MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana Title Flathead Lake Fisheries Studies

Project No. F-33-R-8 Title Develop techniques for sampling juveniles

Job No. I-c and determining trends in Flathead Lake kokanee populations

Period Covered July 1, 1973 through June 30, 1974

ABSTRACT

The second year evaluation was made on the techniques of using the purse seine to establish trends in the kokanee population of Flathead Lake. The seine catch information, in combination with sonar records, creel census data and age analysis, provide relative abundance to compare annual kokanee population trends. Purse seine catches did show considerable variation in the number, size and species of fish caught throughout the sampling period, May 29 through August 20, 1973. Three year old kokanee dominated the seine hauls and fishermen creels. Age I kokanee were only taken during the early part of the period. Seining at night was not as successful as day-time hauls. The use of an artificial light source did not attract kokanee so they could be collected in the seine.

BACKGROUND

Flathead Lake in northwest Montana is the state's largest natural lake and one of the most important fishing lakes. The fishery depends almost entirely on natural reproduction and recruitment from the lake and tributary system. Flathead drainage is part of the Clark Fork River drainage, and joins the Columbia River via the Pend Oreille River. It is an area that is rapidly changing due to the development of its more important natural resources: water, land, timber and recreation.

The lake contains 20 fish species. Knowledge of their habitats and the relationships that exist between them is essential to implement programs for fisheries resource management.

Specially designed gill nets have been used to collect fish, but they did not prove to be an effective method of catching small fish in the open areas of the lake. The recently developed purse seine has proved to be a method of collecting the young year classes of fish. These data are essential in making management recommendations for the fisheries resource of this lake.

OBJECTIVE

It is the objective of this job to develop a method of estimating year to year population trends of the kokanee in Flathead Lake. For a lake of this size, a marking and recapture program requires an effective method of capturing large numbers of juvenile kokanee. A statistical model will have to be developed using estimates of year-class strength, mortality rates, growth rates and migratory patterns which will show the effect of these variables on population density and individual fish size.

PROCEDURES

The recently developed purse seine, Hanzel 1972, 1973, 1974a was fished in the northwest portion of the lake during the entire seining season, May 29 through August 20, 1973. Sampling was designed to gain more information on the nets limitations, its bias and selectivity, and to gain more information of the kokanee.

Operations in handling and fishing the net did not differ from those described by Hanzel, 1974a.

A water temperature profile, a secchi disc reading and sonar record of the fish distribution in the general netting area were taken prior to the setting of all nets.

Fish collected in the seine were transferred to a hold box, anesthetized, weighed to the nearest gram, total length (T.L.) measured in millimeters, scale sample extracted and fish marked with fluorescent pigment (Hanzel, 1973) particles before being released in the lake. Stomach contents and otolith bones were taken periodically through the sampling season.

FINDINGS

Fish reconnaissance cruises, using the recording sonar, were initiated in late May to locate offshore or limnetic concentrations of fish.

The seining operation was initiated when a large school was located near Lakeside, Montana, and fish were found to be occupying water depths from the surface to 42 feet.

Seasonal Catch

Seining started on May 29th and continued through August 20th, when the fish dropped to depths below 40 feet. A total of 23 net hauls were made in three areas of the lake. Sampling sites were located in the northwestern portion of the lake in the recognized migration route used by salmon on their way to reach the spawning areas in the Flathead River system. The sites were located within one mile of the west shoreline. Water depths ranged from 70 to 170 feet. A total of 827 fish were collected in the seine for an average catch of 36.0 fish per haul.

Kokanee represented 85.9 percent of the total catch. The percentages of other fish in the catch were as follows: mountain whitefish, 10.4; pygmy whitefish, 2.4; cutthroat trout, 0.9; peamouth, 0.2; Dolly Varden, 0.1; and lake whitefish, 0.1. Pygmy whitefish, peamouth, Dolly Varden and lake whitefish were taken only during the month of May. Cutthroat trout, although few in numbers, were taken throughout the sampling period. Mountain whitefish were consistently taken in the nets. Their numbers reached the highest single net haul of 14 during July. The largest number of kokanee taken in a single haul was 94 and occurred once in June and once in July. Salmon were represented in all but one net haul, the last netting day on August 20th.

The size and age composition of the salmon changed during the season. A comparison of the mean monthly catch and daily net hauls by age class was possible after the age analysis was made by Hanzel, 1974c. They are presented in Figure 1 and Table 1.

