MONTANA DEPARTMENT OF FISH AND GAME

FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana

Project No.: F-33-R-9 Title: Flathead Lake Fisheries Investigation

Job No.: I-b Title: Measure annual trends in recruitment and migration of the kokanee populations and identify the major factors affecting trends

Period Covered: July 1, 1974 through June 30, 1975

ABSTRACT

Age and growth characteristics were established by analyzing measurements from 1,548 scale samples collected from Flathead Lake during the 1974 growing season. The degree of overlap in the size range between age classes III+ and IV+ did not allow separation on size alone. Three-year-old kokanee dominated the mature fish during the 1974 season. Variability of the dominant age group within the spawning populations was noted.

BACKGROUND

Flathead Lake, in northwest Montana, is the State's largest and one of the most important fishing lakes. This large lake contains 20 fish species. Knowledge of their habits and the relationship between species is essential in managing the fisheries resource. Determination of the age of fish is important because it is basic to assessing intra- and inter-specific relationships. Fish growth, in conjunction with length and weight, relates to productivity.

Age and growth studies have been limited on this lake because of its large size and great depth and the difficulty of obtaining adequate scale samples. The recent fish sampling program, 1967 - 1970, and the development of a new experimental purse seine have provided adequate numbers and size selection of fish and, in turn, scale samples for age and growth analysis of several species of fish, particularly the kokanee.

OBJECTIVES AND DEGREE OF ATTAINMENT

The long-range objective of this job is to establish relative abundance of the six major game fish species in Flathead Lake and to identify the environmental factors affecting population changes. During this year the scale analysis portion of a 3-year age-growth study on kokanee was completed and is reported herein. Substantial progress was also made on the portion of this study involving kokanee otoliths.

PROCEDURES

Scale samples for the age and growth analysis were obtained from fish collected during the 1974 growing season, May 30 through September 15, 1974. A total of 829 samples were collected from fish obtained in the purse seine, while 758 samples were obtained through sportsmen creel checks.

The scale sample was extracted from the fish in an area above the lateral line and just posterior to the dorsal fins. The scales were extracted from the fourth row of scales above the lateral line and stored in individual envelopes for each fish. Fish measurements were made to the nearest millimeter in total length (T.L.) and nearest gram in weight. Plastic impressions were made from the scales in a hydraulic press with head plates regulated at 200°F. Impressions of the scales were enlarged 67 diameters with the aid of a Bausch and Lomb microbeam projector. Measurements of the anterior radii were made along a ventral 20° radial line, (Mosher, 1969) and rounded to the nearest millimeter. These measurements were the same as those used by Hanzel, 1974, in his interpretations of the 1972 and 1973 kokanee growth analysis. Calculated lengths at annulus formation were derived from the body-scale relationship computed from the combined totals of 1972 and 1973 body-scale measurements.

FINDINGS

Kokanee Growth

A total of 1,548 kokanee scale samples collected from Flathead Lake during the 1974 growing season, May 30 through September 15, 1974, were analyzed for age and growth characteristics. A length frequency histogram for the age groups present was prepared (Figure 1). The percentages of each age group were as follows: Age I+ - 11.7; Age II+ - 23.4; Age III+ - 39.9; Age IV+ - 25.0. No fish representing age groups 0+ were taken during the collections. Two fish representing age group V+ were taken, but were not included in this analysis.

The average total length of fish at time of capture, for ages I+ through IV+ respectively, were as follows: 125mm (4.9 inches); 220mm (8.7 inches); 269mm (10.6 inches); 285mm (11.2 inches). The major changes noted when comparing the average lengths for each age group from 1973 to 1974, were the increased size by 18mm (0.7 inches) of the Age III+ kokanee in 1974 and the decreased size by 10mm (0.4 inches) of age IV+ salmon. These changed brought the size ranges of these two age groups so close that ages III+ and IV+ could not be distinguished by size alone (Figure 1). Separation by size alone was possible during the 1972 and 1973 seasons.

Growth rate of the 1974 kokanee was determined after establishing a body-length-scale radius relationship of the combined body-scale measurements obtained during 1972 and 1973 seasons. Collectively, the 430 pair measurements of 1972 and the 1,047 pair measurements obtained in 1973 resulted in attaining a more accurate body-scale relationship.

