

Food Habits of the Spottail Shiner in Indiana Waters of Lake Michigan in 1973

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Abstract

Food habits of the spottail shiner, *Notropis hudsonius*, in Indiana waters of Lake Michigan were examined from June to October, 1973. Chironomid larvae, mainly *Chironomus* spp., and pupae were the major items consumed over the period on a volumetric basis (50%) followed by the epibenthic cladoceran, *Eurycercus lamellatus* (24%) and eggs of the alewife, *Alosa pseudoharengus*, (13%). Dominant food volumes consumed by month included: June, alewife eggs (47%); July, chironomid larvae and pupae (63%); August, *Eurycercus lamellatus* (48%); September, chironomid larvae (53%); and October, chironomid larvae (86%).

Introduction

The purpose of this study was to determine the food habits of the spottail shiner (*Notropis hudsonius* Clinton) in Indiana waters of Lake Michigan from June to October 1973. The food habit data collected were used to evaluate the trophic role of this species in the changing Lake Michigan environment.

No prior analysis of food habits of the spottail shiner has been undertaken in Indiana waters of Lake Michigan and only a few studies deal with this species in the lake. Willis (10) studied monthly and daily abundance of fish, including the spottail shiner, along several transects in Indiana waters in 1973. Wells and House (9) described aspects of the life history of the spottail shiner in southeastern Lake Michigan and Basch (1) presented information on food habits and age and growth in Little Bay de Noc.

Methods and Materials

Spottail shiners were collected along three Lake Michigan transects near Michigan City, Indiana, described in detail by Yager (11). One transect was established at Michigan City (M) with sample stations at depths of 1, 5, and 15 m. The other two transects were located west of Michigan City in the Dunes area (D) and at the mouth of Kintzele Ditch (K). Both D and K transects had sample stations at depths of 1 and 5 m.

Fish were collected twice monthly from June to October in 1973 by trawling and seining. Trawling at all transects and stations, except at the 1 m stations, was accomplished with a standard 5 m bottom trawl. Three tows were made at each station at both noon (11 am to 3 pm) and midnight (11 pm to 3 am) periods. A 12 m by 1.2 m nylon bag seine (3.2 mm square mesh) was used to seine at each 1 m station at the noon and midnight periods.

Fish were quickly removed from nets and preserved intact in about 10% formalin. Later, in the laboratory, a subsample of three fish per

5 mm length interval, when available, was taken for every day of collection and change in location or depth. Each fish was measured in total length and the stomach removed. The portion of the digestive tract used for stomach content analysis was composed of the first two turns of the tract. Stomach contents were then washed into a plexiglass counting cell and surveyed in strips under a binocular microscope using magnification from 40 to 100x. Organisms were identified to species when possible and counted to allow estimation of volumetric components. The volume of each food item was determined by measuring 30 representative intact organisms with the aid of an ocular micrometer and applying measurements to an appropriate figure as described by McComish (4). Volumes for organisms in an advanced stage of digestion were not determined because of the small amount of volume involved. When a volume estimation for a species was similar to data presented by Webb (8), his values were used.

Results and Discussion

General Food Habits

The primary food item groups consumed by spottail shiners ranging in length from 33-147 mm during 1973 (Table 1) were: insects, with a volume of 57%; zooplankton, 28%; and alewife (*Alosa pseudoharengus*) eggs 13%. Specific organisms in their order of importance in the diet were: *Chironomus* spp., which made up 25% of the volume

TABLE 1. Yearly percent volume and percent frequency of occurrence of items in the stomach contents of 476 spottail shiners collected in Lake Michigan near Michigan City, Indiana in 1973.

Organisms	Percent	
	Volume	Frequency
Zooplankton	28	(67)
Cladocera	27	(66)
<i>Alona affinis</i>	2	(36)
<i>Bosmina longirostris</i>	T	(23)
<i>Chydorus spaeicus</i>	1	(24)
<i>Eurycerus lamellatus</i>	24	(55)
Copepoda	1	(15)
<i>Cyclops bicuspidatus</i>	1	(15)
Insecta	57	(77)
Diptera	50	(74)
Chironomidae larvae	27	(60)
<i>Chironomus</i> spp.	25	(56)
Others	2	(7)
Chironomidae pupae	23	(38)
Other adult insecta	7	(10)
Fish	13	(20)
<i>Alosa pseudoharengus</i> eggs	13	(20)
Miscellaneous organisms	2	(6)
Sand	P	(29)
Fish length range (mm)	33-147	
Mean length (mm)	101	

P = present but volume not calculated

and occurred in 56% of the stomachs; the cladoceran *Eurycercus lamellatus*, at a volume of 24% and occurrence of 55%; chironomid pupae, with a volume of 23% and an occurrence of 38%; and alewife eggs, at a volume of 13% and occurrence of 20%. Other items having limited volumetric importance (2% or less) but which were consumed frequently included the cladocerans: *Alona affinis* (36% occurrence), *Chydorus sphaericus* (24%), and *Bosmina longirostris* (23%); and a copepod: *Cyclops bicuspidatus* (15%).

