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ADDITIONAL OBSERVATIONS ON GROWTH RATE AND FOOD HABITS OF THE WALLEYE IN MICHIGAN WATERS [1]

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ABSTRACT

We examined the ages and stomach contents of adult and sub-adult walleyes collected from Houghton Lake, Lake Cadillac, Lake Gogebic, and Lake Whittlesey in 1971, and from Lake Gogebic and three lakes on Isle Royale in 1928. Walleye growth appears to be slower than the state average in these lakes; also, the growth of walleyes in Lake Gogebic, Houghton Lake, and Lake Cadillac may have declined in recent years. Fish, especially yellow perch, were the principal food of the walleye, being found in 67-100% of the stomachs containing food. No correlation was found between size of the walleye and size of prey fish found in its stomach.

Introduction

During the 1940's Paul H. Eschmeyer conducted intensive studies on the life history of the walleye in Lake Gogebic and other Michigan waters. In a comprehensive report (1950) he described the food of walleyes in certain inland lakes: Lake Gogebic, Gogebic and Ontonagon counties; the Muskegon River impoundments (chiefly Hardy and Newaygo ponds), Muskegon, Newaygo, and Mecosta counties; Lake Cadillac, Wexford County; Lake Mary, Iron County; and Lake George, Ogemaw County. Earlier, M. L. Livingston (1946) had reported on the winter food habits of the walleye (and northern pike) in Houghton Lake, Roscommon County.

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Several food habit studies have been made also on walleyes in the Great Lakes. Wagner (1972) worked on Bay de Noc; Parsons (1971), Ewers (1933), Price (1963), and Wolfert (1966) studied western Lake Erie.

This report will give additional data on the growth and feeding of walleyes in lakes Gogebic, Houghton, and Cadillac. Also included are data from Whittlesey, Chickenbone, and Dustin lakes on Isle Royale.

Methods

Dates of capture, size range, and number of walleyes examined during this study are summarized in Table 1. The walleyes collected in 1971 were taken in over-night sets of experimental gill nets by Thomas Kelly. The walleyes collected in 1928 were obtained from the University of Michigan Museum. They were captured in gill nets by Dr. Jan Metzelaar (Lake Gogebic) and Dr. Walter Koelz (Isle Royale lakes).

All specimens were preserved in the field. Later, the contents of their stomachs were examined in the laboratory. Food organisms were counted, their lengths were estimated, and in the case of Houghton Lake and Lake Cadillac, the food was weighed after excess moisture had been removed by blotting with paper towel. The walleyes from Houghton Lake and Lake Cadillac were examined by Roger Lockwood and James Schneider; walleyes from Lake Gogebic were examined by Dr. Metzelaar and Thomas Kelly; and walleyes from the lakes on Isle Royale were examined by Thomas Kelly. Dr. Gerald Smith of the University of Michigan Museum helped identify the fish remains and assisted with the netting on Isle Royale in 1971.

The walleyes which we examined ranged from 17.0 to 61.5 cm (6.7 to 24.2 inches) long. All had completed at least one growing season. No differences in food habits were observed among walleyes in this size range. Consequently walleyes of all sizes were grouped together for presentation of the results.

During examination of the stomachs we noted the presence of a cestode, Bothriocephalus cuspidatus, in 47% of the walleyes from Houghton Lake and in 58% of the walleyes from Lake Cadillac. This identification was confirmed by Warren Yoder of the Fish Disease Unit, Michigan Department of Natural Resources. Apparently this is the first record of this parasite in Michigan walleyes.

Results and discussion

The ages of some of the walleyes sampled in this study, and in other studies on Houghton, Cadillac, and Gogebic lakes, are summarized in Table 2. The data are rather meager and difficult to compare due to differences in time of year the samples were collected and to differences in collecting gear. The following observations can be made tentatively. First, in all lakes walleye growth in 1971 appears to be slower than the state-wide average (Laarman, 1963). Secondly, walleyes in Lake Gogebic were growing more slowly in 1971 than they were in the 1940's (Eschmeyer, 1950). Thirdly, the older walleyes (age IV+) in Houghton Lake seem to have been growing more slowly in 1971 than they were in 1961 and 1962 (field surveys). Additional data collected by district biologists in 1972 substantiate this. Fourthly, the younger walleyes (ages I-III) in Lake Cadillac appear to have been growing more slowly in 1971 than they were in 1962 (field survey), 1947 or 1948 (Beckman, 1947, 1949). No explanation is offered for this widespread decline in walleye growth.

