Foods of Some Fishes from the White River at Petersburg, Indiana

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Abstract

Dorosoma cepedianum and fish of the genus *Carpiodes* fed almost entirely on ooze (mixture of silt and organic matter). *Hybopsis storeriana* and *Ictiobus cyprinellus* fed less strictly on ooze. *Cyprinus carpio* fed on insect larvae and ooze. The principal food of *Ericymba buccata, Lepomis humilis, L. macrochirus, Percina sciera* and *Aplodinotus grunniens* was chironomid larvae. *Phenacobus mirabilis* fed primarily on chironomid and Trichoptera larvae, *Ictalurus punctatus* fed primarily on immature Trichoptera, Chironomidae and Ephemerida, and *Promoxis annularis* ate mostly immature chironomids and trichopterans. *Gambusia affinis* and *Lepomis cyanellus* fed primarily on aquatic insects (especially chironomids in the latter); *Micropterus punctulatus* fed on aquatic insects (especially Corixidae, Ephemerida naiads and Chironomidae) and fish.

Introduction

From May 1971 through November 1972, food habits of fishes of the White River, at Petersburg, Pike County, Indiana were studied as part of a continuing project on the effects of heated effluent upon aquatic resources of the river. The project was initiated in 1965 and financed by The Indianapolis Power and Light Company (IPALCO), culminating in three reports (5, 6, 7). Water from the plant is raised about 12 to 13 degrees C in passing through the generating plant, but there are minor differences in food habits of the fishes as related to the heated water.

Information on food habits of nine species of cyprinid fish is being worked up separately (In preparation). Most of those species, including the most abundant species of fish in the river, tend to feed on invertebrates in summer, ooze and invertebrates in fall, and seeds in winter. There were, however, differences in the major kinds of invertebrates eaten by the various species of fish. The purpose of the present paper is to present information on foods eaten by 21 additional species of fishes of the White River at Petersburg, Indiana.

Materials and Methods

Fish were collected by means of a 600 volt DC battery operated electrofisher (Marine Electronics Co., Donegal, Ireland), and with a 30 x 4 foot, ¼ inch seine. Collections were made during two day periods twice per month June through September and once per month October through February. Inadequate sampling occurred from March through May because of high water and equipment failure. There were three collecting sites (two shocker, one seine) above the plant and 5 below (three shocker, two seine), plus an additional site along and one in the effluent canal. Seine hauls were 45.7 meters long. Electrofisher sites ranged from 914 to 1028 meters long. Each site was sampled once during each collection period. Further details on collecting methods and

sites and information on temperature, oxygen, pH and river depth are presented elsewhere (7).

Material from fish stomachs was examined in water with a 10 to 70 power zoom dissecting microscope. Identifications of stomach contents were made by comparison with items found in the field and follow Pennak (4). Many stomachs contained a single kind of food, but when more than one item was present, data were presented as percent volume. In stomachs with few foods in large pieces, volume was measured by water displacement. When items were in small pieces and well mixed so that it was impractical to separate them, percent volumes were visually estimated. Data were summarized in percent volume (total percentage of the food in the diet) and percent frequency (percent of fish in sample containing a particular food). Empty stomachs were noted, but excluded from calculations. Fish measurements are in standard length (SL).

Description of Study Area

The study area has been previously described (5, 6, 7). The IPALCO plant is about 4 kilometers northeast of Petersburg, Pike County, Indiana, just below the confluence of the East and West forks of the White River. The river forms the boundary between Pike and Gibson Counties. The study area is about 3.2 kilometers long, extending downstream from just above IPALCO. The discharged water from IPALCO is about 13 degrees C above ambient river temperature. Cooling and mixing reduce the temperature to near ambient 3300 feet below IPALCO.

The river is about 140 meters wide and ranges from 1.3 to 4.3 meters at midstream. The current ranges from 3 to 9 decimeters per second, or to about 16.5 decimeters per second during flooding. The water fluctuates about 6.1 meters from low flow to highest flood stage. Much silt is carried, coloring the river tan. The bottom is of soft ooze and silt in deeper holes, and of clean sand on the shallow bars. Proffitt (5) sampled the bottom at 128 localities in the mile below the plant and found rock at 11%, large gravel at 6%, small gravel at 25%, sand at 36% and extremely fine materials at 22% of the localities. Few large aquatic plants are present except in backwaters, although thin filamentous algae are present on the gravelly or rocky areas. Proffitt (5) found dissolved oxygen to be high, the lowest of 906 oxygen measurements in the main stream being 7 mg/liter.

