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MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana Title Flathead Lake Fisheries Studies

Project No. F-33-R-6 Title The seasonal and depth distribution of the

Job No. I-a fish population in Flathead Lake

Period Covered July 1, 1971 through June 30, 1972

ABSTRACT

The first attempts to sample fish at depths greater than 150 feet were made during the fall of 1971. The average catch of a 600-foot long net was six fish per net. Lake whitefish, kokanee, Dolly Varden and pygmy whitefish were collected at the 180-foot level while the latter two species persisted to the 270-foot level.

Floating monofiliment gill nets, 250 feet by 24 feet, were successful in capturing kokanee in the limnetic areas of the lake. A longer net with smaller sized meshes was recommended if kokanee smaller than 230 mm (9.0 inches) were required. The 1 1/2-inch and 2-inch mesh sizes collected the same size salmon as were caught by the fishermen. Plastic bottles attached to the float line at 50-foot intervals with drop lines with depths to twenty feet, were successful in suspending a drift net at predetermined depths.

The average size of mature spawning kokanee was used to reflect annual changes in the lake population from 1938-1972. Other characteristics of the annual kokanee population by area were described using length frequency polygons. Although this method is convenient, and distinct size groups of salmon exist in the length frequency distribution, total length alone cannot be used to determine the spawning year of the females.

BACKGROUND

Flathead Lake, in northwestern Montana, is part of the large intradependent lake-river system that contains populations of migrating salmonids. This system offers the public a national renowned lake and stream fishery and many other types of water-based recreation amidst a setting of mountains. The lake has 126,000 surface acres with a maximum depth of 400 feet. It is fed by a watershed containing over 180 river miles which includes portions of Glacier National Park and the Bob Marshall Wilderness.

Fishery investigations for the Flathead drainage were first initiated in 1953 and directed toward the assessment of the fishery in the river system above the lake. This work defined the interdependent relationship between the lake and river system. The recent work has been directed toward the gathering of knowledge of the fisheries resource, the spatial habitats various species occupy and the factors that tend to degrade or destroy them.

OBJECTIVES

The objectives of this study are to develop techniques for using specialized equipment in determining the relative abundance of the various fishes in the lake, to determine their seasonal geographic and depth distribution and to establish criteria for measuring year to year trends in species populations.

PROCEDURES

A year-around fish sampling program was initiated in 1966 and has continued through December 1970. Fish have been collected on a systematic schedule as the basis for defining the seasonal and depth distribution of populations in the lake (Hanzel, 1970, 1971 and 1972).

With the completion of the systematic sampling, emphasis of the job has shifted toward sampling of small specific areas to determine the areas, range and extent of the seasonal movements of kokanee, Dolly Varden and cutthroat trout.

Floating monofiliment gill nets, 250 feet long and 25 feet deep, were fished on the surface in the limnetic areas of the lake while the 600-foot "Flathead Net" was used for sampling the bottom fish in benthic areas of the lake. The floating net consisted of five sections, each 50 feet with the same mesh sizes as for the "Flathead Net" described by Hanzel, 1970. The floating nets were never fished unattended or left overnight. A one-liter plastic bottle was secured to the float line every 50 feet to position the net and provided additional floatation along the net. The bottles on drop lines, up to twenty feet in length, suspended the drifting net at a predetermined depth.

All measurements were to the nearest millimeter in total length (T.L.), weights to the nearest gram and scale samples extracted and stored in individual envelopes. A cursory examination was also made into the abdominal cavity for sex determination and gonadal development.

FINDINGS

Deep Water Netting

Efforts to sample fish in the deep trench area were first made during August, 1971, as previous netting series has not exceeded sampling depths of

150 feet. A short descriptive note by R. T. Young (Elrod, et.el, 1929) is the only published reference to fish being taken at greater depths. He stated in 1928, "We have taken it (meaning Dolly Varden) down to 275 feet." The maximum depth of the trench reaches 320 feet in the area sampled. Two shelf areas bordering the trench at depths of 180 and 270 feet were located by sonar and selected as netting sites. Two overnight net sets using the 600' x 24' "Flathead Net" were made parallel to the trench on each shelf. Placement and alignment of the net were checked by the use of the sonar. As was expected, the catch of fish was small, six fish per net. Previous catches with the same net in the vicinity set in water shallower than 100 feet, averaged 41.7 fish per net (Hanzel, 1971).

