MONTANA FISH AND GAME DEPARTMTNET
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana

Project No. F-33-R-5 Name Flathead Lake Fisheries Study

Job No. I-a Title The seasonal & depth distribution of the fish population in Flathead Lake

Period Covered July 1, 1970 through June 30, 1971

ABSTRACT

The seasonal fish sampling on Flathead Lake was continued to determine the relative abundance of fish and their geographic and depth distribution. A total of 5,400 fish was collected in 78 net sets during four seasonal netting series. The catch averaged 69.2 fish per net.

No significant changes were noted in the general seasonal area distribution of the major fish species; however, the emphasis on shallow water sampling did increase the total number of fish collected and reflected some changes in species composition. Non-game fish were captured several times more readily in shallow water while game fish species showed a slight drop.

The distribution of three species not previously collected, the redside shiner, largemouth bass and coho (silver) salmon, were described. The coho salmon were survivors of an introduction of this species made in the lake during the spring of 1969. Fish from this plant were observed in the lake for 18 months and then completely disappeared. Returns of considerably less than one-half percent of the 140,000 smolt sized salmon were reported. Early growth rates were excellent but peaked after eight months and then dropped rapidly. Total lengths during first eight months increased to 229 mm (9.0 inches). The largest and last coho recorded was a "jack" salmon measuring 328 mm (12.9 inches) and 348 g (0.77 pounds) on November 3, 1970.

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 in the area were first initiated in 1953 and were directed toward the assessment of the fishery in the river system above the lake. This initial work defined the intradependent relationship between this lake and river system. The recent work has been directed toward the gathering of knowledge to better understand the relationship between the fisheries resource, the spatial habitats they 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 October, 1966 on Flathead Lake to define the seasonal and depth distribution of fish. This program has been continued by seasonally sampling the twenty-two established stations on the lake (Hanzel, 1970). The sampling series were grouped as winter, spring, summer and fall seasons. Information summarized in this report includes the data from the series conducted during the fall, 1969 (September through December), winter, 1970 (March), summer, 1970 (June through August), and the fall, 1970 (October through December).

Sampling was generally conducted from a 35-foot boat, the "Dolly Varden", formerly a commercial fishing boat and now modified to handle specialized fishing gear. The boat is rigged with a gill net reel, a boom and hydraulic powered winch. It also has a recording sonar that is capable of giving precise bottom measurements, locating fish and recording their depth and area distribution.

A typical set was on the bottom and fished overnight for a period of approximately 20 hours. Proper placement and alignment of the nets and depths were checked and recorded on sonar tape. Different sets ranged in water depths from 8 to 144 feet.

Fishing efforts (number of nets and stations sampled) exerted during the two fall series, 1969 and 1970 and the summer series, 1970 were similar to the netting series reported and described by Hanzel, 1970. However, the present netting period stressed the sampling of the shallower water depths from 10 to 90 feet within the established stations. The number of stations sampled during the winter, 1970 was restricted to seven sites by ice. Although this winter series shows considerably less effort than expended during the other seasons, the data collected does represent seasonal trend data for areas along both shorelines and for that area near the mouth of the Flathead River.

All fish collected were measured to the nearest millimeter in total length (T.L.) weighed to the nearest gram and a scale sample extracted and stored in individual envelopes. A cursory examination was also made into the abdominal cavity for sex determination and gonadal development.

FINDINGS

General Netting

Seasonal fish sampling on Flathead Lake was continued to determine the relative abundance of fish, their geographic and depth distribution. Twelve major areas of Flathead Lake (Hanzel, 1971) were sampled during three seasons: the fall of 1969, the summer of 1970 and the fall of 1970. During the winter of 1970 sampling was restricted to seven areas because of the ice conditions on the lake. Other than the efforts to sample fish at shallower depths, from 10 to 90 feet, within the established stations; the same basic fishing techniques have been described, (Hanzel, 1970).

