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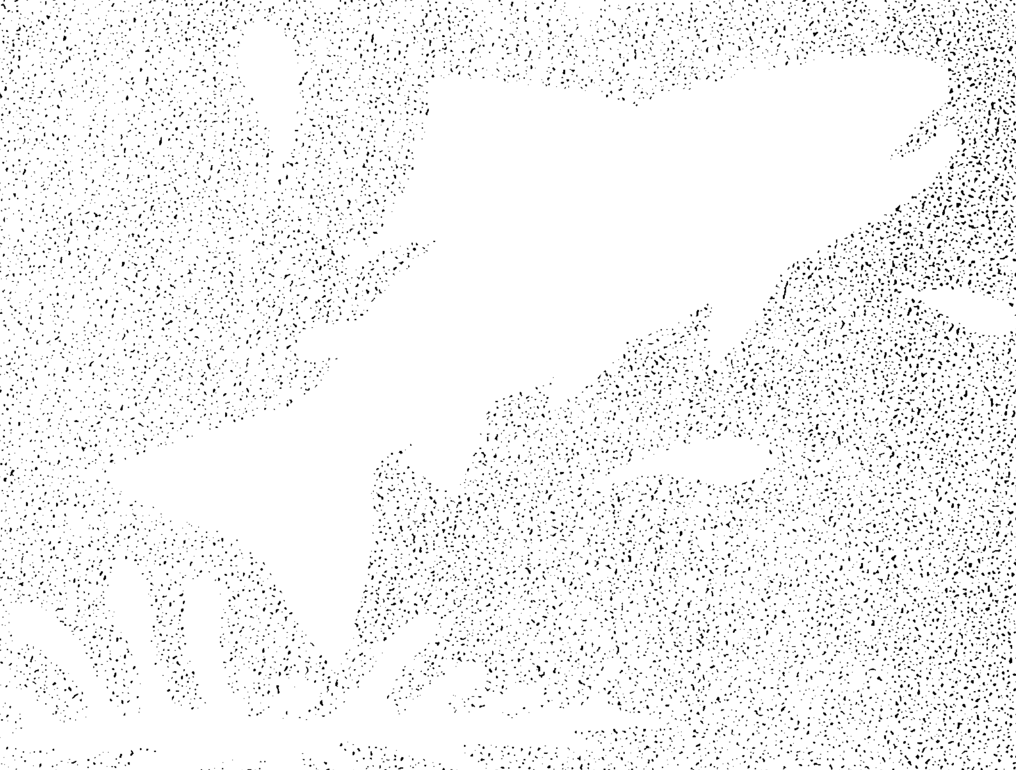

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SURVIVAL, GROWTH AND VULNERABILITY TO ANGLING OF WALLEYES STOCKED AS FINGERLINGS IN A SMALL LAKE WITH BLUEGILLS [1]

By George B. Beyerle

Abstract

Beginning in 1972, 4-inch walleye fingerlings were stocked for three consecutive years at a rate of 45 per acre in 5.6-acre Emerald Lake over an established bluegill population. Survival of the three walleye year classes to September 1975 was 35.2, 21.2, and 0.0%, respectively, resulting in a total standing crop of 25.2 fish per acre (15.1 pounds per acre). Growth of the two surviving year classes was slow. Mean length of age-III walleyes was 13.9 inches and age-II walleyes averaged 10.9 inches (1.3 inches and 2.4 inches, respectively, less than the average growth in Michigan). Bluegills or green sunfish were found in 98% of the walleye stomachs that contained food.

Using data from a previous study, I found that northern pike were 5.8 times more vulnerable than walleyes to angling in Emerald Lake. In 30 man-hours of fishing prior to rotenone treatment, 7 walleyes weighing a total of 4.7 pounds were caught. Assuming catch-per-unit effort remained constant, a yield of 3.0 pounds per acre would be realized after only 107 man-hours of fishing. The standing crop and projected yield of walleyes in Emerald Lake was equivalent to standing crops and yields in "good" walleye lakes.

[1] Contribution from Dingell-Johnson Project F-35-R, Michigan

Introduction

Relatively few lakes in Michigan contain self-sustaining populations of walleyes. Past attempts to rejuvenate existing walleye fisheries and to create new fisheries by stocking either fry or small fingerlings invariably have been unsuccessful (Schneider 1969).