Four fish species collected at 180 feet were: Dolly Varden, pygmy whitefish, lake whitefish and kokanee in decreasing order of abundance. Dolly Varden and pygmy whitefish persisted to the 270-foot level. Although no lake trout were taken in the deep net series. They are known to occupy some of the deeper areas of the lake.

Most of the Dolly Varden taken during the series were immature fish ranging in size from 208 to 477 mm T.L. (8.2 to 18.8 inches). Only one fish exceeded the 18-inch (457 mm) minimum size regulation which is currently enforced for this species on Flathead Lake. All pygmy whitefish were mature and ranged in size from 96 to 124 mm (3.8 to 4.9 inches). The lake whitefish taken were all mature fish that ranged in size from 334 to 403 mm (13.2 to 15.9 inches). One kokanee taken on the 180-foot shelf, was an immature female that measured 225 mm (8.8 inches).

Surface Netting

A series of 10 floating monofiliment gill nets, 250 feet by 25 feet, were made during July, 1971, to collect information on kokanee population structure in the schools found in the limnetic areas of the lake. Catches made in areas where salmon were first located by the sonar were predominently kokanee with an occasional small, 2 to 4 pound, Dolly Varden being taken. The two smaller mesh sizes, the 1 1/2- and 2-inch stretched measure, caught most of the fish. Even the larger Dolly Varden were found in these two mesh sizes suggesting that they were chasing or attracted to the area by the thrashing of the dying salmon. Nets were all set during the daylight and were drift fished for four hours and caught an average of ten fish per net.

Two predominant size groups of salmon were taken in the floating sets. The group of smaller fish ranging in length from 229 to 267 mm (9.0 to 10.5 inches) averaged 260 mm (10.2 inches) while the group of larger fish ranging from 292 to 333 mm (11.5 to 13.2 inches) averaged 318 mm (12.5 inches.) Maturation of individuals of both groups were checked by examining gonadal development. Both immature and mature fish were found within the two size groups, suggesting that size alone cannot be used to determine the maturity of the Flathead Lake salmon. By late July, the salmon were found to be utilizing deeper water and the surface netting was suspended.

Kokanee Creel Checks

The average individual lengths of salmon in the population have often been used as a basis to compare growth in different areas or bodies of water or population differences in different years. Hanzel (1964) and Liek (1960) used these measurements to illustrate the variations in total length at maturity and inferred population differences in Flathead Lake. Measurements were based on individual total lengths taken from mature fish collected on the various spawning grounds. Collection of measurements have been continued and reflect the annual changes that occurred in the Flathead Lake kokanee population, 1938-1972, Figure 1.

In 1968, additional data on kokanee lengths were obtained through creel checks. Scale collections were also made on the salmon prior to the time the maturing salmon scales started showing signs of resorption. Collections were generally made during the latter part of August, three months prior to the data taken from mature fish. Although this data represent a different segment of the kokanee population, they show the same type of fluctuation as in measurements from the spawning populations, Figure 1 (1968-1972). The creel data were from both mature and immature salmon, while all the spawning run data were on mature fish. Differences in total length between the average combined sexes of kokanee taken by anglers during August compared to that taken later during the spawning period for the years of 1968 through 1972 were 23, 23, 20, 25 and 33 mm, respectively.

Other characteristics of the kokanee population can be illustrated by comparing the annual length frequency polygons of angler harvested kokanee, Figure 2. Males outnumbered the females during all the August measurements but the major frequency modes for both sexes remained within the same length interval. The male to female ratio for the years 1968-1972 was 1:0.7, 0.6, 0.4, 0.6 and 0.6, respectively.

