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MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
Job Progress Report

STATE: Montana

TITLE: Northwest Montana Fisheries Investigations

PROJECT NO.: F-7-R-30

TITLE: Inventory of waters of project area

JOB NO.: I-a (Whitefish Lake Report)

PERIOD COVERED: June, 1979 through June, 1981

ABSTRACT

Whitefish Lake was a successful kokanee fishery with fish caught by anglers averaging from 12 to 14 inches in length. It was also used as a kokanee spawn source, and 6.8 million eggs were collected from 1967 through 1975. Kokanee spawning was discontinued after 1975. Since 1976, the kokanee population has declined dramatically in spite of continuing annual hatchery fry planting.

The known man-caused changes that occurred in the lake since 1967 included the introduction of the opossum shrimp (*Mysis relicta*) by the Department in 1968, the introduction of northern pike (*Esox lucius*) in the early 1970's by parties unknown, and removal of kokanee eggs for other lakes starting in 1967. Data presented in this report include information on fish distribution, *Mysis* distribution, plankton densities, lake temperatures, water chemistry, kokanee spawning numbers and spawning areas.

INTRODUCTION

Whitefish Lake is a large oligotrophic lake located near the town of Whitefish, Montana. The surface elevation of the lake is 2,995 feet MSL. The lake has a surface area of 3,350 acres with an average annual vertical fluctuation of 3.5 feet. Generally, low pool elevation is reached in late November or December and high pool occurs in June. Lake fluctuations are controlled by amount of spring runoff and an outlet constriction. The lake shoreline is generally steep and the littoral zone comprises 10 percent of the surface area. The maximum depth of the lake is 222 feet with an estimated 80 percent of the area averaging more than 100 feet deep.

Fish species found in the lake and their abbreviations used throughout this report are listed below. Indigenous fish species are noted with an asterisk.

Common Name	Abbreviation	Scientific Name
Lake trout	LT	*Salvelinus namaycush*
*Mountain whitefish	MWF	*Prosopium williamsoni*
*Bull trout	DV	*Salvelinus confluentus*
Brook trout	EV	*Salvelinus fontinalis*
Yellowstone cutthroat trout	YCT	*Salmo clarki bouvieri*
*Westslope cutthroat trout	WCT	*Salmo clarki lewisi*
Kokanee	KOK	*Onchorhynchus nerka*
Largemouth bass	LMB	*Micropterus salmoides*
Pumpkinseed	PMK	*Lepomis gibbosus*
Yellow perch	YP	*Perca flavescens*
*Largescale sucker	CSU	*Catostomus macrocheilus*
*Longnose sucker	FSU	*Catostomus catostomus*
*Northern squawfish	SQ	*Ptychocheilus oregonensis*
*Peamouth	CRC	*Mylocheilus caurinus*
*Redside shiner	RSS	*Richardsonius balteatus*
Black bullhead	BUL	*Ictalurus melas*
*Sculpins	COT	*Cottus spp.*
Northern Pike	NP	*Esox lucius*
Lake whitefish	LWF	*Coregonus clupeaformis*
*Pygmy whitefish	PWF	*Prosopium coulteri*

Most exotic species (with the exception of kokanee and northern pike) were introduced in the early 1900's. Kokanee were first introduced into Whitefish Lake by the Department in 1945, and northern pike were illegally planted or immigrated sometime in the early 1970's.

Other studies have attributed the increase in fish size and body weight to the successful introduction of *Mysis*. *Mysis* were introduced into Kootenai Lake, British Columbia in 1949 (Sparrow and Larkin 1964). By the early 1960's, mature kokanee which formerly weighed 0.5 pounds averaged two pounds and reached a maximum weight of 10 pounds. Encouraged by these results, other state agencies (California, Idaho, Colorado, Oregon, Washington Minnesota, Montana) initiated their own programs of stocking *Mysis* to enhance the quality of their lake trout or kokanee fisheries. *Mysis* were native to many oligotrophic lakes in the northern United States east of the continental divide and are an important food source for juvenile lake trout in those lakes. The introduction of *Mysis* into Whitefish Lake was intended to enhance both the kokanee and lake trout fishery.

In most years from 1945 through 1979, kokanee fry were planted into Whitefish Lake annually (Table 1). The early plants were successful in establishing a kokanee population. From 1945 through 1974, the fry were planted from shore at the north end of the lake and into Swift Creek approximately 500 yards upstream from the mouth (Figure 1). The method was changed in 1975 to mid-lake boat planting because it was believed that fry survival would be increased. The plants were made approximately one half mile from the mouth of Swift Creek in mid-lake. In past shore planting operations (in other Montana lakes), fry mortalities were observed when shoreline wave action was stranding them on the beaches; it was also believed that

Table 1. Number of kokanee fry planted and number of eggs collected from Whitefish Lake - 1945 through 1980.

Year	Planted	Spawn collected
1945	150,000	---
1946	700,000	---
1947	500,000	---
1948	200,000	---
1949	---	---
1950	---	---
1951	178,750	---
1952	199,125	---
1953	203,008	---
1954	213,165	---
1955	---	---
1956	---	---
1957	---	---
1958	---	---
1959	---	---
1960	---	---
1961	---	---
1962	---	---
1963	---	---
1964	591,608	---
1965	212,160	---
1966	554,320	---
1967	307,584	---
1968	290,296	702,240
1969	---	839,040
1970	151,425	1,346,552
1971	226,200	1,191,726
1972	250,000	459,360
1973	250,000	330,560
1974	250,000	374,528
1975	350,000	991,776
1976	200,000	428,042
1977	200,000	---
1978	350,000	---
1979	379,000	---
1980	290,000	---

losses occurred from fish and bird predation when fry were planted from shore (Bob Domrose; personal communication).

Whitefish Lake spawn taking operations were initiated in 1967 (Table 1). Kokanee eggs were collected to compliment various sources for stocking Montana waters including Whitefish Lake. In 1976, spawn taking operations were discontinued when a dramatic decline in the number of spawners became evident.

OBJECTIVE

The objective of this job was to determine population densities of kokanee in Whitefish Lake and study those physical, chemical and biological factors which may be controlling their numbers.

PROCEDURES

Sampling stations were established at the upper, lower and middle sections of Whitefish Lake. Gill netting sites were located along the shoreline while plankton and water chemistry sites were in mid-lake at stations 1, 2, and 3 (Figure 1). Sampling was done monthly starting in June 1979 and continuing through October 1979. Spawning surveys were done in November and December of 1979 and November 1980.

