FOODS OF CHANNEL CATFISH DURING FLOODING OF THE TOMBIGBEE RIVER, MISSISSIPPI[1]

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Abstract: Food items of 29 channel catfish (*Ictalurus punctatus*) collected during flooding of the Tombigbee River, Mississippi were almost exclusively composed of insects although other arthropods and in 1 case 2 rodents were eaten. Terrestrial insects composed 84.7%, by weight, of the food eaten by catfish taken during floods compared to 1.2%, by weight, of the stomach contents of 15 catfish taken during normal flow conditions. Members of the orders Rodentia, Oligochaeta, Orthoptera and Trichoptera were the dominant foods, by weight, during flood conditions, contributing 64.4, 6.1, 6.0 and 5.8%, respectively. The stomach contents, by weight, of the catfish taken during normal flow were composed mainly of fish (51.0%), trichopterans (17.4%) and crayfish (12.9%).

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The literature is replete with food habit studies demonstrating that channel catfish (*Ictalurus punctatus*) are omnivorous and opportunistic feeders (Forbes 1888, Shira 1917, Boesel 1938, Bailey and Harrison 1945, and Hesse et al. 1979). Few food habit analyses have been conducted using fish captured during flood flows. Studies of food habits of channel catfish collected under conditions of normal flow generally indicate that while an occasional terrestrial organism was taken, the vast majority of the food items was of aquatic orgin. Clemens (1952) attributed miscellaneous terrestrial organisms eaten by channel catfish collected from Tenkiller Reservoir, Oklahoma as victims of recent innundation. The reservoir was rising at the rate of 10 cm/day during the sampling period. Coincidental to a channelization study on the Luxapalila River, Arner et al. (1976) found that channel catfish captured behind innundated levees during periods of flooding fed heavily on terrestrial oligochaetes.

Little has been done to investigate the potentially beneficial influences that flooding may have on the fish of a particular ecosystem. The purpose of this study was to further investigate the food habits of channel catfish during periods of flooding.

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METHODS

Twenty-nine channel catfish were collected in 80 net-days with hoop and gill nets in the Tombigbee River, Mississippi during March and April floods of 1980 and in January 1981 during the filling of the Columbus Pool of the Tennessee-Tombigbee Waterway (Tombigbee River). Twenty sampling stations ranged from the mouth of the Buttahatchie River to 4.8 km north of Hairston Bend (Fig. 1). Nets were set in wooded areas, over grassy fields, and over freshly plowed bare soil. All nets were checked every 24 hours and the catch removed. Channel catfish were placed in labeled plastic bags and transported to Mississippi State University and frozen. Benthic samples were attempted, but not enough samples for adequate analyses were collected.

Fish were later thawed, measured (total length mm) and weighed (g) and a pectoral spine was removed for sectioning and aging as described by Muncy (1959). Stomachs were removed, placed into sealable plastic bags, and preserved with 10% formalin. Stomachs were later removed from their containers and drained on paper toweling. Stomach contents were washed into petri dishes. Wet weights of stomach's contents were determined by substracting weights of the empty stomachs from the values recorded for the full stomachs. Stomach contents were examined under a binocular dissecting microscope at 15× and 30× magnification. Identification was based upon standard taxonomic keys (Ward and Whipple 1959, Borror and White 1970, Pennak 1978). Frequency of occurrence and weight were recorded for each taxon identified. Food item analyses were also conducted on stomachs of 15 channel catfish collected during April 1980, while the Tombigbee River was at normal in-stream flow.

RESULTS AND DISCUSSION

Stomach contents of channel catfish collected during flooding were almost exclusively composed of insects although other arthropods and in 1 case 2 rodents were eaten (Table 1). Neither fish nor identifiable plant materials were found in any of the stomachs. A cotton rat (*Sigmodon hispidus*) and a golden mouse (*Ochrotomys nuttalli*) found in 1 stomach comprised 64.4% of the weight of all food items. The consumption of rodents may be atypical of catfish food habits; however, Forbes (1888) reported finding a rat in 1 channel catfish stomach. Terrestrial oligochaetes (6.1%), orthopterans (6.0%), and aquatic trichopterans (5.8%) contributed approximately the same percentage of the weight of the food items. Members of the Coleptera (2.8), Megaloptera (3.4%), and Chilopoda (2.5%) also contributed significantly to the total weight.