Polygons, for the years 1968 through 1972, compare annual changes in length frequency modes when the fish experienced increased average total length, (1968, 1969, 1970) also when length remained the same, (1971) and in 1972 when there was an apparent decrease in average total length. Two modes were apparent within the same size range in 1969, 1970, and 1971 with the smaller mode of minor importance. In 1972, the smaller mode made up a larger percent of the total sample. With a smaller percent of larger fish in the sample, the average size appeared to be reduced. This change in the pattern does represent a modification in the composition of the kokanee population, at least that segment caught by fishermen, rather than decreased growth rate. The progressive movement of the modes toward larger sized fish from 1968 to 1970 does reflect the effect of an increase in growth rather than changes in the size composition of the catch.

The size range of kokanee checked in fishermen's creels in four fishing areas during the summer of 1971 showed variations between areas, Figure 3. The four sample areas represented three popular fishing areas (Lakeside, Big Arm and Bigfork) and one unusual fishing area (Polson).

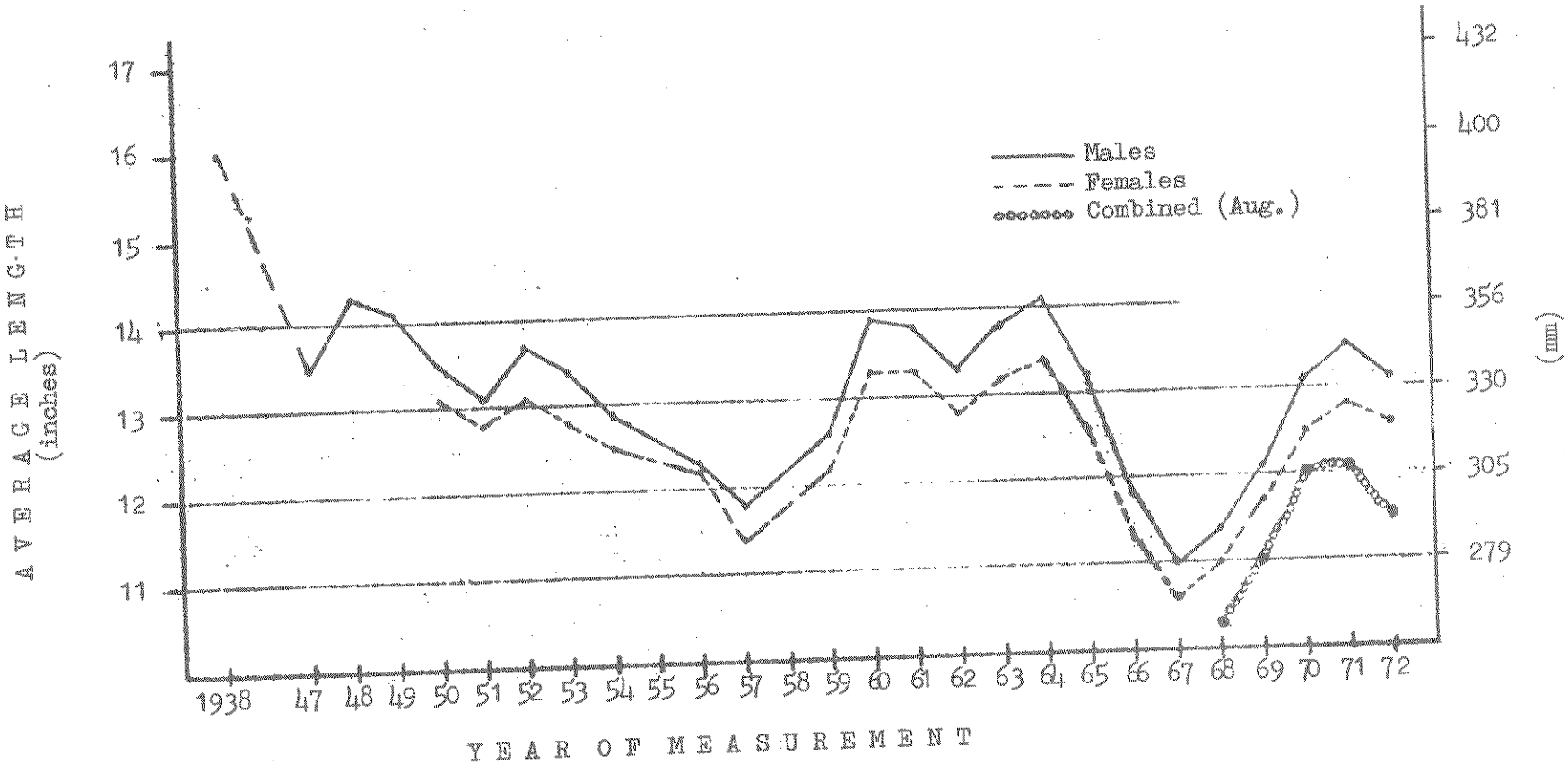

Figure 1. The average size (T.L.) of male and female kokanee at maturity, Flathead Lake, 1938 - 1972 and the average size of combined sexes, by fishermen during August, 1968 - 1972

