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MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana

Project No. F-7-R-20 Name Northwest Montana Fisheries Study

Job No. I-b Title Fish Management Surveys

Period Covered April 1, 1970 through March 31, 1971

ABSTRACT

Opening day creel census data were collected for Lake Mary Ronan and Kilbrennan Lake. The average catch per hour of game fish for Lake Mary Ronan increased from .18 fish in 1969 to .35 fish in 1970. Kokanee comprised 78 percent of the catch. The harvest of brook trout at Kilbrennan Lake on opening day in 1970 was 25 percent greater than in 1969.

Partial control of rough fish species was attempted at Bull Lake by trap netting and partial poisoning with rotenone. Trap netting accounted for the removal of 1,050 rough fish. An estimate of 200 fish were killed by poisoning. The peak of netting success occurred when surface water temperatures reached 52° F..

Dissolved oxygen-temperature profile data were collected at Lake Mary Ronan from early summer thermocline development to the fall overturn period. The thermocline did not penetrate as deeply in 1970 as it did in 1969 and therefore levels of suitable dissolved oxygen were present in more water of suitable temperature in 1970. Low levels of dissolved oxygen in the hypolimnion were similar for both years.

Data for water temperature-dissolved oxygen profiles were collected from 33 lakes. Other physical characteristics were also used to classify lakes as to their generally nutrient conditions. Seven lakes were classified as eutrophic, 20 as mesotrophic and 6 as oligotrophic.

BACKGROUND

Basic data other than fish populations inventories are pertinent to the needs of Fisheries Management. This is a continuous project designed to accumulate and update information on various other aspects of Fisheries Management Procedures.

OBJECTIVES

The objective of this job is to obtain information for fisheries management and for evaluation of the success of various management procedures.

PROCEDURES

Procedures are discussed along with the findings for each segment of the report.

FINDINGS

Opening Day Creel Census

Kilbrennan Lake

An opening day creel census was conducted at Kilbrennan Lake for the fifth consecutive year to determine the effect of a statewide 10 pound, no number limit for brook trout on the harvest rate. The no number limit of brook trout has been in effect since May of 1966. Kilbrennan Lake is one of the better producing brook trout lakes in the state and supports a self-sustaining population which is not supplemented by hatchery fish. The lake is unique in that it is the only brook trout lake that is self-sustaining in Northwest Montana that has a closed season during the spawning period. The lake closes September 1st and remains closed until the opening of the general fishing season the following May.

In 1970, a total of 262 anglers were interviewed on the opening day of fishing season between the hours of 6:45 A.M. and 6:05 P.M.. Anglers were successful in catching 1,328 fish for 1,120 hours of fishing effort. The catch per hour was 1.19 fish and the catch per angler 5.1 fish. Brook trout comprised 99 percent of the catch with rainbow trout making up the remainder. Length and weight data were collected from 109 brook trout. Total length measurements averaged 11.7 inches and 0.59 pounds, the largest average size brook trout since 1966. Resident anglers from Troy and Libby comprised 96 percent of the fishermen. The percent of resident anglers has ranged between 86 to 96 percent over the past five years.

A comparison of data (contact and expanded) for the years 1966 through 1970 is shown in Table 1. Estimated fishing pressure and harvest data were derived from boat and shore fishermen counts made on the lake at the termination of the census (6:05 P.M.) and were added to the contact data to give expanded data.

Table 1. Summary of opening day creel census data collected at Kilbrennan Lake, 1966 through 1970

CONTACT DATA				EXPANDED DATA				
Year	Anglers	Fish	Catch per angler	Anglers	Fish	Anglers hours	Total (pounds)	Catch fish per acre
1966	177	1042	5.9	243	1328	1070	611	22.7
1967	335	2077	6.1	407	2460	1702	900	42.0
1968	357	2597	7.3	386	2808	940	1053	48.0
1969	335	1055	3.2	384	1106	1484	677	18.9
1970	262	1328	5.1	301	1478	1260	872	24.6

The opening day fishing pressure was approximately 22 percent less in 1970 than the opeing day in 1969 although the harvest was 25 percent greater. A total of 15 anglers (5.7 percent) caught 220 brook trout and exceeded the old 10 fish limit by 70 or 5.3 percent of the total harvest.

Lake Mary Ronan

A partial creel census was conducted on the opening day of fishing season to compare opening day harvest rates with those of previous years. A total of 100 anglers checked fished a total of 361 hours and caught 127 game fish. Catch per angler was 1.27 fish and the hourly catch rate was 0.35 fish. Kokanee comprised 78 percent of the catch as compared to 13 percent for rainbow trout and 9 percent for largemouth bass. A comparison of opening day creel census data for the years 1966 through 1970 is shown in Table 2.