Trichopterans appeared more frequently (27.6% occurrence) than members of other orders, but both araneidans and terrestrial oligochaetes occurred in 24.1% of the catfish stomachs. Trichopterans composed 40.3% of the total food items. Centipedes (order Chilopoda) represented 12.4% while isopods (*Asellus*) represented 10.9% of the diet.

Terrestrial organisms occurred in 62.1% of the stomachs compared to 58.6% occurrence for aquatic organisms. Although aquatic organisms were more numerous (64.3% composition) than terrestrial organisms (35.7% composition), terrestrial food items accounted for 84.7% of the weight of the stomach contents while aquatic

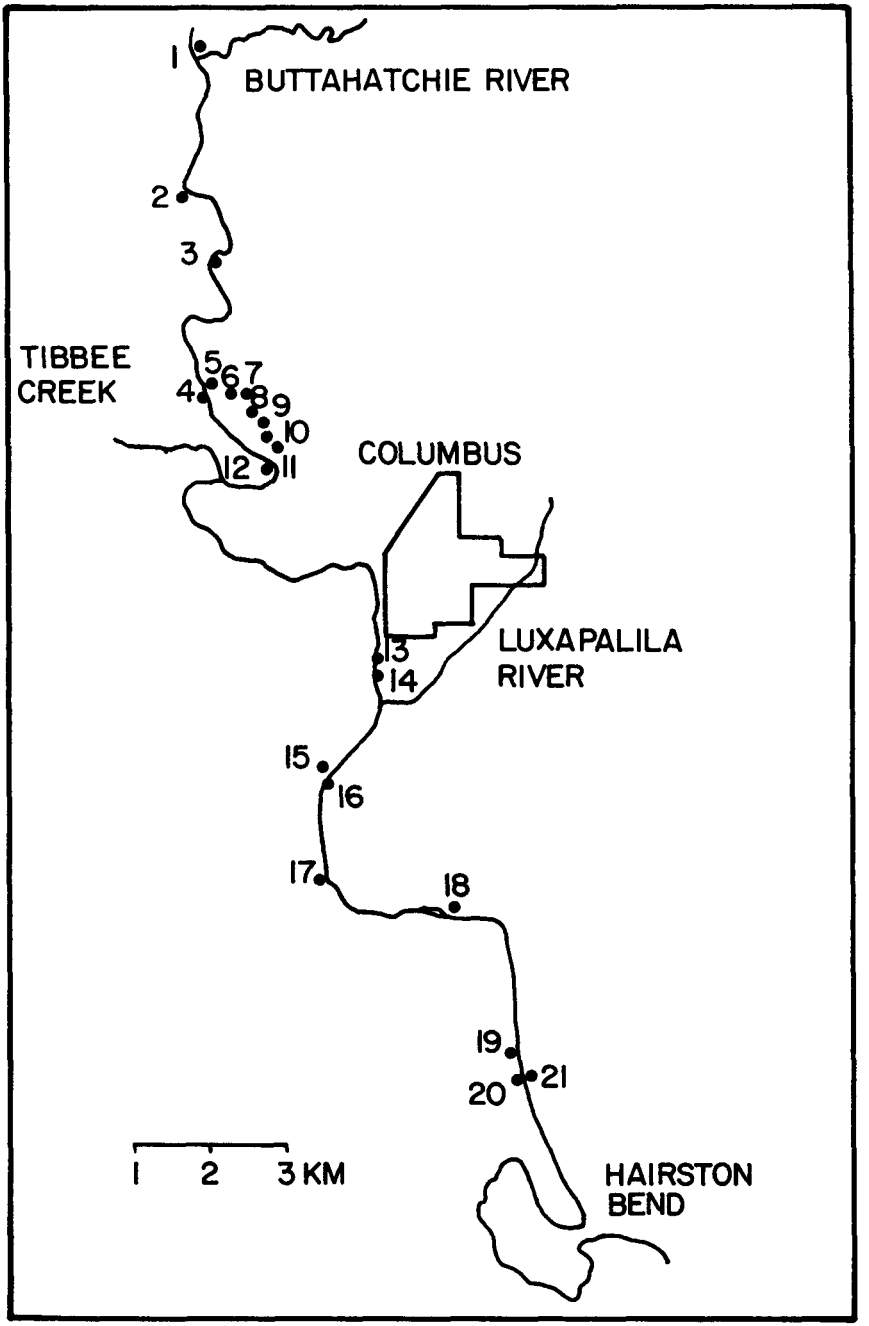

Fig. 1. Sampling site locations on the Tombigbee River, Mississippi, during floods in March and April 1980 and January 1981.

