition. However, niche overlap alone does not necessarily indicate that competition is occurring (Colwell and Futyma, 1971; Pianka, 1974) because the resource in question may not be limiting.

Partitioning of the dietary niche can occur in a number of ways. According to the compression hypothesis

(MacArthur and Wilson, 1967), the greater the number of competing species, the more these species will compress their foraging habitats. According to this hypothesis, species need not limit the variety of food items taken, but rather limit the area in which they forage. However, the niche also may be partitioned by feeding on different kinds of organisms. Lastly, the niche may be partitioned by feeding on different sizes of prey items. Generally, the larger animals are able to feed on larger prey (MacArthur, 1972). Because many female chelonians are larger than males, intraspecific competition may be alleviated in this manner.

Commercial fishermen on the Wabash River near Mt. Carmel, Illinois frequently capture up to six species of turtles in their nets. These include Trionyx muticus, T. spiniferus, Chrysemys picta, Graptemys ouachitensis, Trachemys scripta, and Chelydra serpentina. Since these turtles often drown in the fish nets, this situation offered an opportunity to obtain material to study diet overlap and resource partitioning among these species.

The objectives of my study were to 1) determine the habitat usage of the turtle species occurring in the Wabash River and its backwaters and 2) analyze the diets of these species, including content, amount of overlap, and degree of specialization to determine how food resources were being partitioned within this Chelonian community.

MATERIALS AND METHODS

Six species of turtles were collected between April 17 and October 1, 1989 from the Wabash River and its backwaters near Allendale and Mt. Carmel, Illinois (38.25N, 87.48W). Species collected included: *Trionyx muticus* (50), *Trionyx spiniferus* (4), *Graptemys ouachitensis* (13), *Trachemys scripta* (15), *Chelydra serpentina* (5), and *Chrysemys picta* (4).

Some turtles were obtained from local commercial fishermen who provided specimens which drowned in their fyke nets. Others were collected using hoop traps (baited with chicken liver or fish), and trammel nets. Each specimen was sexed and the carapace length (CL), carapace width (CW), plastron length (PL), and height were measured to the nearest millimeter with vernier calipers. Weights were taken with a Pescola spring scale to the nearest gram. The habitat where each species was collected was noted.

Those turtles collected by fishermen were frozen on the date of capture. The digestive tracts were later dissected and placed in 10% formalin. Turtles captured live were stomach flushed using water in a pressurized weed sprayer equipped with plastic tubing which forced regurgitation of stomach contents onto a screen (Legler, 1977).

Food items for each individual were identified under a dissecting scope and measured volumetrically by water displacement. The data are expressed as 1) Frequency of occurrence- the percent of individuals that contained a particular food item, 2) Individual percent volume- the percent of volume a food item comprised in all individuals that contained that food item, and 3) Total percent volume-the percent of volume a food item comprised relative to the total volume eaten by all individuals (Moll and Legler, 1971; Windell, 1970).

Diet overlap between species was calculated using the Morisita's Index as modified by Horn (1966; Berry, 1975). The formula for this index is:

$$C_{\lambda} = \frac{2 \sum_{i=1}^{s} X_i Y_i}{\sum_{i=1}^{s} X_i^2 + \sum_{i=1}^{s} Y_i^2}$$

where X_i is the proportion of the ith food class eaten by sample X, and Y_i is the proportion of the ith food class eaten by sample Y. In this study, X_i represents the total percent volume of food class i for a particular species in a specified locality (main river or sloughs). In order to eliminate the bias of the different volumes of food eaten by individuals, all samples were converted to 1 cc volume for the purposes of this calculation. For example, a turtle that had eaten 40 cc of Ephemeroptera, 10 cc of fish, and 50 cc of vegetation would have these values converted to .4 cc of Ephemeroptera, 0.1 cc of fish, and 0.5 cc of slightly differently for Tables 3-10 than for use in Morisita's and Horn's Indexes and Figures 1-12 in that unidentified material was excluded from the latter (hence percentages are not the same). Food class designations used appear in Table 1.

The calculations of C_λ varies from 0 to 1 (0 when there are no food items in common, and 1 when all food items are in common and in the same proportions). Diet overlaps of all species combinations were calculated, even though some species were not found in the same habitat. Diet overlap between male and female Graptemys ouachitensis was also determined using this index to determine the degree of intraspecific competition.

The diversity of food items taken in by each species was measured by using Horn's Diversity Index as described by Schoener (1968). The formula for this index is:

$$H' = - \sum_{i=1}^{n} p_i \log p_i$$

where p_i is the frequency of use of the i^{th} food class. In this study, p_i is the total percent volume of food class i [as described by Berry (1975)]. The total percent volume and designated food classes are the same as those used in Morisita's Index. A low number would indicate a specialized diet while a high number would indicate a diverse diet.

RESULTS

Turtles captured in the Wabash River included: Trionyx muticus (39 M:11 F), Trionyx spiniferus (3 M:1 F), Graptemys ouachitensis (3 M:10 F), Trachemys scripta (3 M:2 F), and Chrysemys picta (1 M). In the backwaters of the Wabash River, species collected included: Chelydra serpentina (4 M:1 F), Trachemys scripta (5 M:1 F:3 J) and Chrysemys picta (1 M:1 F)[see Table 2].

Gut Content Analysis

Frequency of occurrence, individual percent volume, and total percent volume for each turtle species studied are found on Tables 3-10. The total percent volume values listed on these tables differ from the total percent volume values used in Morisita's and Horn's Indexes and Figures 1-12 (see methods). Henceforth, I will be discussing the total percent volume data presented in the figures. The complete total percent volume data on the tables, while not discussed in this paper, are listed.

Trionyx muticus (Table 3, Figure 1) was chiefly carnivorous, feeding heavily on insects which made up 84% of its diet with a frequency of occurrence of 87%. Ephemeropterans (31%), trichopterans (18%), and odonates (16%) were the most important groups. Frequencies of occurrence for the above were 52.2%, 43.5%, and 21.7%, respectively. Fish were found in 17.4% of the samples and made up 12% of its diet.

Plant material, altough comprising only 1% of the diet, had a frequency of occurrence of 52.2%.

Some seasonal shift in diet composition was observed in Trionyx muticus. Early in the season (April 17-May 5, Figure 2) smooth softshells ate approximately equal amounts of ephemeropterans (23%), trichopterans (22%), and odonates (22%). Later in the summer (June 24-July 15, Figure 3) ephemeropterans predominated (60%) while trichopterans and odonates were replaced by dipterans (20%) in the diet.

Trionyx spiniferus' (Table 4, Figure 4) diet consisted of 38% ephemeropterans and 25% fish with the frequencies of occurrence being 75% and 25%. Plant material made up 12% of the diet and occurred in 25% of the individuals.

Graptemys ouachitensis also ate relatively large amounts of insects but was more omnivorous (Table 5, Figure 5) feeding on trichopterans (45%), molluscs (7%), and plants (33%). Frequencies of occurrence for the above were 61.5%, 15.4%, and 76.9%, respectively. Coleopterans, though found in over 50% of individuals, made up only 6% of the diet.

Some sexual differences in preferred foods are suggested by this sample. The diet of G. ouachitensis females (Table 6, Figure 6) consisted of trichopterans (59%), molluscs (9%), and plants (29%). Frequencies of occurrence for the above were 70%, 10%, and 60%, respectively. Fish were not eaten by the females in my sample. The males' diet (Table 6, Figure 7) consisted of 33% fish, and 50% plant. Fish were found in 25% of the males, while plants were found in all individuals. Though trichopterans were found in 33.3% of the individuals, the amount was insignificant.

Trachemys scripta was chiefly herbivorous in all habitats (Table 7, Figure 8) eating 80% plant material, 9% Aves, and 7% Coleoptera with frequencies of occurrence of 100%, 8.3% and 50%.

When the sample was divided according to habitat, riverine *Trachemys* tended to be more herbivorous than those collected in the sloughs. *Trachemys* from river ate (Table 8, Figure 9) 93% plant and 7% coleopterans. Plant material occurred in all of the individuals while coleopterans were found in 75% of the individuals. Ephemeropterans occurred in 50% of the sample but in too insignificant (i.e. >1%) amounts to list.

Trachemys (Table 8, Figure 10) collected in sloughs consumed 69% plant material, 17% aves, and 14% insect (Coleoptera 8% and Hymenoptera 6%). Plant material occurred in all, Aves in 14.3%, and insects in 57.1% of the individuals.

The diet of *Chelydra serpentina* (Table 9, Figure 11) included 90% fish, 7% decapods, and 3% plant. Fish were found in 83.3% of the individuals while decapods and plant were found in 33.3% and 66.7%, respectively.

Although insects were not plentiful enough to figure into the total percent volume, they had a frequency of occurrence of 50%.

The diet of Chrysemys picta (Table 10, Figure 12) consisted of 25% fish, 18% molluscs, and 48% plant material with frequencies of occurrence of 50%, 25%, and 75%, respectively. Although insects did not register in the total percent volume, they were present in all the individuals.

Diet Overlap

The percent of diet overlap between the six species as indicated by Morisita's Index is provided in Table 11. The habitat where each species was collected has been designated as river or slough or both. Sample sizes of C. picta were too small to be considered separately and so data from both localities were pooled.

Several species had diet overlaps greater than one-third (33%). The greatest amount of overlap (69.6%) was found between the sympatric softshells, T. muticus and T. spiniferus. Much of the overlap between these species involved mayflies and fish. Trionyx muticus and Graptemys ouachitensis had an overlap of 42.4%, which chiefly involved trichopterans and fish. Riverine Trachemys scripta and Graptemys ouachitensis overlapped 40.9% due to their preference for vascular plants and beetles. Also Chrysemys picta (pooled data), and Chelydra serpentina had an overlap of 43.2% involving fish and vascular plants. Chrysemys picta also had an overlap of 35.9% with Graptemys ouachitensis; algae and vascular plant were the food items held most in common. All other diet overlaps of turtles occurring in the same habitat were less than a 20%. Sympatric species with the least amount of diet overlap were the herbivorous Trachemys scripta with the carnivorous Chelydra serpentina (3.1%) and Trionyx muticus (2.7%). Diet overlap between male and female Graptemys ouachitensis was 23.2% with the greatest overlap occurring in the categories of vascular plants and molluscs. Females consumed more trichopterans while males ate more fish.

