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FOOD OF WALLEYE AND SAUGER IN LAKE WINNEBAGO

by

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INTRODUCTION

The walleye, Stizostedion vitreum (Mitchill) and sauger, Stizostedion canadense (Smith), two closely related species in Lake Winnebago, are being studied to obtain further life-history information for better management and utilization of these important sport fishes. This report is a summary of the food items consumed by these two species in Lake Winnebago, during three sampling periods in the fall of 1960 and winter of 1960 and 1961.

METHODS

Collections of both species during January and February, 1960 and 1961, were made between 10:00 a.m. and 5:00 p.m. from ice fishermen. Only fish that were not frozen were used. In October and November, 1960, stomachs taken from walleyes by trap-netting, trawling, and electro-fishing were examined.

The fish were measured, weighed, and sexed. Stomachs (esophagus to the pylorus) were removed and placed in individual vials containing 10 per cent formalin.

Numerical determinations consisted of counting each individual food item (whole organisms and fragments). Volumetric measurements of whole organisms and fragments from each stomach were made by water displacement in a cylinder, graduated to 0.1 milliliters. Stomachs were grouped according to the total length of each fish at capture. Percentages are based on the number of stomachs containing food.

RESULTS

Walleyes

January-February, 1960

Fish were the most important food item, comprising 98.3 per cent of the total food volume (Table 2). Next in importance were leeches (Helobdella sp.) occurring in 60.3 per cent of the stomachs but comprising only 1.6 per cent of the total food volume. Midge larvae (Tendipes sp.) occurred in only one walleye.

Food preference among the three size-groups did not vary considerably. Lake emerald shiners were the most important forage fish found in all size-groups. Trout-perch and leeches were found only in walleyes over 11 inches. Walleyes over 15 inches utilized the larger forage species -- freshwater drum and white bass.

January-February, 1961

Fish were the most important food item with bait minnows (lake emerald shiner, fathead minnow, and 5-spine stickleback) comprising 11.2 per cent of the total food volume (Table 3). Hook marks through the eyes or back distinguished these species as bait minnows. Midge larvae were the most-represented natural food item, occurring in 21.7 per cent of the stomachs.

Food preference among the three size-groups did vary considerably. Walleyes under 11 inches utilized Daphnia pulex and the mayfly nymph (Caenis sp.). Only fish over 15 inches utilized freshwater drum. The unidentified fish remains are suspected to be from bait minnows since natural forage fishes (troutperch and lake emerald shiner) were scarce in Lake Winnebago during 1960.

October-November, 1960

In this sample, 573 (56.2 per cent) walleyes were obtained from trap nets which accounts for the high percentage of empty stomachs. Walleyes held in trap nets for two or three nights have time to digest or regurgitate their food.

Fish were the most important food item, comprising 99.7 per cent of the total food volume (Table 4). Yellow perch were utilized by walleyes in all size-groups, being the most preferred item in fish over 11 inches. Troutperch occurred in 53.3 per cent of the walleyes under 11 inches, but were only of minor importance in walleyes over 11 inches. Lake emerald shiners were utilized by walleyes in all size-groups, but comprised only 3.9 per cent of food items found. Brown bullheads were utilized by walleyes in all size-groups. Walleyes over 15 inches also utilized walleyes, saugers, white bass, freshwater drum, spottail shiners, rock bass, pumpkinseed, black crappie, mooneye, and burbot. Unidentified fish remains in most cases were perch, troutperch, or lake emerald shiners.

Invertebrate organisms were most numerous in fish under 15 inches. Leeches, Hyallolella sp., and midge larvae were found in walleyes from all size-groups.

Saugers

January-February, 1960

Fish were the most important food item, comprising 99.7 per cent of the total food volume (Table 5). Troutperch were the most preferred forage fish occurring in 24.4 per cent of the stomachs. Lake emerald shiners were utilized by all size-groups, occurring in 23.4 per cent of the stomachs. Fish over 14 inches utilized freshwater drum. Unidentified fish remains in most cases were from troutperch and lake emerald shiners.

All size-groups utilized leeches and midge larvae.

January-February, 1961

Midge larvae were the most abundant food item occurring in 61.0 per cent of the stomachs and comprised 18.3 per cent of the total food volume (Table 6). Leeches were utilized by all size-groups.

Fish accounted for 81.7 per cent of the total food volume of which 47.3 per cent was bait minnows as determined from hook marks. Unidentified fish remains were probably from bait minnows since natural forage species were low in abundance.