The following physical, chemical and biological data were collected:

1. Temperature profiles, dissolved oxygen content, standard conductance, alkalinities and pH.

2. Daytime plankton samples were collected using a plankton net with a 0.20 square meter opening and a mesh size of 80 microns. Each plankton sample was collected from separate 100 foot vertical tows. The number of animals per liter was determined from these tows by diluting the samples to a total volume of 800 to 1,000 mililiters and directly counting the number of animals in five 1-mililiter subsamples from each dilution. The subsamples were collected with a Henson Stemple pipette. Calculations were made by dividing the total number of animals by the volume of water filtered per sample. The adult plankters were identified down to cyclopoids, calanoids and cladocerans. Daphnia and Bosmina were counted separate of other plankton groups as these genera may be important to kokanee. Nauplii were counted separate of the other groups and not identified.

3. *Mysis* distribution was determined by making 25 foot, 50 foot and 100 foot vertical tows. They were made at night with the same net used for the plankton tows. The number of *Mysis* per sample was counted.

4. A total of 24 sinking net sets and 49 floating net sets were made during the sampling period. All nets used were 125 feet

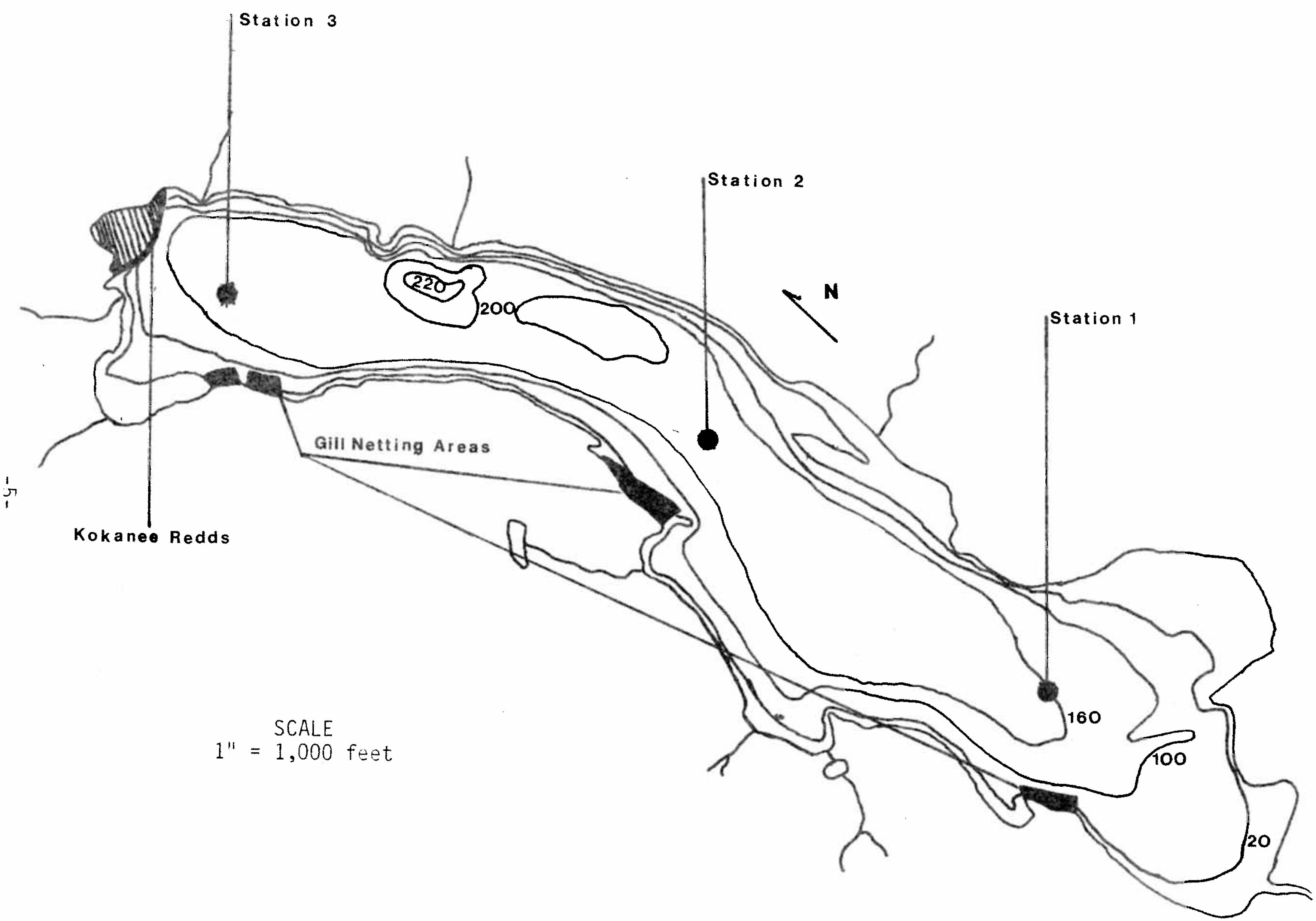

Figure 1. Whitefish Lake water quality, plankton and gill net sampling stations.

by 6 feet standard experimental gill nets with bar mesh of 3/4 inch, 1 inch, 1½ inch, 1 3/4 inch and 2 inch sizes. The sinking nets were set singly from the shoreline out at depths ranging from six feet to 75 feet. The floating nets were set in the immediate vicinity of the sinking nets and two nets were ganged extending from the shoreline out 250 feet. They were fished near the shoreline at each of the three gill netting areas and were overnight sets of approximately 12 hours (Figure 1). Independent of our regular netting, some drifting gang sets of floating gill nets were fished overnight in mid-lake near stations 2 and 3 (Figure 1).

5. Age and growth were determined from scales collected from northern pike, westslope cutthroat trout, bull trout, mountain whitefish and lake whitefish.

6. Food habits of northern pike, westslope cutthroat trout, lake whitefish and bull trout were determined.

7. Abundance of kokanee in the lake and their utilization of known spawning areas was examined and surveys were made of other lake areas to locate other spawning sites.

ACCOMPLISHMENTS

Physical and Chemical Lake Characteristics

Water quality parameters measured during this study are listed in Table 2. Temperature isotherms for the three sample stations are shown in Figures 2, 3, and 4. The water quality parameters measured appear to be within the tolerance limits of kokanee and other salmonids. Water quality measurements as present here are similar to those reported for Whitefish Lake by the Montana Department of Health and Environmental Sciences and Sonstelie (1974).