Table 2. Summary of opening day creel census collected from Lake Mary Ronan, 1966 through 1970

Year	Fishermen contacted	Number fish caught	Average catch per angler	Average catch per hour
1966	65	248	1.2	0.32
1967	98	118	1.2	0.25
1968	215	348	1.6	0.25
1969	62	58	0.9	0.18
1970	100	127	1.3	0.35

Angler success in catch per hour was approximately twice as great in 1970 as in 1969 and was the most successful since the opening day creel census was initiated in 1965. Greater angler success rate was attributed to the marked increase in catch of kokanee. In 1969 kokanee comprised 16 percent of the opening day catch as compared to 78 percent in 1970. Ninety percent of the kokanee harvested in 1970 were of age class 2+ and averaged between 10 and 11 inches in total length.

Experimental Removal of Rough Fish Species from Bull Lake

An attempt to control rough fish in Bull Lake with the use of a fish toxicant (Pro-noxfish) was repeated for the second successive year. The key target species to be controlled were northern squawfish, longnose suckers, coarsescale suckers and peamouth. In June of 1969 an estimated 960 rough fish were killed by applying fish toxicant to concentrations of spawning fish as they moved into the shoal areas.

Removal of rough fish species in 1970, was accomplished by a combination of trap netting and the application of a rotenone base toxicant.

In late May, squawfish and suckers began to congregate along the shoal areas in preparation to spawning. Night-light observations were made to determine areas of greatest concentrations. These areas were located on shallow gravel bars swept clean by fish preparing to spawn.

Trap nets were fished during the period of May 27th through June 4th. A total of 30 overnight net sets during this period accounted for the removal of 1,050 rough fish. The species composition of the rough fish was 49 percent coarsescale suckers, 26 percent squawfish, 20 percent longnose suckers and 5 percent peamouth. A few game fish species, including largemouth bass and brook trout, were caught and released.

At the start of the netting operations, the catch per net night was low with the majority of suckers and squawfish being immature. Immature fish comprised 82 percent of the squawfish and 60 percent of the coarsescale sucker catch collected on May 28th. Surface water temperatures in the shoal area were 49° on this date. As air temperatures warmed, the water temperature rose to 52° by June 2nd. Concentrations of fish increased and the catch per net night of mature fish increased considerably. Mature fish comprised 98 percent of the squawfish and 96 percent of the coarsescale sucker catch on June 2nd. A summary of fish captured in trap nets is presented in Table 3.

Table 3. Summary of fish caught in trap nets from Bull Lake, 1970

Date	Number of net sets	CSu	LNSu	Sq	PM	Total	Catch per net night
5/27-28	5	55	12	2	7	76	15.2
5/28-29	5	25	12	8	1	46	9.2
6/ 1-2	5	155	47	35	29	266	53.2
6/ 2-3-4	10	203	101	85	12	401	40.1
6/ 4-5	5	75	34	146	6	261	52.2
Total	30	513	206	276	55	1,050	35.0

CSu - coarsescale suckers, LNSu - longnose suckers, Sq - squawfish, PM - peamouth

At the termination of the netting operations, few squawfish and suckers were observed where nets had been placed. Apparently trap netting had been effective in these specific areas. Night observations along the shoal areas indicated the presence of rough fish was scattered but widespread throughout the lake.

Partial poisoning of shoal areas was attempted the nights of June 1st and June 3rd. Several areas with dense concentrations of squawfish and suckers were located during the day and flagged with marking tape. These areas were treated with pro-noxfish applied with a pressure pump later in the evening. Post treatment observations indicated a relative light kill. An estimate of 200 fish were removed by this method of control.

Scale samples were collected from several hundred fish. An age analysis of the rough fish species will be used to determine the effectiveness of several years removal of the mature spawning adults.

Lake Mary Ronan Dissolved Oxygen-Temperature Measurements

Insufficient oxygen concentrations in the cooler waters of the thermocline are believed to be responsible for the low survival of kokanee and subsequent poor fishing in recent years.

In 1969 and 1970, a vertical series of temperature-oxygen measurements were recorded at the deepest portion of the lake (47 feet). Data were collected at two-week intervals from the formation of the thermocline in June to the fall overturn period.

Survival of kokanee fry and finglerling is known to be very poor with dissolved oxygen concentrations of less than 4.0 ppm or temperatures higher than 60° F. for an extended period of time. 1/ A comparison of the availability and minimum dissolved oxygen tolerances of 1969 and 1970 is shown in Figure 1.

1/ Fulton, Leonard A. January 24, 1963. The Effect of Temperature on Incubating Eggs, Juvenile and Adult Salmon. Administrative Report, BCF, Seattle.