Survival and growth of any stocked fish are dependent on many interacting factors. Initial survival is related to the condition or health of the fish when stocked and the physical and chemical suitability of the water to the particular species being stocked. Important factors in survival and growth following stocking are the density of acceptable food organisms, the density of potential predators and competitors, and the availability of food organisms to the predators. Availability is important to both the stocked fish and their food, and to the organisms that prey on the stocked fish.

As with other fishes, the success of past walleye stockings probably has been proportional to the extent to which the fish manager correctly predicted the interaction of the various survival and growth factors in his stocking strategy. Walleye fry, small fingerlings, and large fingerlings all have their place in a stocking program. The challenge to the fish manager is to recognize the situations where each size of walleye can best be utilized. To aid the manager in his determinations, much more information is needed on the potential for survival and growth of stocked walleyes of all sizes in combination with various other fish species, and in lakes of different characteristics. In this study we wanted to measure the survival and growth of 4-inch walleye fingerlings stocked in a small lake with bluegills as the only other fish species. We also wanted to test the angling vulnerability of walleyes in a small lake.

Procedure

The existing fish population in Emerald Lake (5.6 acres), Calhoun County, was poisoned with rotenone in September 1971. In June 1972, 25 pounds of adult bluegills (over 4.0 inches) and 30 pounds of juvenile bluegills (under 4.0 inches) were stocked.

Shoreline observations in early fall 1972, indicated that fewer than anticipated young-of-the-year bluegills were present. Consequently, in October, 20 pounds (2,500 fish per acre) of young-of-the-year bluegills were stocked. In fall 1973, shoreline observations indicated the existence of a relatively large 1973 year class of bluegills. During the first 2 years of the study, Emerald Lake was infiltrated with a small number of green sunfish which produced small to moderate year classes in 1973 through 1975. No estimate was made of the relative abundance of young-of-the-year bluegills in 1974 and 1975 because of the presence of these young green sunfish.

Marked walleye fingerlings from Wolf Lake Hatchery were stocked at a rate of 45 per acre in October 1972 (250 walleyes; mean length 4.1 inches), October 1973 (250 walleyes; mean length 4.0 inches), and August 1974 (250 walleyes; mean length 3.9 inches). To control aquatic plant growth, Emerald Lake was treated in June 1972 and June 1974 with Aquathol-Plus and copper sulfate and in June 1975 with Diquat and copper sulfate.

In July 1973, a fisheries aide equipped with scuba gear observed about seven walleyes 6-7 inches in length near the bottom (8-foot depth) in cooler, spring-fed water. No young bluegills were observed in the cooler water. In June 1974, three walleyes about 10 inches in length were observed on the bottom closer to shore (4- to 6-foot depth) near a small patch of weeds. These same areas also were inhabited by bluegills of various sizes.

During the last week of August 1975, three research personnel fished Emerald Lake for a total of 30 man-hours (15 man-hours trolling from a boat and 15 man-hours casting from shore). Spinners, spoons, plugs and live bait were used in an attempt to catch as many walleyes as possible.

Emerald Lake was poisoned with rotenone in September 1975. During the 5 days following the rotenone treatment all walleyes and other fish were picked up. Walleyes were separated into year classes, measured and weighed. Stomach contents were analyzed for all walleyes collected during the first 2 days following treatment. Bluegills and green sunfish were collected and weighed en masse. A random sample was taken from the collection, and the relative abundance and standing crop were estimated for each inch group. Incidental fishes collected included 5 largemouth bass (1.5 pounds per acre), 1 yellow perch, 1 carp, and 7 bullheads.

Results and discussion

The survival and growth of walleyes in Emerald Lake are shown in Table 1. As expected the first walleyes stocked (1972 year class) had the highest survival, 35.2%. Survival of the 1973 year class was also relatively high, 21.2%. However, none of the 1974 year class of walleyes was recovered. In 1974 the walleye fingerlings were stocked in mid-August when the surface water temperature in Emerald Lake was 80 F. The stocked fingerlings remained in warm, shallow water and seemed to turn almost white in color. When disturbed they swam off a few feet but not into the deeper, cooler water. Thus, it is assumed that many, if not all, of the 1974 year class walleyes died of temperature shock shortly after being stocked.