Water temperature profiles show that the lake is cold throughout most of the year. The maximum temperature recorded in 1979 was 72° at the surface during late July and early August. A shallow thermocline extending from 23 feet to 35 feet deep developed in July and continued into September. Temperatures within this thermocline ranged from 60°F to 52°F (Figure 5).

Plankton and *Mysis*

The number of zooplankton organisms per liter of water is presented in Table 3. Cyclopoids were the most abundant organism followed by cladocerans and calanoids. The lowest total number of organisms occurred in July. During the sampling period, cladocerans (*Bosmina* and *Daphnia*) were low in June, peaked in August, and declined thereafter.

During June, mysids were abundant at all depths sampled after dark with about half as many found in the 25 foot vertical tow as compared

Table 2. Summary of physical and chemical data, Whitefish Lake, 1979.

	Total alkalinity	pH	Standard conductivity	Dissolved oxygen and water temperature: Surface	Dissolved oxygen and water temperature: Depth	Secchi disc reading
Station I						
June 12	76	7.8	190	9.6 ppm (61°F)	10.0 ppm(42°F)100 ft deep	---
July 17	72	7.7	110	8.7 ppm (72°F)	9.1 ppm(40°F) 94 ft deep	23'
August 21	75	7.8	180	8.1 ppm (70°F)	7.9 ppm(44°F) 90 ft deep	29'
September 24	85	7.6	150	8.7 ppm (64°F)	8.0 ppm(45°F) 79 ft deep	28'
October 29	--	---	---	9.4 ppm (52°F)	7.8 ppm(43°F) 79 ft deep	37'
Station II						
June 12	76	7.8	190	9.7 ppm (61°F)	9.6 ppm(42°F) 90 ft deep	13'
July 17	76	7.8	110	9.4 ppm (69°F)	9.9 ppm(40°F)100 ft deep	24'
August 21	81	7.6	156	9.0 ppm (69°F)	8.6 ppm(41°F)100 ft deep	29'
September 24	--	---	---	8.6 ppm (64°F)	6.5 ppm(46°F)180 ft deep	31'
October 29	--	---	---	9.4 ppm (52°F)	6.8 ppm(44°F)145 ft deep	31'
Station III						
June 12	--	---	---	(62°F)	(42°F)	--
July 17	79	7.9	110	9.0 ppm (69°F)	9.4 ppm(41°F)100 ft deep	--
August 21	87	7.1	160	8.2 ppm (69°F)	8.2 ppm(41°F)100 ft deep	29'
September 24	86	7.7	150	8.7 ppm (64°F)	7.1 ppm(45°F)145 ft deep	34'
October 29	--	---	---	9.4 ppm (52°F)	6.3 ppm(44°F)145 ft deep	29'

STATION 1

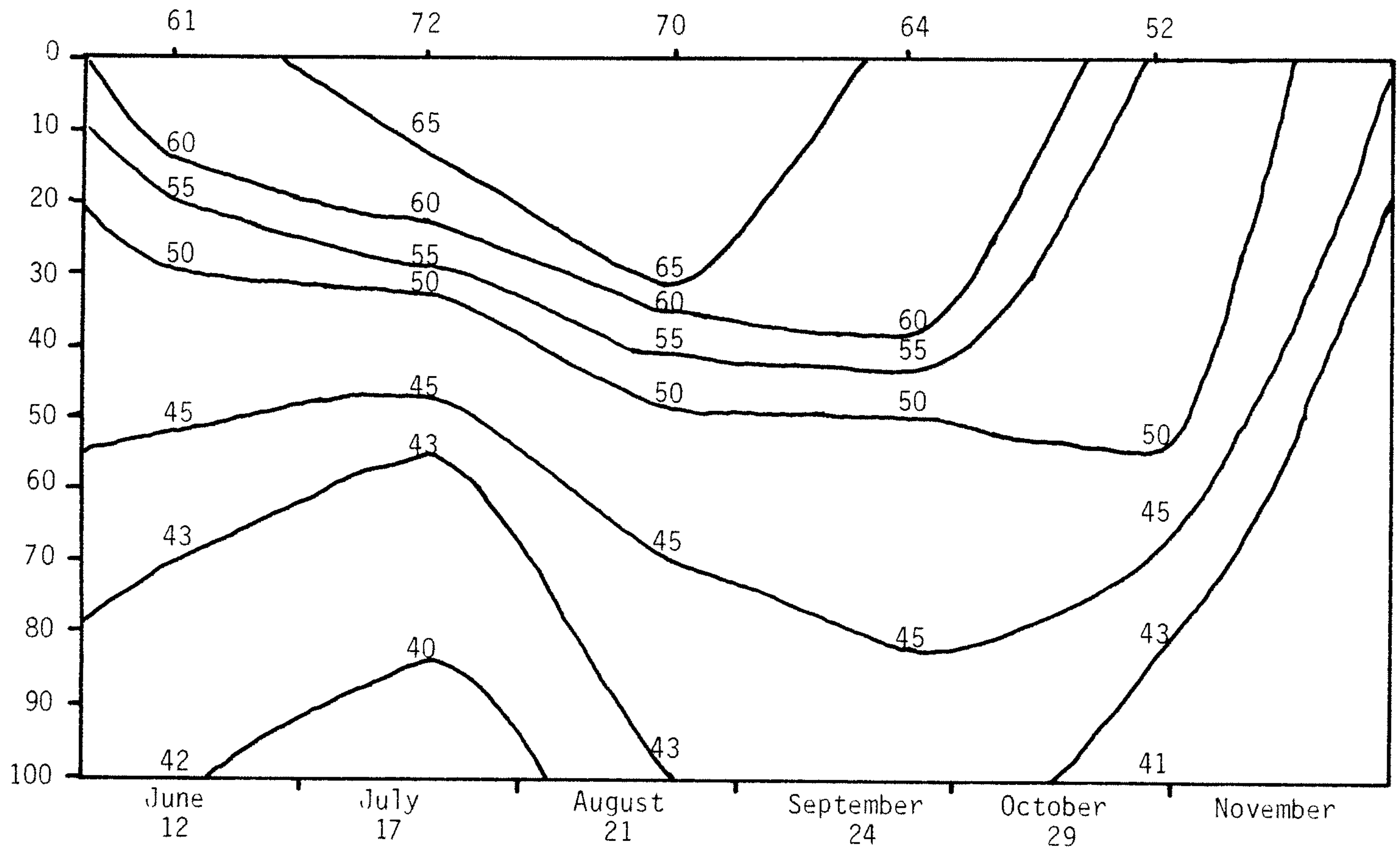

Figure 2. Temperature isotherm Station 1, Whitefish Lake, 1979.