A total of 5,400 fish were collected in 78 net sets during the four netting series for an average of 69.2 fish per net. The major fish species collected, listed in order of relative numbers were: peamouth 1/, kokanee, northern squawfish lake whitefish, yellow perch, Dolly Varden, mountain whitefish and pygmy whitefish. Minor species represented 6.5 percent of the total fish taken, they were, in decreasing order of numbers caught: longnose sucker, largescale sucker, lake trout, redside shiner, cutthroat trout, silver salmon and largemouth bass.

There were no significant changes in the general seasonal area distribution of the major fish species from that described by Hanzel, 1970; however, the shallower water sampling did increase the total number of fish collected and reflected changes in the species composition.

A summary of all the seasonal netting data is presented in Table 1 with the findings of the first netting period, November 1967 through August 1969 separated from the second period, September 1969 through December 1970. These illustrate the comparative differences in species composition found during the deep and shallow water sampling. The total netting data represents the best year-around picture of the relative fish abundance found in Flathead Lake.

Shallow water sampling yielded more than one and one-half times as many fish as the deep water sampling; with shorter nets and fewer sampled stations. Non-game fish made up most of the increase with their numbers gaining four fold while the game fish numbers showed a slight drop.

1/ Common names of fishes in this report are those given in American Fisheries Society, Special Publication No. 6, 1970. A list of common and scientific names from the United States and Canada. Pub. No. 2, Second Edition, 102pp.

Table 1. Species composition of netting series are given as percent of the total sample size with other netting data for Flathead Lake, Winter 1968 through Fall 1970

Fish Species	PERCENT SPECIES COMPOSITION										
	FIRST PERIOD November '67 - August '69				SECOND PERIOD September '69 - December '70				First Period Totals	Second Period Totals	Total Period
	Winter 1968	Spring 1968	Fall 1968	Summer 1969	Fall 1969	Winter 1970	Summer 1970	Fall 1970			
Lake whitefish	53.2	48.5	31.3	50.7	7.3	30.0	11.2	24.6	44.8	13.2	25.7
Peamouth	11.0	1.9	6.5	1.7	24.0	2.1	29.1	19.2	5.0	23.5	16.2
Kokanee	3.0	6.4	19.4	9.9	28.1	2.9	0.4	16.4	10.9	17.7	15.0
Northern squawfish	11.0	15.1	12.7	5.5	15.4	10.0	16.4	10.4	10.4	14.3	12.7
Dolly Varden	12.0	16.3	14.5	16.0	7.7	17.9	4.9	8.7	14.8	7.5	10.4
Yellow perch	0.6	0.2	2.2	0.3	2.3	0.7	31.2	1.0	1.0	8.9	5.8
Pygmy whitefish	3.0	4.2	8.7	11.3	0.9		0.9	9.3	7.7	3.0	4.8
Mountain whitefish	2.0	2.8	0.4	1.2	6.2	20.7	1.4	6.6	1.4	5.5	3.9
Longnose sucker	1.3	2.3	2.2	0.8	1.6	10.0	2.3	1.3	1.5	1.9	1.8
Largescale sucker	1.2	0.1	0.6	0.4	1.4	1.4	2.0	1.0	0.7	1.4	1.1
Lake trout	0.1	2.2	1.5	0.6	1.6		0.2	1.2	1.0	1.2	1.1
Redside shiner					2.5					1.2	0.7
Cutthroat trout	1.6			1.5	0.6	4.3		0.1	0.8	0.4	0.5
Coho salmon					0.3					0.2	0.1
Largemouth bass					0.1					0.1	0.0+
Total fish	702	575	1,088	1,147	2,584	140	1,325	1,351	3,512	5,400	
Stations sampled	22	20	19	24	27	7	20	24	85	78	163
Predominant net length	350'	600'	600'	600'	350'	250'	125'	350'			
Fish per net	31.9	28.8	57.3	47.8	95.7	20.0	66.3	56.3	41.3	69.2	54.7

Changes in Species Composition

Pie diagrams representing the percent of species composition for each of the netting periods and the total are presented in Figure 1. Most noticeable species changes was a decrease in percentage of lake whitefish and an increase in peamouth. Although an increase in the number of non-game fish was expected during the shallow water netting, all the species did not show a proportional gain.