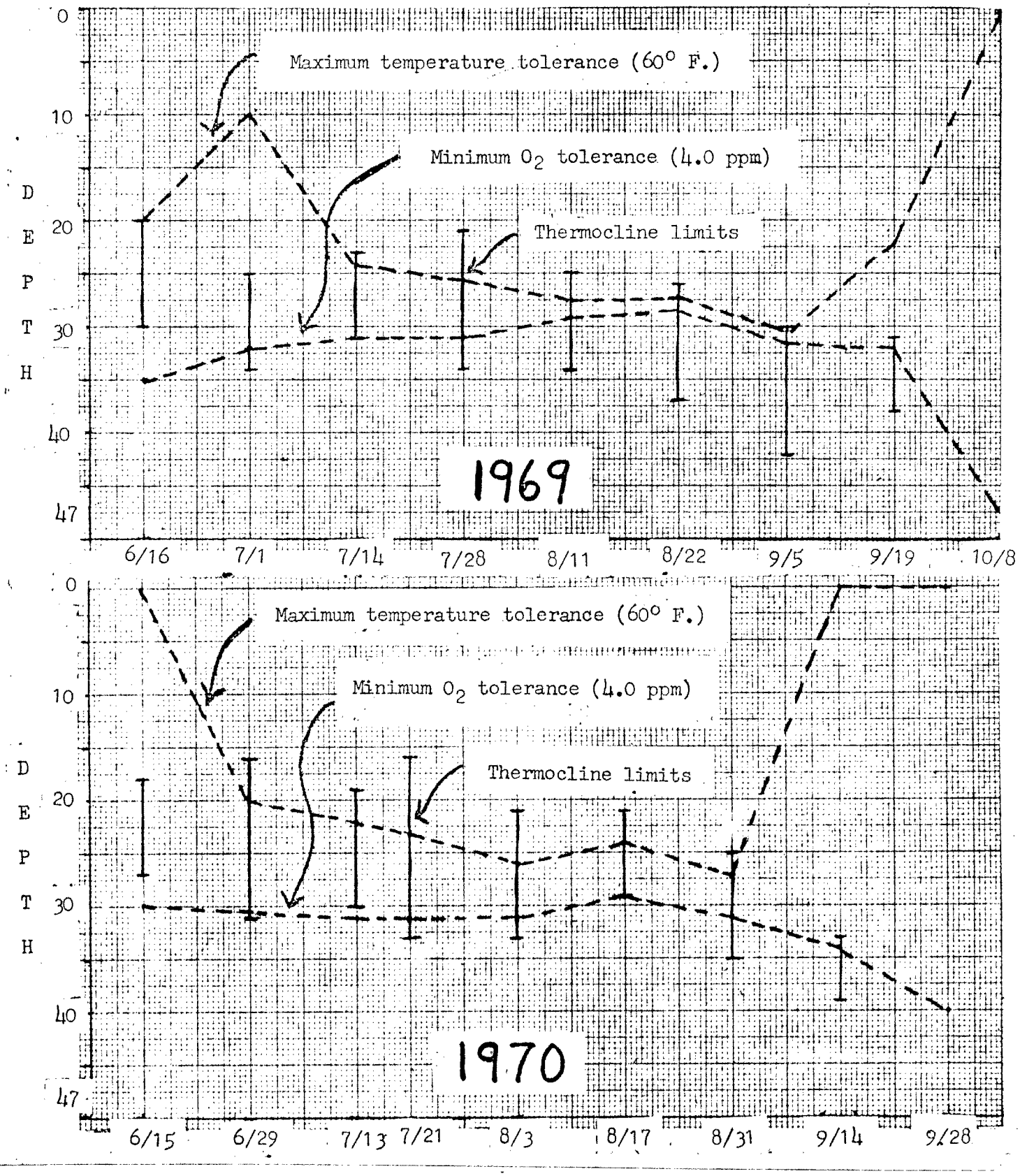

Figure 1. The availability of vertical kokanee habitat in relation to maximum water temperature tolerance (60° F.), minimum dissolved oxygen tolerance (4.0 ppm) and location of thermocline in Lake Mary Ronan during the summer of 1969 and 1970.

The amount of depth considered suitable for kokanee exhibited an increase during the summer months of 1970 in comparison to 1969. The depth of the suitable zone ranged from 4 to 9 feet as compared to 1 to 6 feet for 1969 from mid-July through August.

Thermocline development was closer to the surface in 1970 with the lower thermocline depths having higher dissolved oxygen levels. The lower limits of the thermocline in the late summer months ranged from depths of 30 to 39 feet below the surface in 1970 as compared to depths of 35 to 42 feet below the surface in 1969.

Dissolved oxygen deficiencies near the lake bottom showed little variation over the two year period. Dissolved oxygen levels of less than 4.0 ppm were recorded at depths greater than 29 feet in 1970 as compared to 27.5 feet in 1969. Highest extention of the hypolimnion occurred during the late August of both years.