STATION 2

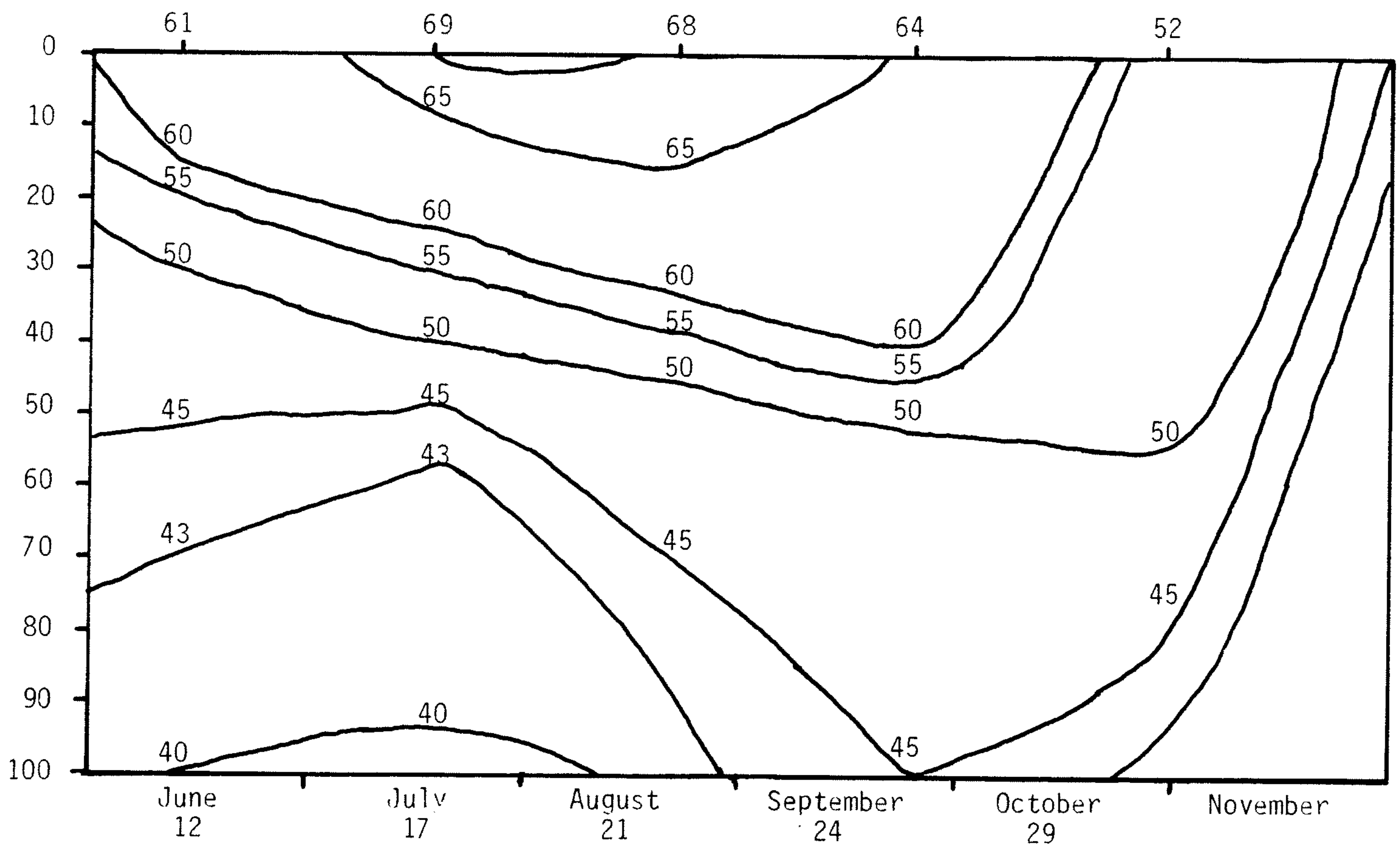

Figure 3. Temperature isotherm Station 2, Whitefish Lake, 1979.