Non-game Fish

Largest increase of non-game fish was shown in yellow perch, as their numbers increased over fourteen (14.0 x) times in the shallow water sampling. Peamouth followed, with an increase of over seven (7.0 x) times. Increases of the other fish were: largescale sucker (3.5 x), northern squawfish (2.1 x), and longnose sucker (1.8 x). No comparison was made on the redside shiner as they were only taken during the second netting period. The percent of non-game fish to total catch for the first and second netting periods was 18.6 and 51.2 percent, respectively.

Game Fish

Largest increase of fish occurred in the catch of mountain whitefish with an increase of nearly six (6.0 x) times. Other game fish showing increases were kokanee (2.5 x) and lake trout (1.8 x). Declines in game fish numbers found in the shallow water were noted in the Dolly Varden (0.8 x), cutthroat trout (0.8 x), pygmy whitefish (0.6 x) and lake whitefish (0.5 x). No comparison was available for the largemouth bass and coho salmon.

Seasonal Depth Preferences

Several species of fish frequent depths of less than 20 feet for limited periods of time. These movements into the shallows are stimulated by either the spawning motivation or for food. The largest concentrations of such fish are the spawning kokanee. These salmon gather along the shore in nearly all gravel shoal areas of the lake except Polson Bay where spawning salmon are only rarely taken. Salmon first move into the shallows in late October and generally persist through December. Stefanich, 1954 and Hanzel, 1964, have previously described the kokanee spawning concentrations in the lake and river system.

Large piscivorous species, such as the lake trout and Dolly Varden, are attracted to the salmon spawning grounds, to apparently feed on the dead and dying salmon. They continue to utilize the shallows until the salmon have completely disappeared. The largest concentrations of lake trout in the shallow were found along the southern shore areas of Big Arm Bay and along the gravel shores of Wildhorse Island. Approximately 80 percent of these large fish netted were returned to the water unharmed, as most of them were only tooth-hooked.