Results and Discussion

A total of 21 species of fish is reported upon in this paper. A few species fed entirely or almost entirely on what we have here referred to as "ooze". This substance consisted of sand and silt particles but included pieces of dead plant and animal material, algae and other microflora and microfauna. The fish presumably obtained this material either from the bottom or from suspension in the water, and used the included organic matter as food. The "ooze feeders" have been discussed first, then other species are grouped by family. Ooze is available and was found in stomachs at all seasons.

Ooze Feeders

Dorosoma cepedianum (Lesueur). Gizzard shad (Clupeidae).

The 41 stomachs of this species examined all contained 100% ooze. Minkley (3) reported detrital materials, diatoms and other algae, chironomid larvae and oligochaetes in stomachs he examined.

Carpiodes sp. Carpsuckers (Catostomidae)

Three species of *Carpiodes* were taken during the present study, *C. velifer* (Rafinesque), *C. carpio* (Rafinesque) and *C. cyprinus* (Lesueur), but the three are considered together here. Of 203 stomachs examined, 156 contained food. Of these, 151 contained 100% ooze. Of the remaining five, 2 contained 100% (6 and 4 individuals, respectively) 1 had 30% and 1 had 20% chironomid larvae, whereas one had 15% Trichoptera larvae. The remainder of the food in these stomachs was ooze.

CYPRINIDAE—minnows

Cyprinus carpio Linnaeus. Carp

Ten carp with food were examined (June through August; 27 to 120 mm standard length). Foods, with percent volumes and frequencies, were chironomid larvae (36.5, 50), ooze (31.5, 40), larval trichopterans (20.0, 30) and unidentified invertebrates (12.0, 20). Carlander (1) summarizes the food of carp as basically bottom fauna, (particularly chironomids), plankton and plant remains.

Ericymba buccata Cope. Silverjaw minnow.

Fifteen silverjaw minnows containing food were taken (June through October, 17 to 51 mm SL). The major food was chironomid larvae, with 14 fish containing it (87.7% of the volume). A total of 121 larvae were found in the 14, averaging 8.6 per fish. Other foods were unidentified larvae (6.7% frequency, 6.7% volume); *Plumatella* (4.3, 6.7); and ooze (1.3, 6.7). Dale C. Wallace (pers. comm.) found that *Ericymba* in Vigo County, Indiana, feeds extensively on chironomid larvae.

Hybopsis storeriana (Kirtland). Silver chub.

Nine silver chubs with food were examined (July-September, 31 to 62 mm). Foods were ooze (66.1% volume, 77.8% frequency), Trichoptera larvae (13.3, 33.3), stratiomyid larvae (11.1, 11.1), chironomid pupae (8.3, 33.3), and unidentified invertebrates (1.1, 11.1). Carlander (1) indicates cladocerans, copepods, chironomids and Ephemerida have been reported as foods.

CATOSTOMIDAE—suckers

Ictiobus cyprinellus (Valenciennes). Bigmouth buffalo.

Stomachs of 29 young bigmouth buffalo (15 to 32 mm SL; June through August) were examined. Dominant in stomachs was "ooze" at 84.7% volume and 86.2% frequency. Other foods were chironomid larva (11.4% volume 20.7% frequency), chironomid pupae (2.2; 3.4), and unidentified invertebrate (1.7; 3.4). Carlander (1) states that the

species feeds mostly on cladocerans, copepods and chironomids, but most of the literature on food in this species concerns lakes rather than rivers.

ICTALURIDAE—freshwater catfishes

Ictalurus punctatus (Rafinesque). Channel catfish.

Forty-four channel catfish with food, all young, were examined (Table 1) during the present study (28 to 50 mm; July and August). The chief food was larval caddis worms (Trichoptera, mostly *Hydropsyche*), followed by chironomid larvae. The average number of trichopterans and chironomids in fish eating those foods, was 4.4 and 4.1. The four top foods were all aquatic insect larvae and pupae and collectively comprised 92.2 percent of the total volume.

CYPRINODONTIDAE—killifishes

TABLE 1. *Food of 44 young channel catfish,* Ictalurus punctatus, *from the White River at Petersburg, Indiana.*

Food items	Percent Volume	Percent Frequency
Trichoptera, larvae	70.9	86.4
Chironomid larvae	11.0	61.4
Ephemerida, naiads	5.5	9.1
Chironomid pupae	4.8	25.0
Syrphid fly larvae	1.9	2.3
Unidentified invertebrate	1.4	9.1
Plecoptera naiad	1.3	2.3
Elmid larvae	1.3	2.3
Vegetation	0.9	2.3
Tipulid larvae	0.5	2.3
Coleopterous larvae	0.5	2.3
Odonata naiads	0.2	2.3
	100.2	

Fundulus notatus (Rafinesque). Blackstripe topminnow.