Food availability

Forage fish availability in Lake Winnebago from September through November, 1959 and 1960, was obtained by trawling with a 10- or 12-foot bait trawl (Table 1). Trawling data are not reliable in determining abundance of lake emerald shiners since the shiners are pelagic and the catch by trawls is too irregular.

An abundance of adult troutperch, and young-of-the-year troutperch and freshwater drum were available to the walleyes and saugers during January and February, 1960. Poor spawning success and survival of the 1960 year class of troutperch, freshwater drum, and lake emerald shiners made these forage species unavailable to the walleye and sauger during the fall of 1960 and winter of 1960-1961. Lack of forage species during this period forced the walleyes and sauger to use the ever-abundant midge larvae. Palm (1960) stated that several localized areas of Lake Winnebago had 150 to 175 larvae per square foot late in the fall, 1960. Areas with low larvae density had from 50 to 75 larvae per square foot.

TABLE 1

Availability of Forage Fish
(Lake Winnebago, September -
November, 1959 and 1960)

Species	Age	Average Catch Per Haul*	
		1959	1960
Troutperch	Adult	37.2	17.2
Troutperch	"0" age	668.8	63.9
Lake emerald shiner	Adult and "0" age	9.9	8.0
Freshwater drum	"0" age	39.1	1.5

*Each haul consisted of a 7-minute tow of a 10-foot bait trawl; 53 hauls were made in 1959 and 47 in 1960.

DISCUSSION

January-February, 1960 and 1961

When forage fishes were generally present in abundance (1960), walleyes preferred the less available lake emerald shiner while troutperch were utilized to a greater extent by the saugers. In most cases the unidentified fish remains found in walleye stomachs were considered lake emerald shiner remains because of their smaller size and general appearance. Sibley (1929) reported that walleyes preferred lake emerald shiners over troutperch in the Erie-Niagara System, New York, and Doan (1942) found that walleyes preferred lake emerald shiners over freshwater drum and white bass in Western Lake Erie. Eschmeyer (1950) reported that walleyes preferred minnows over troutperch in Lake Gogebic, Michigan.

Even when a good population of young-of-the-year freshwater drum (3-7 inches in total length) was available, these fish were not readily utilized by walleyes or saugers. Only walleyes over 15 inches and saugers over 11 inches utilized drum. Rapid growth in length and body width soon makes the drum unavailable to fish under 11 inches.

During the winter of 1961, when forage fishes were scarce, the walleye and sauger utilized midge larvae. These larvae were found in 61.0 per cent of the sauger stomachs and 21.7 per cent of the walleye stomachs in the 1961 sample. All size-groups of saugers utilized these larvae to a greater extent than did the walleyes. During this time, walleyes and saugers also demonstrated their ability to "rob" bait minnows from the angler. In the 1961 sample, 21.7 per cent of the walleyes and 30.8 per cent of the saugers had bait minnows in their stomachs in addition to the unidentified fish remains which were considered bait minnows in this sample. Creel census during the sampling period indicated that anglers using lake emerald shiners for bait had better success than anglers using fathead minnows.

All size-groups of walleyes and saugers utilized leeches. Walleyes and saugers under 11 inches utilized the most invertebrates and a greater variety of them.

October-November, 1960

Since troutperch, freshwater drum, and lake emerald shiner populations in Lake Winnebago were low during the fall of 1960, walleyes showed a greater preference for yellow perch which were completely lacking in the winter samples of 1960 and 1961. Walleyes taken while electro-fishing in bays and along the shore utilized more yellow perch than walleyes taken from deeper areas of the lake. Samples obtained from trawling and trap-netting showed that walleyes preferred troutperch and white bass. Walleyes over 15 inches utilized yearling white bass, freshwater drum, walleyes, and saugers to a

greater extent than walleyes examined from the two winter samples. Brown bullheads were found in walleyes from all size-groups that were taken in bays or along the shore.

SUMMARY

Walleyes showed a greater preference for lake emerald shiners, while saugers preferred troutperch.

When forage fishes were unavailable the walleyes and saugers utilized midge larvae.

Freshwater drum, because of rapid growth in length and body width, soon became unavailable to walleyes and saugers under 11 inches.

Brown bullheads were utilized by all size-groups of walleyes that were taken in bays or along the shore during the fall.

Food preference among the size-groups of walleyes did not vary considerably.

Leeches were utilized by walleyes and saugers in all size-groups.

Walleyes and saugers under 11 inches utilized more and a greater variety of invertebrate organisms.

Food preference among the size-groups of saugers did not vary considerably.

LITERATURE CITED

DOAN, KENNETH H.