Summer water temperatures exceeding 60° F. penetrated depths of greater than 25 feet for an extended period of time from July 29th through September 5, 1969. During a comparable period in 1970 temperatures exceeding 60° F. at depths greater than 25 feet were recorded on only two occasions, August 3 and August 31.

The development of the thermocline closer to the surface in 1970, provided an enlargement of kokanee habitat in 1970 during critical summer months.

Classification of Lakes as to Nutrient Condition

Water temperature-dissolved oxygen profiles, secchi disc readings, and water chemistry data were collected from 33 lakes in District One during the summer of 1970. These data, and other physical characteristics, were used to classify lakes in relation to their general nutrient condition. The criteria used in catagorizing the lakes as to their nutrient condition are presented in Table 4. Oxygen-temperature profiles are shown graphically in Figure 2. Some physical and chemical parameters determined for these lakes are presented in Table 5. The parameters of dissolved oxygen concentrations, depth and vegetative abundance were weighted most heavily for applying classification ratings.

Seven lakes considered as highly fertile eutrophic lakes include Island, Martin, Rainbow, Rogers, Topless, Lake of the Woods, and Lake Mary Ronan. With the exception of Lake Mary Ronan and Island Lakes, these lakes are relatively shallow (12' to 25' maximum depth), do not stratify in summer, and attain water temperatures approaching the optimum temperature for salmonoids. Serious oxygen voids occur frequently during winter stagnation, often times to where oxygen uptake is complete. Attempts to stock Rainbow Lake with rainbow trout failed because of winter oxygen depletion. Partial winter mortalities of grayling

Table 4. Criteria used in classifying 33 Western Montana lakes

Characteristics	Eutrophic 1/	Mesotrophic 2/	Oligotrophic 3/
Dissolved Oxygen	Wide range of conditions	Summer stratification -O_2 High in epilimnion Low or void in hypolimnion	Relatively high at all depths
Depth	Shallow	Shallow to deep	Very deep
Vegetative Abundance	Rooted aquatics abundant Develop heavy algal blooms	Rooted aquatics Occasional algal blooms	Few rooted aquatics Occasional light algal blooms
Littoral Area	Large	Large to small	Very small
Water Exchange	Little or none	Little or none	Usually large
Temperature Regime	Wide range of conditions	Usually high	Summer stratification Evident
Transparency	Usually low	Usually high	Usually high
Chemical Content (Total alkalinity, pH, dissolved solids)	Usually high	Usually high	Usually low

1/ Eutrophic Lakes (7) - Martin, Rainbow, Rogers, Wood, Topless, Mary Ronan, Island.

2/ Mesotrophic Lakes (20) - Crystal, Middle Thompson, Lower Thompson, Upper Thompson, Bootjack, Foy, Dollar, Echo, Little Beaver, Beaver, Horseshoe, Glen, Loon, Lavon, Savage, Marl, Frank, Murray, Bull, Kilbrennan.

3/ Oligotrophic Lakes (6) - Little Bitterroot, Lindbergh, Blaine, Swan, Holland, Dickey.