In this small sample (Table 2) no one food was dominant. Rather a diversity of foods was found, 18 types in all. The top five foods were all aquatic organisms, if, as seemed to be the case, "adult chironomidae" (the individuals had just transformed) were taken under water. A total of about 65% of the food was considered as aquatic, and 35 as terrestrial. One fish was taken in Janary and had 100% Ephemerida naiads in its stomach, and one in February with 100% freshly transformed chironomid adults. The rest were taken from July through September (29 to 56 mm).

POECILIIDAE—livebearers

Gambusia affinis (Baird and Girard). Mosquitofish.

Six mosquitofish with food were taken (June and September; 20 to 34 mm). Each stomach contained only one kind of food, 2 with chironomid larvae, 2 with chironomid pupae, 1 with adult Trichoptera, and one

with small fish. Carlander (1) summarizes the principal foods as mosquito larvae and pupae, a few copepods, algae and fish.

CENTRARCHIDAE—sunfishes

TABLE 2. *Food of 17 blackstripe topminnows,* Fundulus notatus, *from the White River, at Petersburg, Indiana.*

Food Item	Percent Volume	Percent Frequency
Chironomid larvae	20.3	35.3
Ephemerida naiads	12.9	17.6
Corixidae	10.6	17.6
Chironomid pupae	8.2	11.7
Chironomid adult	6.5	11.7
Trichoptera adults	6.5	11.7
Aphididae	6.2	11.7
Dipterous pupae	5.9	5.9
Spider	5.9	5.9
Chrysopidae	4.7	11.7
Dolichopodidae	3.8	5.9
Cicadellidae	3.2	5.9
Adult Diptera, unidentified	2.1	5.9
Formicidae	1.5	5.9
Trichoptera larvae	0.9	5.9
Chalcidae	0.6	5.9
Phoridae	0.3	5.9
	100.1	

Lepomis cyanellus (Rafinesque). Green sunfish.

Stomach contents of ten green sunfish were examined (22 to 89 mm; average 51.5 mm; June through September). Major foods were chironomid larvae (39.5% volume, 80% frequency), Trichoptera larvae (24.0, 40) and Ephemerida naiads (14.0, 20). The average numbers of these items in fish containing them were 8.0, 1.5 and 1.0. Other foods eaten were chironomid pupae (7.0, 20), Plecoptera naiads (7.0, 20), Corixidae (3.5, 20), unidentified fish (3.5, 20), and unidentified larvae (1.5, 10). Carlander reports that green sunfish eat a greater variety of foods than most other sunfish.

Lepomis humilis (Girard). Orangespotted sunfish.

Only ten of the orangespotted sunfish contained food. The top food was chironomid larvae, primarily *Glyptotendipes lobiferus*, which comprised 54.5% of the volume and was eaten by 7 of the fish. The number of chironomids per fish ranged from 4 to 98 and averaged 24.9. Other foods in stomachs were *Plumatella* (11.5, 20), Corixidae (10.5, 20), damselfly naiads (10.0, 10), Trichoptera larva (7.5, 10), unidentified invertebrate (4.0, 10), and chironomid pupae (2.0, 20). Carlander (unpublished manuscript) reports this species feeds primarily on insects.

Lepomis macrochirus (Rafinesque). Bluegill.

The stomachs of 59 small bluegills were examined (17 to 132 mm; June through January; 28 in summer, 29 in fall, and 2 in winter). The

data were examined by season and by size groupings, but were quite similar; hence all data for this species were combined (Table 3).

The major food of bluegills from the White River was chironomid larvae, at 72.8% volume. Of the 59 fish, 54 contained this food and many of them only this. They averaged 21.9 larvae per fish. The top four foods were all aquatic insect larvae, and collectively comprised 91.1% of the volume of food in stomachs. Many of the chironomids were

TABLE 3. *Foods eaten by 59 small* LEPOMIS MACROCHIRUS *from the White River at Petersburg, Indiana*

Food Item	Percent Volume	Percent Frequency
Chironomid larvae	72.8	91.5
Chironomid pupae	8.7	37.3
Ephemerida naiads	6.9	62.7
Trichoptera larvae	2.7	15.3
Spider	2.5	3.4
Tipulid larvae	1.7	1.7
Unidentified invertebrate	1.3	6.8
Trichoptera, adults	1.2	3.4
Formicidae	0.8	1.7
Corixidae	0.6	5.1
Crustacea, unidentified	0.3	1.7
Cicadellidae	0.3	1.7
Gerridae	0.2	1.7
Plumatella	0.1	3.4
	100.1	

Glyptotendipes lobiferus.