Since Trachemys scripta were found in both the river and the sloughs, the degree of diet overlap with turtles that occurred in the same habitat can be compared with the diet overlap of the species that occurred in a different habitat. All turtles occurring in the river, Trionyx muticus, T. spiniferus, and Graptemys ouachitensis, showed a greater degree of diet overlap with the Trachemys scripta from the sloughs than with the riverine Trachemys scripta. Chelydra serpentina, which occurred in the sloughs, had a greater diet overlap with the Trachemys scripta that occurred in the sloughs than with the T. scripta that occurred in the river, but the amounts were relatively small. There was also a 93.5% overlap between Trachemys scripta from the sloughs and those from the river.

Diversity Index

Horn's Diversity Index was calculated for all turtle species studied (see Table 11). *Trachemys scripta* and *Chelydra serpentina* had the lowest indexes (.254 and .386, respectively) while *Trionyx muticus* had the highest (1.960) diversity.

DISCUSSION

The turtles studied varied in habitat preference. By setting traps in both the Wabash and in the backwaters, general habitat preferences were determined. *Trionyx muticus*, *T. spiniferus*, and *Graptemys ouachitensis* were found only in the main river. *Chelydra serpentina* were found only in the sloughs. *Trachemys scripta* and *Chrysemys picta* were collected in both habitats.

Trionyx muticus were captured in the greatest numbers (50). *Trionyx spiniferus* were rare (4). Williams and Christiansen (1981) reported that *T. spiniferus* occupy major and minor streams with much brush, while *T. muticus* prefer open water, usually with sandy bottoms. The area of the river in which turtles were captured was open with many sandy banks and thus most suitable for *T. muticus*.

The number of male *T. muticus* that were collected exceeded the females by a 3.5:1 ratio. This does not necessarily indicate that males were more numerous than females, but rather could be due to a bias in sampling (Ream and Ream, 1966). The fyke and trammel nets in which turtles were collected were located at the edges of the river. Males are more associated with the edge of the river while females prefer the open water (Plummer, 1977; Plummer and Farrar, 1981; Williams and Christiansen, 1981). Plummer (1977) also found a greater number of males than females (6.8:1 ratio) and attributed this difference to biased sampling. It was also possible that a female caught in a net during breeding season attracted many males (Plummer, 1977; Ream and Ream, 1966).

Gut Content Analysis

Trionyx muticus has been reported to be primarily carnivorous (Anderson, 1965; Ernst and Barbour, 1972). I found that insects were the most abundant component of the diet (84%) and plants were scarce (1%). My results are comparable with findings of Williams and Christiansen (1981) who found that insects made up 75% and plants only 1.2% of the T. muticus diet in Iowa. Such a low total percent volume of plant material being consumed suggests accidental ingestion (Williams and Christiansen, 1981). However, T. muticus has been known to take large quantities of plant material. Plummer and Farrar (1981) reported mulberries and cottonwood seeds made up 34.3% and 15.3%, respectively, of the male T. muticus' diet. In females, mulberries accounted for 16.3% of its diet. Other plant types reported in the T. muticus diet are algae, fruits, and hard nuts (Carr, 1952; Weid, 1865 in Anderson, 1965).

The greater variety in the diet of T. muticus early in the season may reflect a reduction in the variety of prey as the season progressed. However, no quantitative studies were done to determine if such changes in prey numbers actually occurred throughout the season.

Trionyx spiniferus ate more plant material than did T. muticus (12% as opposed to 1%). Similarly, Williams and Christiansen (1981) found that plant material comprised 12.8% of the diet of T. spiniferus. For the most part, however, T. spiniferus is also carnivorous. It feeds more heavily on decapods than does T. muticus. In this study decapods made up 13% of T. spiniferus', whereas they were absent in T. muticus' diet. Williams and Christiansen (1981) found only 1% decapods in T. muticus and 24.2% in T. spiniferus. Decapods were also found to be a common food item of T. spiniferus by Cochran and McConville (1983). This difference in the ingestion of decapods by softshells could be due to a stronger jaw structure in T. spiniferus (Webb, 1962 in Dalrymple, 1977) which allow for crushing (Dalrymple, 1977). It could also be attributed to difference in foraging location (Williams and Christiansen, 1981). In this study, rocks/sand made up 1% of T. muticus' diet and 12% of the diet of T. spiniferus suggesting the latter may be feeding more on the bottom. Williams and Christiansen (1981) also found a tendency for rocks/sand to be consumed more often by T. spiniferus than by T. muticus.

The third strictly riverine species, Graptemys ouachitensis, is more omnivorous than the softshells with 33% of its diet being plant material. A previous study (Vogt, 1981) reported that males are more carnivorous than females. In this study males were more herbivorous than the females with plants comprising 50% of the males' diet as opposed to 29% of the females' diet. However, my sample size (n=3) was too small to draw any definite conclusions. Vogt (1981) found that plants made up 31.5% of the females' diet, which is very close to what I found. Trichopterans made up a very large (59%) portion of the females' diet and occurred in 70% of the samples. When trichopterans were present in an individual, they made up most of that individuals' diet (95-100%). Vogt (1981) found similar results in a population of G. pseudogeographica and G. ouachitensis. In his study trichopterans and ephemeropterans were the only stomach contents of some individuals. He suggested that either some individuals are specializing in eating a particular food type, or that when these individuals happen upon a great abundance of a particular food type, they take advantage of it.

The diet of Trachemys scripta in all habitats comprised 80% plant material. Insects (Coleoptera and Hymenoptera) made up 10% of its diet. Marchand (1942) in Clark and Gibbons (1969) found similar results with 9% animal material in adult T. scripta from Florida and Moll and Legler (1971) found a total percent volume of 7.0% animal material in adult T. scripta from Panama.

Previous studies have shown juveniles to be more carnivorous than the adults (Clark and Gibbons, 1969; Hart, 1983; Moll, 1990; Moll and Legler, 1971). This dietary shift takes place in the first and second growing seasons and is essentially complete when the turtle reaches a plastron length of 64 mm (Clark and Gibbons, 1969). All Trachemys scripta in my study were over 64 mm in plastron length and so had already shifted to a more herbivorous diet. Other emydids such as Graptemys pseudogeographica and Chrysemys picta undergo a similar dietary shift (Ernst and Barbour, 1972; Marchand, 1942, and Pope, 1939 in Hart, 1983; Moll, 1976). An explanation for this dietary change is that when the turtles become larger, the energy expended on foraging for small carnivorous prey is not profitable (Clark and Gibbons, 1969; Marchand, 1942 in Hart 1983).

Riverine Trachemys scripta were the most herbivorous consuming 93% plant material while those in the sloughs ate 69% plants. A bird was found in only one digestive tract but it made up 17% of the total volume consumed. Why T. scripta in the river are more herbivorous than those found in the backwaters will be discussed in the diet overlap section.

Chelydra serpentina were found to be highly piscivorous (90% of the diet). Plants made up only a small portion of the diet (3%). Previous studies indicate that the diet of C. serpentina is highly variable. Alexander (1943, in Coulter, 1957) states

" ... there is a high correlation between the availability of various food items taken and the amounts of each taken...". Budhabhatti and Moll (1990) found that overall amounts of plant and animal food were equal in the diet in a northern Illinois population. Fish was the most important animal food comprising 24% of its diet. Coulter (1957) found 27% of the C. serpentina sampled that were living in an area of high aquatic bird density had eaten birds. What percentage of these birds are taken as carrion or were taken alive was not known. In Michigan, Lagler (1943) found that animal material comprised a total percent volume of 73.8% and plant material 36.2%; fish made up 35.4% of its diet. Hammer (1969) found plant material and molluscs to be the main component of the snapping turtle diet in South Dakota marshes. Such variability indicates that Chelydra serpentina is a highly opportunistic feeder.

Chrysemys picta was the most omnivorous species studied with 48% of its diet being plant and the remaining 52% animal. C. picta also consumed a significant amount of algae (36% of the diet). High algae consumption is not surprising because it has been documented (Ernst and Barbour, 1972) that C. picta forages among clusters of algae and other aquatic vegetation. As mentioned earlier, C. picta like T. scripta undergoes a dietary shift as it matures. The C. picta in this study were all adults and would therefore be less carnivorous than juveniles. Marchand (1942) in Anderson (1965) found that C. picta adults consumed 88% plant material by volume, which was mostly duckweed and algae. In juveniles, vegetation made up only 13% of the diet. In contrast, Ernst and Barbour (1972) reported that C. picta adults had a diet that consisted of 61.2% animal and 38.8% plant; algae made up 14% of the diet.

Diet Overlap

Three species (T. muticus, T. spiniferus, and G. ouachitensis) live exclusively in the river and feed on large amounts of aquatic insects. In order to explain how these species can coexist, feeding behavior must be considered. Of these three T. muticus and T. spiniferus had the highest diet overlap (69.9%). However, there is evidence these softshells are utilizing different microhabitats (Williams and Christiansen, 1981), thereby partitioning the niche. Trionyx spiniferus feeds more on the bottom and closer to the edge of the river while T. muticus feeds more in the water column. These generalizations were arrived at because of the differences in food items consumed and also by the amounts of rocks/sand incedentedly ingested. It should be noted that T. spiniferus was rare as compared to T. muticus in my sample. This difference in relative abundance might allow them to coexist or indicate that T. spiniferus is being replaced (Pianka, 1974). There is also some indication that intraspecific competition of _T. muticus_ is being reduced since males and females feed in different microhabitats, with females preferring the deeper waters (Plummer and Farrar, 1981). The diet overlap of all other species pairs that occurred in the same habitat was generally low, the next largest being 42.4% by _T. muticus_ and _G. ouachitensis._ Vogt (1981) reported that female _G. ouachitensis_ feeds on the surface of the water, however, the rather large amount of Trichoptera in the diet of Wabash _G. ouachitensis_ suggests bottom feeding. This could indicate a difference in microhabitat usage between the two species.

Since _T. scripta_ occurred in both the river and the sloughs, diet overlap was compared with sympatric species and allopatric species. Turtles occurring in the river had a higher overlap in diet with the _T. scripta_ from the slough than with the _T. scripta_ from the river. This could indicate that due to competition, there is more pressure to partition the niche and reduce diet overlap where they occur sympatrically. This could also explain why _T. scripta_ in the river are more herbivorous than in the sloughs, in as much as carnivorous specialists are working the river, animal food may be in relative short supply.

The _Chelydra serpentina_ (in the sloughs) had a higher overlap with the _T. scripta_ occurring in the same habitat than with the T. scripta in the river. This is opposite of the previous findings. However, the amounts of overlap were very small for both sites and probably of little significance.