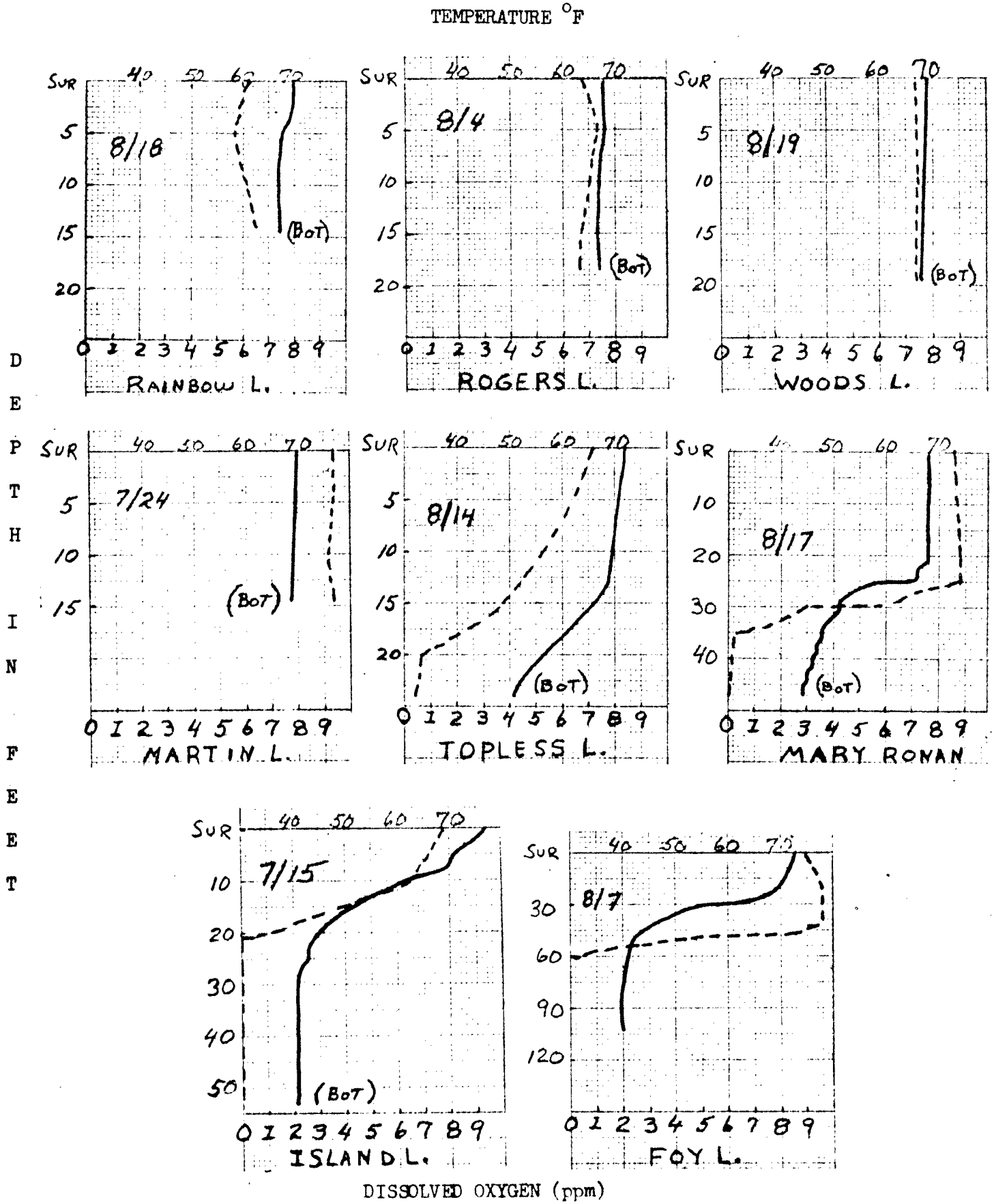

Figure 2. Summer oxygen-temperature profile of lakes surveyed in 1970.
_____ - temperature, _ _ _ _ _ _ _ _ - dissolved oxygen