Flemer and Wolcott (2) found some of the major foods of the bluegill to be chironomid larvae, copepods, cladocerans, Formicidae, Ephemerida and Corixidae.

Lepomis megalotis (Rafinesque). Longear sunfish.

Carlander (unpublished manuscript) reports aquatic insects form the bulk of the diet of *L. megalotis*, with entomostracans, fish eggs, terrestrial insects, snails, crayfish, and other forms also being eaten.

The chief food eaten by *L. megalotis* at Petersburg during June through November, was chironomid larvae (Table 4). This food comprised 82.9% of the food in stomachs, and was found in all but two fish. Many of the fish had large numbers of chironomids. The second most important food, at 5.7 percent volume was chironomid pupae. These two foods together comprised nearly 90% of the food in the sample. The 61 fish over 40 mm standard length had eaten somewhat less of this food, at 75.5% of their diet by volume.

Lepomis punctatus (Valenciennes). Spotted sunfish.

Only one spotted sunfish was taken (the first in Indiana in many years). It was 114 mm standard length, and its stomach contained 35 chironomid larvae, *Glyptotendipes lobiferus.* It was taken 23 September, 1972.

TABLE 4. *Food of 118 Longear sunfish* (LEPOMIS MEGALOTIS) *from the White River at Petersburg, Indiana, ranging from 17 to 136 mm standard length. Fish were taken from June through November.*

Item	Percent Volume	Percent Frequency
Chironomidae, larvae	82.9	98.3
Chironomidae, pupae	5.7	18.6
Trichoptera, larvae	5.3	14.4
Ephemerida, naiads	1.3	5.1
Plumatella	1.2	4.2
Corixidae	1.1	4.2
Elmidae, larvae	0.7	0.8
Zygoptera, naiad	0.5	1.7
Coleoptera, larvae	0.4	0.8
Unidentified invertebrate	0.3	1.7
Trichoptera, adult	0.2	0.8
Anisoptera, naiad	0.1	0.8
Unidentified Diptera	0.1	0.8
Chironomidae, adult	0.1	0.8
Phalangida	0.1	0.8
Unidentified material	trace	0.8
Stratiomyidae, larvae	"	0.8
	100.0	

Micropterus punctulatus (Rafinesque). Spotted bass.

A total of 120 spotted bass with food, mostly young, were examined. There were some differences related to size of fish (Table 5). Water boatmen (Corixidae), were important in all size classes, making up about 25% of the total volume of food eaten. Chironomid larvae were important in the larger and smaller fish, but less important in the 40-69 mm class. Ephemerida naiads were important in the small, and less important in the medium sized fish. None at all were found in stomachs of larger spotted bass. Naiads of damselflies (Zygoptera) somewhat replaced Ephemerida in the larger size classes. Fish became increasingly important with increasing size, at 13.2, 20.8, and 25.7% volume respectively in the three size classes.

There are seasonal changes associated with the size classes. The fish were taken during July, August and September (46, 34 and 40 fish, respectively). Ranges and mean lengths of fishes those months were 17-51 (38.5), 33-147 (60.4), and 61-280 (99.7). Thus, the fish under study appeared to be growing rapidly. The food changes could be seasonal changes related to availability, but likely were primarily related directly to differing sizes of the fish.

Some of the foods taken in larger numbers in individual stomachs were chironomid larvae (average of 12.9 per stomach in the 41 fish having eaten this food), Trichoptera larvae (3.5 in 8 fish), and Corixidae (3.4 in 54 fish).

Carlander (unpublished manuscript) states that small spotted bass feed on entomostracans, and later turn to chironomids and other aquatic insects. Fish and crayfish are important foods of larger individuals (51 mm and above).