The food items eaten by spottail shiners in this study have also been reported by other researchers. McCann (3) and Price (5) reported spottail shiners feeding on chironomid larvae, and McCann (3), Price (5), Smith and Kramer (7), and Basch (1) all report high amounts of cladocerans consumed. Spottail shiners feeding on fish eggs have also been reported previously (1, 6, and 7) and Edsall (2) has observed them feeding on eggs of spawning alewives.

The variety of food items consumed indicates spottail shiners fed on organisms at different levels in the water column. It appears, however, that major feeding activity was at or near the bottom since the epibenthic cladoceran *Eurycercus lamellatus*, chironomids, and alewife eggs were major food items. Further evidence for major near-bottom feeding activity comes from the relatively high frequency of occurrence for sand found in stomachs (29%).

Monthly Food Habits

Chironomids (larvae and pupae) were the major food items eaten by spottail shiners in all months of the study except June and August (Table 2; Fig. 1). *Chironomus* spp. accounted for at least 90% of the chironomid volume in all months and was the primary food consumed in September and October. Chironomid pupae were an important item in the diet from June through September and the major item consumed by spottails in July, which probably corresponds to a peak emergence period. Of the zooplankton consumed, only *Eurycercus lamellatus* was significant in volume and frequency of occurrence in more than one month. This cladoceran was the major food item consumed by spottail shiners during the month of August. Although *Alona affinis*, *Bosmina longirostris*, *Chydorus sphaericus* and *Cyclops bicuspidatus* were not volumetrically significant, they reached their peak in occurrence in the diet in August. Alewife eggs were consumed in large quantities as the major item in June and were a significant item in July. Sand was present in the stomachs during all months except September, indicating the spottails were feeding mainly near the bottom.

Summary

General food items of spottail shiners in Indiana waters of Lake Michigan for five combined months of 1973, in order of volumetric importance were: insects, including chironomid larvae (mainly *Chironomus* spp.) and pupae, the epibenthic cladoceran *Eurycercus lamellatus*, and alewife eggs. Fish were probably feeding mostly at or near the bottom as indicated by food consumed and occurrence of sand in stomachs.

TABLE 2. Monthly percent volume and personal frequency of occurrence (parentheses) of items in stomach contents of spottail shiners collected at the 1 and 5m Lake Michigan stations near Michigan City, Indiana in 1973.

Organisms	June	July	August	Sept.	Oct.
Zooplankton -----	10 (55)	22 (65)	52 (86)	23 (57)	3 (36)
Cladocera -----	10 (53)	22 (65)	52 (86)	21 (57)	3 (33)
<i>Alona affinis</i> -----	T (18)	T (25)	4 (65)	8 (41)	1 (6)
<i>Bosmina longirostris</i> -----	T (8)	1 (21)	T (42)	T (10)	T (6)
<i>Chydorus sphaericus</i> -----	T (23)	T (19)	T (36)	2 (29)	
<i>Eurycerus lamellatus</i> -----	10 (40)	21 (57)	48 (78)	11 (24)	2 (27)
Copepoda -----	T (14)	T (13)	T (21)	2 (17)	T (3)
<i>Cyclops bicuspidatus</i> -----	T (10)	T (10)	T (20)	2 (16)	T (3)
Insecta -----	42 (53)	67 (85)	43 (78)	76 (88)	92 (97)
Diptera -----	30 (47)	63 (81)	38 (78)	71 (88)	86 (88)
Chironomidae larvae -----	13 (24)	26 (73)	16 (59)	53 (86)	86 (88)
<i>Chironomus</i> spp. -----	13 (24)	26 (70)	14 (53)	45 (75)	81 (85)
Others -----	T (1)	T (11)	2 (27)	8 (22)	5 (12)
Chironomidae pupae -----	17 (24)	37 (58)	22 (36)	18 (29)	
Other adult insecta -----	12 (21)	4 (12)	5 (6)	5 (10)	6 (18)
Fish -----	47 (59)	11 (24)			
<i>Alosa pseudoharengus</i> eggs -----	47 (59)	11 (24)			
Miscellaneous organisms -----	1 (4)	T (2)	5 (8)	1 (6)	5 (18)
Sand -----	P (31)	P (43)	P (28)		P (3)
Stomachs examined -----	102	144	148	49	33
Fish length range (mm) -----	37-145	64-147	37-141	33-140	42-136
Mean length (mm) -----	104	112	91	103	79

P = present but volume not calculated

On a monthly basis between June and October, chironomids were the major food consumed except in June and August. Alewife eggs were the major item consumed in June while *Eurycerus lamellatus* was the dominant August food.