During 1966-68, a northern pike-bluegill population was established and maintained for 3 years in Emerald Lake (Beyerle, 1971). In that study survival of the first year-class of planted fingerling pike was exceedingly high (60.4%). However, survival of the two succeeding planted stocks was only 0.8 and 9.2%, respectively. In a similar northern pike-bluegill population at 15-acre Daggett Lake, Barry County, survival of the three consecutive plantings of fingerling pike was 44.1, 2.7, and 1.5%, respectively. The consistently high survival of the first stocking of fingerling walleyes or northern pike in each study is convincing evidence that, in small lakes where there is an abundant supply of food (even young bluegills) and a minimum number of other piscivorous fishes of the same or larger size, a significant population of these predatory species can be established. The relatively high survival of the second stock of walleyes compared with the very low survival of equivalent stocks of northern pike suggests that either relatively more small bluegills were available during the second year of the walleye study or that larger pike are much more cannibalistic than larger walleyes. Survival of the first two year classes of walleyes in Emerald Lake totaled 25.2 fish per acre (Table 1), of which 13.6 fish per acre (53.9%) were 13.0 inches or larger. Threinen (1955) and Mayhew (1960) have estimated that 14 to 20 walleyes per acre are necessary to produce "good" fishing. Thus, the standing crop of walleyes in Emerald Lake had the potential to produce "good" walleye fishing.

In contrast to the high survival, growth of both year classes of walleyes was rather slow. The 4.1-inch fingerlings stocked in fall 1972 averaged only 13.9 inches by September 1975--1.3 inches less than state average. Similarly 4.0-inch fingerlings stocked in 1973 were 10.9 inches in September 1975--2.4 inches less than state average.

During the 2 days immediately following the rotenone treatment, stomach contents were removed from 71 walleyes, 55 (77.5%) of which contained food (Table 2). Unidentified items were the only food found in five stomachs. Of the remaining 50 stomachs with food, 49 (98.0%) contained fish (bluegills or green sunfish) or fish remains. Crayfish were found in two stomachs and caddis larvae were also found in two stomachs. There was essentially no difference between the two year classes of walleyes in percentage of stomachs containing food, but stomachs of age-III walleyes averaged 4.5 items compared to 2.8 items per stomach of age-II walleyes. Mean length of fish in the stomachs was 1.81 inches; 1.62 inches for age-II walleyes and 1.85 inches for age-III walleyes.

No fish over 3.0 inches in length were found in the stomachs of age-II walleyes (Table 3), but seven centrarchids (5.1% of the total number of food items), ranging in length from 3.1 to 5.1 inches were contained in the stomachs of age-III walleyes. Among fish food items for which the length could be determined, 76.9% from age-II walleyes and 84.8% from age-III walleyes were under 2.0 inches in length. However, when the estimated standing crop of centrarchids was compared with walleye stomach contents (Table 3), there was a statistically significant tendency for age-II walleyes to select 2.0- to 2.9-inch centrarchids. Although age-group III walleyes seemed to select 3.0- to 3.9-inch centrarchids, this tendency was not statistically significant at the 95% level.

In both studies at Emerald Lake, the standing crop of centrarchids (bluegills and green sunfish) at the time of chemical treatment was similar; 132 pounds per acre in the pike study and 146 pounds per acre in the walleye study. Although 98% of the feeding walleyes contained centrarchids, only 29% of feeding pike consumed centrarchids while 50% contained bullfrog tadpoles. Emerald Lake contained a large population of tadpoles during the pike study, but tadpoles were very scarce throughout the walleye study.

In the following discussion of comparative angling vulnerability, "catchable size" walleyes and northern pike are defined as all fish of the two oldest age groups--walleyes over 10.0 inches in length and northern pike over 13.0 inches in length. "Legal size" walleyes are 13.0 inches in length and over; "legal size" northern pike are 20.0 inches in length or longer.

