Food Habits of Flathead Catfish in the Cape Fear River, North Carolina

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Abstract: Food habits of flathead catfish (*Pylodictis olivaris*) in the Cape Fear River were determined through analysis of 184 stomachs collected during the spring and summer of 1986. Fish were collected with a 5-bar, hand-cranked telephone generator (magneto). The objective was to determine if frequency of occurrence and percent by numbers of individual food items in the diet of flathead catfish changed significantly between 1979 and 1986. Current data indicate ictalurids, clupeids, and centrarchids remain the primary food items in the diet of Cape Fear River flathead catfish; however, a shift from ictalurids to clupeids as the primary food item occurred between 1979 and 1986. Centrarchids occurred with equal frequency in flathead catfish stomachs during 1979 and 1986 but were less numerous in the 1986 samples. There is no evidence to support anglers' claims that flathead catfish may be responsible for the reputed decline in sunfish populations within the river. Decapods were more abundant in flathead catfish stomachs in 1986 while frequency of occurrence remained unchanged. Pelecypods were less abundant in the 1986 samples but occurred with significantly higher frequency.

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Flathead catfish were first introduced to the Cape Fear River in 1966 when 11 adults weighing a total of 107.0 kg were released near Fayetteville, North Carolina, by North Carolina Wildlife Resources Commission (NCWRC) personnel. Flathead catfish is a solitary species preferring medium to large rivers with deep holes and abundant drift piles, sunken logs, log jams, and standing timber (Minckley and Deacon 1959, Cross 1967, Morris et al. 1968, Pflieger 1975, Glodek 1980). Guier et al. (1981) documented the establishment of a reproducing flathead catfish population in 1976 with the collection of 5 specimens representing several age groups. Since its introduction the flathead catfish population has expanded to inhabit 201 km of the mainstream Cape Fear and is considered the top level predator within the system (Guier et al. 1981).

The flathead catfish is a highly predatory species and was suspected of having adverse effects on the native fish species of the Cape Fear River. As early as 1970 NCWRC fisheries biologists received reports from local fishermen that native bullhead (*Ictalurus* spp.) populations were declining. The fishermen attributed this decline to flathead catfish predation. Apparently, rapid expansion of the flathead catfish population during the mid-1970s resulted in a tremendous reduction in the bullhead population. This study was initiated in response to complaints from local fishermen concerning a perceived decline in sunfish (*Lepomis* spp.) populations in the river. The objective of this study was to determine if frequency of occurrence and percent by numbers of individual food items of flathead catfish in the Cape Fear River have changed significantly since 1979.

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Methods

The Cape Fear River forms at the confluence of the Deep and Haw rivers in Piedmont, North Carolina and flows southeasterly for approximately 274 km where it discharges into the Atlantic Ocean at Cape Fear near Southport. Ninety percent of the drainage basin lies within the Coastal Plain and encompasses an area of approximately 1,916,600 ha. Below river Km 219, the river is regulated during low and moderate stages by 3 federal navigation locks and dams. The lunar tidal influence extends from the mouth of the river upstream to Lock and Dam No. 1, a distance of approximately 113 km.

Flathead catfish were collected from 1 April 1986 through 30 September 1986 from the mainstream Cape Fear River at Fayetteville, Tarheel/Elizabethtown, Elwell's Ferry, and Riegelwood. All flathead catfish collected during this study were taken with a 5-bar, hand-cranked telephone generator (Morris and Novak 1968). Morris and Novak (1968) reported flathead catfish are particularly susceptible to capture using this device. The collecting operation was conducted using a shocking boat and a pickup or chase boat which was used to chase and capture catfish stunned by the electrofisher. Areas shocked included drift piles, log jams, sunken logs, and standing timber located in the deeper pool areas along both banks.

Stomach contents were collected from all flathead catfish exceeding 1.0 kg in weight using the pulsed gastric lavage technique (Foster 1977). Approximately 25.0% of all fish were sacrificed to verify the effectiveness of the technique. Individual food items were identified (if possible), sorted, counted, and weighed.

Food habit data (frequency of occurrences, percent by numbers) collected during this study were statistically compared ($\alpha = 0.05$) with food habit data collected by Guier et al. (1981) using the following statistical test for comparing the equality of 2 percentages (Sokal and Rohlf 1969):

$$t_s = \frac{\arcsin \sqrt{p_1} - \arcsin \sqrt{p_2}}{\sqrt{820.8 \left(\frac{1}{N_1} + \frac{1}{N_2} \right)}}$$

where

p_1 = the proportion of food item 1 in the 1979 samples
p_2 = the proportion of food item 1 in the 1986 samples
N_1 = sample size for 1979
N_2 = sample size for 1986
820.8 = a constant representing the parametric variance of a distribution of arcsine transformations of proportions or percentages.

All significance testing was conducted at the $\alpha = 0.05$ level of significance.

Results

Examination of stomachs from sacrificed fish indicated pulsed gastric lavage removed approximately 100% of all material present. Occasionally, a large particle would become lodged in the esophagus and require removal with forceps. It is an excellent technique for collecting stomach contents without injury to the fish.