Diets of male and female Graptemys ouachitensis only overlapped 23.7%. However, due to the small sample size and uncharacteristic results of the male's diet, this degree of overlap is inconclusive. Vogt (1981) did not measure diet overlap between males and females but noted that males are more carnivorous and females are more omnivorous. It would follow that intraspecific competition is reduced by males and females selecting different food items.

Diversity Index

The more specialized the species are in a given location, the greater the number that can coexist at that location (Pianka, 1974). While Horn's Index is useful in explaining the coexistence of species in this study, it is somewhat misleading in that plant material could only be broken down into two categories (vascular plant and algae) while animal material was broken down into finer categories. Hence, herbivorous turtles will appear to be very specialized even though they may feed on a wide variety of plants. Therefore this formula is useful in comparing carnivores, but difficulties arise when comparing a carnivore with an omnivore or herbivore.

The riverine *Trachemys scripta* has a specialized diet (H'= .254) by this system because it feeds primarily on plants. This probably allows coexistence with the more generalized carnivores, *T. muticus*, *T. spiniferus*, and the omnivore, *G. ouachitensis* (H'= 1.960, 1.488, and 1.511, respectively). The *Chelydra serpentina* in the sloughs also appears specialized (H'= .386) because they fed heavily on fish. The *T. scripta* in the sloughs, like the *T. scripta* in the river fed heavily on plants, but to a lesser degree, and thus appears as more of a generalist (H'=.928). The *C. serpentina* and the *T. scripta* are able to coexist in part because they specialized on different food items.

In conclusion, *Trionyx muticus* appears to be a very common species in the Wabash River in this location. *Graptemys ouachitensis* appeared in moderate amounts, while the other riverine turtles (*T. spiniferus*, *Trachemys scripta*, and *Chrysemys picta*) were quite rare. In the sloughs, *T. scripta* were the most common, followed by *Chelydra serpentina*, and *Chrysemys picta*. Most communities are similar to this, being comprised of one or two common species and many rare ones (Krebs, 1985).

Although perhaps not as apparent as in bird communities, at least three feeding guilds can be distinguished within this community of chelonians. The three riverine species (*T. muticus*, *T. spiniferus*, and

G. ouachitensis) comprise a guild that specializes in aquatic insects. Chelydra serpentina, in this study, depicts a piscivorous guild. Trachemys scripta portrays a guild specializing in aquatic macrophytes. Pseudemys concinna, another member of this herbivorous guild, occurs in the Wabash (Moll and Morris, 1991), but was not taken in this study. Lastly, the omnivorous Chrysemys picta demonstrates no particular specializations.

Through the specializations depicted in these guilds, competition is reduced and coexistence is possible. Whether these specializations were brought about because of competition or whether these species simply can coexist because of these specializations cannot be said definitely. However, the reduced numbers of T. spiniferus, the rather specialized diet of the Wabash Chelydra serpentina as compared to other areas, and the greater degree of herbivory of riverine Trachemys scripta compared to those in the sloughs, suggest that interspecific competition could have played a part.

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Table 1. Food class designations

Coleoptera
Diptera
Ephemeroptera
Hymenoptera
Lepidoptera
Odonata
Trichoptera*
Decapoda
Isopoda
Mollusca
Fish
Aves
Vascular Plant
Algae
Rocks/Sand

* Includes cases

Table 2. The number and general habitat of turtles collected.

Species	River	Sloughs
Trionyx muticus	50	
Trionyx spiniferus	4	
Graptemys ouachitensis	13	
*Trachemys scripta**	5	9
Chelydra serpentina		5
*Chrysemys picta**	1	2

*The habitat of one specimen is unknown.

Table 3. Dietary analysis of <u>Trionyx muticus</u> from the Wabash River in 1989. S denotes stomach sample (n=31), I denotes intestine sample (n=27), B denotes both stomach and intestine combined (n=46). Data are expressed in percentage. An asterisk (*) denotes an unmeasurable amount.

Taxon	Frequency of Occurrence			Individual Volume			Total Volume		
	S	I	B	S	I	B	S	I	B
Animal	93.5	100.0	95.7	81.6	29.4	62.0	80.6	29.4	61.7
Insect	83.9	92.6	87.0	74.3	19.0	50.5	72.1	18.4	48.8
Coleoptera	19.4	48.1	39.1	1.9	2.9	1.8	0.4	1.2	0.7
Coleoptera Dytiscidae	0.0	7.4	4.3	0.0	*	*	0.0	*	*
Coleoptera Hydrophilidae	3.2	0.0	2.2	*	0.0	*	*	0.0	*
Diptera	6.5	7.4	10.9	7.7	*	5.1	0.4	*	0.5
Diptera Chironomidae	0.0	7.4	4.3	0.0	*	*	0.0	*	*
Diptera Tabanidae	3.2	0.0	2.2	14.3	0.0	7.1	0.4	0.0	0.2
Ephemeroptera	51.6	59.3	52.2	70.3	16.4	44.0	54.9	13.5	36.7
Ephemeroptera Ephemeroidea	6.5	18.5	13.0	36.4	*	7.4	1.7	*	1.0
Heteroptera	16.1	18.5	21.7	*	*	*	*	*	*
Hemiptera	12.9	14.8	17.4	*	*	*	*	*	*
Hemiptera Corixidae	3.2	0.0	2.2	*	0.0	*	*	0.0	*
Homoptera	3.2	3.7	4.3	*	*	*	*	*	*
Homoptera Aphididae	0.0	3.7	2.2	0.0	*	*	0.0	*	*
Heteroptera	16.1	18.5	21.7	*	*	*	*	*	*
Hymenoptera	3.2	11.1	17.4	50.0	*	2.7	0.4	*	0.2
Hymenoptera Apidae	3.2	0.0	2.2	50.0	0.0	25.0	0.4	0.0	0.2
Hymenoptera Formicidae	0.0	0.0	6.5	0.0	0.0	*	0.0	0.0	*
Lepidoptera	6.5	0.0	6.5	10.0	0.0	8.6	1.3	0.0	0.7
Odonata	22.6	14.8	21.7	11.1	4.7	5.6	2.1	1.2	1.7
Odonata Zygoptera	9.7	3.7	8.7	5.6	*	1.6	0.4	*	0.2
Odonata Anisoptera	12.9	3.7	10.9	23.1	50.0	11.9	1.3	1.2	1.2
Plecoptera	6.5	0.0	4.3	*	0.0	*	*	0.0	*
Trichoptera	35.5	44.4	43.5	11.4	1.4	4.8	4.2	0.6	2.6
Insect Unknown	16.1	25.9	28.3	57.1	8.6	22.0	8.4	1.9	5.7
Crustacea	3.2	0.0	2.2	*	0.0	*	*	0.0	*
Mollusca	0.0	18.5	17.4	0.0	7.4	4.0	0.0	1.2	0.5
Mollusca Bivalvia	0.0	11.1	13.0	0.0	*	*	0.0	*	*
Mollusca Gastropoda	0.0	7.4	4.3	0.0	18.2	11.1	0.0	1.2	0.5
Fish	12.9	3.7	17.4	18.2	*	9.8	1.7	*	1.2
Unidentified Animal	38.7	40.7	60.9	42.1	32.7	35.8	6.8	9.8	11.2
Plant	51.6	48.1	52.2	1.1	*	0.6	0.8	*	0.5
Monocot	6.5	3.7	10.9	2.9	*	1.7	0.4	*	0.2
Lemnaceae	0.0	0.0	2.2	0.0	0.0	*	0.0	0.0	*
Poaceae	6.5	0.0	4.3	2.9	0.0	2.0	0.4	0.0	0.2
Dicot	35.5	25.9	34.8	1.5	*	0.6	0.4	*	0.3
Algae	0.0	3.7	2.2	0.0	*	*	0.0	*	*
Unidentified Plant	12.9	18.5	17.4	*	*	*	*	*	*
Rocks	9.7	18.5	30.4	*	5.3	2.5	*	1.2	0.5
Unidentified	61.3	92.6	73.9	57.9	73.4	57.1	18.6	69.4	37.3

Table 4. Dietary analysis of Trionyx spiniferus from the Wabash River in 1989. S denotes stomach sample (n=3), I denotes intestine sample (n=1), B denotes both stomach and intestine combined (n=4). Data are expressed in percentage. An asterisk (*) denotes an unmeasurable amount.

Taxon	Frequency of Occurrence			Individual Volume			Total Volume		
	S	I	B	S	I	B	S	I	B
Animal	100.0	0.0	75.0	76.9	0.0	76.9	76.9	0.0	24.7
Insect	100.0	0.0	75.0	7.7	0.0	7.7	7.7	0.0	2.5
Coleoptera	66.7	0.0	50.0	*	0.0	*	*	0.0	*
Ephemeroptera	100.0	0.0	75.0	7.7	0.0	7.7	7.7	0.0	2.5
Hymenoptera Formicidae	33.3	0.0	25.0	*	0.0	*	*	0.0	*
Trichoptera	33.3	0.0	25.0	*	0.0	*	*	0.0	*
Crustacea Decapoda	33.3	0.0	25.0	10.0	0.0	10.0	3.8	0.0	1.2
Fish	33.3	0.0	25.0	7.7	0.0	7.7	3.9	0.0	1.2
Unidentified Animal	66.7	0.0	50.0	69.6	0.0	69.6	61.5	0.0	19.8
Plant	33.3	0.0	25.0	10.0	0.0	10.0	3.9	0.0	1.2
Rocks/Sand	33.3	100.0	50.0	10.0	3.6	4.6	3.8	3.6	3.7
Unidentified	50.0	100.0	75.0	25.0	96.4	80.3	15.4	96.4	70.4

Table 5. Dietary analysis of *Graptemys ouachitensis* from the Wabash River in 1989. S denotes stomach sample (n=11), I denotes intestine sample (n=12), B denotes both stomach and intestine combined (n=13). Data are expressed in percentage. An asterisk (*) denotes an unmeasurable amount.

