MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FISHERIES DIVISION

Fisheries Research Report No. 1842

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LONGEVITY, SURVIVAL AND HARVEST OF TAGGED WALLEYES IN LAKE GOGEBIC, MICHIGAN [1]

By James C. Schneider, Paul H. Eschmeyer, [2]
and Walter R. Crowe [3]

ABSTRACT

Returns from 4,400 walleyes tagged in Lake Gogebic, Michigan, in 1947, extended over 18 years. One fish had reached an estimated age of 26 or more years at the time of recovery and two others 23 years. The longevity of walleyes in Lake Gogebic apparently was not due to unusually low natural mortality but to low fishing mortality and statistical chance. The sexes differed significantly in rates of fishing mortality and survival. Anglers recaptured 12.6% of the females but only 7.3% of the males; survival was 65.4% for females and 80.4% for males.

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[1] A contribution from Federal Aid in Fish Restoration Project F-35-R, Michigan.

[2] Present address: U.S. Fish and Wildlife Service, Editorial Office, CSU, Fort Collins, Colorado 80523.

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A tagging study at Lake Gogebic in Michigan's Upper Peninsula, has yielded unique information on longevity and tag retention in the walleye (Stizostedion v. vitreum). In May 1947, No. 3 Monel metal strap tags were applied to the upper or lower jaws of 4,400 walleyes (Eschmeyer 1950). Tags were returned by anglers during each of the next 18 years --the last in 1965. The numbers of returns in different years were as follows: 1947--64, 1948--80, 1949--47, 1950--56, 1951--39, 1952--17, 1953--7, 1954--19, 1955--3, 1956--7, 1957--8, 1958--6, 1959--5, 1960--2, 1961--2, 1962--1, 1963--1, 1964--1, and 1965--1.

The fish recovered in 1965 had been out for 18 years (plus 1 day), that in 1964 for 17 years (minus 2 days) and that in 1963 for 16 years (plus 27 days). Although no scale samples were taken from these three walleyes (all males--sex was easily determinable at the time of tagging, which was during the spawning season), their ages at tagging were estimated by comparing their lengths in 1947 with the average lengths of male walleyes collected in 1947 for which ages were determined (Table 1). On the basis of these estimated ages and the known period of liberty, the walleyes recaptured in 1964 and 1965 were probably each 23 years old and the one recaptured in 1963 was 26 years old or older. To the best of our knowledge the greatest age previously reported in the literature is "a possible 20 years" (Scott and Crossman 1973).

Growth of the three walleyes (all tagged on the lower jaw) was extremely slow during the period of liberty, as judged by the measurements reported by the anglers who recovered them. Increases in total lengths (mm) were only 31, 112, and 99 for the fish recovered in 1963, 1964, and 1965, respectively. Growth of walleyes in Lake Gogebic was slow (Eschmeyer 1950), and jaw tags tend to retard growth (Eschmeyer and Crowe 1955).

The rates of tag returns for male and female walleyes differed markedly (Table 2). Returns totaled 7.3% for males and 12.6% for females. Although the average length of females was longer than that of males at the time of tagging, the observed difference in rate of recapture

between the sexes was not size related. Considering only walleyes 483 mm long or longer when released (all of which were tagged on the upper jaw), returns were 5.3% for males and 13.2% for females; for smaller walleyes (all tagged on the lower jaw), returns were 7.5% for males and 12.2% for females. The difference between the sexes was highly significant in all three groups--chi-squares with 1 df were 22.53 for all sizes, 8.52 for larger walleyes and 12.81 for smaller walleyes. We infer that the higher exploitation of females may have been a result of a more aggressive feeding behavior, and consequently, greater vulnerability to angling. More aggressive feeding by female than by male walleye might also account for the faster growth of females observed by Eschmeyer (1950) in Lake Gogebic and by others in other waters--e.g., Stroud (1949), Hile (1954) and Forney (1965).