STATION 3

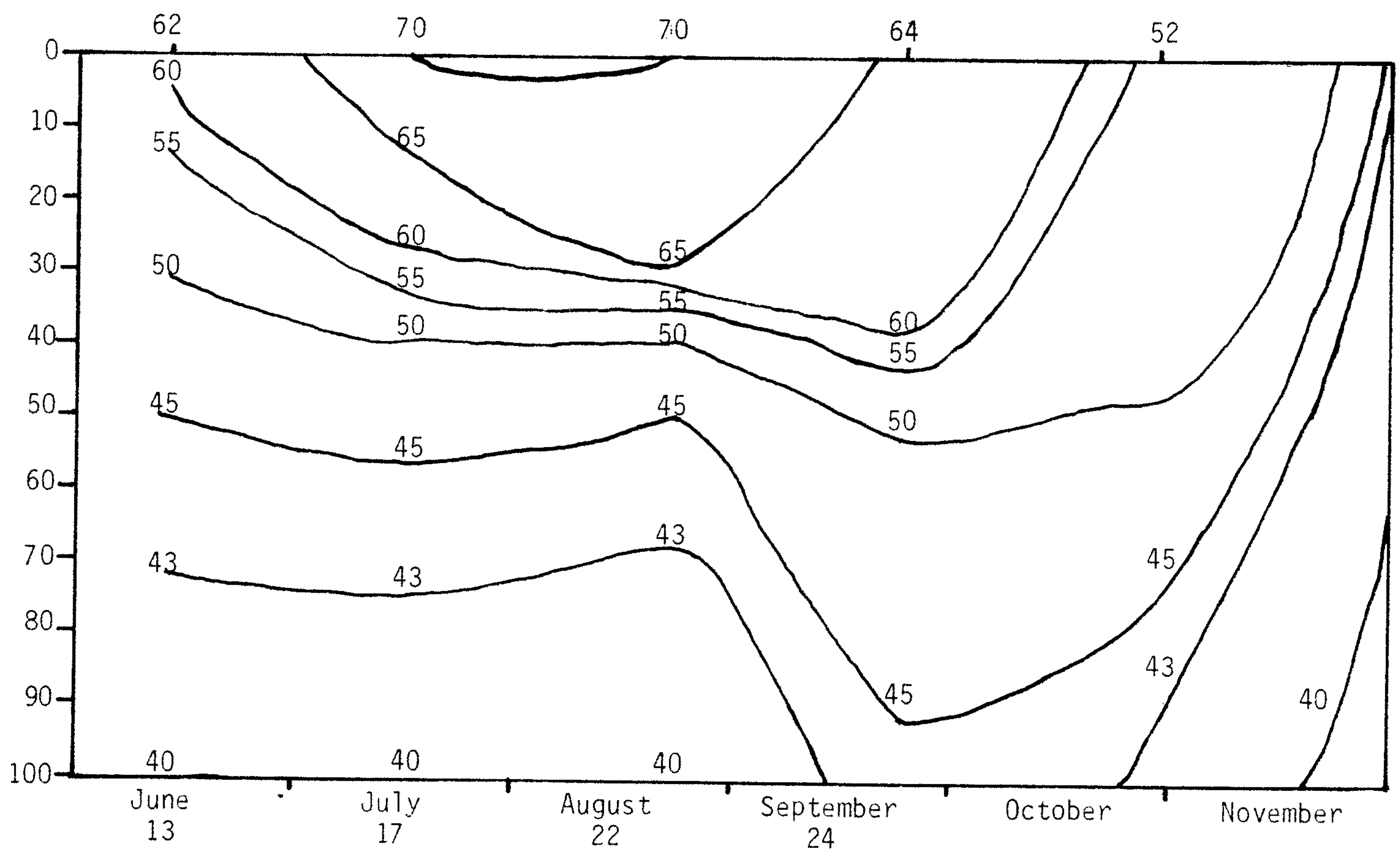

Figure 4. Temperature isotherm Station 3, Whitefish Lake, 1979.

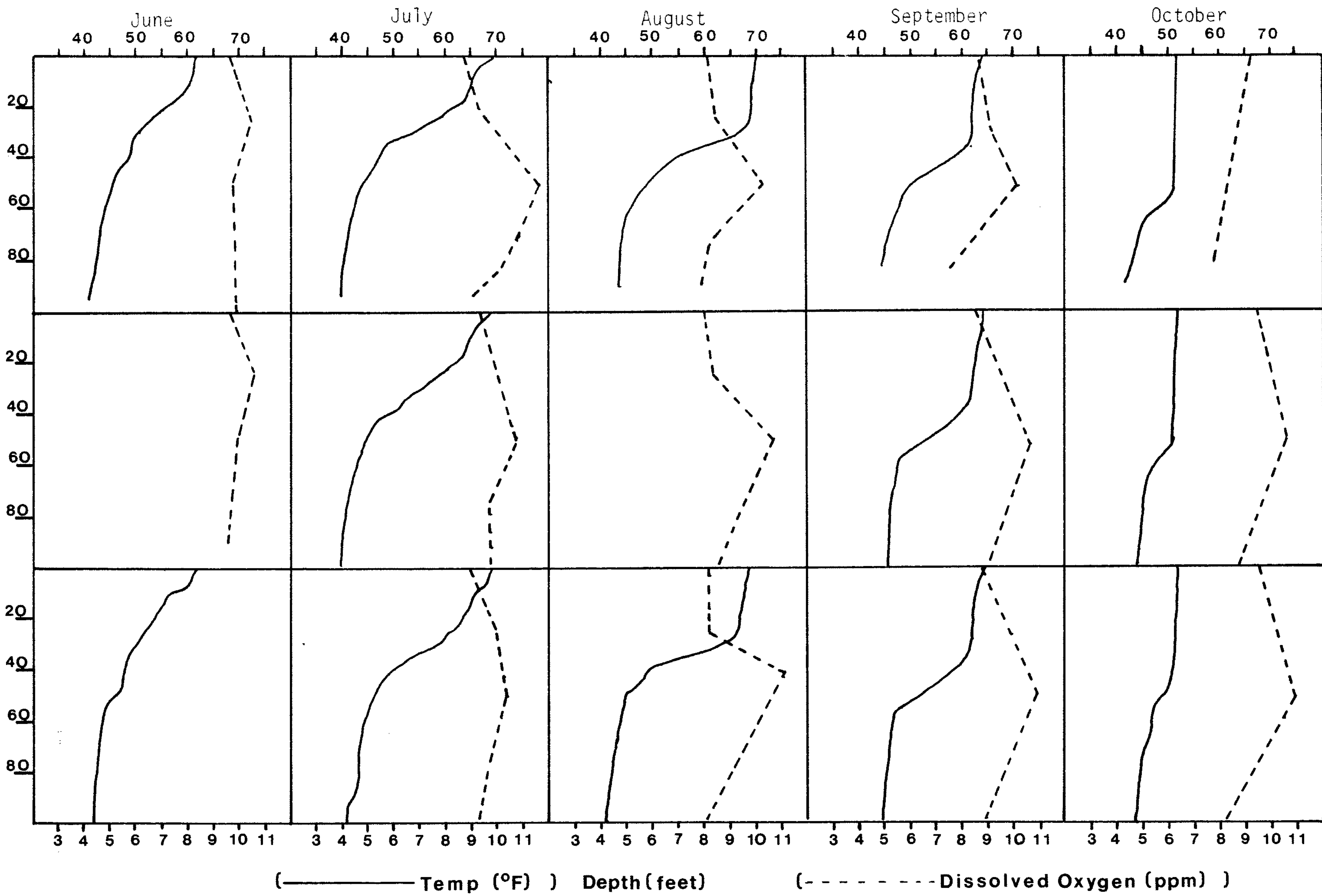

Figure 5. Temperature and dissolved oxygen profiles at three stations Whitefish Lake, 1979.

Table 3. Number of animals and percent of the total of Cyclopoid, Calanoid, Daphnia and Bosmina at three stations on Whitefish Lake, 1979.

Station	Month	No./liter(%) Cyclopoid	No./liter(%) Calanoid	No./liter(%) Daphnia	No./liter(%) Bosmina	Total No./liter
I	June	15.4(98.1)	0.2(1.9)	(0.0)	(0.0)	15.7
	July	4.9(70.0)	0.2(2.9)	1.4(20.0)	0.5(7.1)	7.0
	Aug.	16.8(55.3)	1.0(3.3)	8.1(26.6)	4.5(14.8)	30.4
	Sept.	12.0(61.2)	0.3(1.5)	5.8(29.6)	1.5(7.6)	19.6
	Oct.	19.7(93.4)	(0.0)	1.2(5.7)	0.2(0.9)	21.1
II	June	14.7(96.7)	(0.0)	0.3(2.0)	0.2(1.3)	15.2
	July	9.3(85.4)	0.3(2.7)	1.0(9.2)	0.3(2.7)	10.9
	Aug.	12.5(67.9)	0.8(4.3)	1.8(9.9)	3.3(17.9)	18.4
	Sept.	8.2(83.7)	(0.0)	1.3(13.2)	0.3(3.1)	9.8
	Oct.	10.7(93.0)	(0.0)	0.8(7.0)	(0.0)	11.5
III	July	5.6(83.6)	0.2(3.0)	0.6(8.9)	0.3(4.5)	6.7
	Aug.	17.9(73.4)	0.9(3.7)	2.9(11.9)	2.7(11.0)	24.4
	Sept.	11.9(83.8)	0.5(3.5)	1.5(10.6)	0.3(2.1)	14.2
	Oct.	10.1(94.4)	(0.0)	0.5(4.7)	0.1(0.9)	10.7