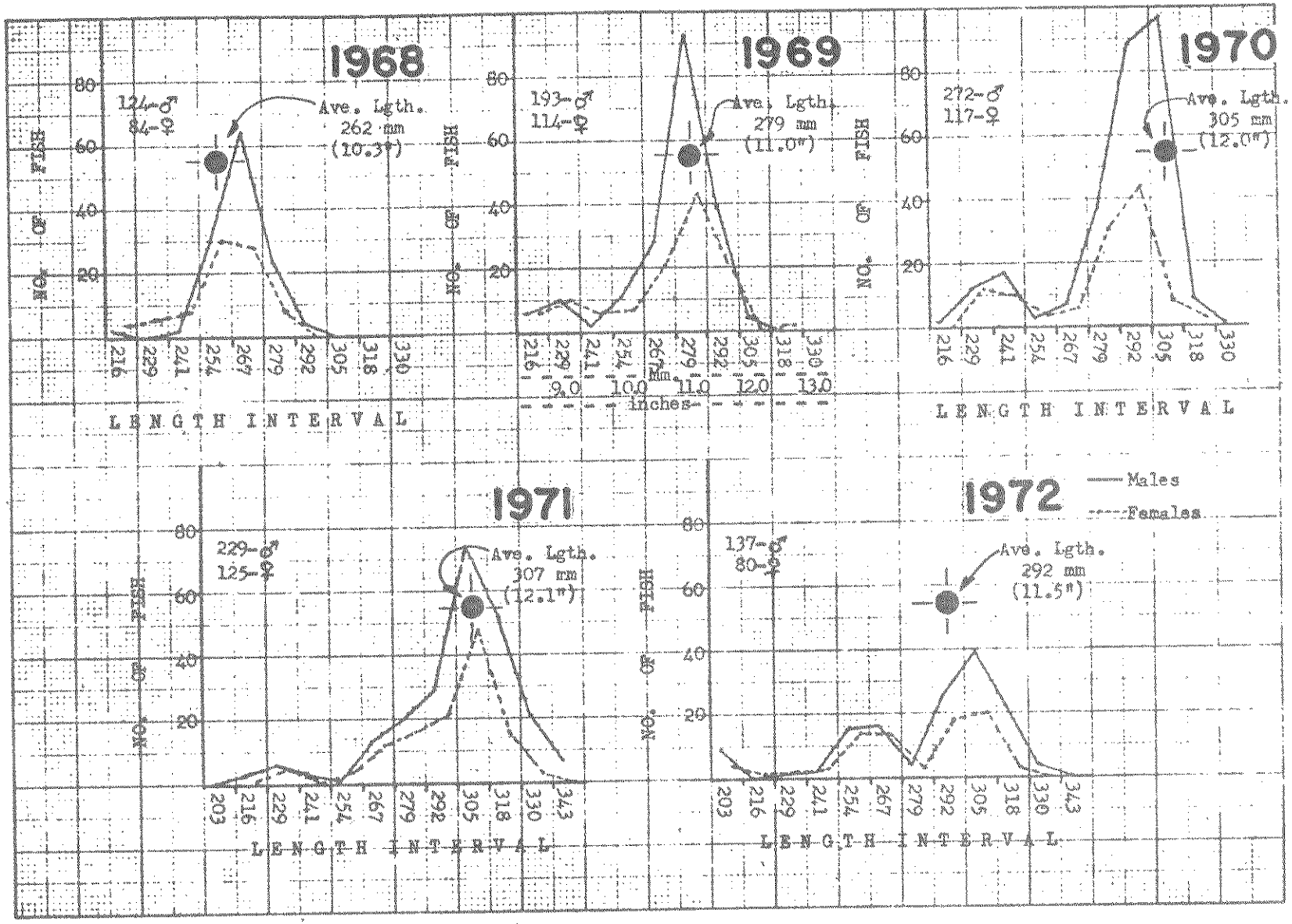

Figure 2. Length frequency polygons of male and female kokanee checked in fishermen creels during the month of August on Flathead Lake from 1968 through 1972. The average length of the sexes combined is shown and plotted within the appropriate length interval