Taxon	Frequency of Occurrence			Individual Volume			Total Volume		
	S	I	B	S	I	B	S	I	B
Animal	100.0	83.3	92.3	88.2	83.3	84.4	88.2	81.8	83.4
Insect	81.8	66.7	76.9	80.7	82.9	81.4	70.0	73.2	72.4
Coleoptera	45.5	50.0	53.8	13.0	1.4	3.3	5.0	0.8	1.8
Coleoptera Scarabacidae	9.1	8.3	15.4	50.0	14.3	8.7	5.0	0.2	0.4
Coleoptera Hydrophilidae	9.1	0.0	7.7	*	0.0	*	*	0.0	*
Diptera Chironomidae	9.1	0.0	7.7	5.9	0.0	2.0	1.0	0.0	0.2
Ephemeroptera	18.2	16.7	30.8	*	*	*	*	*	*
Hymenoptera	9.1	16.7	23.1	*	*	*	*	*	*
Hymenoptera Apidae	0.0	8.3	7.7	0.0	*	*	0.0	*	*
Hymenoptera Formicidae	9.1	0.0	7.7	*	0.0	*	*	0.0	*
Odonata Zygoptera	0.0	8.3	7.7	0.0	*	*	0.0	*	*
Plecoptera	9.1	0.0	7.7	*	0.0	*	*	0.0	*
Trichoptera	63.6	50.0	61.5	79.8	85.2	82.2	64.0	72.4	70.4
Crustacea Isopoda	18.2	0.0	15.4	22.2	0.0	22.2	3.0	0.0	0.7
Mollusca Gastropoda	9.1	16.7	15.4	44.4	87.9	70.0	5.9	8.4	7.8
Fish	9.1	0.0	7.7	100.0	0.0	72.7	3.9	0.0	1.0
Unidentified Animal	27.3	8.3	30.8	22.4	11.1	5.9	5.4	0.2	1.5
Plant	63.6	66.7	76.9	3.6	17.9	5.1	2.0	3.9	3.4
Monocot	18.2	33.3	46.2	*	1.3	0.2	*	0.2	0.1
Poaceae	9.1	33.3	38.5	*	1.3	0.3	*	0.2	0.1
Dicot	45.5	50.0	53.8	4.4	17.6	4.2	1.5	2.0	1.8
Algae	9.1	16.7	15.4	50.0	27.2	26.9	0.5	1.2	1.0
Unidentified Plant	9.1	16.7	23.1	*	20.0	3.2	*	0.5	0.4
Unidentified	54.5	66.7	76.9	19.0	20.4	19.5	9.8	14.3	13.2

Table 6. Dietary analysis of Graptemys ouachitensis from the Wabash River in 1989. F denotes females (n=10) and M denotes males (n=3). Both stomach and intestine have been combined. Data are expressed in percentage. An asterisk (*) denotes an unmeasurable amount.

Taxon	Frequency of Occurrence		Individual Volume		Total Volume		
	F	M	F	M	F	M	
Animal	90.0	100.0	85.5	50.0	84.4	50.0	
Insect	80.0	66.7	83.7	8.7	74.4	8.3	
Coleoptera	50.0	66.7	3.0	8.7	1.6	8.3	
Coleoptera Hydrophilidae	10.0	0.0	*	0.0	*	0.0	
Coleoptera Scarabacadae	10.0	33.3	9.1	8.3	0.1	4.2	
Diptera Chironomidae	10.0	0.0	2.0	0.0	0.3	0.0	
Ephemeroptera	40.0	0.0	*	0.0	*	0.0	
Hymenoptera	20.0	33.3	*	*	*	*	
Hymenoptera Apidae	10.0	0.0	*	0.0	*	0.0	
Hymenoptera Formicidae	10.0	0.0	*	0.0	*	0.0	
Odonata Zygoptera	0.0	33.3	0.0	*	0.0	*	
Plecoptera	10.0	0.0	*	0.0	*	0.0	
Trichoptera	70.0	33.3	83.6	*	72.5	*	
Isopoda	10.0	33.3	7.7	*	0.8	*	
Fish	0.0	33.3	0.0	72.7	0.0	33.4	
Mollusca Gastropoda	10.0	33.3	80.8	*	8.0	*	
Unidentified Animal	30.0	33.3	5.2	16.7	1.2	8.3	
Plant	60.0	100.0	4.8	8.3	3.2	12.5	
Monocot	50.0	33.3	0.2	*	0.1	*	(+)
Poaceae	40.0	33.3	0.3	*	0.1	*	(+)
Dicot	40.0	100.0	4.0	8.3	1.7	8.3	(+)
Algae	20.0	0.0	28.6	0.0	1.0	0.0	
Unidentified Plant	20.0	0.0	3.4	*	0.4	*	
Unidentified	70.0	100.0	18.7	37.5	12.4	37.5	

(+) These categories combined have an extra total percent volume of 4.2

Table 7. Dietary analysis of *Trachemys scripta* from the Wabash River and sloughs thereof in 1989. S denotes stomach sample (n=11), I denotes intestine sample (n=3), B denotes both stomach and intestine combined (n=12). Data are expressed in percentage. An asterisk (*) denotes an unmeasurable amount.

Taxon	Frequency of Occurrence			Individual Volume			Total Volume		
	S	I	B	S	I	B	S	I	B
Animal	81.8	66.7	83.3	37.1	8.3	10.1	34.6	0.8	9.4
Insect	54.5	66.7	66.7	11.3	0.4	1.4	3.8	0.4	1.3
Coleoptera	36.4	66.7	50.0	20.0	0.4	1.0	2.2	0.4	0.8
Coleoptera Scarabacidae	9.1	0.0	8.3	25.0	0.0	25.0	1.1	0.0	0.3
Ephemeroptera	18.2	33.3	25.0	*	*	*	* (+)	*	* (¯)
Heteroptera	9.1	0.0	8.3	*	0.0	*	* (+)	0.0	* (¯)
Hymenoptera Formicidae	18.2	0.0	16.7	12.5	0.0	12.5	0.5	0.0	0.2
Lepidoptera	9.1	0.0	8.3	*	0.0	*	* (+)	0.0	* (¯)
Megaloptera	9.1	0.0	8.3	*	0.0	*	* (+)	0.0	* (¯)
Trichoptera	9.1	0.0	8.3	*	0.0	*	* (+)	0.0	* (¯)
Crustacea	9.1	0.0	8.3	*	0.0	*	*	0.0	*
Mollusca Bivalvia	0.0	33.3	8.3	0.0	0.7	0.7	0.0	0.4	0.3
Fish	18.2	33.3	16.7	27.7	*	6.5	12.6	*	3.2
Aves	9.1	0.0	8.3	96.6	0.0	96.6	15.4	0.0	3.9
Unidentified Animal	36.4	0.0	33.3	14.3	0.0	14.3	2.8	0.0	0.7
Plant	100.0	100.0	100.0	59.3	66.2	64.4	59.3	66.2	64.4
Monocot	72.7	100.0	83.3	58.6	22.7	23.9	22.5	22.7	22.6
Lemnaceae	45.5	33.3	41.7	63.8	*	13.9	20.3	*	5.2
Poaceae	36.3	66.7	50.0	*	33.8	26.0	*	20.4	15.2
Dicot	81.8	100.0	83.3	43.8	37.8	39.1	36.8	37.8	37.6
Saliaceae	0.0	33.3	8.3	0.0	41.7	41.7	0.0	3.8	2.8
Ulmaceae	0.0	33.3	8.3	0.0	*	*	0.0	*	*
Unidentified Plant	9.1	33.3	16.7	*	11.0	8.0	*	5.7	4.2
Rocks	9.1	0.0	8.3	*	0.0	*	*	0.0	*
Unidentified	36.3	66.7	41.7	42.3	68.1	65.7	6.1	33.0	26.2

(+) These categories combined hav a total percent volume of 1.1
(¯) These categories combined have a total percent volume of 0.3

Table 8. Dietary analysis of *Trachemys scripta* from the Wabash River and sloughs of the river in 1989. R denotes turtles from the main river (n=4) and S denotes turtles from the slough (n=7). Both stomach and intestine have been combined. Data are expressed in percentage. An asterisk (*) denotes an unmeasurable amount.

Taxon	Frequency of Occurrence		Individual Volume		Total Volume		
	R	S	R	S	R	S	
Animal	75.0	85.7	2.2	42.4	1.8	43.5	
Insect	75.0	57.1	1.7	9.6	1.4	5.9	
Coleoptera	75.0	28.6	1.7	20.0	1.4	2.4	
Coleoptera Scarabacadae	0.0	14.3	0.0	25.0	0.0	2.4	
Ephemeroptera	50.0	14.3	*	*	*	*	(+)
Heteroptera	0.0	14.3	0.0	*	0.0	*	(+)
Hymenoptera Formicidae	25.0	14.3	*	16.7	*	1.2	
Lepidoptera	0.0	14.3	0.0	*	0.0	*	(+)
Megaloptera	0.0	14.3	0.0	*	0.0	*	(+)
Trichoptera	0.0	14.3	0.0	*	0.0	*	(+)
Crustacea	25.0	0.0	*	0.0	*	0.0	
Fish	0.0	14.3	0.0	*	0.0	*	
Aves	0.0	14.3	0.0	96.6	0.0	32.9	
Unidentified Animal	25.0	42.9	50.0	11.4	0.4	4.7	
Plant	100.0	100.0	33.3	50.6	33.3	50.6	
Monocot	75.0	85.7	9.2	64.3	8.9	42.4	
Lemnaceae	25.0	57.1	0.5	78.3	0.4	42.4	
Poaceae	50.0	42.9	16.0	*	2.9	*	
Dicot	100.0	71.4	24.4	12.5	24.4	8.2	
Saliaceae	25.0	0.0	41.7	0.0	7.2	0.0	
Ulmaceae	25.0	0.0	*	0.0	*	0.0	
Unidentified Plant	0.0	14.3	0.0	*	0.0	*	
Rocks	0.0	14.3	0.0	*	0.0	*	
Unidentified	50.0	42.3	67.3	35.7	64.9	5.9	

(+) These categories combined have a total percent volume of 2.3.

Table 9. Dietary analysis of *Chelydra serpentina* from sloughs of the Wabash River in 1989. S denotes stomach sample (n=6). Data are expressed in percentage. An asterisk (*) denotes an unmeasurable amount.

Taxon	Frequency of Occurrence	Individual Volume	Total Volume
	S	S	S
Animal	100.0	97.5	97.5
Insect	50.0	*	*
Ephemeroptera	16.7	*	*
Crustacea Decapoda	33.3	6.3	3.9
Fish	83.3	88.0	84.7
Mollusca Bivalvia	16.7	*	*
Unidentified Animal	50.0	66.7	8.9
Plant	66.7	5.8	1.9
Monocot	50.0	*	*
Cyperaceae	16.7	*	* (+)
Lemnaceae	33.3	*	*
Poaceae	33.3	*	* (+)
Dicot Polygynaceae	16.7	*	* (+)
Unidentified Plant	33.3	10.0	1.3
Rocks/Sand	33.3	2.6	0.6
Unidentified	16.6	*	*

(+) These categories combined have a total percent volume of 0.6.