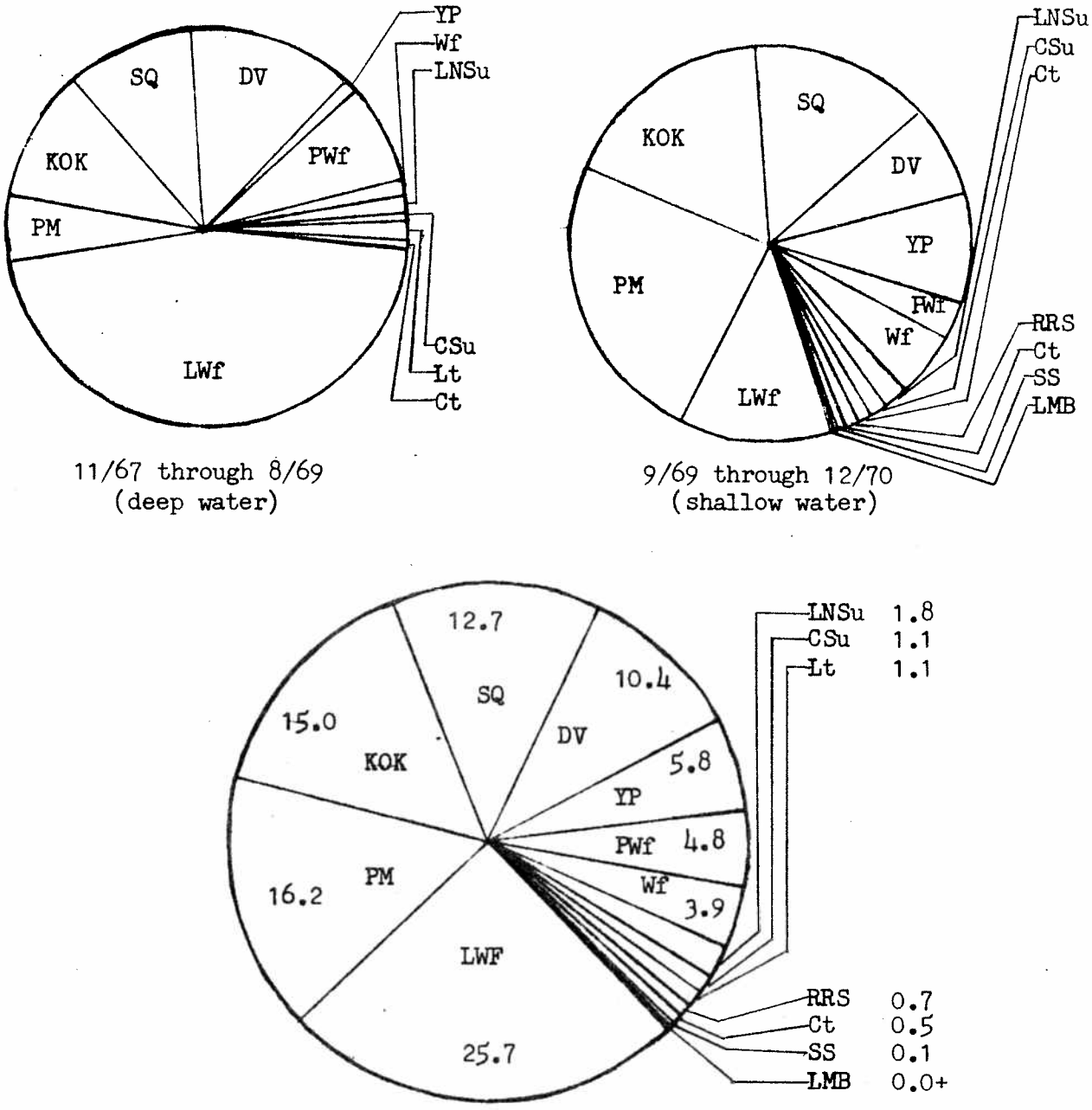

Figure 1. Percent composition by species of total fish netted in Flathead Lake during two netting periods and combined totals, November 1967 through December 1970.

Lake whitefish also seek the shoal areas of the lake for spawning but seem to prefer the more gentler sloping shoals along the west shoreline. Their spawning season unusually does not start until late December, at which time most salmon have completed their spawning and are no longer present. The concentrations of lake whitefish did not attract the large number of piscivorous fish as did the kokanee. The cutthroat trout was the only fish found to frequent the whitefish spawning areas during this winter season. Their attraction was the large and available supply of loose kokanee and whitefish eggs that were dislodged from the gravels by wave action.

Pygmy whitefish seldom frequent the shallow waters except during their movements to known spawning areas in the Swan and Flathead River where they congregate in the areas of the river mouths of a period of time prior to entering the system to spawn.

New Species

Redside Shiners & Largemouth Bass

Three species not previously collected in the nets were taken during fall series of 1969. These species were the redside shiner, largemouth bass and the coho salmon. The redside shiners are native to the lake and were found to frequent the shallow shore area to depths of 20 feet during the summer and fall months. The shiner population then apparently moves away from the shoreline into the deeper waters.

The incidence of bass in the net catch was low, a total of three fish. This net catch reflects the extreme caution bass possess in avoiding gill nets. Sport fishermen do catch bass in numerous bay areas, but the most popular and productive area is the southern portion of Polson Bay. Robbins, 1966, reported an annually estimated harvest of 2,300 bass. He found the bass to average 12.2 inches (310 mm) in total length and weigh 1.07 pounds (486 mm).

Coho Salmon

History of Introduction.- An experimental introduction of coho salmon was made into Flathead Lake during the spring of 1969. To achieve maximum survival from the planting of small size salmon a planting site was selected at the north end of the lake near the mouth of the Swan River. The choice of site allows the entire 28 mile length of Flathead Lake to absorb the strong downstream migratory tendency of the small coho. A dam on the Swan River, approximately one mile from the lake, affords an excellent location to concentrate the returning adults. This structure would limit the area of return which would aid sportfishing harvest and improve the changes to evaluate the success of this introduction.