The food organisms found in the stomachs of walleyes collected in 1971 are summarized in Tables 3 and 4. Fish were found in 67-100% of the stomachs containing food. The yellow perch was the most important prey fish. We also found walleye (2), darter (1), sculpin (2), white sucker (1), spottail shiner (1), centrarchid (1), and esocid (1). Many other fish in the stomachs could not be identified due to their advanced state of digestion. Foods of minor importance were crayfish, amphipods, midge larva, and nymphs of mayflies and dragonflies. The "miscellaneous" category included plant material, snails, and unidentified substances.

The food organisms eaten in 1928 were of the same types. Walleyes from the three lakes on Isle Royale were eating fish exclusively. Altogether, six perch and unidentified fish were found in the six stomachs containing food. Walleyes from Lake Gogebic, on the other hand, ate mostly invertebrates. Hexagenia nymphs were the principal food--averaging 12.1 organisms per stomach. Crayfish and dragonfly nymphs were of secondary importance. Metzelaar (unpublished report, 1928) also noted the presence of a 9.4-cm walleye in the stomach of one adult walleye, and the fin ray of a large fish in the stomach of another adult walleye, in this same collection.

Comparison of my data to information given by Eschmeyer (1950) and Metzelaar (unpublished report, 1928), suggests that some changes in walleye feeding may have taken place at Lake Gogebic and Lake Cadillac. At Lake Gogebic, the predominant food of walleyes in the fall of the year appears to have changed from mayflies in 1928 to fish in 1947 and 1971. At Lake Cadillac, walleyes appear to eat more fish (frequency of occurrence of 100% versus a frequency of occurrence of 76%) and fewer insects (frequency of occurrence of 13% versus a frequency of occurrence of 38%) in July of 1971 than they did in the summer of 1948. If these changes are real and not simply artifacts caused by small sample sizes, they may reflect long-term changes in the ecology of the lake or, what is more likely, they may be short-term changes caused by annual or daily fluctuations in food supply.

Adequate data are not available to determine if the food habits of walleyes in Lake Whittlesey or Houghton Lake have changed. Livingston (1946) found only fish in walleyes caught by anglers from Houghton Lake during the winter of 1939. Our data from July 1971, indicate that their summer diet also was mainly fish.

The size of the fish found in the stomachs of walleyes from the study lakes was measured to determine if length of prey fish was correlated with length of walleye. The two largest walleyes we sampled (61.5 and 61.0 cm) had eaten the largest prey (8.0 and 18.1 cm); however, among the remaining walleyes which were 17 to 40 cm long, no correlation was evident.

There were striking differences in the size of prey eaten by walleyes from different lakes. Excluding the two large walleyes mentioned above, walleyes from Houghton Lake ate fish 1.0-2.7 cm long; walleyes from Lake Cadillac ate fish 2.3-4.3 cm long; walleyes from Lake Gogebic ate fish 3.6-7.2 cm long; and walleyes from Lake Whittlesey ate fish 3.6-10.9 cm long. Presumably these differences were related to the size of prey fish available in each lake. Some of the difference was due to the time of the year when sampling took place. Fish were collected from Houghton Lake and Lake Cadillac in July when young-of-the-year perch, the principal food, were small. Fish were collected from Lake Gogebic and Lake Whittlesey in September, when young perch were larger.

Our data on the food habits of walleyes in Houghton Lake, Lake Cadillac, Lake Gogebic, and the lakes on Isle Royale, when added to data given by Eschmeyer and others, confirm the importance of fish--especially young perch--in the diet of adult and sub-adult walleyes in Michigan. Occasionally insects (chiefly mayflies and midges) make up significant portions of the diet in certain lakes (such as impoundments on the Muskegon River) or in certain seasons (principally during the insect hatches). Cannibalism by large walleyes on under-yearlings has been observed, but it appears to be infrequent.

Table 1.--Summary by lake of sampling dates, size, and number of walleyes examined

Lake	Date	Walleye length (cm)	Number of walleyes		
			With food	Empty	Total
Houghton	6-7 July 1971	31.4-61.5	13	8	21
Cadillac	8-9 July 1971	17.6-36.4	15	4	19
Gogebic	29 Sep 1971	17.0-61.0	16	4	20
Gogebic	17-21 Sep 1928	29.0-46.3	9	0	9
Whittlesey	1-3 Oct 1971	27.4-48.5	17	9	26
Whittlesey	Sep 1928	25.5-35.5	2	2	4
Chickenbone	Sep 1928	15.4-31.2	3	2	5
Dustin	Sep 1928	35.7	1	0	1