Table 1. Percentage of weight, of occurrence and of composition of the food items of 29 channel catfish collected from the Tombigbee River, Mississippi, during floods in March and April of 1980 and January of 1981.

Food Items	Origin[a]	% Weight	% Occurrence	% Composition
Oligochaeta	t	6.1	24.1	4.2
Araneida	t	1.8	24.1	5.1
Isopoda				
Asellus	a	1.0	10.3	10.9
Amphipoda				
Hyalella azteca	a	0.0	3.4	0.5
Decapoda				
Astacidae	a	2.1	13.8	0.9
Ephemeroptera				
Hexagenia	a	0.0	3.4	0.3
Odonata		1.1	10.3	1.1
Anisoptera	a	0.6	6.9	0.4
Zygoptera	a	0.5	6.9	0.6
Orthoptera		6.0	10.3	7.6
Oedipodinae	t	1.2	6.9	1.1
Gryllus	t	4.8	6.9	6.5
Plecoptera	a	0.0	3.4	0.1
Hemiptera		0.3	13.8	0.6
Reduviidae	t	0.2	6.9	0.3
Pentatomidae	t	0.1	6.9	0.3
Homoptera				
Aphididae	t	0.0	3.4	0.1
Megaloptera				
Sialidae	a	3.4	6.9	0.8
Coleoptera	t, a	2.8	17.2	2.6
Carabidae	t	0.7	10.3	0.6
Harpulus	t	1.0	6.9	0.9
Scarabaeidae	t	1.1	6.9	0.5
Trichoptera		5.8	27.6	40.3
Damaged Trichoptera	a	4.3	24.1	33.7
Hydropsychidae	a	0.6	3.4	3.0
Hydropsyche orris	a	0.4	13.8	1.8
Potamyia flava	a	0.0	10.3	0.9
Polycentropus	a	0.5	3.4	0.9
Lepidoptera		0.8	20.7	3.0
Noctuidae	t	0.3	3.4	0.1
Pyralidae	t	0.5	17.2	2.9
Diptera		1.7	13.8	8.9
Tipulidae	a	1.7	10.3	3.5
Chironomidae	a	0.0	6.9	5.4
Hymenoptera				
Formicidae	t	0.0	3.4	0.3
Chilopoda	t	2.5	6.9	12.4
Rodentia	t	64.4	3.4	0.3

[a] t = terrestrial, a = aquatic.

organisms composed only 15.3% of the weight. Even without the weight contribution of the rodents, terrestrial food items still accounted for 50.4% of the total weight.

Diets, by weight, of catfish 2 to 3 years old and from 150 mm to 239 mm in length were dominated by oligochaetes, isopods, and anisopterans (Table 2). Diets of 3 to 4-year-old fish, ranging from 240 mm to 314 mm in length, were composed mainly of oligochaetes, crickets, trichopterans, and tipulid pupae. The diets of the 315-mm to 550-mm catfish (ages 4 to 9 years) were chiefly composed of rodents, trichopteran larvae and crickets. Although the largest length group of fish fed on a greater diversity of organisms than did the smallest length group of fish, all 3 groups of fish fed on trichopteran larvae, terrestrial oligochaetes, and astacids. There was no clearcut difference between the presence of terrestrial and aquatic organisms according to length groups of the fish. Bailey and Harrison (1945) found on a volume basis that small channel catfish ($\leq$10 cm) fed almost exclusively on insect larvae, 10 to 30-cm fish utilized insects heavily (68%), but catfish larger than 30 cm switched to a primarily fish diet with large insects still important. The diets of the larger fish included a higher percentage of terrestrial forms.

Fifteen channel catfish collected while the Tombigbee River was at normal in-stream flow, fed chiefly on aquatic organisms (Table 3). Only 3 terrestrial organisms representing the orders Lepidoptera and Hymenoptera were found, accounting for 1.2% of the total weight of the stomach contents. This small percentage can be compared to 84.7%, by weight, of terrestrial organisms found in the stomachs of channel catfish captured during flooding. Aquatic invertebrates accounted for 47.2% by weight of the food eaten by catfish taken during a normal flow in the Tombigbee River. Aquatic invertebrate food items of channel catfish taken during floods comprised 15.3% by weight. Catfish captured during flooding did not contain fish, but fish comprised 51.0% of the weight of stomach contents of catfish taken during periods of normal water levels (Fig. 2). Chironomids and hydropsychids comprised 33.4% and 29.7% of the diet by number in catfish collected during normal flow which was similar for catfish captured during flooding in which 40.3% of the food items was composed of trichopterans.