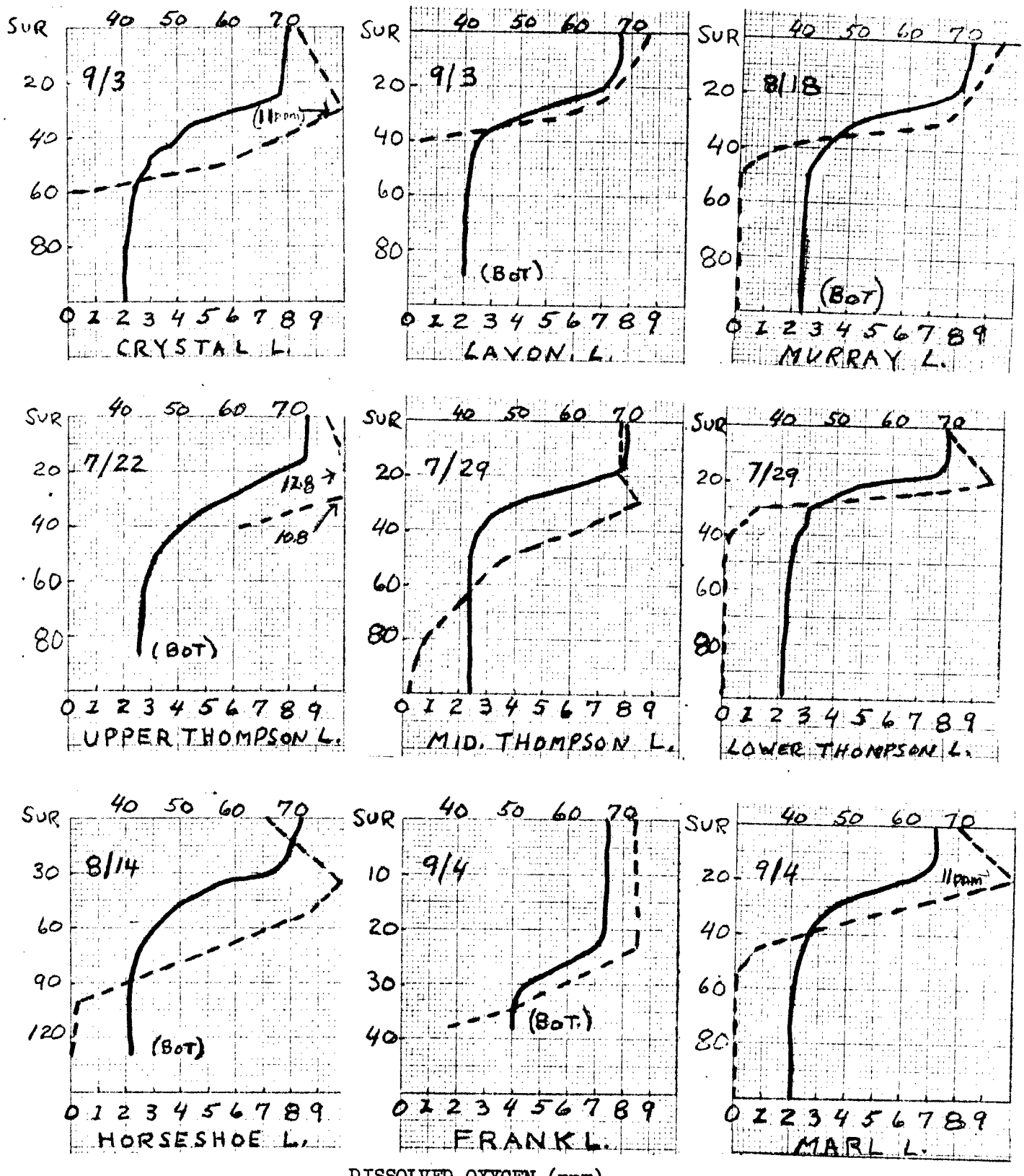

Figure 2. Continued.

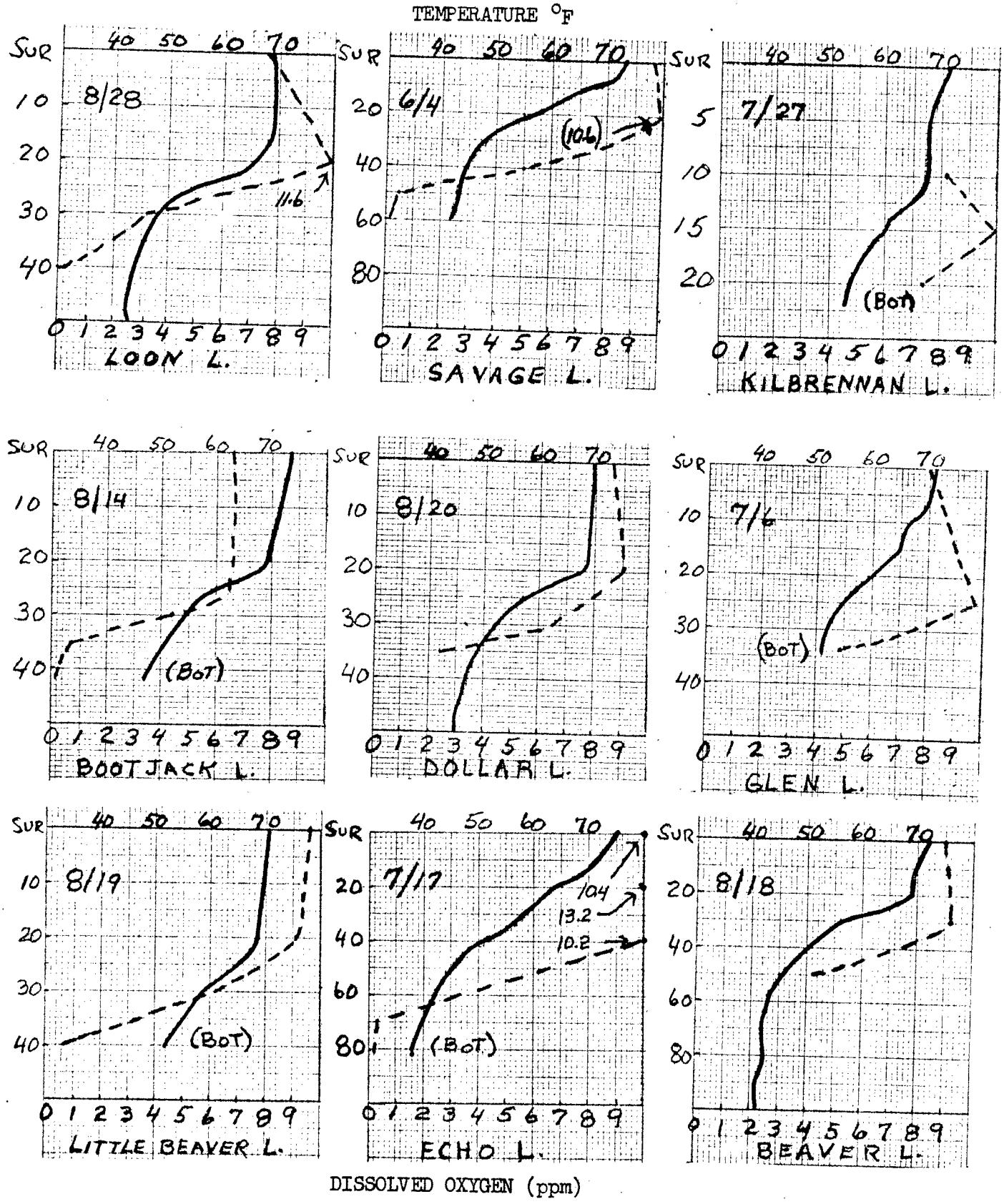

Figure 2. Continued.