Female walleyes had a correspondingly higher rate of total mortality and a shorter life-span than males. Females were retaken during only a 9-year interval. Although this shorter period may have been a consequence of the smaller number of females tagged (only 20.1% of the total), a more extensive analysis suggested other possibilities: For each sex, the logarithm of number of recaptures was plotted against year of recapture with recaptures for the last 4 years averaged to smooth the data (Fig. 1). Only data from walleyes shorter than 483 mm when tagged (hence, all tagged on the lower jaw) were included. The slope of the regression lines is a measure of the survival rate of tagged walleyes as affected by fishing mortality, natural mortality, and tag loss. We assume here that the rate of tag loss was independent of sex, and that the rate of fishing and the likelihood of a recapture being reported were nearly constant (at least without trend) through the years. The annual survival rates so derived were 80.4% for males and 65.4% for females. These rates differed at the 90% level of confidence; the limits were 77.1-84.0% for males and 56.1-76.0% for females.

Much of the variation in the regressions--especially for females--resulted from the small number of recaptures in the year of release. This small return occurred despite rather extensive publicity given the experiment

by posters at points of access about the lake, articles in local newspapers, and personal contacts by a full-time creel census clerk. Stresses caused by the tag or by the tagging operation may have disrupted feeding and reduced the vulnerability of tagged walleyes to anglers during the first year, or perhaps the catch was low because natural forage was abundant. Exclusion of the data for the first year reduced the estimated survival from 80.4 to 79.9% for males and from 65.4 to 59.2% for females, and increased to the 99% level the statistical probability that the survival of the sexes differed.

Most of the 20-41% annual loss of tagged walleyes appears to have been due to natural causes. The sport fishery was light (only 1.5% of the tags were returned the first year) but its effect cannot be soundly estimated because the experiment depended solely on the voluntary return of tags by anglers; furthermore, tagging mortality of at least 1.6% is known to have occurred. Fishing effort may have been slightly higher in the years after 1947, but for the entire study returns were only 8.5%. Thus we judge that annual exploitation was roughly 4% and losses from other causes exceeded 16%. Inasmuch as the jaw tags seemed to be retained well, natural mortality in Lake Gogebic walleyes was apparently significantly above 4 to 5%, the lowest estimates reported for other waters (Forney 1967; Olson 1957). We conclude that the extended period of tag returns in Lake Gogebic was not a result of unusually low natural mortality but of the large number of walleyes tagged and the correspondingly high probability that a few tagged fish would survive for a long time.

Table 1.--Years at liberty and estimated age at recovery of three male walleyes jaw tagged in Lake Gogebic, Michigan, May 1947

Average calculated length of male walleyes in 1947[a]		Recoveries		
Age group	Length (mm)	Length at tagging (mm)	Period at liberty[b] (years)	Estimated age at recapture
V	386	384	18 (1965)	XXIII
VI	424	422	17 (1964)	XXIII
X	457	470	16 (1963)	XXVI+

[a] From Eschmeyer (1950).

[b] Year of recovery in parentheses.

Table 2.--Release and recapture data for male and female walleyes in relation to length at tagging

Length (mm)	Release data: Number[1] Male	Release data: Number[1] Female	Release data: Percent Male	Release data: Percent Female	Recovery data: Number observed[2] Total	Recovery data: Number observed[2] Male	Recovery data: Number observed[2] Female	Recovery data: Number expected[3] Male	Recovery data: Number expected[3] Female
305-482	3,179	564	84.9	15.1	306	237	69	259.9	46.1
483-737	266	303	46.8	53.2	54	14	40	25.2	28.8
All fish	3,445	867	79.9	20.1	360	251	109	287.6	72.4

[1] A total of 4,400 were tagged but the sex of 17 fish was not determined, and 60 males, 11 females and 1 walleye of unknown sex were found dead soon after release.

[2] Not included here are six returns which were submitted without tag numbers and for which sex could not be traced.

[3] The expected number of recaptures equals total number of recaptures times sex ratio at release. The null hypothesis is that males and females will be recaptured in direct proportion to their frequency in the tagged population.