This introduction of coho salmon was the second attempt to establish a large sized salmon in the lake. The first attempt was described in the 1917-18 Montana Fish and Game Biennial Report stating:

> "About 20 months ago some 600,000 eyed eggs of the Quannat or Chinook salmon were hatched at Somers and planted in a number of lakes in Flathead County. Anglers have been catching king salmon in several lakes including Flathead. In November, 1918, blueback salmon (kokanee) 2/, were netted from Lake Ronan (one of the lakes planted with the 1916 Chinook eggs). They further state "There may have been a mistake in the selection of the 1916 eggs (suggesting a mixture of eggs received from Oregon)."

Old timers around the lake tell of the spawning fish reaching weights of nearly five pounds. They also related that they had found smaller, different looking salmon which suggests the possibility of questionable identification or the verification of the mixture of eggs from Oregon.

The coho eggs for this recent introduction were taken and fertilized in Oregon and flown green to the Washoe Park Trout Hatchery near Anaconda, Montana. They were hatched and reared at this station until being planted into the lake. Crowded conditions at the station necessitated the planting of 115,000 smolt sized salmon into Swan Bay on May 16 and 20, 1969. The fish averaged 71 mm (2.8 inches) in total length at the time of planting. The remainder of fish scheduled for the lake were retained at the hatching station until they appeared to have lost their tendency of strong downstream movement. After the fish lose this tendency they reach a life stage commonly referred to as "post-smolt". Approximately one month before planting, the entire lot of "post-smolt" fish were marked by an adipose fin clip. These fish were planted on August 4, 1969 at the same site on the Swan River. They averaged 89 mm (3.5 inches) in total length at the time of planting.

The survival, growth and distribution of the coho in the lake were checked by returns through the regular lake netting program and through warden creel census. Additional returns were solicited through the news media. Fishermen were asked to relay catch data to the District Fish and Game office, in Kalispell.

Distribution and dispersal pattern. - The first returns of the coho plant were fish that represented the "pre-smolt" plant. They were taken by sport fishermen on August 23, 1969 while trolling for kokanee salmon in the northern area of the lake. There were no further reports of coho until the first week in October, when they were taken regularly by both the netting crew and anglers. They remained in the catch through March, 1970 and then suddenly disappeared. Only two cohos were reported the following spring and summer; both were taken in June. The last coho reported from the lake was taken on November 3, 1970; some 18 months after planting. Surveilance for coho was continued throughout the following year, particularly in the vicinity of the Swan River Bay and in the river below the fish ladder. The area where the adult salmon should have returned. The attempts to find or locate the mature salmon failed.

2/ Notes of explanation in parenthesis are by the author.

The pattern of lake dispersal first began with the returns being reported from the northern area and then showing a progressive spreading down along both shorelines to the south end of the lake (Figure 2). The first two returns were reported from the more pelagic or open areas of the lake, while all other returns were taken near shore in waters less than 20 feet. Coho were taken at all other sampling areas of the lake before they were taken at Big Arm Bay.

The first "post-smolt", adipose clip, return was reported during November, 1969 and was caught along the northeast shore of the lake. Other marked fish taken during the same month indicated the "post-smolt" fish had already dispersed over most of the lake. Although the number of areas from which the "post-smolt" fish were taken was less than the "pre-smolt" fish (Figure 2); the returns of fish from both plants showed similar dispersal patterns.

Several observations of fish schools, found surfacing along the shoreline, were reported by both anglers and the netting crew during the first fall after the coho were planted. These schooling fish were believed to be coho, since all fish collected from the passing schools were identified as coho. These schools were found along both shorelines and ranged in numbers 100 to 200 fish.

Survival.- Return data was collected on total of 128 coho representing 0.1 percent return from the 140,000 fish planted. Although 82.1 percent of the salmon introduced were "pre-smolt" fish, over half of all the returns (55.9 percent) were "post-smolt" or marked fish. The percentage of fish returned for both the "pre- and post-smolt" fish plants were very small; 0.05 and 0.28 percent, respectively.