Average total length and weight of all flathead catfish collected during the study was 65.0 cm (33.0 cm to 112.0 cm) and 4.5 kg (1.0 kg to 21.5 kg). Stomachs from 184 flathead catfish were examined and analyzed (Table 1). Fifty-five percent (102) of the stomachs were empty. Fish were the dominant food item in the diet of Cape Fear River flathead catfish during 1986. They occurred in 86.0% of the stomachs containing food and accounted for 65.5% by number and 97.0% by weight of all food items consumed by flathead catfish during 1986. Clupeids were the dominant food group in the diet. White shad (*Alosa sapidissima*) accounted for approximately 51.0% of the diet by weight during 1986; however, the shad only occurred in stomachs collected during April and May, suggesting their consumption may be related to seasonal influences (distribution and abundance). White shad weighing 1.1 kg and 1.5 kg occurred in the stomachs of flathead catfish weighing 6.5 kg and 17.2 kg, respectively.

Ictalurids, primarily white catfish (*Ictalurus catus*), blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), and flathead catfish, were the second most abundant forage items consumed by flathead catfish. Two specimens of snail bullhead (*Ictalurus brunneus*) were the only other ictalurids observed in the diet of Cape Fear River flathead catfish.

Centrarchids (*Lepomis macrochirus* and *L. microlophus*) occurred in only 9.0% of the stomachs containing food (Fig. 1) and were a relatively small compo-

Table 1. Percent numbers and weights of food items in stomachs of flathead catfish collected from the Cape Fear River, North Carolina during 1986 (N = 82).

Food item	% no.	% wt.
Astacidae	8.62	1.19
Palaemonidae	2.87	0.03
Pelecypoda	18.39	0.41
Gastropoda	0.57	0.07
Brachyura	1.72	1.21
Terrestrial insects	1.72	0.03
Tricoptera	0.57	0.02
Osteichthyes		
Lepisosteus osseus	4.02	0.70
Alosa sapidissima	4.60	50.70
Dorosoma cepedianum	7.47	6.39
Notropis *spp.*	16.09	0.56
Ictalurus brunneus	1.15	1.32
I. catus	2.87	0.24
I. furcatus	2.87	20.11
I. punctatus	2.87	6.75
Pylodictis olivaris	0.57	0.18
Lepomis macrochirus	3.45	3.16
L. microlophus	1.15	0.29
Perca flavescens	0.57	0.42
Leiostomus xanthurus	1.15	1.71
Paralicthyes lethostigma	0.57	0.22
Unidentified fish remains	16.09	4.29
Totals	99.95	100.00

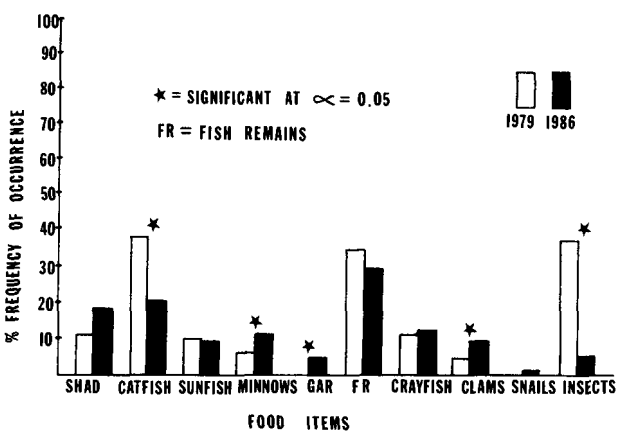

Figure 1. Percent frequency of occurrence of food items occurring in flathead catfish stomachs collected from the Cape Fear River, North Carolina, during 1979 (from Guier 1981) and 1986 (from present study).

nent of the diet. Cyprinids were common in the flathead catfish diet during 1986 but accounted for less than 1.0% by weight of the diet. Other fish of minor occurrence in the diet were longnose gar (*Lepisosteus osseus*) and yellow perch (*Perca flavescens*). Decapods (crayfish) and pelecypods (freshwater clams) were relatively abundant in the diet but did not account for a major proportion (by weight) of the food items consumed.

Discussion

Fairly large samples sizes ($N \geq 500$) are required when conducting food habit studies aimed at detecting significant differences among food groups between study years (K. Pollock, pers. commun.). It is difficult to detect significant differences between percentages or proportions when the actual difference between them is small (i.e., 10.0% to 9.0% = 1.0% versus 30.0% to 10.0% = 20.0%). Our small sample sizes may possibly obscure significant differences between food item groups when differences between proportions are small. Therefore, we encourage caution in interpreting our food habit data when the results indicate no significant difference.