to the 100 foot vertical tows (Figure 6). *Mysis* collected in June averaged over 10 mm and two percent of the sample averaged 20 mm in length. *Mysis* of these sizes are considered mature. The immature *Mysis* are 4 to 6 mm in length (Larkin 1948). *Mysis* were absent from 25 foot vertical tows in July, August, and October and were substantially fewer in the 50 and 100 foot tows from July through October.

In August and September, 100 foot vertical tows were made at twilight and one hour after dark. *Mysis* were only found in samples collected after dark during these two months.

Fish Species Distribution

The total catch of westslope cutthroat trout, lake whitefish, northern pike and bull trout by station, by month, and by net type is listed in Table 4. The distribution of westslope cutthroat trout, lake whitefish and bull trout was nearly equal throughout the sampling areas. Westslope cutthroat trout were caught most frequently in the upper half of surface nets and in that part of the gang nets nearest the shoreline. Lake whitefish and bull trout catches occurred more frequently in bottom nets near the shorelines. Although northern pike were caught in all of the sampling areas, the largest number was from the littoral zone at station 3 where 47 (out of a total catch of 58) were caught. The bottom nets caught 52 pike and surface nets caught six pike.

Fish species also taken in the sampling included mountain whitefish (27), lake trout (14) and nongame fish species. A total of 391 nongame fish (54 percent of the catch) were caught during the sampling period. The most abundant species were largescale suckers. northern squawfish and peamouth. Their distribution was nearly equal throughout the three sampling areas and occurred most frequently in bottom nets with one exception; peamouth occurred frequently in both bottom and surface nets.

Independent of the regular sampling and during the month of September, four ganged surface nets were set adrift overnight in the midwaters of the lake off of station 2 and 3. A total of 10 westslope cutthroat trout (8 in one net) and 23 peamouth (20 in one net) were caught.

Growth Rate

Growth rates of bull trout, lake whitefish, westslope cutthroat trout (planted and wild), northern pike and mountain whitefish are listed in Table 5. No aging was done on nongame species. Because of the small numbers gamefish species collected and aged, few conclusions can be drawn from the data. Indications are that the growth rates are fair for all of the fish species that were aged.

Stomach Content Analyses

Frequency of occurrence of food organisms from westslope cutthroat trout, lake whitefish and bull trout stomachs are listed in Table 6. Few

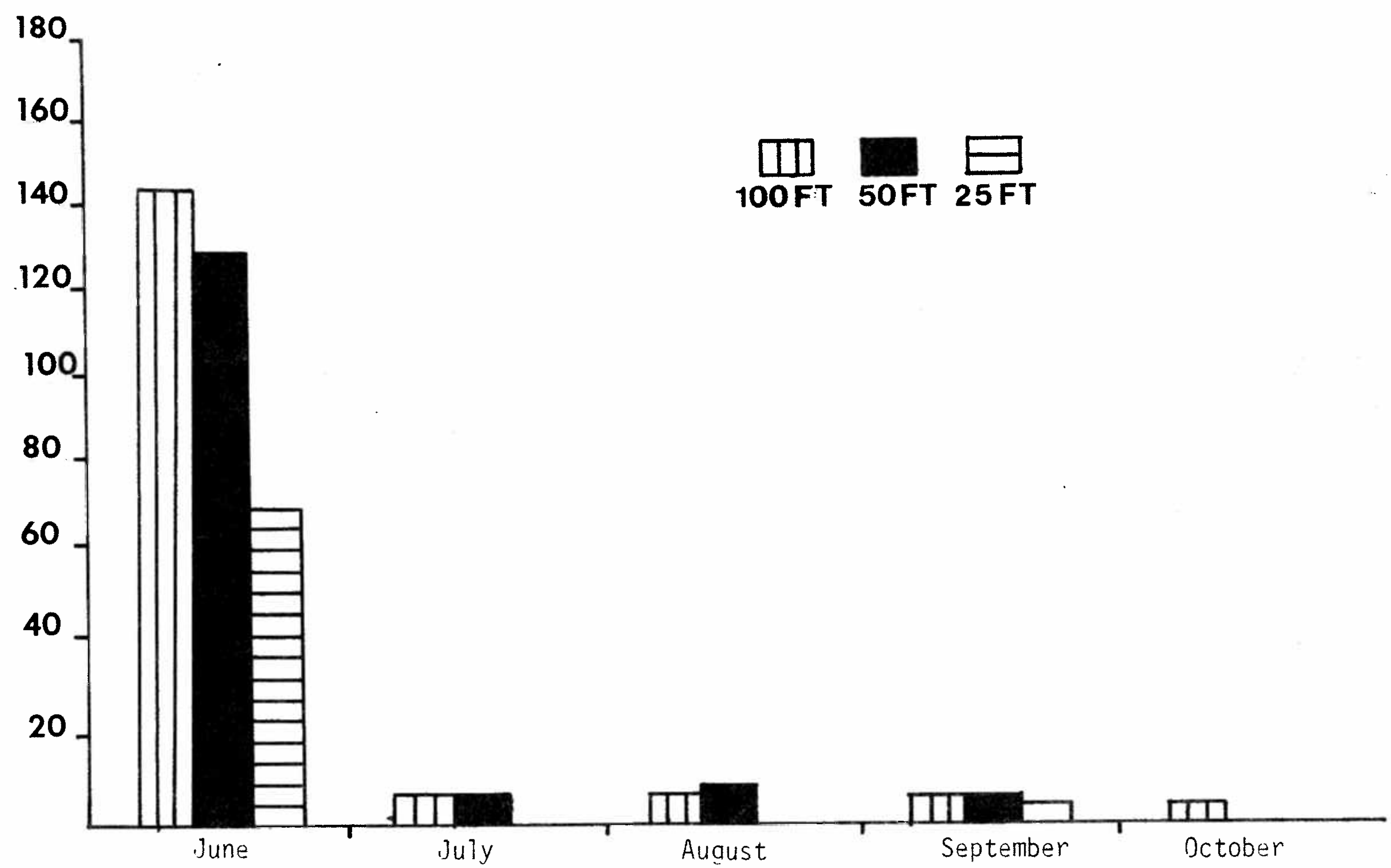

Figure 6. The average number of *Mysis* collected in 25, 50 and 100 foot vertical night tows from station 1, 2 and 3 (combined) Whitefish Lake, 1979.