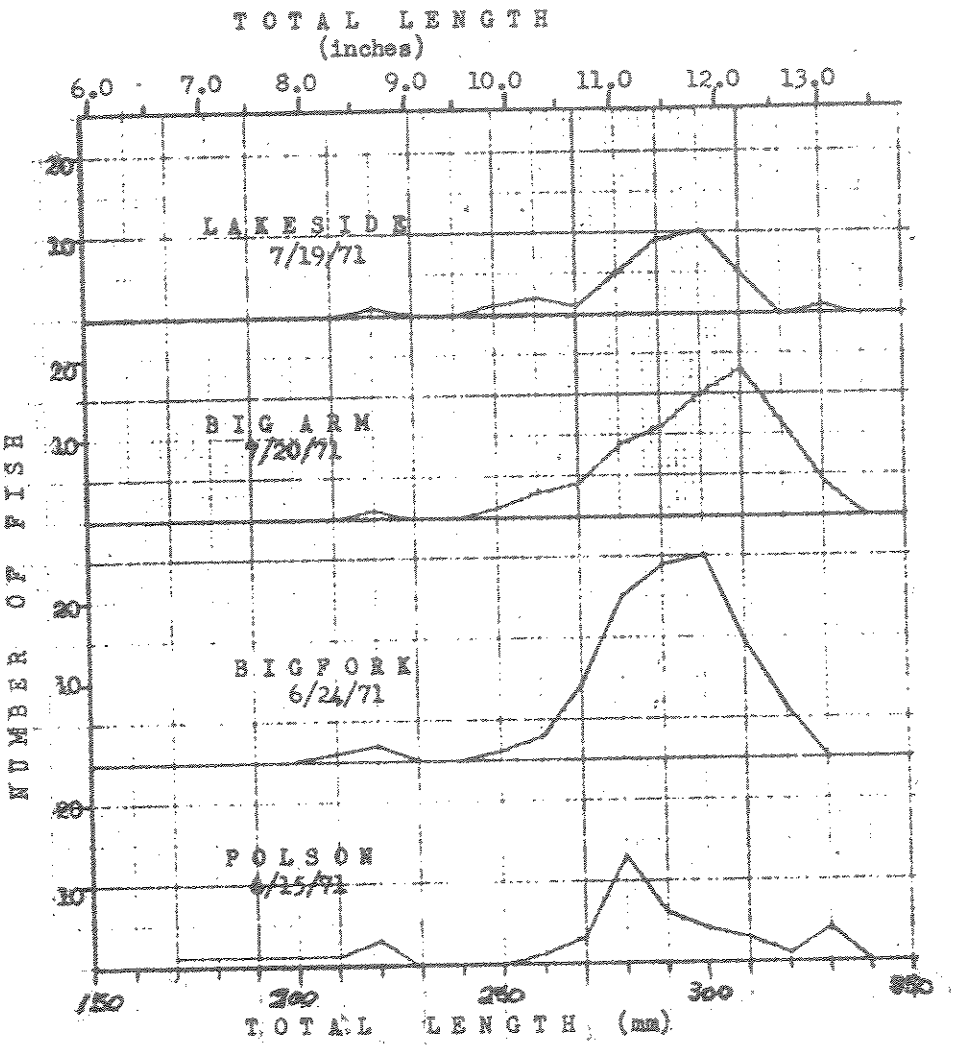

Figure 3. Length frequency polygons of kokanee collected by fishermen in four distinct fishing areas of Flathead Lake, June 15 - July 20, 1971.