1942. Some meteorological and limnological conditions as factors in the abundance of certain fishes in Lake Erie. *Ecol. Monogr.*, 12:293-314.

ESCHMEYER, PAUL H.

1950. The life history of the walleye, Stizostedion vitreum vitreum, (Mitchill), in Michigan. *Univ. of Michigan Studies No. 3*, pp. 56-74.

PALM, DANIEL and WILLIAM HILSENHOFF

1960. Winnebago Lake fly control project. Annual report 1960. *Univ. of Wisconsin*, pp. 34-37.

SIBLEY, C. K.

1929. The food of certain fishes of the Lake Erie drainage basin. A biological survey of the Erie-Niagara system. *Suppl. 18th Ann. Rept. N. Y. Cons. Dept. (1928)*, pp. 180-188.

TABLE 2

Stomach contents of walleyes from
Lake Winnebago, January-February, 1960

Total sample: 130
Stomachs with food: 58 (44.6%)

Size class	7-11" (7 fish)			11-15" (16 fish)			15-22" (35 fish)			Total		
	Per cent stomachs with item	Avg. no. items/ stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/ stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/ stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/ stomach	Per cent total volume
Lake emerald shiner	28.6	1.0	52.9	6.2	2.0	21.6	20.0	1.3	15.7	17.2	1.3	19.5
Freshwater drum							11.4	1.2	17.5	6.9	1.2	13.6
Trout perch				6.2	1.0	32.2	5.7	1.0	11.9	5.2	1.0	13.8
White bass							2.9	1.0	24.8	1.7	1.0	19.3
Unidentified fish remains	71.0	1.0	47.1	37.3	1.0	44.9	30.8	1.1	28.2	37.9	1.0	32.1
Leeches, <i>Helobdella</i> sp.				50.0	1.9	1.3	77.1	5.1	1.9	60.3	4.3	1.6
<i>Tendipes</i> larvae	14.3	2.0	Tr.							1.7	2.0	Tr.

Tr. - Trace, less than 0.1 per cent of volume.

TABLE 3

Stomach contents of walleyes from
Lake Winnebago, January-February, 1961

Total sample: 56
Stomachs with food: 32 (57.1%)

Size class	7-11" (15 fish)			11-15" (4 fish)			15-22" (13 fish)			Total		
	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume
Lake emerald shiner				25.0	1.0	4.8				3.1	1.0	0.8
Freshwater drum							38.4	1.0	72.4	15.6	1.0	47.7
Bait minnows	20.0	1.0	36.0	75.0	1.0	25.3	7.6	1.0	4.0	21.7	1.0	11.2
Unidentified fish remains	33.3	1.4	51.4	50.0	3.5	69.9	38.4	2.6	20.2	37.5	2.3	35.7
Leeches, <u>Helobdella</u> sp.	13.3	2.0	0.5				15.3	1.0	Tr.	12.5	1.5	0.2
<u>Tendipes</u> larvae	26.6	11.7	5.3				23.0	19.3	3.3	21.7	14.9	3.1
<u>Caenis</u> sp.	13.3	10.5	4.9							6.2	10.5	0.9
<u>Daphnia pulex</u>	6.6	338.0	1.9							3.1	338.0	0.4

Tr. - Trace, less than 0.1 per cent of volume.

Bait minnows - Lake emerald shiner, fathead, 5-spine stickleback.

TABLE 4
Stomach contents of walleyes from
Lake Winnebago, October-November, 1960

Total sample: 1,018
Stomachs with food: 311 (30.5%)