Growth.- Growth of the coho in Flathead Lake was considered excellent during their first eight months in the lake (Figure 3) and only fair to poor the remainder of the time in the lake. The accelerated growth peaked at eight-months, with the fish attaining lengths of 229 mm (9.0 inches) during the period. Growth rates dropped rapidly thereafter showing increases of 66 mm (2.6 inches) during a 12-month period, November, 1969 to November, 1970. The growth rate of the earlier plant of "pre-smolt" fish accelerated faster than the later plant of "post-smolt" fish. Growth of the "pre-smolt" fish during the first three month period showed a total increase in length of 127 mm (5.0 inches) compared to 79 mm (3.1 inches) for the "post-smolt" fish. The difference in total lengths of the returns from both plants taken during November illustrates the effect of the three month planting delay on the growth of the "post-smolt" fish. The total lengths of 12 "pre-smolt" and 43 "post-smolt" fish for November, 1969 were 262 mm (10.3 inches) and 168 (6.6 inches), respectively. The maximum size and weight attained by the coho after 18 months in the lake, was 328 mm (12.9 inches) and 348 (0.77 pounds).

Two unusual concentrations of coho were found during the surveilence of the lakes small tributaries. Both concentrations were slow growing as a result of taking up residence in a stream habitat rather than in the lake. The first of these stream residing fish were noticed in November, 1969, in Swan River Bay; when a school of 150 "post-smolt" coho were observed amidst a school of spawning