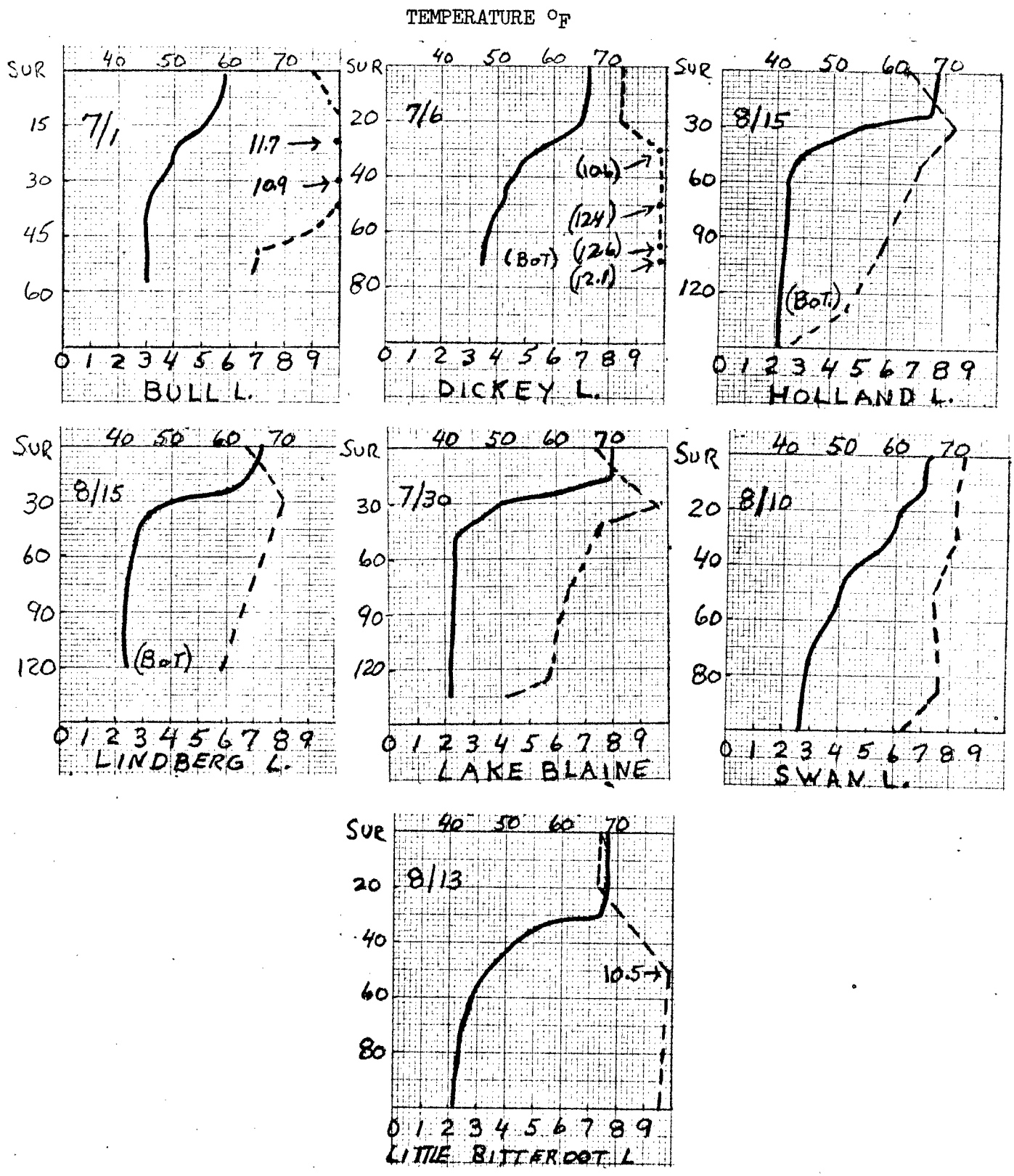

Figure 2. Continued.