The dominant age class of kokanee taken during May was that of yearling salmon (82.1 percent). During June, the younger fish apparently moved from the area for their numbers dropped considerably. June dominance of yearlings shifted to three year old salmon. For the remainder of the season, July and August, no single age dominance was present. The dominance was shared by the two and three year old fish. The oldest group, age four, never represented more than 10 percent of the catch during any one period. The total purse seine catch, percent by age group was: Age I, 10.8; Age II, 43.1; Age III, 41.0; Age IV, 5.1.

May - June Sampling

Seining during May and June was accomplished within an area known as Glacier Bay, near Lakeside, Montana. The operation continued in this area from May 29th through June 28th when the fish moved out of the immediate area.

Seven seine hauls were made in Glacier Bay and caught an average of 44.7 fish per haul, or a total of 313 fish. Net catches ranged from 12 to 95 fish with 235 fish being marked with fluorescent pigment and released back to the bay.

Surface water temperatures during the May - June period ranged from 54° to 64° F., with the thermocline not present until early June, as water warmed rapidly during June, the upper limit of the thermocline dropped to a depth of 30 feet. Secchi disc readings ranged from 2.5 to 12 feet during the early spring run-off period.

July Sampling

Soon after fish disappeared from the Glacier Bay area in late June, another concentration was located approximately four miles north, an area known as Lakeside Bay. It was not ascertained whether this was the same school as in Glacier Bay. The age composition was similar, however; none of the fish previously marked in Glacier Bay were taken at this new site.

Nine seine hauls were made in the Lakeside Bay area. They caught an average of 46.8 fish per haul or 421 fish. Net catches ranged from 20 to 106 fish; with 309 fish marked and released in the Lakeside Bay area.

