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cc: Fish Division ✓  
Education-Game  
Inst. for Fish. Res.  
C. T. Yoder  
W. R. Crowe

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DIVISION OF FISHERIES  
MICHIGAN DEPARTMENT OF CONSERVATION  
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Report No. 1421

THE BLUEGILL POPULATION IN BIG BEAR LAKE,  
OTSEGO COUNTY, MICHIGAN

By

Walter R. Crowe

Abstract

At Big Bear Lake, Otsego County, Michigan, age determinations made from scales of bluegills revealed that during a period of more than a decade (1940-1953) virtually the whole bluegill population was composed of fish belonging to the 1938 year class. Throughout the period of intensive investigation, 1940 to 1946, survival of bluegill from year classes subsequent to 1938 was negligible, and fish collecting as late as 1953 indicated that, to the present time, a successful bluegill year class has not appeared.

Possible reasons for poor survival of year classes subsequent to 1938 are suggested.

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THE BLUEGILL POPULATION IN BIG BEAR LAKE,  
OTSEGO COUNTY, MICHIGAN<sup>✓</sup>

Walter R. Crowe

Introduction

In an earlier paper (Crowe, 1953) I reported that the bluegills in Big Bear Lake had seemingly failed to maintain their numbers and that they occupied a questionable position as a component of the fish population in the lake.

Pronounced year-class dominance is a common phenomenon and has been fully described for many sport and commercial fishes. That a single year class should form the greater part of a population of adult bluegills is not unusual, but that the survival of virtually the whole population should depend upon a single year class is remarkable. The almost complete failure during the period of more than a decade of new bluegill year classes to appear is extraordinary. Survival of bluegill progeny from year classes subsequent to 1938 in Big Bear Lake has been negligible. The poor survival is more striking when one considers that this lake appears to be admirably suited to the production of centrarchid fishes.

The physical and biological features of the lake were described earlier (Crowe, 1953), but some of the more salient features should be repeated.

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<sup>✓</sup>Contribution from the Institute for Fisheries Research, Michigan Department of Conservation.

Big Bear Lake is 350 acres in area. It has a maximum depth of 35 feet and a mean depth of 15.8 feet. Since the lake is thermally unstratified, the whole basin is habitable by fish throughout the year. Bottom soils consist of sand and gravel at the margin; and pulpy peat underlies the deeper water. The lake is fairly well supplied with cover in the form of vegetation or brush shelters. The game fish population consists of largemouth bass, smallmouth bass, pumpkinseeds, rock bass, and yellow perch. There are no walleyes or northern pike. Coarse fish are represented by the abundant white sucker, and the less numerous brown and yellow bullheads. Forage species present are the bluntnose minnow, common shiner, mudminnow, western banded killifish, northern muddler, and Iowa darter. Except for the perch, all of the game fish make excellent growth. The lake's reputation as a fish producer is good.