Table 4. Number of westslope cutthroat trout, lake whitefish, northern pike and bull trout caught by sinking and floating gill nets in Whitefish Lake, June through October 1979.

Species	Net Type	Station 1						Station 2						Station 3					
		Jun	Jul	Aug	Sep	Oct	Total	Jun	Jul	Aug	Sep	Oct	Total	Jun	Jul	Aug	Sep	Oct	Total
WCT	Sinker	0	1	6	0	0	7	0	2	1	1	--	4	0	4	1	0	0	6
	Floater	0	3	4	5	0	12	2	6	1	0	8	17	3	5	9	8	2	27
LWF	Sinker	26	5	10	1	5	47	9	7	5	1	--	22	36	12	0	0	4	52
	Floater	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1
NP	Sinker	1	0	0	1	0	2	0	0	1	8	--	9	10	11	7	9	4	41
	Floater	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	2	6
DV	Sinker	0	0	5	4	3	12	0	2	2	1	--	5	0	6	0	0	4	10
	Floater	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0

Table 5. Growth rates of game fish from Whitefish Lake.

Species	Average length in inches at annulus						
	I	II	III	IV	V	VI	VII
Bull trout	3.1(35)[1/]	5.8(35)	8.5(35)	11.9(23)	15.4(16)	18.4(6)	21.0(2)
Lake Whitefish	3.1(44)	7.7(44)	11.3(41)	13.6(35)	15.2(14)	15.7(1)	
Westslope[2/] Cutthroat	2.9(30)	5.7(30)	9.9(7)				
Westslope[3/] Cutthroat	4.7(28)	8.9(8)	11.9(3)	15.6(1)			
Northern Pike	8.6(43)	13.7(20)	19.1(1)				
Mountain Whitefish	4.0(13)	7.3(12)	9.6(7)	10.8(2)			

1/ Number in parentheses is sample size.

2/ Naturally spawned cutthroat.

3/ Hatchery reared cutthroat where planting marks or annulus I were indistinguishable.

Table 6. Percent frequency of occurrence of food items found in stomachs of westslope cutthroat trout, bull trout and lake whitefish collected from Whitefish Lake, 1979.

		Percent frequency of food items			
Month	Species	Terrestrial insects	Aquatic insects	Zooplankton	Fish
June	WCT(5)*	100	80	0	0
	LWF(14)	0	86	43	0
	DV(6)	33	33	67	83
July	WCT(19)	90	68	5	0
	LWF(12)	0	25	75	0
	DV(9)	0	33	0	67
August	WCT(8)	100	37	0	0
	DV(3)	0	0	0	67
October	WCT(10)	80	70	80	0
	DV(7)	0	0	0	29
December	DV(1)	0	0	0	100

* Number of stomach samples collected

conclusions should be drawn from the small number of stomachs collected. The samples indicate that westslope cutthroat trout start feeding more on zooplankton in October when terrestrial insects are less available. McMullin (1979) found that westslope cutthroat feed on *Daphnia* (zooplankton) during the early spring, fall and winter months. The two identifiable fish species found in bull trout stomachs were largescale sucker and yellow perch.

In June and July, lake whitefish fed mainly on Diptera larvae, copepods, mysids and some *Daphnia*. *Mysis* were found in five of the twelve lake whitefish stomachs in July.

Table 7 lists the percent of occurrence of the food items found in northern pike stomachs. Their diet was 100 percent fish and contained the following identifiable species: largescale sucker, westslope cutthroat, mountain whitefish, yellow perch, redside shiner, and northern squawfish. The other stomachs contained unidentified fish remains and 15 stomachs were empty.

Table 7. Occurrence of fish in northern pike stomachs. Whitefish Lake June through December, 1979.

Month	Number of pike	Number of empty stomachs	Percent Frequency of food items						Unidentified fish remains
			WCT	WF	CSU	RSS	YP	SQ	
June	3	0	0	0	33	0	0	0	67
July	14	5	7	0	7	7	0	14	36
August	7	3	14	0	0	0	14	0	29
September	10	2	0	10	33	0	20	0	20
October	5	2	40	40	0	0	0	0	0
December	6	1	0	0	17	17	0	0	0

Kokanee Spawning

The historical spawning area is at the north end of the lake between the mouths of Swift Creek and Smith Creek (Figure 1). Visual observations were made of this spawning area during daylight and darkness in November and December 1979 and November 1980. In 1979, a few active redds were observed in depths of three inches and down to an estimated 15 feet. Some spawners were collected by electrofishing. The number of spawners was estimated at about 150 to 200 fish. In 1980, no active redds or spawners were observed. Gill nets fished over the spawning area at depths of six feet down to 60 feet were unsuccessful in capturing kokanee in 1980.

From the years 1967 through 1979, a sample of kokanee spawners was collected, by either the spawning crew or by gill netting, for the purpose of determing the total average length of mature spawning fish and age composition (Figure 7). The average total length of spawners ranged from