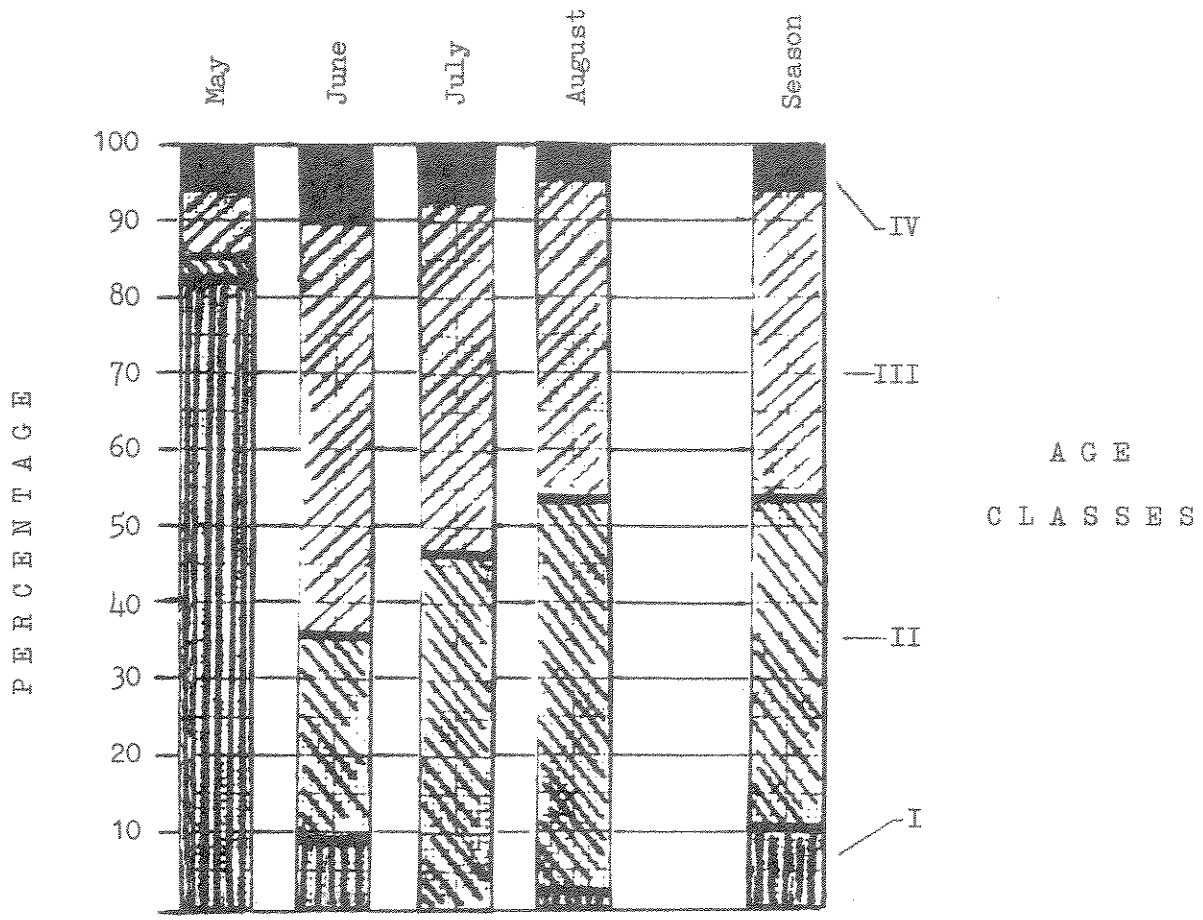

Figure 1. The age class composition of kokanee concentrations by month and season as determined by the percent of the fish taken in purse seine hauls made during the 1973 season, Flathead Lake

Table 1. The age class composition of three kokanee concentrations sampled by a purse seine in Flathead Lake during 1973

Area	Date	Time	Age class percentage 1	2	3	4	Total fish
Glacier Bay	5/29	1100	25.0	--	50.0	25.0	12
	5/20	1100	100.0	--	--	--	36
	5/30	1300	81.1	10.8	5.4	2.7	37
	6/ 7	0735	9.1	27.3	54.5	9.1	11
	6/27	1105	--	27.9	55.8	16.3	43
	6/27	1345	--	55.3	36.2	8.5	94
	6/28	1130	--	34.8	60.9	4.3	45
Lakeside Bay	7/ 3	1100	--	60.0	33.3	6.7	17
	7/10	1100	--	47.3	50.0	2.7	74
	7/10	1350	--	61.8	35.3	2.9	36
	7/11	2115	--	72.4	27.6	--	29
	7/20	1014	--	50.5	47.3	2.2	94
	7/24	0718	5.4	54.1	37.8	2.7	38
	7/24	0915	--	52.6	42.1	5.3	20
	7/24	1120	--	65.4	30.8	3.8	27
	7/25	0643	18.5	51.9	29.6	--	27
Angel Point	7/30	1327	--	--	100.0	--	2
	7/31	1858	--	--	80.0	20.0	5
	7/31	2035	16.0	56.0	28.0	--	25
	8/ 1	1930	--	60.7	32.1	7.1	28
	8/ 1	2100	--	62.5	25.0	12.5	9
	8/20	1330	--	--	100.0	--	1
Total							710

Surface water temperatures during July ranged from 64° to 69° F. with the upper limits of the thermocline found between 30 and 45 feet below the surface. Secchi disc readings increased from 12 to 23 feet during the month.

August Sampling

Seining during August moved to an area six miles south of Lakeside to an area known as Angel Point. Fish in this new area were located much deeper than previous schools. They were found occupying depths from 40 to 60 feet below the surface.

Seven net hauls were made in the Angel Point area and caught an average of 13.3 fish per net, or a total of 93 fish. Scarcity of fish or efficiency of the net on deep located salmon are shown with a 20-fish reduction in the average net haul catch during August. Net catches range from 1 to 31 fish with 44 fish marked and released at Angel Point.

Surface water temperatures during August ranged from 69° to 72° F. with the upper limits of the thermocline persisting at 40 feet. Secchi disc readings ranged from 23 to 40 feet.

The use of the recording sonar in conjunction with the seining operation was valuable in locating fish concentrations and determining relative abundance; however, net catches were not directly correlated to the numbers of fish indicated on the sonar.

Sample Time vs Net Catch

Seine hauls were made from sunrise to after sunset, or from 0645 hours to 2115 hours. The time of day did affect the numbers of fish taken in the net. Best catches occurred during the morning from 0900 to 1200 hours (Table 2). The fish were found with sonar between depths of 18 to 35 feet with the exception that during late August most fish were found below 40 feet. Fish concentrations were found nearer to the surface during the dawn and dusk feeding periods but hauls at this time produced fewer fish and many may have escaped the net more readily because they were near the surface.

Table 2. Purse seine catch during five daily sampling periods, Flathead Lake, 1973

Hours	No. of hauls	Average No. of fish caught	Total fish caught
0600 - 0859	3	32.0	96
0900 - 1159	10	43.9	439
1200 - 1759	5	36.8	184
1800 - 1959	3	22.3	67
2000 - 2200	2	20.5	41
Totals	23	36.0	827

After sunset, kokanee rapidly seek out water depths from 20 to 30 feet deeper than depths found during the daylight hours. Evening concentrations were found to occupy depths more than 50 feet (Figure 2, A, B, C). Seining efforts during the evening hours did produce fish but their numbers were fewer than during the daylight hours. It is possible that a seine capable of fishing deeper than the one used could produce larger evening catches. The maximum fishing depth of the net used was 48 feet.