Year-Class Dominance Among Bluegills  
at Big Bear Lake

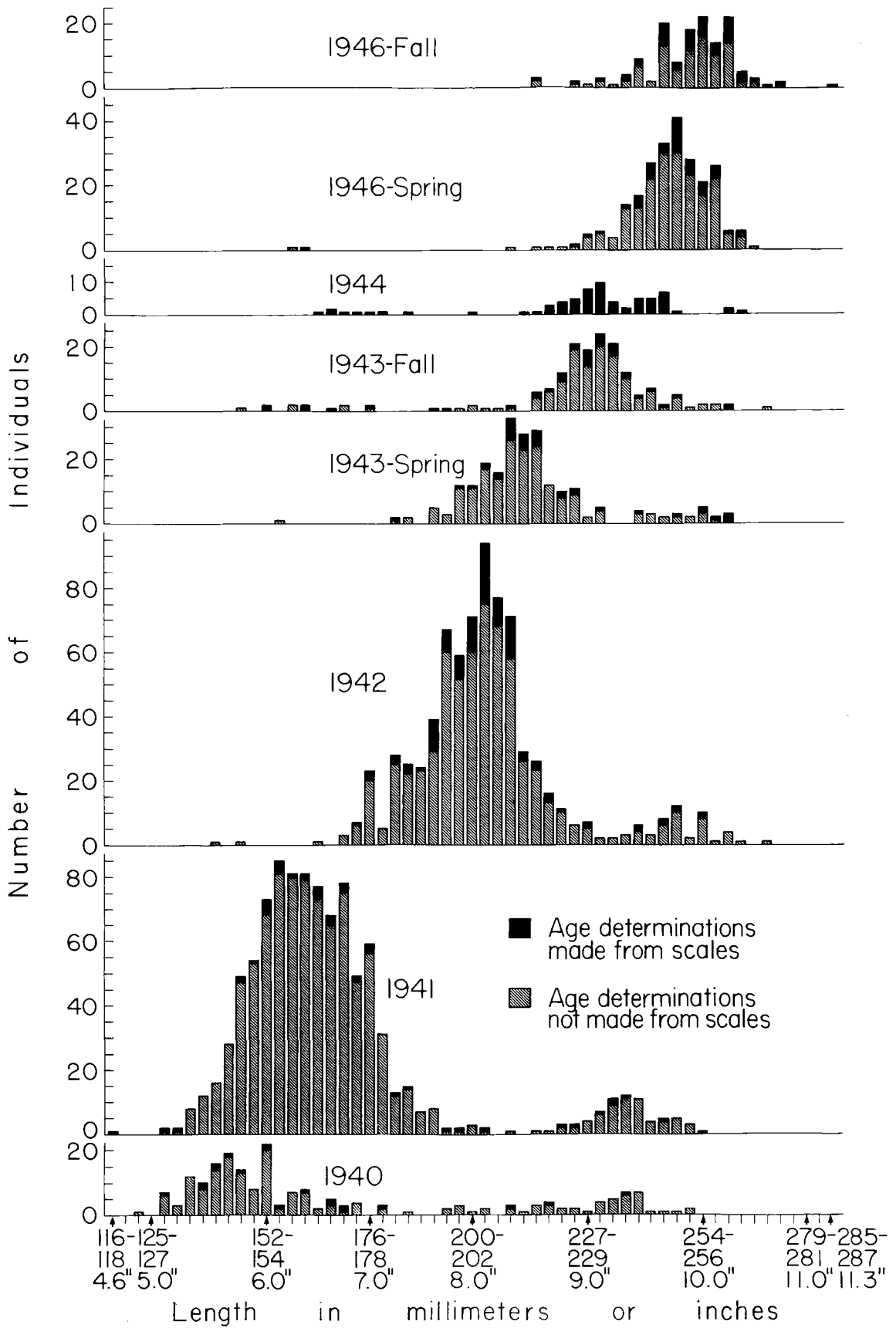
The game fish population of Big Bear Lake was the subject of rather detailed investigation between 1940 and 1946. During this period, the numerical abundance of the various game species was estimated by a mark-and-recapture technique. Results were described earlier (Crowe, 1953). It was noted that bluegills which appeared in the trap-net catches became progressively larger as time elapsed. This phenomenon was not apparent for the other species, and the obvious inference was that there was no recruitment to the bluegill population from year to year whereas the other game fish populations were being replenished by growth of younger fish.

Figure 1 illustrates the progressive increase in size of the bluegills captured during the six-year period. Not all of the bluegills captured were measured but most of them were, and the length-frequency distribution shown in the figure is certainly representative of the bluegills captured in the trap nets. We have no reason to suspect that the average size of the net-caught bluegills was not identical with the average size of the two-year-old and older bluegills in the lake. A census of the fishing in the lake was taken throughout the period, and while bluegills never formed a substantial part of the fish harvest from Big Bear Lake, those which were caught by fishermen were of sizes comparable to those captured in the trap nets.

Scale samples for age determination were secured from some bluegills each year. As can be seen from an examination of Figure 1, the number of scale samples is not large but samples each year were taken from bluegills representing the entire size range. Results of age determinations are summarized in Table I. Each year the major portion of the scale samples come from bluegills belonging to a single year class, and year classes other than 1938 were poorly represented. A comparison of Table I with Figure 1 reveals that the length distribution of the bluegills, whose ages were determined, closely approximates the length distribution of those which were measured but not aged. Apparently most of the larger bluegills (4.6 inches or larger) in Big Bear Lake during the period of 1940 to 1946 were fish of the same age.