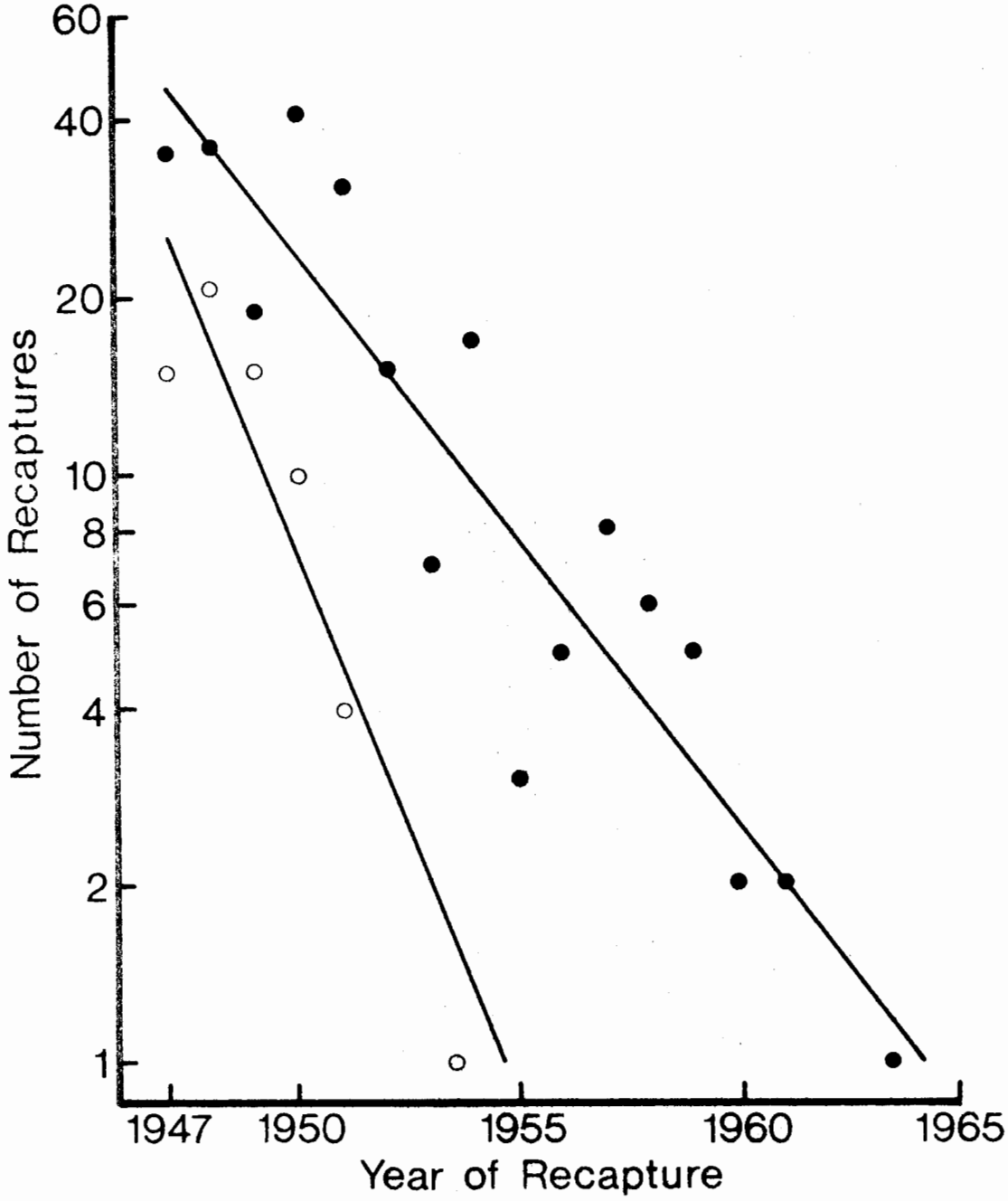

Figure 1.--Annual number of recaptures of male (●) and female (○) walleyes tagged on the lower jaw at Lake Gogebic, May 1947.

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