When kokanee are near the surface (Figure 2, A), they appear to indicate fewer fish on sonar recordings than do the distribution patterns made prior to or after their ascent to the surface (Figure 2, B). Fewer fish are probably indicated when near the surface since the scanning beam of the transducer is smaller at the surface. Fish in waters less than 4 feet deep would be missed because this is the depth at which the transducer is mounted on the boat.

Artificial Light

Light has often been utilized to attract fish at night. This technique was tested on the kokanee during August. A panel of four 150 watt, (2 spot and 2 flood) reflector type bulbs, provided the light source and was mounted on a plate submerged to a depth of 3 feet along the side of the research vessel. A secchi disc could be seen to a depth of 28 feet with the lights on. The boat was set to travel in a fixed circle at a constant rate of speed with the sonar instrument operating. Three consecutive circles were made with the boat; first one with the lights off, then on and then off (Figure 2, D). The fish appeared to avoid the lighted area but return after the source was turned off as shown on sonar recordings. After seeing the results of fish reacting to the light source, no artificial lights were used or further tested during the evening seine operations.

Surface fish concentrations are sometimes missed on sonar; however, no fish were visible in the lighted area around the boat. Also, if the fish were attracted to the light, their movements to the surface should have been recorded.

Kokanee Creel Census

Two different concentrations of kokanee were sampled by checking sport fishermen creels. The sampling was conducted during the months of June, July and August to measure the variability of the catch through the season (Table 3). Census for June only include the Bigfork area since the kokanee had not moved that early in the season into Big Arm.

The Bigfork fishing area is located in the northeastern portion of the lake; while the Big Arm area is a large, isolated bay found in the southwestern portion. The areas are more than 16 miles apart.

Three year old salmon dominated the fishermen catch through the sample period in both areas. The combined sport fishermen catch, composition by age group, was Age I - 0.2 percent, Age II - 16.9 percent, Age III - 63.7 percent and Age IV - 19.2 percent. Four year old salmon were found to be more prevalent in the Bigfork area than in Big Arm.