During the week previous to the chemical treatment of Emerald Lake, research personnel spent 30 man-hours fishing for walleyes--15 hours casting from shore and 15 hours trolling. A total of 7 walleyes were caught (6 by casting; 1 by trolling) of which 5 were "legal size". The total catch per man-hour was 0.23 walleye, and 0.16% of "catchable size" walleyes were hooked for each man-hour of fishing. For "legal size" walleyes (a total population of 76 fish) the catch per man-hour was 0.17 fish and 0.22% of all "legal size" walleyes were caught per man-hour. When the angling vulnerability of northern pike was tested in 1968, 16 pike were caught in 11 man-hours of fishing. The total catch per man-hour was 1.45 pike, and 0.95% of "catchable size" pike were hooked each man-hour. Two of the 21 "legal size" pike were caught (0.18 pike per man-hour), and 0.86% of the standing crop of "legal size" pike were caught per man-hour. Allowing for the slight difference in standing crops of "catchable size" walleyes and northern pike (25.2 and 27.4 fish per acre, respectively), a comparison of total catch per man-hour shows that the northern pike were 5.8 times more vulnerable to angling than the walleyes.

Based on these fishing results, it may be predicted that angling over an established population of northern pike in a small lake would be relatively spectacular but short-lived, while fishing for walleyes would be relatively slow but would last longer. The five "legal size" walleyes caught during 30 man-hours of fishing weighed an estimated 4.7 pounds, representing a yield of 0.84 pound per acre. Assuming the rate of catch remained constant, a yield of 3 pounds per acre would be reached after 107 man-hours of fishing (equivalent to about 11 days of fishing for three men). Lakes in Minnesota that yield 2-4 pounds per acre of walleye per year are considered to be "good" walleye lakes (Groebner 1960; Johnson 1964).

In summary, survival of walleyes stocked as 4-inch fingerlings in a small lake with bluegills was surprisingly high, but growth was considerably below state average. After 3 years, the resulting standing crop of walleyes and projected fishing quality were equivalent to that found in "good" walleye lakes.

Table 1.--Survival and growth of walleyes in Emerald Lake, September 1975. Data include fish caught in angling vulnerability test.

Year class	Survival			Growth in inches			
	Per-cent	Number per acre	Pounds per acre	Mean total length Stocked	Mean total length Recov-ered	State aver-age	Growth index
1972	35.2	15.7	11.4	4.1	13.9	15.2	-1.3
1973	21.2	9.5	3.7	4.0	10.9	13.3	-2.4
1974	0.0	0.0	0.0	3.9	....	9.5	-9.5
Totals	....	25.2	15.1	....	....	....	....

Table 2.--Stomach contents of walleyes taken from Emerald Lake with rotenone and by angling, 1975

	Rotenone			Angling		
	Year class			Year class		
	1972	1973	Total	1972	1973	Total
Stomachs examined	44	27	71	5	2	7
Stomachs with food	34	21	55	2	1	3
Stomachs empty	10	6	16	3	1	4
Percent with food	77.3	77.8	77.5	40.0	50.0	42.9
Analysis of stomach contents						
Number of stomachs containing:						
Centrarchids	24	10	34	1	1	2
Fish remains	11	13	24	1	0	1
Crayfish	2	0	2	0	0	0
Caddis larvae	1	1	2	0	0	0
Unidentified	5	2	7	0	0	0
Total stomachs with fish	28	21	49	2	1	3
Percent of feeding walleyes with fish	96.6[a]	100[a]	98.0[a]	100	100	100
Mean number with food items in stomachs with food	4.5	2.8	3.8	1.0	1.0	1.0
Mean length of fish items (inches)	1.85	1.62	1.81	3.8	2.6	3.2
Range (inches)	1.2-5.1	1.1-2.8	1.1-5.1	3.8	2.6	3.2

[a] Stomachs with unidentified items not used in calculation of percentage.

Table 3.--Frequency of occurrence of centrarchids of various sizes in the standing crop and stomachs of walleyes, Emerald Lake, 1975

Length interval (inches)	Estimated standing crop		Walleye stomach contents in percent by age groups	
	Fish per acre	Percent	Age II	Age III
1.3 - 1.9	24,229	84.1	76.9	84.8
2.0 - 2.9	3,166	11.0	23.1	10.1
3.0 - 3.9	731	2.5	0.0	3.6
4.0 - 4.9	244	0.8	0.0	0.0
5.0 - 5.9	304	1.1	0.0	1.4
6.0+	122	0.4	0.0	0.0

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