Table 2.--Average total length in centimeters by age group, of walleyes from the study lakes (number of fish in parentheses)

Lake and date	Age group I	II	III	IV	V	VI	VII	VIII
Houghton								
Sep 1960	23.1 (27)	....	39.6 (5)	43.7 (3)	48.3 (1)	50.8 (2)	....	....
May 1962	....	26.1 (2)	32.3 (28)	40.6 (5)	45.5 (6)	46.2 (4)	50.0 (6)	50.0 (2)
July 1971	....	....	35.6 (6)	36.8 (8)	....	43.2 (3)	51.3 (3)	....
June 1972	....	....	34.3 (4)	40.9 (8)	....	48.3 (4)	50.8 (2)	51.6 (2)
Cadillac								
June 1947	21.3 (4)	29.2 (13)	33.5 (22)	37.1 (72)	39.4 (97)	42.7 (74)	45.0 (28)	47.0 (16)
June 1948	....	28.4 (25)	31.5 (3)	36.1 (130)	38.9 (43)	41.7 (22)	43.4 (23)	46.0 (7)
Oct 1961	24.9 (2)	31.2 (7)	38.6 (1)	....	46.2 (1)	....	....	....
July 1971	18.1 (2)	27.1 (5)	34.4 (9)	36.0 (3)	....	....	....	....
Gogebic								
Sep 1928	....	....	37.7 (2)	42.2 (5)	39.8 (1)	....	....	....
Jan 1941-47	11.7 (519)	23.8 (390)	30.7 (375)	36.1 (351)	40.1 (256)	43.7 (142)	49.5 (85)	54.4 (56)
Sep 1971	18.5 (7)	26.4 (4)	32.7 (7)	....	....	61.0 (1)	....	....
Whittlesey								
Sep 1971	....	28.9 (3)	....	34.4 (1)	37.1 (3)	43.2 (5)	45.0 (5)	46.0 (1)
Sep 1928	....	25.2 (1)	28.9 (2)	....	35.5 (1)	....	....	....
Chickenbone								
Sep 1928	15.4 (1)	....	28.0 (1)	29.6 (2)	....	34.5 (1)	....	....
Dustin								
Sep 1928	....	....	....	....	35.7 (1)	....	....	....
State average	24.1	33.8	38.6	43.7	47.2	48.8	49.8	54.9

Table 3.--Frequency of occurrence (%), number per fish, and weight per fish, of food organisms in the stomachs of walleyes collected from Houghton Lake and Lake Cadillac in July 1971, based on stomachs containing food

Food type	Houghton Lake			Lake Cadillac		
	Freq. (%)	Number per fish	Wt. per fish (mg)	Freq. (%)	Number per fish	Wt. per fish (mg)
Insects (total)	15.0	0.6	10	20.0	0.3	tr
Chironomidae	15.0	0.5	7	13.3	0.1	tr
Ephemeroptera	0.0	0.0	0	0.0	0.0	0
Other	7.7	0.8	3	13.3	0.1	tr
Crustacea (total)	0.0	0.0	0	20.0	0.4	0
Crayfish	0.0	0.0	0	6.7	0.1	4
Amphipoda	0.0	0.0	0	13.3	0.3	tr
Fish (total)	92.3	5.8	586	100.0	7.6	1780
Yellow perch	23.1	3.5	138	93.3	7.5	1752
Other	7.7	0.2	423	6.7	0.1	28
Unidentified	61.5	2.2	25	0.0	0.0	0
Miscellaneous (total)	7.7	tr[1]	3	0.0	0.0	0

[1] tr = trace.

Table 4.--Frequency of occurrence (%), and number per fish, of food organisms in the stomachs of walleyes collected from Lake Gogebic and Lake Whittlesey in September 1971, based on stomachs containing food

Food type	Lake Gogebic		Lake Whittlesey	
	Freq. (%)	Number per fish	Freq. (%)	Number per fish
Insects (total)	6.2	0.1	35.3	0.9
Chironomidae	6.2	0.1	11.8	0.2
Ephemeroptera	0.0	0.0	17.6	0.2
Other	0.0	0.0	11.8	0.5
Crustacea (total)	6.2	0.1	0.0	0.0
Crayfish	6.2	0.1	0.0	0.0
Amphipoda	0.0	0.0	0.0	0.0
Fish (total)	87.5	1.2	70.6	1.4
Yellow perch	50.0	0.6	23.5	0.4
Other	12.5	0.1	23.5	0.2
Unidentified	50.0	0.5	47.0	0.8
Miscellaneous (total)	25.0	0.2	17.6	0.2

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