Low water temperature (an average of 12.5 C in 1980 and 4.0 in 1981) did not appear to overly influence the feeding of the channel catfish since there were few totally empty stomachs. However, the low water temperature may have reduced digestive rates, giving the impression of recent feeding. Bailey and Harrison (1945) noted the temperature between 10 and 34 C did not seem to inhibit channel catfish feeding, but fish taken from colder water rarely contained food items. Two points are of particular interest here. Tombigbee River catfish evidently fed actively even when water temperature was quite cold (4 C). Secondly, certain terrestrial organisms were available for exploitation even during January.

The 15-year average monthly discharges for the Tombigbee River at Columbus, Mississippi for January, February, March and April are more than twice the average annual discharge of 184 m^3/sec (6499 cfs) (U.S. Geological Survey 1965-1979). This reflects the seasonal flooding which typically occurs in the winter and early spring in the Tombigbee River basin and corresponds to the time when channel catfish convert many nutrients contained in consumed organisms into gonadal development (Sneed and Clemens 1964). The additional food made available by floods may have special significance to the well-being of channel

Table 2. Percentage of weight of food items found in 3 size groups of channel catfish collected from the Tombigbee River, Mississippi, during floods in March and April of 1980 and January of 1981.

Food Items	150-239 mm (n = 12)	240-314 mm (n = 9)	315-550 mm (n = 8)
Oligochaeta	39.3	32.1	2.1
Araneida	0.0		2.1
Isopoda			
Asellus	19.7		0.5
Amphipoda			
Hyalella azteca	1.6		
Decapoda			
Astacidae	1.6	2.8	2.1
Ephemeroptera			
Hexagenia		0.9	
Odonata			
Anisoptera	11.5		0.3
Zygoptera		0.9	0.5
Orthoptera			
Oedipodinae			0.4
Gryllus		15.6	5.3
Plecoptera		0.0	
Hemiptera			
Reduviidae			0.3
Pentatomidae		0.0	
Homoptera			
Aphididae	0.0		
Megaloptera			
Sialidae		1.8	3.7
Coleoptera		1.8	
Carabidae		0.9	0.6
Harpulus	0.0		1.1
Scarabaiidae			1.2
Trichoptera			
Damaged Trichoptera	1.6	14.7	3.9
Hydropsychidae			0.6
Hydropsyche orris		0.9	0.7
Potamyia flava		0.0	0.0
Polycentropus			0.6
Lepidoptera			
Noctuidae	9.8		
Pyralidae	3.3	0.0	0.5
Diptera			
Tipulidae	6.6	27.6	
Chironomidae	4.9	0.0	
Hymenoptera			
Formicidae		0.0	
Chilopoda			2.8
Rodentia			71.0

Table 3. Percentages of weight, of occurrence and of composition of the stomach contents of 15 channel catfish collected from the Tombigbee River, during periods of normal water level in April of 1980.

Food Items	% Weight	% Occurrence	% Composition
Isopoda			
Asellus	7.5	40.0	14.2
Decapoda			
Astacidae	12.9	33.3	1.8
Ephemeroptera			
Hexagenia	4.6	26.6	4.9
Odonata			
Anisoptera	4.9	33.3	1.4
Coleoptera	0.0	13.3	0.4
Dytiscidae	0.0	6.6	0.2
Gyrinidae	0.0	6.6	0.2
Trichoptera	17.4	60.0	42.5
Damaged Trichoptera	3.3	13.3	6.3
Hydropsychidae	10.8	60.0	29.7
Hydropsyche	2.9	46.6	4.2
Hydropsyche orris	0.4	13.3	1.6
Potamyia flava	0.0	20.0	0.7
Lepidoptera	0.0	6.6	0.2
Diptera			
Chironomidae	0.8	46.6	33.4
Hymenoptera	1.2	13.3	0.4
Vespidae	1.2	6.6	0.2
Formicidae	0.0	6.6	0.2
Damaged fish	51.0	13.3	0.7

catfish in terms of the contribution of terrestrial food to gonadal development and to the general growth of sexually immature fish. As already noted, Bailey and Harrison (1945) showed that channel catfish became less insectivorous and more piscivorous as fish size increased. Furthermore, Appelget and Smith (1951) found that 4 and 5-year-old Mississippi River channel catfish attained most of their growth by mid-summer, while slower and more continuous growth throughout the growing season was exhibited by older fish. Their findings may be explained as follows. The growth pattern of the younger fish roughly corresponds to the period of high water in the Mississippi River basin and the cessation of mid-summer growth may be influenced by the return to normal water levels and the unavailability of terrestrial organism. The piscivorous nature of the older fish may be reflected in the continuous growth throughout the season.