The Lakeside area is located in the northwest end of the lake, the Big Arm area along the southwest shore, the Bigfork area in the northeast end and the Polson area in the extreme southern portion. The three popular areas are fished regularly by fishermen but salmon are only caught rarely in the Polson area. A large school of kokanee apparently entered Polson Bay and were found by fishermen on June 1st, kokanee remained in the vicinity of the city dock until June 21st, then disappeared. This was the first record of salmon taken in the Polson area during the spring or summer months.

The polygons of the salmon caught in the regular fish areas appeared similar in the composition with only a slight increase in the size of the fish as the season progressed. Fish from Polson Bay were represented by an additional mode near the maximum size. It was unusual to find salmon this large so early in the season.

Size distribution of the kokanee taken in these four areas is summarized in Table 1. While the size range did not differ between the areas significantly, the extremes of the range did occur in the Polson area, which was also the earliest site sampled.

It was also noted in the sample from the Polson area that the average size of the females exceeded the average size of the males. Female kokanee from Bigfork were the smallest and averaged 16 mm (0.6 inches) less than the average length of the males. Average sizes of both sexes in the Lakeside and Big Arm sample were nearly the same.

The state of maturity of the female salmon was determined by comparing the size of the egg diameters. It was determined that female salmon would spawn that fall if egg diameters were 1 mm or larger by July 1st. The proportion of females that would spawn that coming fall from the four areas ranged from 68.2 to 73.3 percent. A considerable overlap exists in the size ranges of total length measurements, between the group of females that would and would not spawn that year.

Comparison of data from the floating net, the creel data and from data obtained at fall spawning exemplify that changes do exist between the annual, seasonal and area kokanee populations. These variations in the size composition within the harvested segment of the population probably occur when the annual growth has increased or decreased. Although convenient size groups of salmon in the population do exist, size alone cannot be used to determine the year of maturity for the female salmon.

RECOMMENDATIONS

The present emphasis of this study should be continued with the special consideration given to the three major game fish species, kokanee, Dolly Varden and cutthroat trout. Emphasis should be on the range and extent of the seasonal movements and the areas utilized by the two year old and younger fish. We also need to develop methods for determining relative abundance. The work planned will be conducted within the small selected areas during

Table 1. The size range, average length of the kokanee, the percent females in the sample collected by fishermen in four distinct fishing areas and the range and percentage of females that will spawn this season, Flathead Lake, June 15 - July 20, 1971. Measurements are recorded in mm and (parenthesis) inches.

Area Collection Date Number of Fish	Lakeside 7/19/71 35	Big Arm 7/20/71 72	Bigfork 6/24/71 105	Polson 6/15/71 42
Average size of fish	295 (11.6")	298 (11.7")	291 (11.5")	283 (11.1")
Average length males	299 (11.8")	299 (11.8")	295 (11.6")	281 (11.0")
Length range males	223-330 (8.8"-13.0")	223-327 (8.8"-12.9")	214-325 (8.4"-12.8")	176-334 (6.9"-13.3")
Average length females	291 (11.5")	296 (11.6")	279 (11.0")	285 (11.2")
Length range females	257-311 (10.1"-12.3")	262-322 (10.3"-12.6")	268-311 (10.5"-12.3")	194-334 (7.6"-13.3")
Percent females	45.7%	38.9%	24.8%	53.6%
Percent females spawning this year	73.3%	68.7%	68.2%	72.0%
Size range females spawning this year	280-311 (11.0"-12.3")	295-322 (11.6"-12.7")	277-311 (10.9"-12.3")	194-334 (7.6-13.3")
Size range females spawning next year	257-282 (10.1"-11.1")	262-277 (10.3"-10.9")	268-283 (10.5"-11.6")	209-296 (8.2"-11.6")

limited seasons. The knowledge gained through the work on this job will aid in the determinations and the accurate assessment of age and growth of the fish populations in this lake.

The suspended drift fishing of monofiliment gill nets was considered a satisfactory method of collecting salmon in the limnetic area, but it is recommended that the nets used contain more netting of each mesh, 150 feet rather than 50 feet used; and that they contain two smaller mesh sizes, 3/4 and 1 inch stretched measure and to delete the meshes larger than 2 inches.

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Prepared by Delano A. Hanzel

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