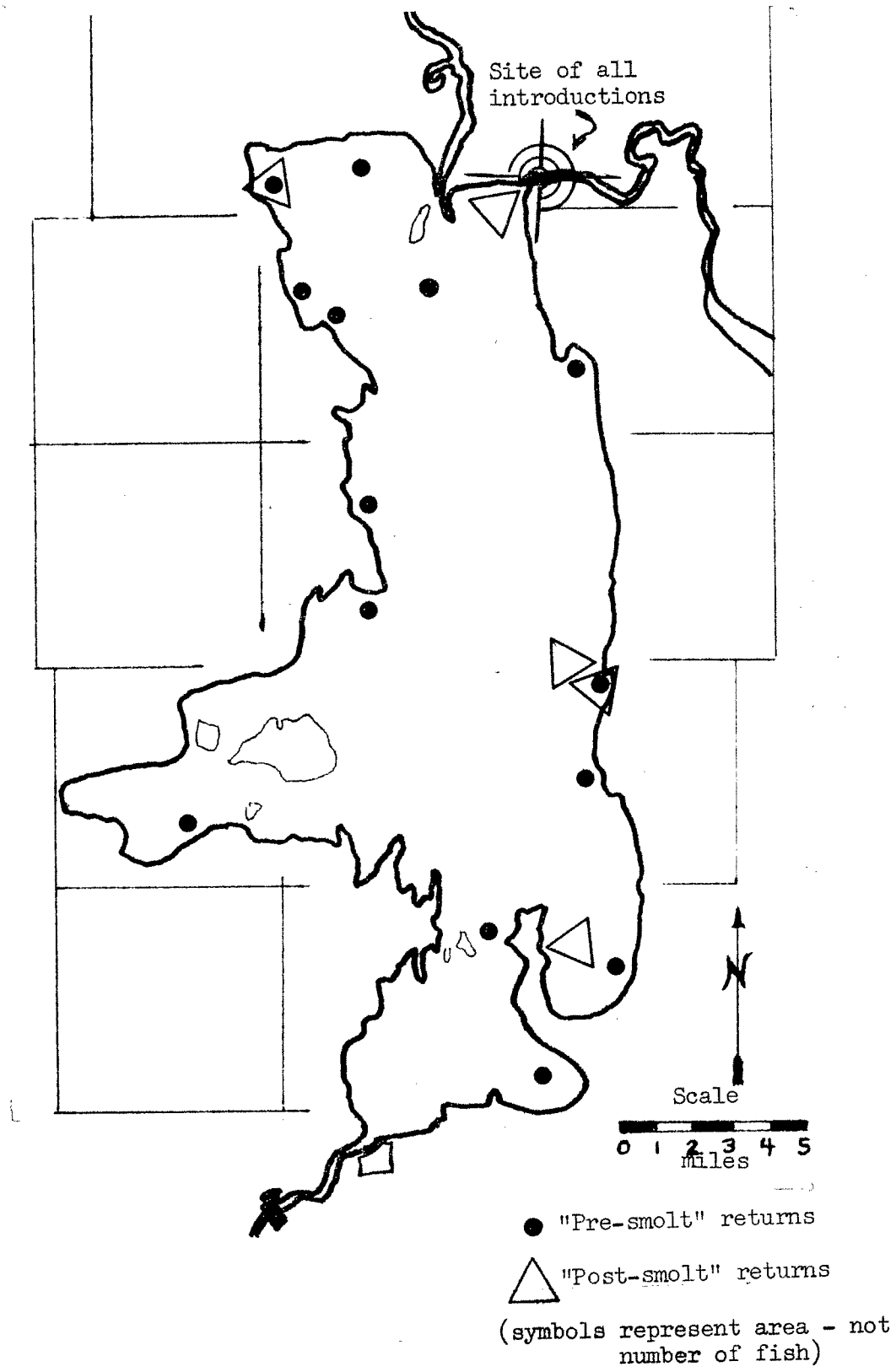

Figure 2. The catch distribution of coho salmon in Flathead Lake. August 1969 - November 1970.