TABLE 5. *Food of 120 spotted bass,* MICROPTERUS PUNCTULATUS, *from the White River at Petersburg, Indiana, taken July through September.*

Food item	Under 40 mm SL		40-69 mm SL		70 + SL		All fish	
	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.
Number examined	(33)		(47)		(40)		(120)	
Corixidae	26.4	48.5	28.3	46.8	21.1	40.0	25.4	45.0
Ephemerida, naiads	20.2	36.4	15.4	23.4	—	—	11.5	19.2
Chironomidae, larvae	20.2	30.3	7.6	34.0	29.0	37.5	18.1	34.2
Unidentified fish	13.2	18.2	15.2	19.1	17.6	20.0	15.4	19.2
Unidentified animal	7.4	15.2	1.6	8.5	0.6	5.0	2.9	9.2
Trichoptera, larvae	3.6	12.1	6.3	17.0	4.5	5.0	5.0	15.0
Chironomidae, pupae	3.6	12.1	2.6	8.5	4.7	20.0	3.6	13.3
Acrididae	3.0	3.0	0.5	2.1	—	—	1.0	1.7
Raphidophoridae	1.1	3.0	0.4	2.1	—	—	0.5	1.7
Gerridae	0.8	3.0	3.3	8.5	—	—	1.5	4.2
Ephemerida, adult	0.8	3.0	—	—	—	—	0.2	0.8
Amphipoda	0.2	3.0	—	—	—	—	tr	0.8
Trichoptera, adult	—	—	3.7	10.6	3.0	5.0	2.5	5.8
Notropis spilopterus	—	—	3.7	4.3	3.6	5.0	2.7	3.3
Earthworm	—	—	2.1	2.1	—	—	0.8	0.8
Notropis atherinoides	—	—	1.9	2.1	2.5	2.5	1.6	1.7
Rheumatobates rileyi	—	—	1.8	4.3	—	—	0.7	0.8
Zygoptera, naiad	—	—	1.7	2.1	5.5	10.0	2.5	4.2
Anisoptera, naiad	—	—	1.6	4.3	—	—	0.6	1.7
Phalangida	—	—	1.1	2.1	—	—	0.4	0.8
Corydalis cornutus	—	—	0.5	2.1	—	—	0.2	0.8
Chironomidae, adult	—	—	0.4	2.1	—	—	0.2	0.8
Collembola	—	—	0.1	2.1	—	—	tr	0.8
Vegetation	—	—	0.1	2.1	—	—	tr	0.8
Crayfish	—	—	—	—	2.5	2.5	0.8	0.8
Pimephales vigilax	—	—	—	—	2.0	5.0	0.7	1.7
Hybognathus nuchalis	—	—	—	—	1.8	2.5	0.6	0.8
Hemiptera, unidentified	—	—	—	—	0.9	2.5	0.3	0.8
Bryozoa	—	—	—	—	0.4	2.5	0.1	0.8
Aphid	—	—	—	—	0.1	2.5	tr	0.8
Cicadellidae	—	—	—	—	0.1	2.5	tr	0.8
	100.5		99.9		99.9		99.8	

tr = trace

Pomoxis annularis Rafinesque. White crappie.

Eight white crappies with food were taken (25 to 165 mm, June through September). Food was as follows: chironomid larvae (48.7% volume, 62.5% frequency), Ephemerida naiads (27.5, 50.0), Corixidae 13.1, 25.0), and Trichoptera (10.6, 25.0). Chironomid larvae ranged from 2 in the smallest fish, to over 150 in one of the larger ones. Trichoptera numbered from 1 to 7, and Ephemeridae from 1 to about 60. Based on this small sample, this species has to be classed as a diperous feeder.

PERCIDAE—perches

Etheostoma asprigene (Forbes). Mud darter.

Four mud darters with food were taken (August and September, 35 to 43 mm). Foods were naiads of Ephemerida (43.8% volume;

75% frequency), chironomid larvae (35.0, 50), and Trichoptera larvae (21.3, 25).

Percina sciera (Swain). Dusky darter.

Eight dusky darters with food were taken (July through December; 26-70 mm). The major food was chironomid larvae; 7 of the 8 fish had eaten this food, and it comprised 61.9% of the total volume of food in the sample. Numbers of larvae per fish ranged from 1 to 28, averaging 10.1. Other foods found in stomachs were naiads of Ephemerida (20.0% volume; 37.5% frequency), larval trichopterans (14.4; 37.5) and an unidentified hemipteran (3.8, 12.5).

SCIAENIDAE—drums

Aplodinotus grunniens Rafinesque. Freshwater drum.

Eight drum with food were examined (40 to 84 mm, August through November). The major food was chironomid larvae, all eight fish having eaten it (81.3% of the volume). Larvae ranged from 5 to 56, averaging 28.9 per fish. Other foods eaten were Ephemerida naiads (10.0% volume), chironomid pupae (3.8), Corixidae (3.1), and larval Trichoptera (1.9).

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