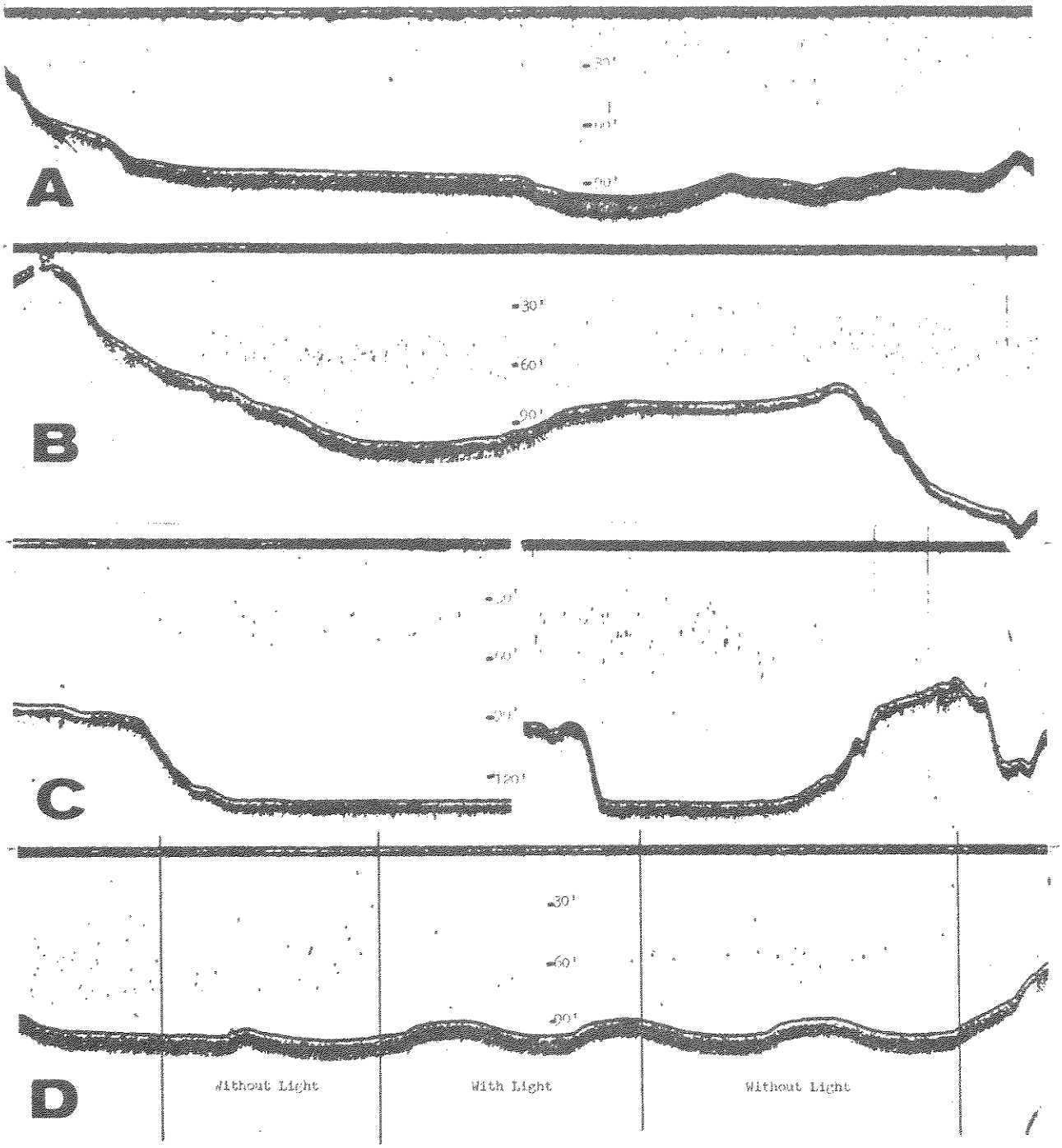

Figure 2. Sonar echograms depicting the effect of natural and artificial lights on kokanee school distribution. A- Sonar run, two miles long, at 1900 hours or 2 hours before sunset, fish from 6 to 30 feet, 7/11/73. B- Sonar run, same as A, 2330 hours, bright moonlight, fish between 42 and 72 feet, 7/11/73. C- Two echograms taken 1 hour apart, before 2030 hours and after sunset, 2150 hours, Secchi Reading 28 feet, 7/31/73. D- Three circle runs repeated at 2330 hours, 8/1/73, runs without, with and without an artificial light source.

Table 3. Age composition of kokanee caught by sports fishermen in two fishing areas during the 1973 season, Flathead Lake

Area	Date	Age class percentage 1	2	3	4	Total fish
Bigfork	6/11	--	1.4	68.5	30.1	73
	7/16	--	22.7	68.7	8.6	141
	8/ 8	1.0	9.3	58.8	30.9	97
Big Arm	7/18	--	32.5	57.5	10.0	40
	8/10	--	27.5	55.0	17.5	40
Average		.02	16.9	63.7	19.2	391

RECOMMENDATIONS

Further detailed analysis of the seining information or comparison of the catch to seine data would be premature without more knowledge of the net's limitations, bias or selectivity and more knowledge of the kokanee population and its variability in the lake.

It is recommended that the purse seining operation for kokanee in the limnetic areas of the lake be continued for another year. The research vessel should locate fish concentrations early in the spring with the seining to commence and continue in one area as long as the fish are available. Most of the seining should be accomplished during the morning and afternoon hours so the maximum number of fish would be captured and made available to the mark and recapture phase of the study. Attempts should also be made to conduct angler creel checks in the vicinity the seine is being fished.

LITERATURE CITED

Hanzel, Delano A. 1972. Develop techniques for sampling juvenile kokanee and determine trends in kokanee populations. Progress Report, Montana Department of Fish and Game, F-33-R-5, Job I-c, Multilith. 5pp.

Hanzel, Delano A. 1973. Develop techniques for sampling juvenile kokanee and determine trends in kokanee populations. Progress Report, Montana Department of Fish and Game, F-33-R-6, Job I-c, Multilith. 5pp.

Hanzel, Delano A. 1974a. The seasonal and depth distribution of the fish population in Flathead Lake. Progress Report, Montana Department of Fish and Game, F-33-R-7, Job I-a, Multilith. 25pp.

Hanzel, Delano A. 1974b. Age and growth analysis of the fishes of Flathead Lake, Kokanee. Progress Report, Montana Department of Fish and Game, F-33-R-7, Job I-b, Multilith. 6 pp.

Hanzel, Delano A. 1974c. Age and growth analysis of the fishes of Flathead Lake, Kokanee. Progress Report, Montana Department of Fish and Game, F-33-R-8, Job I-c, Multilith. 8pp.

Prepared by: Delano A. Hanzel

Date: September 23, 1974

Waters referred to:

Flathead Lake 7-6400-03