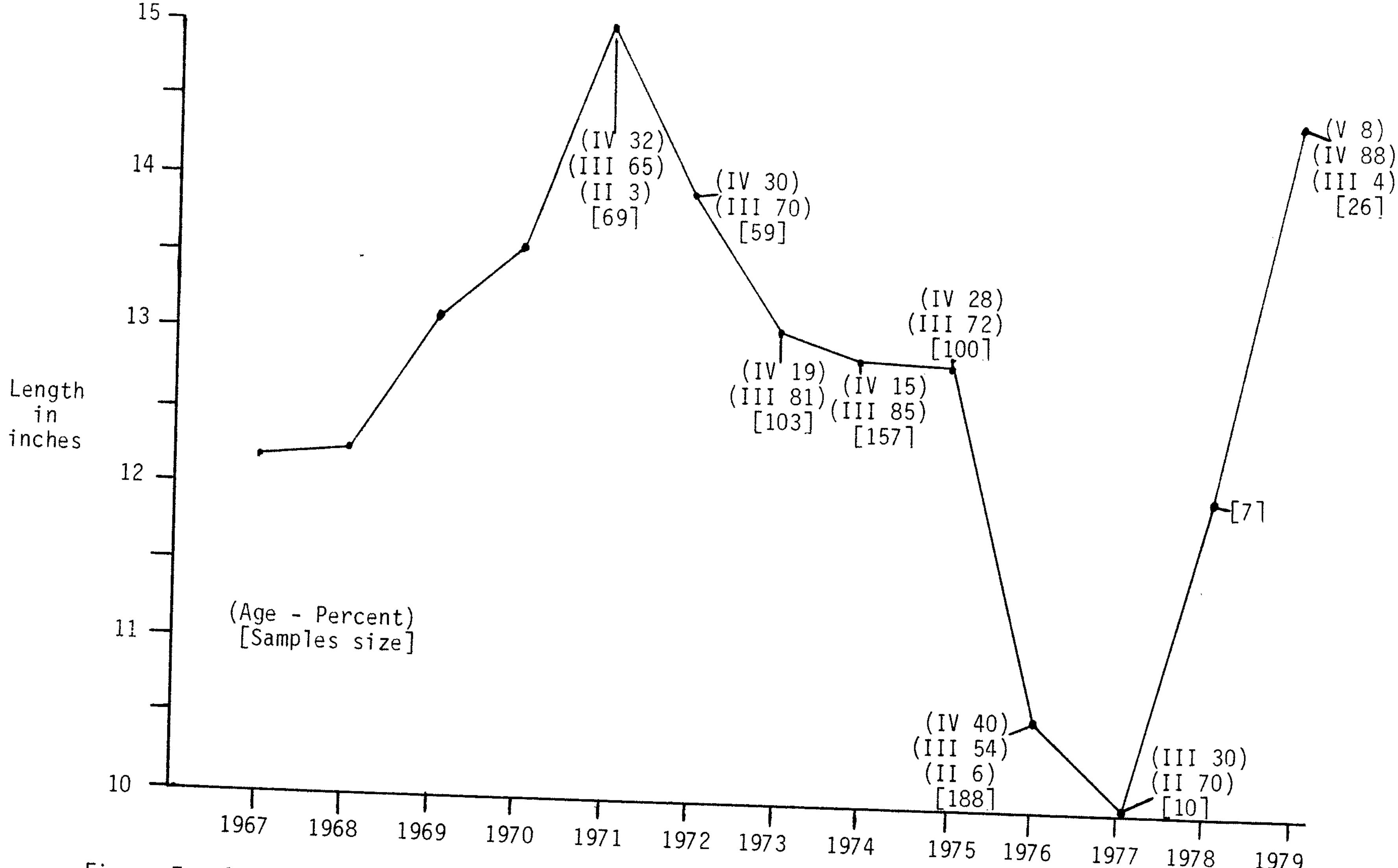

Figure 7. Average length, percent of age composition and number of kokanee in samples from 1967 through 1979, Whitefish Lake, Montana.

12.3 inches to 15.1 inches during the years of 1967 through 1975. During the period, the age composition was dominated by 3+ spawners (74.6% average), followed by 4+ spawners (24.8% average) with only three percent of the spawners being 2+. In 1976 (when the decline in numbers of kokanee spawners became evident), a sample of 188 mature fish was collected by gill nets. From this sample, 40 percent were 4+, 54 percent were 3+, and six percent were 2+ spawners. From a sample of 26 spawners in 1979, eight percent were 5+, 88 percent were 4+, and four percent were 3+.

DISCUSSION

Water temperatures, dissolved oxygen and water chemistry parameters are within the tolerance range for survival and good growth of kokanee.

Distribution of other salmonids appears uniform throughout the lake. The expanding northern pike population could cause severe declines in some fish species, but it is believed that they would not have devastated a pelagic kokanee population. Their distribution seems to be primarily concentrated in a few littoral areas, and 81 percent of the catch was taken from the littoral area at the northwest end of the lake.

The possibility of northern pike or predator fish feeding heavily on emerging fry was not investigated and more study should be given to this possible impact.

There is wide acceptance of the hypothesis that kokanee populations are density dependent. When fish densities are low, the growth rates are good, and when the population increased, the competition for food becomes greater with a subsequent decline in the growth rates. Kokanee spawners in Whitefish Lake between years 1967 through 1975 averaged between 12 and 14 inches in length. In 1976, the state spawning crew reported a severe decline in the spawning population and from a sample of 188 fish, the average length was under 11 inches. This decline of over two inches average total length was not caused by a change in age class structure to younger spawners, because 94 percent were 3+ and 4+ years old and there was an increase in 4+ spawners to 40 percent (Figure 7). The decline in both numbers and size spawners then is apparently not a kokanee density related cause and suggests that some other effect is impacting their food supply.

In Pend Oreille and Priest Lakes in Idaho, Rieman and Bowler (1980) found that the kokanee population declines were not compensated by a response of increased growth. These two lakes have well established *Mysis* populations. The data from studies done on these lakes indicate a direct influence on the cladoceran populations by some interaction with *Mysis*. The result is a reduction of *Daphnia* and *Bosmina* populations and a change in their temporal distribution. There is no pre-*Mysis* plankton data for comparison with the 1979 data on Whitefish Lake. Reduced cladoceran populations have been reported from other lakes where *Mysis* were introduced. In Lake Tahoe, California-Nevada, Morgan, Thelkeld and Goldman (1978) report a significant decline in *Daphnia* and *Bosmina* following the establishment of *Mysis*. In Lake Washington, Eggers (1978) reported a decline in *Neomysis atwatchensis* and a subsequent reestablishment of *Daphnia*. *Neomysis* are a genera of the family Mysidae which inhabit fresh water rivers, lakes and brackish water estuaries in Washington, Oregon and California (Pennak 1953). The data from one year of sampling is limited, but suggests that the establishment of a *Mysis* population may be related to the decline of kokanee in Whitefish Lake.

RECOMMENDATIONS

1. Evaluate the introduction of kokanee as fingerlings and delay the plants until early July to increase their survival. The survival of young-of-the-year kokanee from delayed hatchery stocking showed to be substantially better survival than wild fish in Lake Pend Oreille, Idaho (Reiman and Bowler 1980). Hatchery fish should be marked with tetracycline to help distinguish survival of hatchery plants versus wild fish.

2. Continue to monitor the number, size, and age composition of lakeshore spawning kokanee annually.

3. Population trends of all fish species should be determined periodically using appropriate gear.

4. Comparison of plankton relationships in Whitefish, Ashley and Flathead Lakes should be made with respect to temporal distribution.

5. Consideration should be given to methods of controlling northern pike populations.

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