Size class	7-11" (45 fish)			11-15" (56 fish)			15-26" (210 fish)			Total		
Food item	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume
Walleye							4.5	1.1	5.4	2.9	1.1	5.1
Sauger							1.4	1.0	2.5	0.9	1.0	2.4
Yellow perch	2.0	1.0	0.2	33.9	1.4	60.5	52.3	1.7	36.2	41.8	1.7	36.3
White bass							17.1	1.1	39.2	11.6	1.2	37.1
Freshwater drum							6.6	1.4	2.9	4.5	1.4	2.8
Trout perch	53.3	1.1	83.8	7.1	1.5	10.6	4.5	1.0	0.4	11.9	1.1	2.4
Lake emerald shiner	8.8	1.3	3.4	10.7	1.7	4.2	0.9	1.0	Tr.	3.9	1.4	0.2
Spottail shiner							0.4	1.0	Tr.	0.3	1.0	Tr.
Rock bass							0.9	1.0	0.9	0.6	1.0	0.9
Pumpkinseed							3.3	1.0	2.5	2.3	1.0	2.4
Brown bullhead	13.3	1.5	9.4	7.1	1.7	11.9	9.5	1.5	6.5	9.6	1.5	6.7
Black crappie							0.4	1.0	1.8	0.3	1.0	1.7
Mooneye							0.4	1.0	0.2	0.3	1.0	0.2
Freshwater burbot							0.4	1.0	0.1	0.3	1.0	0.1
Unidentified fish remains	8.8	1.0	1.4	25.0	1.2	10.5	10.0	1.2	1.1	12.5	1.1	1.4
Leeches, <i>Helobdella</i> sp.	2.0	5.0	Tr.	3.5	1.5	0.1	1.9	2.8	Tr.	2.3	2.7	Tr.
<i>Leptodora</i> sp.				1.8	52.0	0.1				0.3	52.0	Tr.
<i>Hyallela</i> sp.	20.0	31.0	0.7	21.4	111.0	1.8	0.4	228.0	Tr.	7.1	83.6	0.1
<i>Tendipes</i> larvae	13.3	6.0	0.5	1.8	1.0	Tr.	0.4	18.0	Tr.	2.6	6.9	Tr.
<i>Hexagenia</i> sp.	2.0	1.0	Tr.							0.3	1.0	Tr.
<i>Caenis</i> sp.	11.1	2.6	0.2	1.8	1.0	0.1				1.9	2.3	Tr.
<i>Ephemerella</i> sp.				8.9	2.8	0.1				1.6	2.8	Tr.
<i>Limnephilus</i> sp.	2.0	1.0	0.2							0.3	1.0	Tr.
<i>Physa</i> sp.	2.0	1.0	0.1							0.3	1.0	Tr.

Tr. - Trace, less than 0.1 per cent of volume.

TABLE 5

Stomach contents of saugers from
Lake Winnebago, January-February, 1960

Total sample: 629
Stomachs with food: 316 (50.3%)

Size class	6-11" (7 fish)			11-14" (218 fish)			14-18" (91 fish)			Total		
	Food item	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach
Trout perch	14.3	1.0	41.6	22.0	1.1	46.0	30.7	1.1	58.7	24.4	1.1	51.0
Lake emerald shiner	14.3	1.0	33.3	24.8	1.3	39.2	20.9	1.1	15.3	23.4	1.2	29.5
Freshwater drum				0.5	1.0	0.4	10.9	1.0	14.9	3.5	1.0	6.2
Common shiner							1.1	1.0	1.2	0.3	1.0	0.5
Unidentified fish remains	57.1	1.0	25.0	40.4	1.1	14.2	30.7	1.1	9.7	37.9	1.0	12.5
Oligochaetes							1.1	2.0	Tr.	0.3	2.0	Tr.
Leeches, <i>Helobdella</i> sp.	14.3	1.0	Tr.	27.1	1.1	Tr.	37.4	1.4	0.1	29.7	1.2	0.1
<i>Tendipes</i> larvae	14.3	1.0	Tr.	1.8	3.5	Tr.	2.2	3.5	Tr.	2.2	3.1	0.1
<i>Physsa</i> sp.				0.5	1.0	Tr.				0.3	1.0	Tr.

Tr. - Trace, less than 0.1 per cent of volume.

TABLE 6

Stomach contents of saugers from
Lake Winnebago, January-February, 1961

Total sample: 231
Stomachs with food: 136 (58.9%)

Size class	6-11" (13 fish)			11-14" (73 fish)			14-18" (50 fish)			Total		
Food item	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume	Per cent stomachs with item	Avg. no. items/stomach	Per cent total volume
Trout perch				2.7	2.0	11.2				1.5	2.0	4.5
Lake emerald shiner				6.8	1.4	6.3	2.0	2.0	1.3	4.4	1.5	3.9
Freshwater drum				2.7	1.0	11.2	4.0	1.0	12.8	2.9	1.0	11.4
Bait minnows	15.3	1.0	34.7	30.1	1.7	42.2	40.0	1.2	51.4	30.8	1.5	47.3
Unidentified fish remains	46.1	1.3	53.4	17.8	1.2	8.7	20.0	1.7	18.1	21.3	1.4	14.5
Leeches, <i>Helobdella</i> sp.	7.6	1.0	Tr.	4.1	1.0	Tr.	4.0	1.0	Tr.	1.5	1.0	Tr.
<i>Tendipes</i> larvae	61.5	10.8	11.8	65.7	33.0	20.3	54.0	36.2	16.3	61.0	31.9	18.3

Tr. - Trace, less than 0.1 per cent of volume.

Bait minnows - lake emerald shiners and fathead minnows.