Table 5. Some parameters used to classify lakes in Northwestern Montana

Lake	Date	Alkalinity A/B 1/ (ppm)	Standard Conductance 2/	pH	Secchi Disc (feet)	Maximum Depth (feet)	Temperature Range (F^{O}) (top to bottom)
Eutrophic							
Rainbow	8/18	0/144	238	7.5	14	12	70-67
Rogers	8/ 4	0/125	230	-	17	18	68-67
Woods	8/19	0/120	225	7.8	17	20	69-68
Martin	7/24	0/104	203	8.4	14	17	70-69
Topless	8/14	-	-	-	19	24	72-51
Island	7/15	0/73	161	-	13	53	77-41
Mary Ronan	8/17	0/70	155	8.2	17	47	68-44
Mesotrophic							
Foy	8/ 7	114/675	1199	8.9	19	133	73-40
Crystal	9/ 3	11/162	297	8.5	22	143	73-40
Lavon	9/ 3	32/170	322	8.1	27	89	68-41
Marl	9/ 4	20/246	557	8.2	15	100	66-40
Frank	9/ 4	164/626	1058	9.0	26	40	67-50
Murray	8/18	30/176	324	8.4	23	101	71-43
Upper Thompson	7/22	7/146	385	8.9	19	100	75-41
Middle Thompson	7/29	-	-	-	26	160	70-42
Lower Thompson	7/29	-	-	-	22	140	70-41
Horseshoe	8/14	7/124	225	8.2	37	133	72-41
Loon	8/28	0/140	248	8.0	20	50	69-43
Savage	6/ 4	0/143	143	7.8	18	59	73-42
Kilbrennan	7/27	0/24	37	7.8	14	22	71-53
Bootjack	8/14	0/105	197	8.2	27	90	73-47
Dollar	8/20	7/132	224	7.8	22	50	70-45
Glen	7/ 6	-	-	-	20	38	71-51
Little Beaver	8/18	12/180	313	8.0	28	40	71-52
Beaver	8/18	10/150	321	8.2	32	110	72-41
Echo	7/17	-	-	-	29	75	75-41
Bull	7/ 1	0/21	48	7.3	21	70	67-44

Table 5. Continued

Lake	Date	Alkalinity A/B 1/ (ppm)	Standard Conductance 2/	pH	Secchi Disc (feet)	Maximum Depth (feet)	Temperature Range (F°) (top to bottom)
Oligotrophic							
Dickey	7/ 6	-	-	-	30	74	66-47
Holland	8/15	0/70	143	8.2	34	156	69-41
Lindberg	8/15	0/22	33	7.9	33	125	67-42
Blaine	7/30	0/120	220	8.2	27	140	70-42
Swan	8/10	-	-	-	27	132	67-43
Little Bitterroot	8/13	0/51	100	7.8	41	260	68-41

1/ A/B = Phenopthelian / Methyl orange

2/ Micromhos/cm

populations which occur on occasions in Rogers Lake are probably due to oxygen consumption of decaying plant and animal life at the mud-water interface.

Island Lake and Lake Mary Ronan are deeper lakes (maximum depths of approximately 50 feet) which stratify during the summer. These lakes have vigorous growths of rooted aquatics and develop heavy algal blooms. During summer stagnation, dissolved oxygen voids extend upward from the hypolimnion into the lower depths of the thermocline. The recent decline of the Lake Mary Ronan kokanee fishery was probably due, in part, to mortalities of kokanee fry resulting from oxygen depletion in the cooler waters of the thermocline.

A total of 20 lakes were catagorized as being moderately fertile and classified as "mesotrophic". These lakes are generally deep with most lakes ranging from 50 to 150' in maximum depth. Summer stratification takes place with oxygen depletion complete or nearly so in the hypolimnion but with sufficient oxygen in the thermocline for living conditions of salmonoids. Some lakes are sheltered from wind activity and do not exhibit a spring and fall turnover. A buildup of hydrogen sulfide in the hypolimnion generally occurs in this type of situation. Lakes of this class are quite responsive to incoming nutrients and are subject to more rapid eutrophication from increasing lake shore development projects, and overgrazing of the watershed.

Six lakes have been classified as being oligotrophic. These lakes are very deep with maximum depths ranging from 74 to 260 feet. Dissolved oxygen concentrations are generally high at all depths during summer stratification. Total alkalinity and total dissolved solids are usually low. Lakes of this type are generally associated with benthic type feeders such as lake whitefish.

RECOMMENDATIONS

It is recommended that the project be continued to obtain information needed for evaluation of the success of various management procedures not covered by routine inventory type surveys.

Prepared by Robert Domrose

Date June 6, 1972

Waters referred to:

11-7980-3	11-8640-3	7-5300-3	7-7300-3	5-9152-3
11-8040-3	11-8720-3	7-5380-3	7-7700-3	5-9232-3
11-8180-3	11-8940-3	7-6000-3	7-8080-3	5-9392-3
11-8220-3	11-9120-3	7-6180-3	7-8400-3	5-9760-3
11-8340-3	11-9140-3	7-6420-3	7-9000-3	
11-8380-3	11-9480-3	7-6780-3	7-9580-3	
11-8520-3	11-9830-3	7-7260-3		
11-8580-3		7-7280-3		