Figure 1

# BIG BEAR LAKE BLUEGILLS, 1940-1946, SHOWING DOMINANCE OF 1938 YEAR CLASS





VI	8.8-9.2	8.9-9.6	8.4-8.9	8.9-9.5	8.4-9.7		9.0-9.3	8.5-9.9
	9.0	9.4	8.7	9.3	9.1		9.2	9.4
	(2)	(4)	(2)	(5)	(39)		(2)	(6)
VII	8.9-9.7	9.7-10.0			9.3-10.2	9.4-10.0	9.4-9.5	9.3
	9.3	9.9			9.7	9.7	9.4	9.3
	(5)	(5)			(5)	(2)	(3)	(1)
VIII			9.5-10.1		9.7-10.4		9.5-10.1	9.3-11.3
			9.9		10.2		9.8	10.1
			(3)		(3)		(30)	(35)
IX			9.8-10.1	9.8	9.8		10.0-10.4	10.4-10.5
			10.0	9.8	9.8		10.2	10.4
			(2)	(1)	(1)		(6)	(2)
X				10.2-10.3				
				10.3				
				(2)				

\*For each group of fish, length range and mean length are given in inches. Number of specimens is shown in parentheses. Predominant 1938 year class is outlined, for clarity.



Possible Reasons for Poor Survival  
of Bluegills Hatched After 1938

Reasons for the failure of bluegills representing year classes other than 1938 to appear in significant numbers are not the subject of this report, but a few pertinent observations are in order.

Literature dealing with fisheries management contains many references to the bluegills high reproductive potential, and its tendency to over-populate lakes and ponds under a wide variety of ecological conditions. Bluegills can, and do, spawn under diverse situations, and have been observed spawning throughout most of the summer. Modern concepts of fish management agree that only under the most unusual circumstances is it necessary to stock bluegills on a maintenance basis, whereas usually much effort is put into trying to keep the number of small bluegills down to a desirable minimum. The almost complete failure of "new" bluegills to appear at Big Bear Lake can hardly be attributed to lack of spawning. In late summer and early fall, particularly in 1941 and 1942, young-of-the-year bluegills could be captured by seine with little difficulty. The species was frequently observed spawning. In later years, possibly as a result of a declining population of adults, young-of-the-year bluegills were not so readily captured. The 1938 year class may have represented stocked fish, but this is regarded as improbable in view of numerous studies on survival of hatchery bluegills in other lakes, and in view of the poor survival in Big Bear Lake from plantings made in 1937 and 1939.

The following plants of bluegills were made in Big Bear Lake:

<u>Year</u>	<u>Number</u>	<u>Age</u>
1934	3,000	4 months old
1935	4,000	4 months old
1936	none	
1937	6,000	3 months old
1938	8,000	5 months old
1939	35,750	3 months old

No bluegills have been stocked since 1939 and the species has almost disappeared from the lake. One is forced to consider the possibility that, if bluegills are to survive in Big Bear Lake, periodic introductions may be necessary.

Another possible explanation for the poor survival of bluegills hatched subsequent to 1938 is predation. There have been two or three events which may have had a considerable influence on the survival of bluegills. Suckers were removed in 1943 (Crowe, 1953). Young suckers may have been serving as a buffer species and, when they were no longer available, predation on bluegills may have increased. Secondly, starting about 1945, perch in the lake began to reach rather large size, and for a period of a few years, they provided outstanding fishing. These larger perch may have been more effective as predators than were the smaller ones which had been present earlier. Thirdly, the smallmouth bass has apparently become relatively more abundant than formerly, and predation by this species may have inhibited survival to maturity by bluegills. For predation to have been effective, the reproductive rate of the bluegills must have been low as compared with that of pumpkinseeds or bass (which in itself would be unusual), or the predators must have been highly selective. Predation

on bluegills by other species in Big Bear Lake has not been carefully investigated and its possible importance as a limiting factor is merely suggested here.

Investigations of the lake after 1946 have been brief, at most for a day or two each year. Sufficient fish collecting has been done to reveal that the bluegills are extremely scarce. On the other hand, the species has not disappeared entirely (a single three-year-old was captured by trap net in 1953), and the appearance of a successful year class at any time remains a distinct possibility.

#### Acknowledgments

The investigation at Big Bear Lake was conducted under the supervision of Dr. A. S. Hazzard, Director of the Institute for Fisheries Research. I am indebted to Dr. G. P. Cooper of the Institute who reviewed this paper, and who offered valuable help in its preparation, to Mr. Arthur Schiffman for assistance in the field, and to Mr. William Cristanelli for the preparation of the figure.

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#### LITERATURE

Crowe, Walter R. 1953. Analysis of the Fish Population of Big Bear Lake, Otsego County, Michigan. Pap. Mich. Acad. Sci., Arts, and Letters, 38 (1952): 187-206.