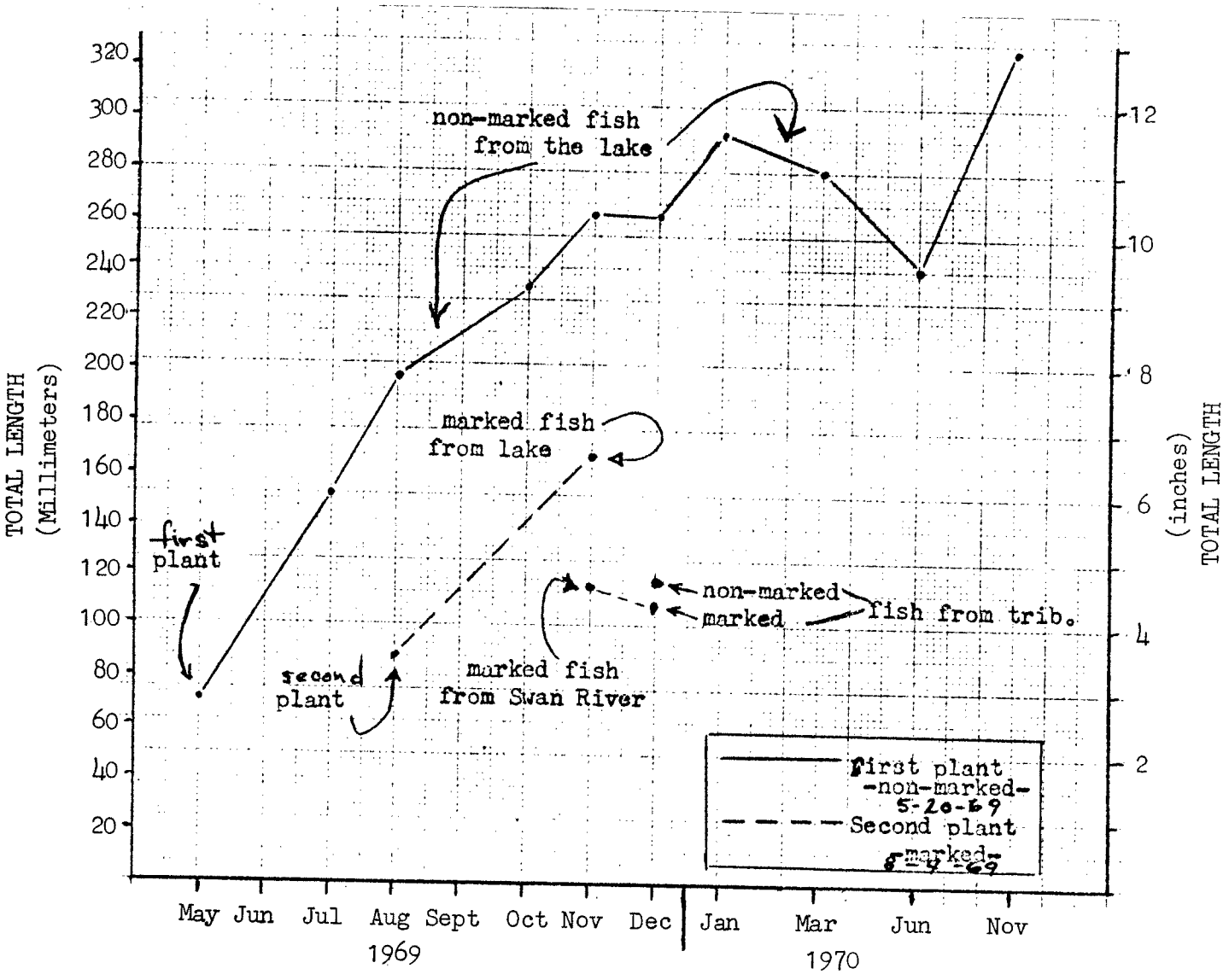

Figure 3. Growth patterns, average monthly length, of coho salmon in Flathead, May, 1969 through November, 1970

pygmy whitefish. These small coho averaged 117 mm (4.6 inches) or a growth of 28 mm (1.1 inches) since being planted. Fish from this same plant taken in the lake averaged 168 mm (6.6 inches); or 51 mm (2.0 inches) larger than the stunted fish collected in the bay. During December, another school of approximately 100 coho were found in a small west shore tributary of the lake, Yellow Bay Creek. This stream is located 12 miles south of the planting site and on the same side of the lake. The coho found in this school were a mixture of "pre- and post-smolt": fish, approximately 50 percent from each plant. All the coho in this stream exhibited the "stunted" phenomenon. The "pre-smolts" were planted in May and the "post-smolts" in August yet both groups had grown only 46 mm (1.8 inches) and 20 mm (0.8 inches) respectively since planting. The average length of "pre-smolt" fish taken in the lake during December was 145 mm (5.7 inches) longer than the "pre-smolt" fish found in Yellow Bay Creek.

Other facts.- No serious problems were encountered in identifying coho. Both their general appearance (McConnell, 1963) and scale characteristics (Mosher, 1969) were readily distinguishable from the kokanee salmon.

Visible egg development was observed in female coho, a total of four, taken during November, 1969 through January, 1970. Egg diameters measured during this period were less than 1 mm. These females ranged in size from 234 mm (9.2 inches) to 292 mm (11.5 inches).

An early maturing male, called a "jack" salmon, was found and was the last coho recorded from the lake. He was a "pre-smolt" fish caught near the mouth of a small east shore tributary, Stoner Creek, on November 3, 1970. This fish was one year younger than the age at which most coho mature. His gonads were greatly enlarged and were white in color.

Examination of stomach contents from coho taken during October showed a predominance of terrestial insects while the November predominance was Leptodora a large predacious Cladocera.

After reviewing the sequence of facts on the coho, starting with the initial survival of both the "pre- and post-smolt" fish, their dispersal in the lake, the measurement of good initial growth, the frequent returns during the first fall and then the sudden disappearance; it is concluded that the strong downstream urge of the coho was not completely lost in the hatchery or was even absorbed by the large size of Flathead Lake. This persistent urge was apparently only delayed for one year, the spring of 1970, the time when most coho disappeared.

Fisheries workers in Idaho, downstream from Flathead Lake, were notified of the introduction. They were asked to watch for coho with the clipped adipose fins and to relate any other unusual concentrations of coho that might have originated from Flathead Lake. No reports were received on the downstream coho. Negative reports on possible upstream movements were made by Department Wardens and the kokanee egg collection crew, and from Glacier National Park officials.

RECOMMENDATIONS

The present emphasis of this study should be continued with 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. This work should be conducted within small selected areas during limited seasons. The knowledge gained through the previous work, particularly on the general area and depth distribution and on the techniques needed to collect individual fish species will aid the investigation of these more detailed studies.

Prepared by Delano A. Hanzel

Date May 30, 1972

Waters referred:

7-6400

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