Table 10. Dietary analysis of <u>Chrysemys picta</u> from the Wabash River and sloughs thereof in 1989. S denotes stomach sample (n=4), I denotes intestine sample (n=2), B denotes both stomach and intestine combined (n=4). Data are expressed in percentage. An asterisk (*) denotes an unmeasurable amount.

Taxon	Frequency of Occurrence			Individual Volume			Total Volume		
	S	I	B	S	I	B	S	I	B
Animal	100.0	100.0	100.0	72.9	12.5	48.8	72.9	12.5	48.8
Insect	50.0	100.0	75.0	11.1	9.4	8.6	4.2	9.4	6.2
Coleoptera	25.0	100.0	50.0	16.7	3.1	4.3	2.1	3.1	2.5
Coleoptera Scarabacidae	0.0	50.0	25.0	0.0	7.1	5.0	0.0	3.1	1.2
Diptera	50.0	0.0	50.0	5.6	0.0	3.1	2.1	0.0	1.2
Diptera Chironomidae	50.0	0.0	50.0	*	0.0	*	*	0.0	*
Hemiptera Belostomatidae	25.0	0.0	25.0	*	0.0	*	*	0.0	*
Lepidoptera	0.0	50.0	25.0	0.0	*	*	0.0	*	*
Odonata Zygoptera	0.0	50.0	25.0	0.0	*	*	0.0	*	*
Ortroptera Bladidae	0.0	50.0	25.0	0.0	*	*	0.0	*	*
Unknown Insect	0.0	50.0	25.0	0.0	11.1	7.7	0.0	6.3	2.5
Mollusca Gastropoda	25.0	0.0	25.0	100.0	0.0	30.8	16.7	0.0	10.0
Crustacea	25.0	50.0	50.0	*	*	*	*	*	*
Fish	50.0	0.0	50.0	78.6	0.0	52.4	45.8	0.0	27.6
Aves	25.0	0.0	25.0	*	0.0	*	*	0.0	*
Unidentified Animal	25.0	50.0	50.0	25.0	7.1	12.5	6.2	3.1	5.0
Plant	50.0	100.0	75.0	38.9	31.2	29.3	14.6	31.2	21.2
Monocot <u>Juncus</u>	25.0	0.0	25.0	16.7	0.0	16.7	4.2	0.0	2.5
Dicot	25.0	100.0	50.0	*	3.1	1.7	*	3.1	1.2
Algae	50.0	100.0	75.0	22.2	28.1	22.4	8.3	28.1	16.2
Unidentified Plant	25.0	0.0	25.0	8.3	0.0	8.3	2.1	0.0	1.2
Unidentified	50.0	100.0	75.0	33.3	56.3	41.4	12.5	56.2	30.0

Table 11. Morisita's index and H' diversity index of turtles in the Wabash River and sloughs thereof in 1989. R denotes the locality of river, S denotes slough. T.m.= Trionyx muticus; T.sp.= Trionyx spiniferus; G.o.= Graptemys ouachitensis; T.sc.= Trachemys scripta; C.s.= Chelydra serpentina; C.p.= Chrysemys picta

	T.sp.-R	G.o.-R	T.sc.-R	T.sc.-S	C.s.-S	C.p.-R,S	H'
T.m.-R	.696	.424	.027	.043	.218	.192	1.960
T.sp.-R	____	.186	.199	.216	.445	.310	1.488
G.o.-R	____	____	.409	.442	.144	.359	1.511
T.sc.-R	____	____	____	.935	.003	.208	.254
T.sc.-S	____	____	____	____	.031	.231	.928
C.s.-S	____	____	____	____	____	.432	.386
C.p.-R,S	____	____	____	____	____	____	1.551

Figure 1. Dietary analysis of *Trionyx muticus* from the Wabash River (n=23). Percentages represent total volume of each food category.

DIET-TRIONYX MUTICUS

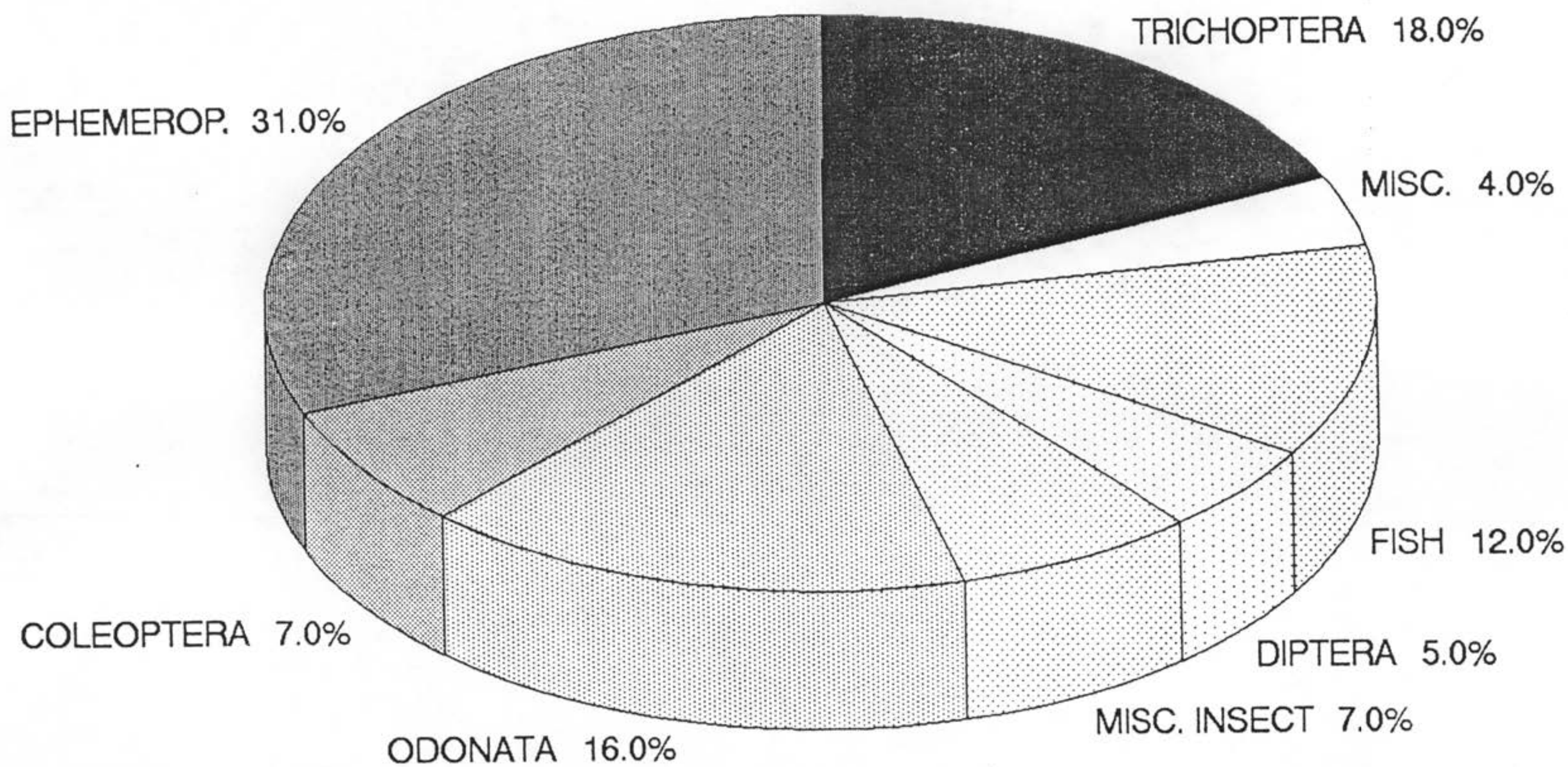

Figure 2. Dietary analysis of *Trionyx muticus* from April 17-May 5 (n=17). Percentages represent total volume of each food category.

DIET-TRIONYX MUTICUS
EARLY

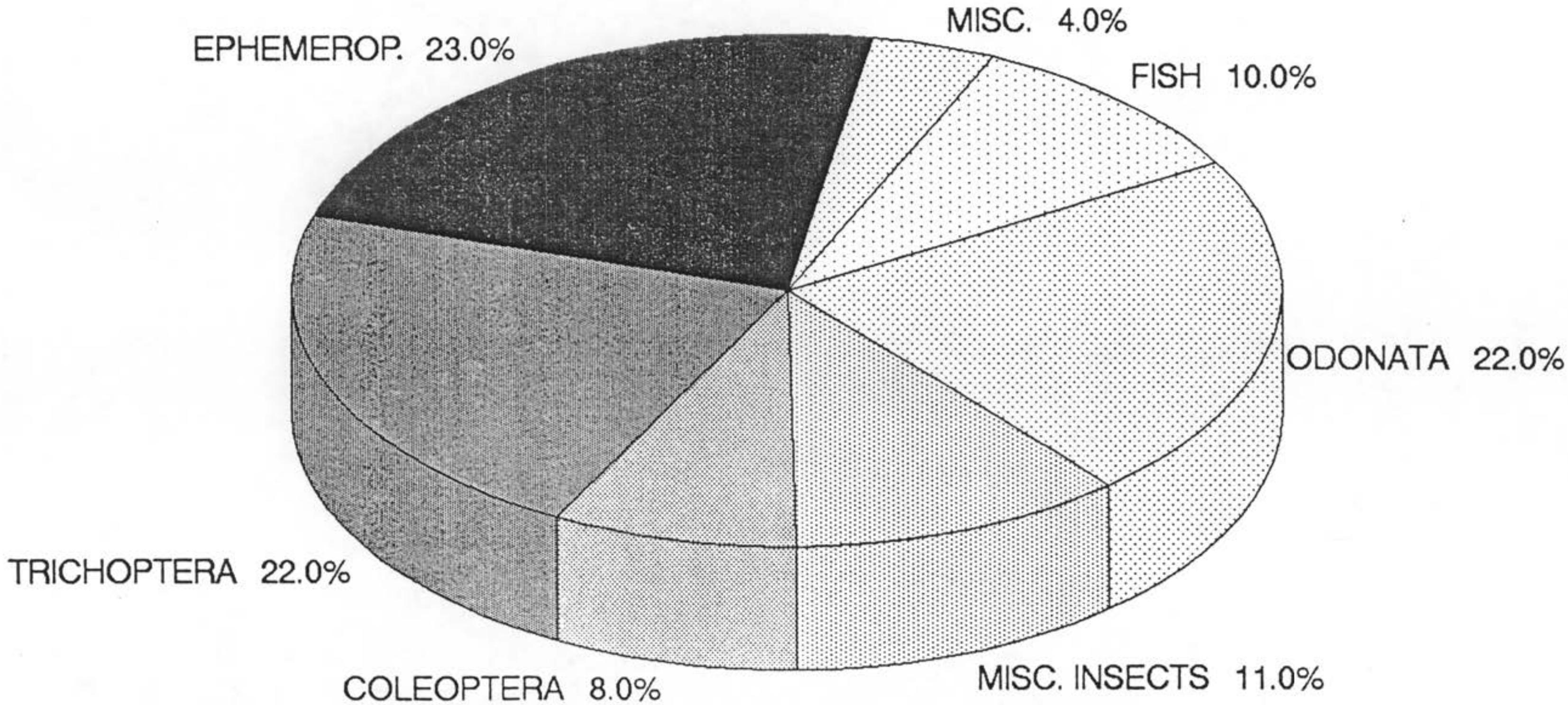

Figure 3. Dietary analysis of <u>Trionyx muticus</u> from June 24-July 15 (n=5). Percentages represent total volume of each food category.