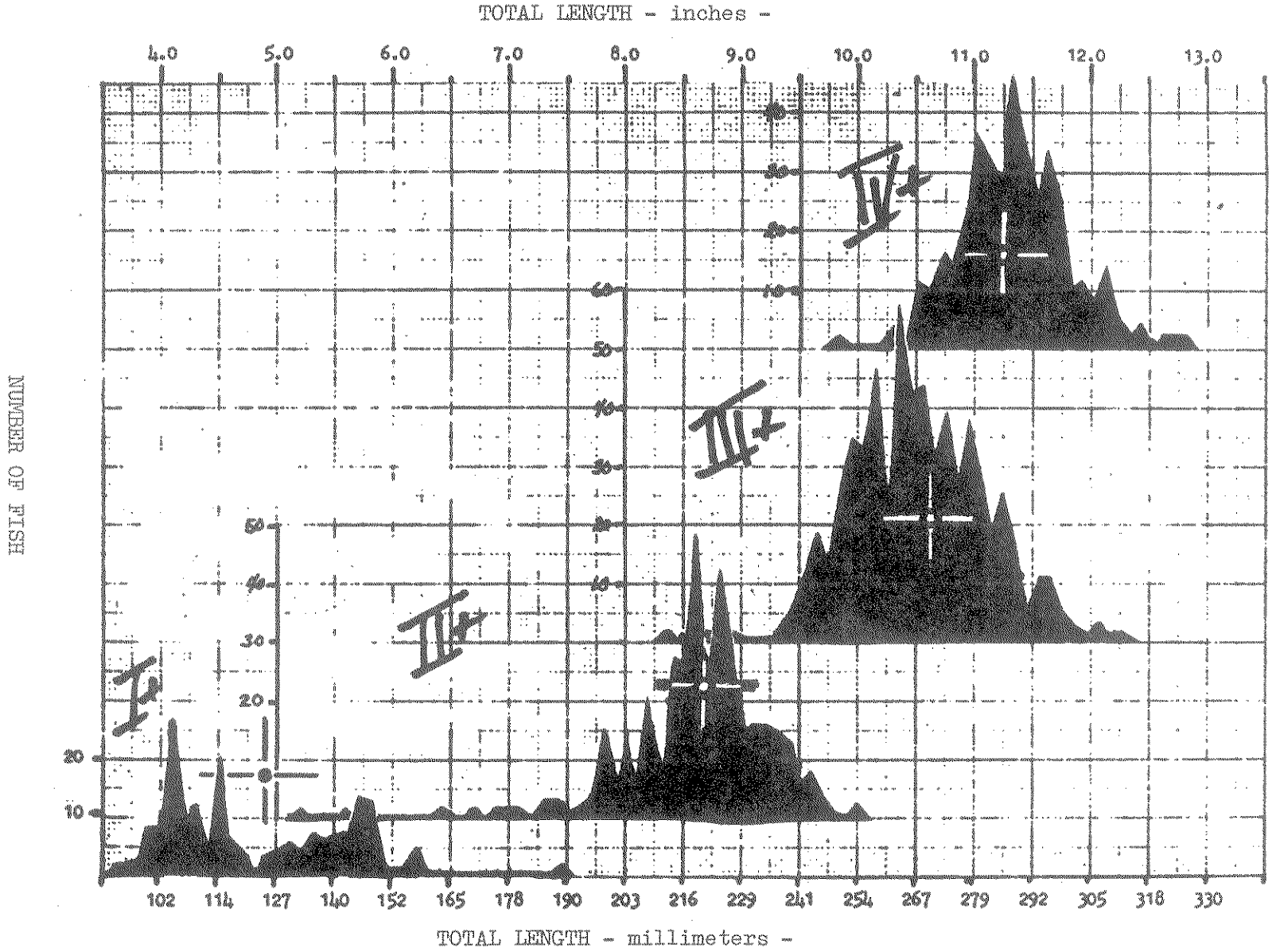

Figure 1. Length frequency histograms showing the age groups represented by 1,548 kokanee with the average length point indicated, for each age group taken in Flathead Lake, May 30 through September 15, 1974

The combined data yielded a value of the coefficient of variation "R" of 0.9880. The regression equation calculated from the combined 1972-73 measurements was: Body Length (T.L.) = 2.3 Anterior Scale Radius + 53.0.