Further flood food habit studies should attempt to overcome difficulties in obtaining larger sample sizes when fish are widely dispersed during floods. Most fish were captured from stations over cleared lands. Gill and hoop nets fished 1920 hours produced only 29 channel catfish, for an average catch per unit effort of 0.015 fish/hour.

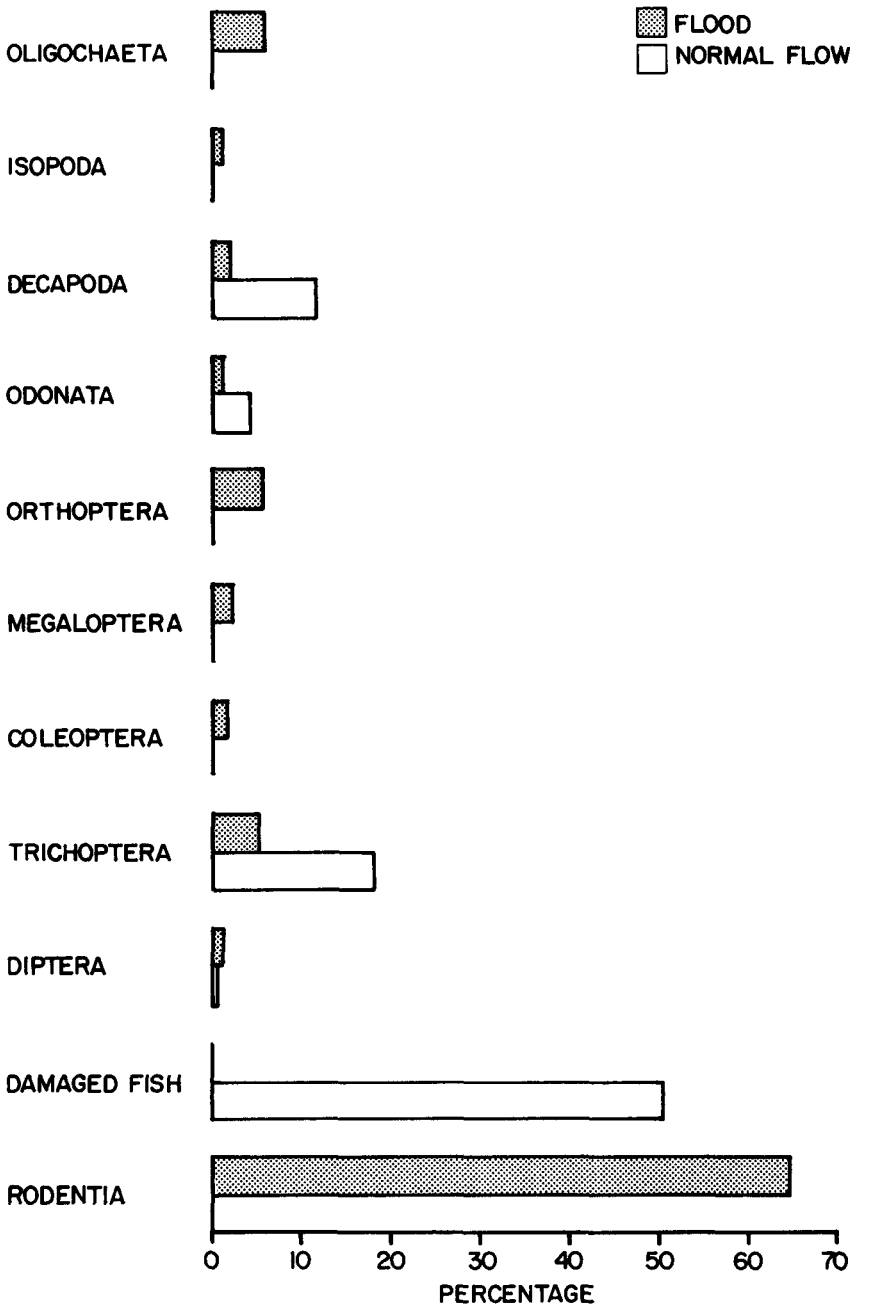

Fig. 2. A comparison of the important food groups of the stomach contents of channel catfish collected from the Tombigbee River, Mississippi, during periods of flooding and during normal flow by percentage of weight.

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