DIET-TRIONYX MUTICUS
LATE

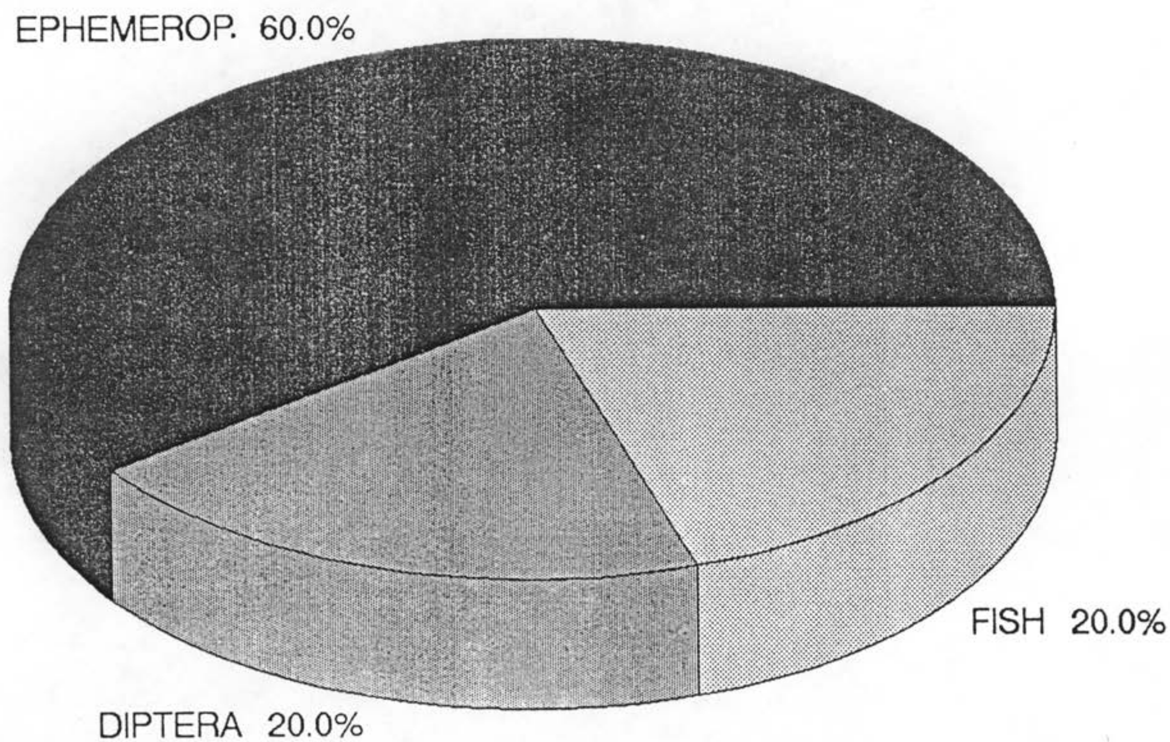

Figure 4. Dietary analysis of *Trionyx spiniferus* from the Wabash River (n=2). Percentages represent total volume of each food category.

DIET-TRIONYX SPINIFERUS

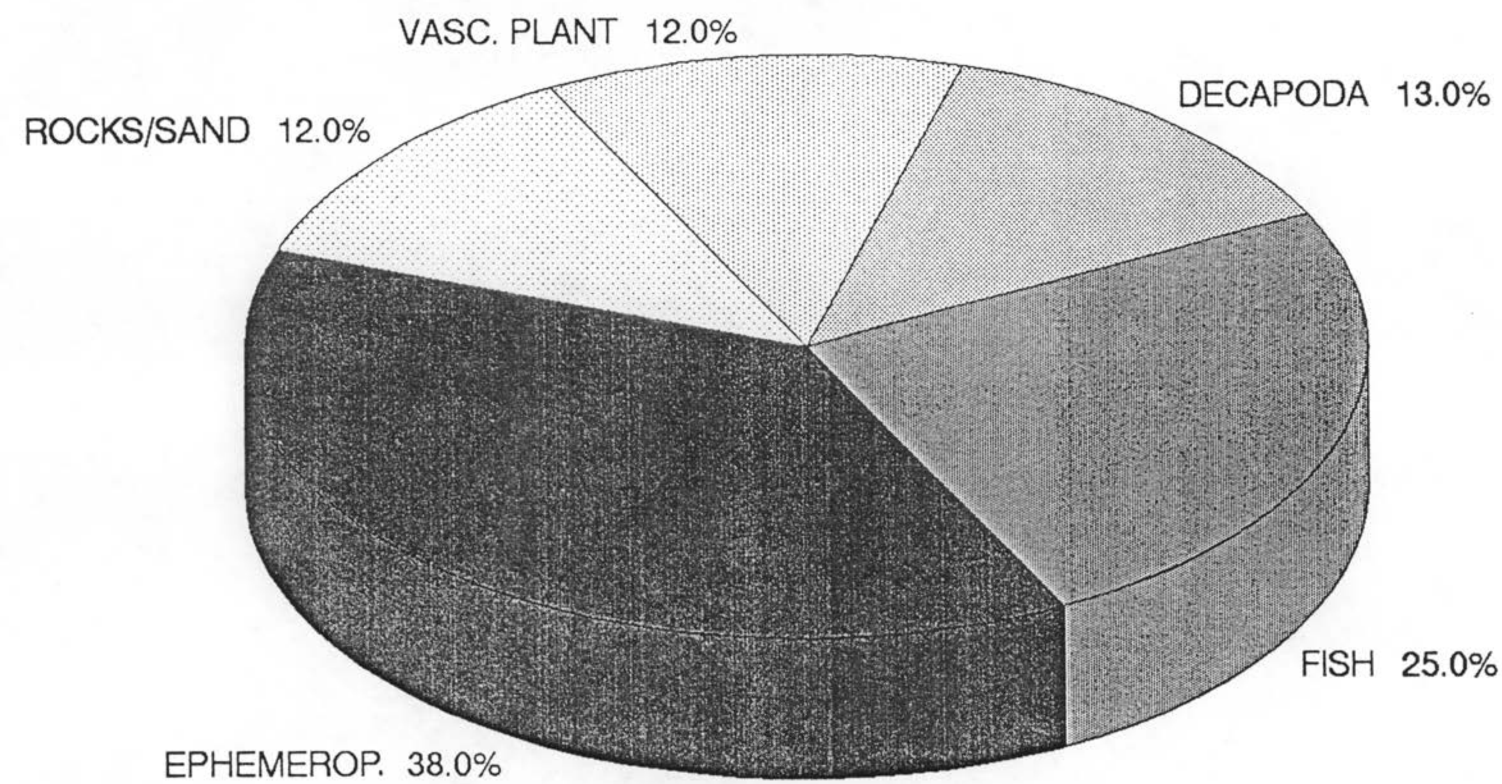

Figure 5. Dietary analysis of *Graptemys ouachitensis* from the Wabash River (n=13). Percentages represent total volume of each food category.

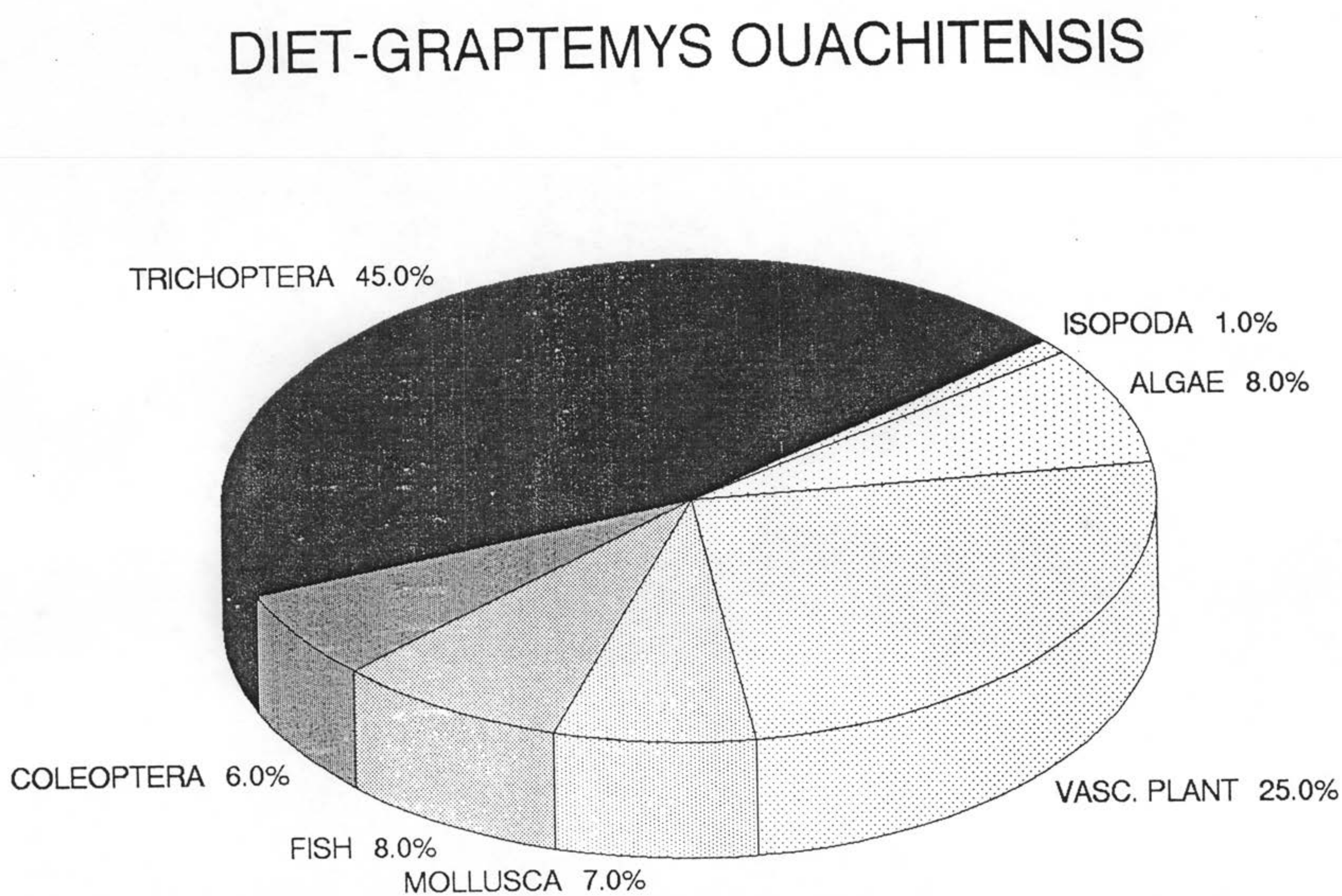
DIET-GRAPTEMYS OUACHITENSIS
TRICHOPTERA 45.0%
ISOPODA 1.0%
ALGAE 8.0%
VASC. PLANT 25.0%
MOLLUSCA 7.0%
FISH 8.0%
COLEOPTERA 6.0%

Figure 6. Dietary analysis of female *Graptemys ouachitensis* (n=10). Percentages represent total volume of each food category.