Growth increments were calculated by age groups, sex and state of maturity (Table 1). State of maturity was established by examining gonadal tissues and determining whether the fish would or would not spawn during the 1974 season. The presentation of the data in these catagories allows comparison of growth for different periods for any specific age and also provides data on fish the same age that would mature at different rates.

The difference in calculated lengths of mature and non-maturing fish, for ages three years and older, were not as significant during 1974 as was found during the 1972 and 1973 analyses, i.e., during the earlier years non-maturing fish of the same age were smaller than those that would spawn that particular season.

The average increments of growth, sexes and stages of maturity combined for ages one through four were: 111, 84, 45, and 19mm respectively. Forty-two percent of a typical salmon growth would occur during the first year of life, thirty-two percent the second, eighteen percent the third and eight percent the fourth year of life.

Age at Maturity

Age at maturity was determined for 729 kokanee (Table 2). Three-year-old salmon comprised the dominant age group of the mature fish (57.9 percent). Four-year-old salmon made up the remainder with (42.1 percent).

The change of dominant age classes and their percent of the spawning composition during the last four spawning seasons illustrates the variability in the age composition of the Flathead Lake fish. As stated in previous reports, the 1973 population was dominated by age class three (72.6 percent). Age class four dominated the 1972 spawning population with 71.0 percent of the spawners; while in 1971, ages three and four shared dominance with 51.9 and 45.9 percent of the spawners, respectively. Age groups two and five are found in the spawning populations but rarely represent more than 10.0 percent of the mature fish, collectively.

The sex ratio of males to females during the 1974 season was the same as the 1973 season with 1.0 male to 0.7 females; this ratio is compared to 0.6 and 0.5 females per male during 1972 and 1971 seasons, respectively.

Table 1. Average calculated total length (millimeters) and average length at capture of kokanee that will spawn (+) and will not spawn (-) in 1974 Flathead Lake, May 30 - September 15, 1974.

Group	Sex	No. of Fish	Average length at capture -mm-	Average length at capture -inches-	Calculated length at annulus formation 1	2	3	4
I+	♂-	23	106	4.2	108	-	-	-
	♀-	25	113	4.5	107	-	-	-
	Unk	131	131	5.2	114	-	-	-
II+	♂-	78	228	8.9	109	204	-	-
	♂+	-	-	-	-	-	-	-
	♀-	58	229	9.0	110	208	-	-
	♀+	-	-	-	-	-	-	-
	Unk	229	216	8.5	106	198	-	-
III+	♂-	49	258	10.2	113	191	238	-
	♂+	214	277	10.9	114	197	244	-
	♀-	25	255	10.0	114	193	240	-
	♀+	158	272	10.7	115	197	242	-
	Unk	169	262	10.3	112	191	238	-
IV+	♂-	10	282	11.1	119	203	248	268
	♂+	165	290	11.4	111	194	240	261
	♀-	2	272	10.7	117	199	239	271
	♀+	106	284	11.2	111	190	236	258
	Unk	106	286	11.3	109	186	235	258
Average Increment	♂				108	96	39	18
	♀				107	101	32	18
	Unk				114	84	40	20
Average Length	♂	539			112	197	242	261
	♀	374			112	196	240	258
	Unk	635			110	193	237	258
Total		1,548	Weighed average of body length at annulus formation		111	195	240	259

Table 2, The percentage of the total number of male and female kokanee in each age class considered mature and the percentage of the mature fish in individual age classes, Flathead Lake, May - August, 1974.

	Males		Females		Combined	
Age Class	% Mature	% of Total Mature	% Mature	% of Total Mature	% Mature	% of Total Mature
II+						
III+	81.4	56.5	86.3	59.8	83.4	57.9
IV+	94.3	43.5	98.1	40.2	95.8	42.1
		100.0		100.0		100.0

RECOMMENDATIONS

It is recommended that the assessments of the growth characteristics from kokanee scale collections be discontinued. The age and growth analysis for cutthrout trout and Dolly Varden should be initiated.

LITERATURE CITED

Hanzel, Delano A. 1974. Age and growth analysis of fishes of Flathead Lake - Kokanee. Progress Report, Montana Department of Fish and Game. F-33-R-7, Job 1-b, Multilith.

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Waters referred to: Flathead Lake 7-6400-03