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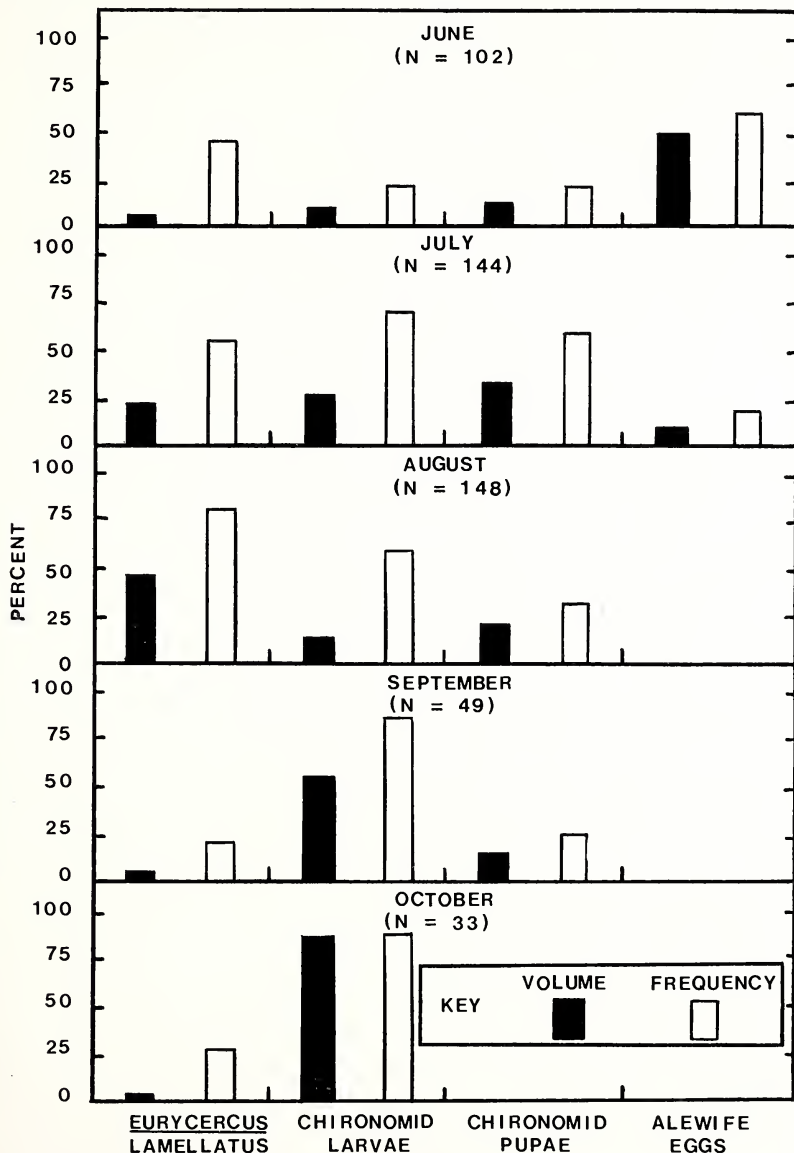


FIGURE 1. Monthly percent volume and percent frequency of occurrence of the four major food items consumed by spottail shiners at the 1 and 5 m Lake Michigan stations near Michigan City, Indiana in 1973.

Literature Cited

1. BASCH, R. E. Age, growth and food habits of the spottail shiners, *Notropis hudsonius* (Clinton), in Little Bay de Noc, Lake Michigan. Unpubl. M.S. Thesis, Mich. State Univ., East Lansing, 53 p.
2. EDSALL, T. A. 1964. Feeding by three species of fishes on the eggs of spawning alewives. *Copeia*, 1964 (1):226-227.
3. MCCANN, J. A. 1959. Life history studies of the spottail shiner of clear lake, Iowa, with particular reference to some sampling problems. *Trans. Am. Fish. Soc.* 88:336-343.
4. MCCOMISH, T. S. 1967. Food habits of bigmouth and smallmouth buffalo in Lewis and Clark Lake and the Missouri River. *Trans. Am. Fish. Soc.* 96:70-74.
5. PRICE, J. W. 1963. A study of the food habits of some Lake Erie fish. *Bull. Ohio Biol. Surv.* 2 (1):1-89.
6. SIBLEY, C. K. 1929. The food of certain fishes of the Lake Erie drainage basin. *Suppl. Ann. Rept. N. Y. Conservation Dep. No. 18*, p. 180-188.
7. SMITH, L. L., JR. and R. H. KRAMER. 1964. The spottail shiner in lower Red Lake, Minnesota. *Trans. Am. Fish. Soc.* 93:35-45.
8. WEBB, D. A. 1973. Daily and seasonal movements and food habits of the alewife in Indiana waters of Lake Michigan near Michigan City, Indiana, in 1971 and 1972. Unpubl. M.S. Thesis, Ball State Univ., Muncie, Ind. 104 p.
9. WELLS, L. and R. HOUSE. 1974. Life history of the spottail shiner (*Notropis hudsonius*) in southeastern Lake Michigan, the Kalamazoo River, and Western Lake Erie. *U.S. Bur. Sport Fish. Wildl. Res. Report.* 78:1-10.
10. WILLIS, T. B. 1975. Monthly and daily abundance of fish at sites in Indiana waters of Lake Michigan near Michigan City, Indiana in 1973. Unpubl. M.S. Thesis, Ball State Univ., Muncie, Ind. 133 p.
11. YAGER, R. O. 1976. Food habits of the spottail shiner in Indiana waters of Lake Michigan in 1973. Unpubl. M. S. Thesis, Ball State Univ., Muncie, Ind. 103 p.