Flathead catfish exceeding 30 cm feed primarily on fish (Minckley and Deacon 1959; Turner and Summerfelt 1970; Pflieger 1975; J. C. Borowa, unpubl. rep. F–22, N.C. Wildl. Resour. Comm. 1982). In a 1979 study of the stomachs from 105 Cape Fear River flathead catfish, Guier et al. (1981) reported they fed predominantly on ictalurids (39.0%), clupeids (12.0%) and centrarchids (10.0%) (Fig. 1). Data collected during the present study indicate flathead catfish are still utilizing these forage items. Shad were consumed with equal frequency in 1979 and 1986 but a significantly higher number occurred in the 1986 diet. However, there was a significant reduction of ictalurids, in both frequency of occurrence and percent by numbers, indicating a possible shift in food habits from ictalurids to clupeids between study years.

Shad availability is dependent upon the annual shad run up the river which normally occurs between 15 March and 1 May in any given year. Guier et al. (1981) conducted their sampling in May, June, August, and September of 1979 while sampling was conducted from April through September during the present study. The apparent shift in food habits from ictalurids to clupeids was the result of the temporal difference in sampling schedules between the 2 studies. By beginning their sampling in May, Guier et al. (1981) missed the majority of the shad run up the river in 1979 and therefore their food habit data did not adequately reflect the true percentage of shad (especially white shad) in the flathead catfish diet for 1979. In addition, the shad forage base (especially white shad) available to flathead catfish in 1986 could have been much larger than that available in 1979 and could be another explanation for the shift in food habits. More white shad were observed coming back down the river in 1986 than in the past 5 to 6 years (Earl Russell, pers. commun.). The majority of adult white shad returning down river die and sink to the bottom becoming easy forage for flathead catfish.

Edmundson (J. P. Edmundson, unpubl. rep., W. Va. Dept. of Natl. Resour. 1974) reported sunfish were the dominant forage consumed by flathead catfish in Bluestone Reservoir, West Virginia. Sunfish occurred in approximately 10.0% of the flathead catfish stomachs examined by Guier et al. (1981). There was no significant difference in the frequencies of occurrence of centrarchid food items in the flathead catfish diets between 1979 and 1986 (Fig. 1). There were, however, significantly fewer sunfish in the 1986 diet indicating sunfish were not as heavily foraged in 1986 (Fig. 2). A decline in available sunfish between 1979 and 1986 could explain the lower number of sunfish in the 1986 diet; however, there are no data to support anglers' claims that flathead catfish are responsible for the reputed decline in sunfish populations in the Cape Fear River.

Ictalurids and cyprinids were the principal food items consumed by flathead catfish in the Missouri River (Morris et al. 1968). There was a significantly higher proportion (both in frequency of occurrence and percent total numbers) of cyprinid food items in the 1986 diet. According to Hackney (1965), flathead catfish selected centrarchids and ictalurids over cyprinids in experiments conducted in plastic-lined pools and earthen ponds. There was no significant difference in the proportion of unidentified fish remains comprising the diet between 1979 and 1986.

Previous studies (Morris et al. 1968, Pflieger 1975) have indicated crayfish can serve as a major food item in the diet of flathead catfish. The number of crayfish consumed in 1986 was significantly higher than the number consumed during 1979 (Fig. 2) but frequency of occurrence remained the same, indicating more crayfish may have been available for consumption during 1986. Frequency of occurrence of freshwater clams was significantly higher in the 1986 samples while the percent total numbers was significantly lower. This may indicate either preference for clams by flathead catfish increased during 1986 or that fewer clams were available for consumption.

In summary, the diet of flathead catfish in the Cape Fear River between 1979 and 1986 remained fairly constant. A shift from catfish to shad as the primary food

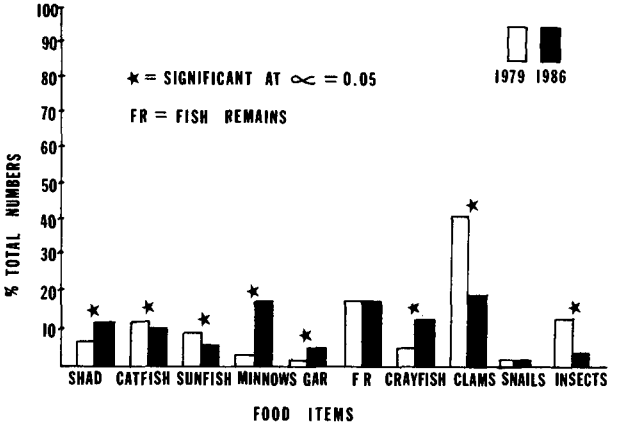

Figure 2. Percent total numbers of food items occurring in flathead catfish stomachs collected from the Cape Fear River, North Carolina, during 1979 (from Guier 1981) and 1986 (from present study).

item occurred between 1979 and 1986. This shift was probably the result of temporal differences between sampling schedules between 1979 and 1986, the result of more shad in 1986, or both. Sunfish were consumed with equal frequency in 1979 and 1986 but occurred in fewer numbers in the 1986 samples. This indicated a possible decline in sunfish since 1979. There are no data to support anglers' claims that flathead catfish are responsible for the reputed decline in sunfish populations within the Cape Fear River. Crayfish were more abundant in flathead catfish stomachs during 1986 while frequency of occurrence remained unchanged. Finally, freshwater clams were less abundant in flathead catfish stomachs in 1986 but occurred with significantly higher frequency.

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