DIET-GRAPTEMYS OUACHITENSIS
FEMALE

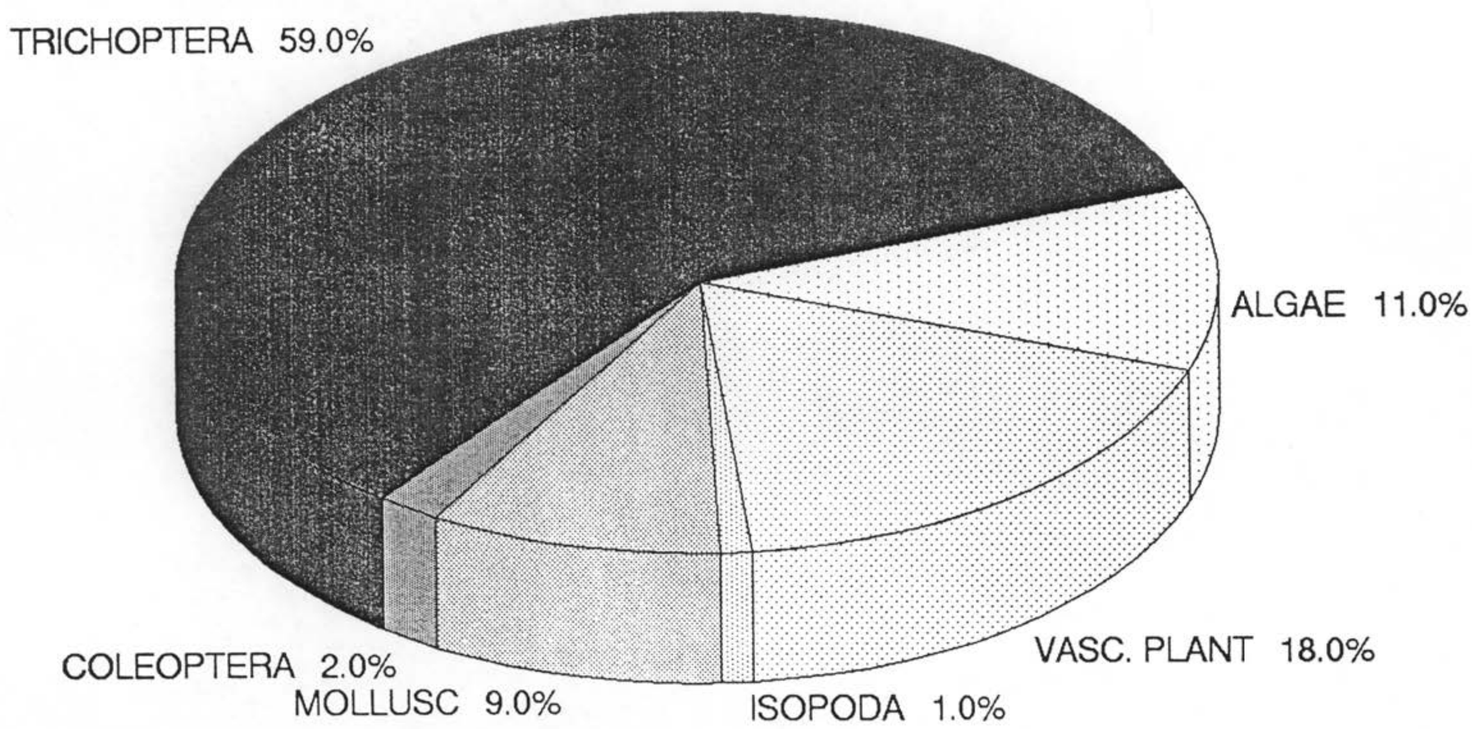

Figure 7. Dietary analysis of male *Graptemys ouachitensis* (n=3). Percentages represent total volume of each food category.

DIET-GRAPTEMYS OUACHITENSIS

MALE

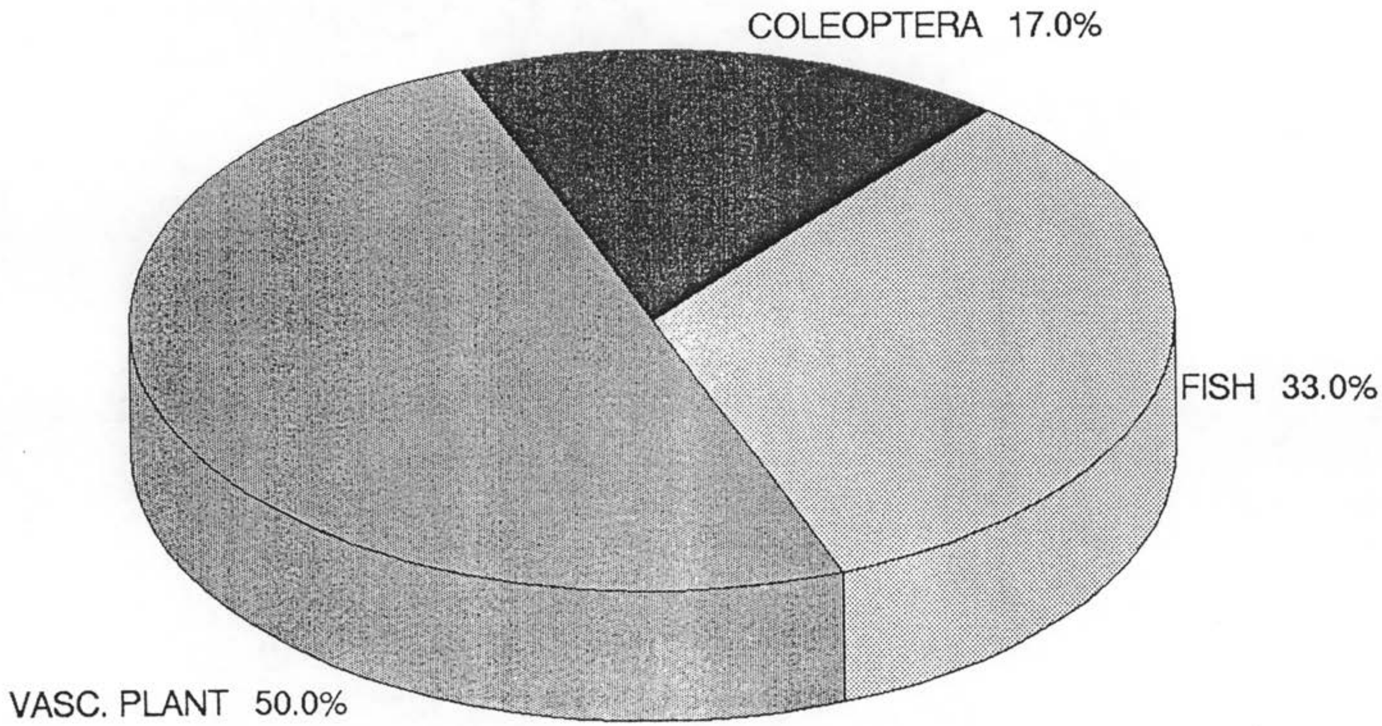

Figure 8. Dietary analysis of Trachemys scripta from the Wabash River and the sloughs thereof (n=11). Percentages represent total volume of each food category.

DIET-TRACHEMYS SCRIPTA

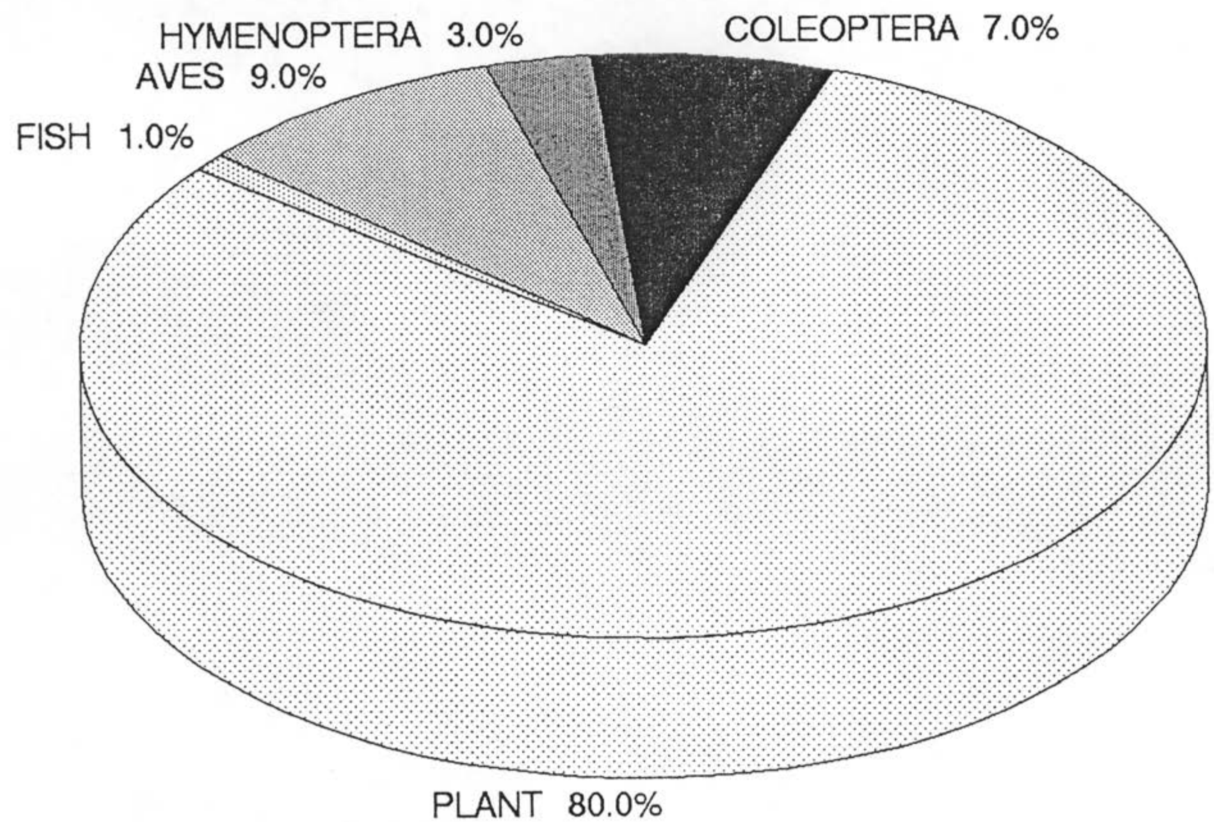

Figure 9. Dietary analysis of Trachemys scripta from the Wabash River (n=4). Percentages represent total volume of each food category.

DIET-TRACHEMYS SCRIPTA
RIVER

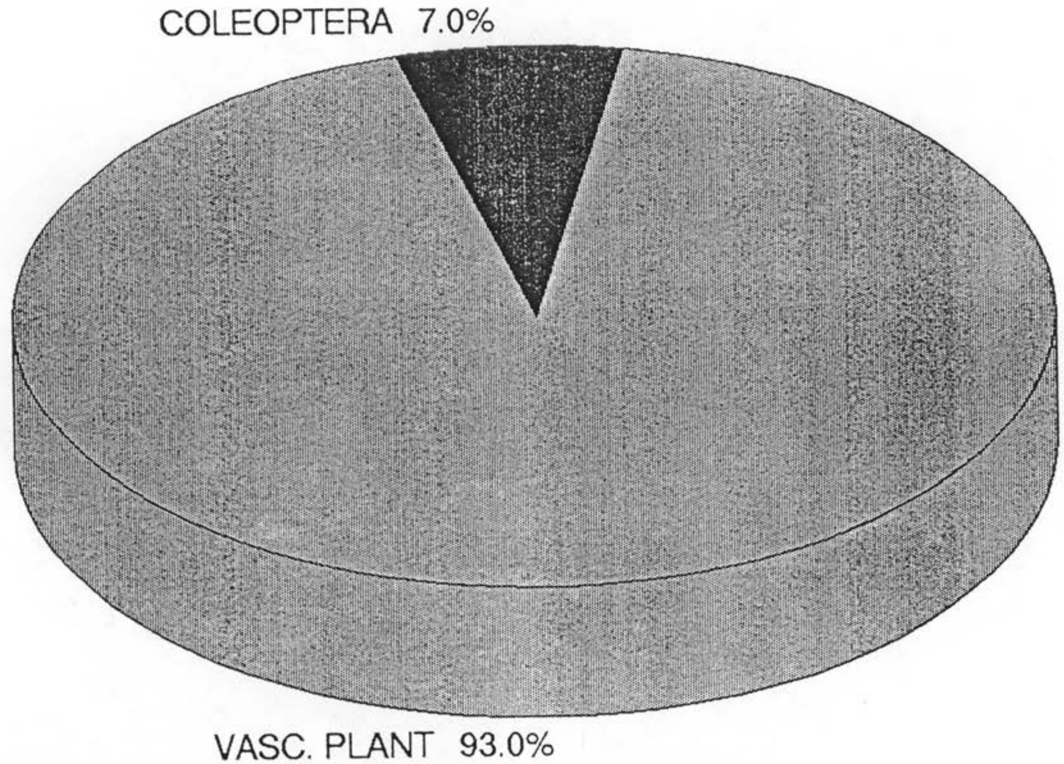

Figure 10. Dietary analysis of *Trachemys scripta* from the sloughs of the Wabash River (n=6). Percentages represent total volume of each food category.

DIET-TRACHEMYS SCRIPTA
SLOUGH

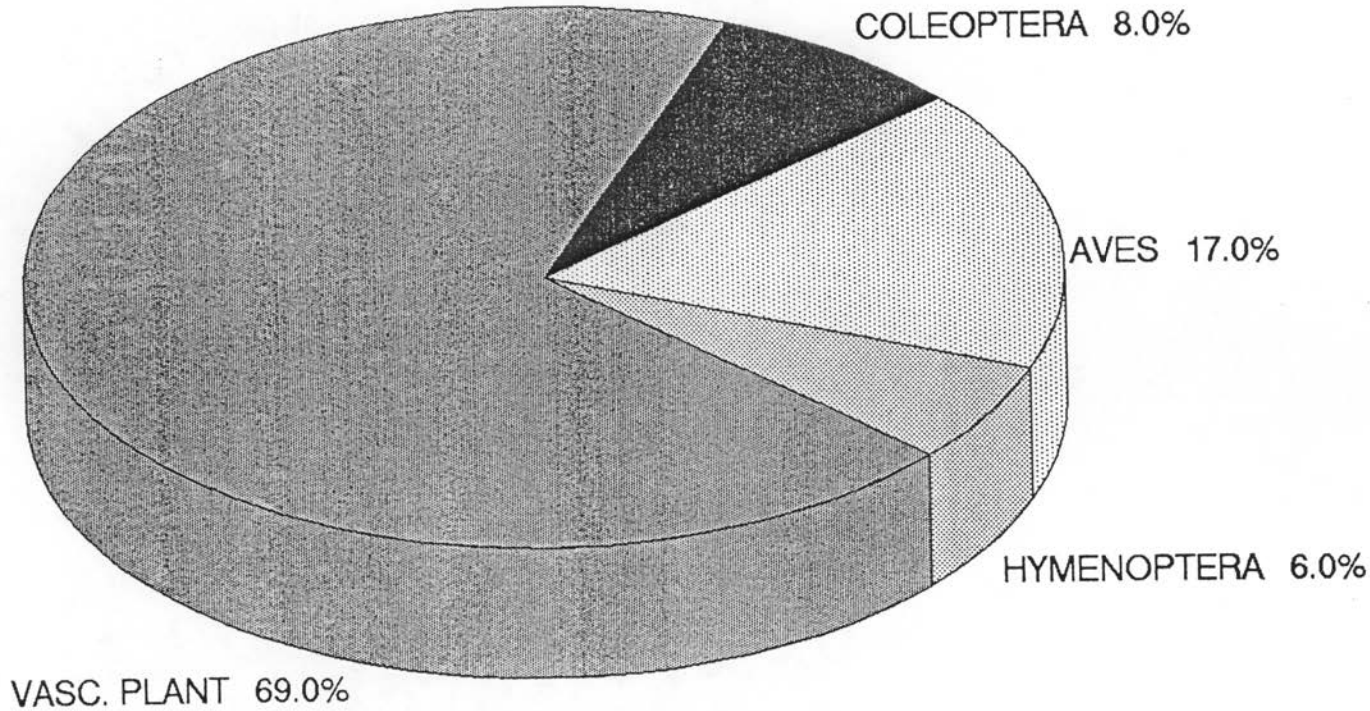

Figure 11. Dietary analysis of _Chelydra serpentina_ from the sloughs of the Wabash River (n=5). Percentages represent total volume of each food category.

DIET-CHELYDRA SERPENTINA

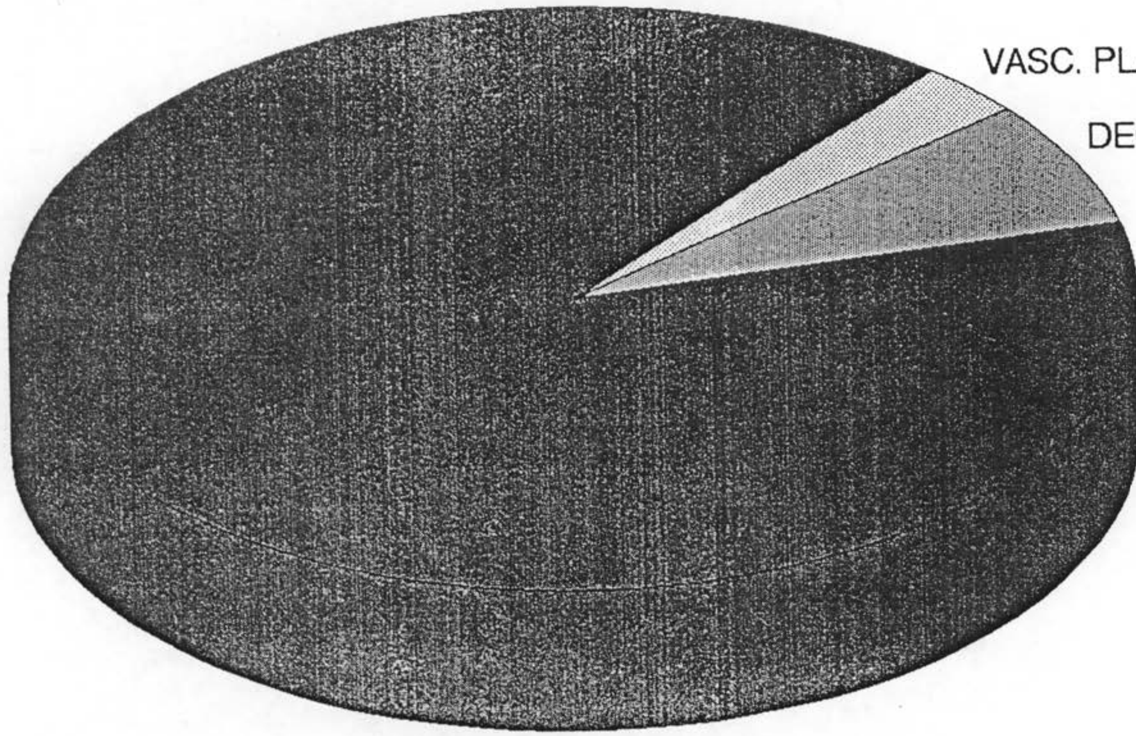

Figure 12. Dietary analysis of Chrysemys picta from the Wabash River and the sloughs thereof (n=4). Percentages represent total volume of each food category.

DIET-CHRYSEMYS PICTA