MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana

Project No. F-7-R-19 Title Northwest Montana Fisheries Study

Job No. I-b Title Fish Management Surveys

Period Covered April 1, 1969 through March 31, 1970

ABSTRACT

Opening day creel census data were collected for Lake Mary Ronan and Kilbrennan Lake. The average catch per hour at Lake Mary Ronan decreased from 0.25 in 1968 to 0.18 in 1969. Kokanee in the angler harvest declined for the third consecutive year. Total opening day harvest of brook trout in 1969 from Kilbrennan Lake decreased by 39.3 percent as compared to 1968.

A boat fry-trap was constructed to collect kokanee fry in the Flathead River above Flathead Lake. A general description of the construction and operation of the trap is discussed. No fry were collected during initial attempts.

Bioassay field tests were conducted at Bull Lake using Fintrol concentrate (active ingredient Antimycin A) on five species of fish. Concentrations of 2.5 to 20 ppb of Fintrol concentrate were used. A concentration of 20.0 ppb was found effective in killing squawfish and suckers.

Dissolved oxygen temperature profile data were collected at Lake Mary Ronan at two week intervals from the middle of June through the middle of September. During the summer stagnation period the dissolved oxygen concentration fell below 4.0 ppm by mid July in the lower part of the thermocline and fell below 4.0 ppm in the upper part of the thermocline by the middle of August. The relationship of kokanee habitat to oxygen-temperature tolerances is briefly discussed.

Water chemistry and temperature data were collected from 4 stations on the Flathead River above Flathead Lake to moniter changes which might affect recruitment of trout or salmon to the lake. A summary of the data collected from 1967 to 1970 is presented.

OBJECTIVE

The objective of this job is to obtain information needed 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

Lake Mary Ronan

A partial creel census was conducted on opening day at Lake Mary Ronan to compare the opening day catch rate of game fish with those of previous years. A total of 62 anglers checked, fished a total of 324 hours and caught 58 game fish. The catch per angler was 0.94 fish and the hourly catch rate was 0.18 fish. Rainbow trout made up 28 percent of the catch while kokanee and largemouth bass each comprised 16 percent of the catch. A comparison of opening day creel census data for years 1966 through 1969 is shown in Table 1.

Table 1. Summary of opening day creel census collected from Lake Mary Ronan, 1966 through 1969

Year	Fishermen contacted	Number fish caught	Average catch per angler	Average catch per hour
1966	65	248	1.20	0.32
1967	98	118	1.20	0.25
1968	215	348	1.62	0.25
1969	62	58	0.94	0.18

The catch per angler and catch per hour in 1969, decreased significantly when compared to the 1968 opening day data. The composition of kokanee in the catch showed a decrease for the third consecutive year. In 1967 kokanee comprised 51 percent of the catch as compared to 37 percent in 1968 and 16 percent in 1969. The average catch (game fish) per man hour for the entire 1968 summer fishing season was 0.22 fish (Job Completion Report, F-7-R-18, Job No. 3, Lake Mary Ronan Summer Creel Census).

Kilbrennan Lake

Opening day creel census information has been collected for Kilbrennan Lake for the fourth consecutive year. The census was conducted to determine the effect of a state-wide 10-pound brook trout limit on one of the better producing brook trout lakes in Montana. Kilbrennan Lake supports a self-sustaining population of brook trout which is not supplemented by hatchery fish.

A total of 335 anglers were interviewed on the opening day of fishing season in 1969. These anglers were successful in catching 1,055 fish for 1,344 hours of fishing effort. The catch per angler was 3.2 and the hourly catch rate was 0.79 fish. Brook trout comprised 98.5 percent of the catch while rainbow trout made up the remaining 1.5 percent. The average length and weight measurements from 131 brook trout was 11.4 inches and 0.62 pounds. A comparison of data (contact and expanded) for the years 1966 through 1969 is shown in Table 2. Estimated fishing pressure and harvest data were derived from boat and shore fishermen on the lake at 7:00 P.M. (termination time of the census). Estimated data were added to the contact data to give expanded data.

Table 2. Summary of opening day creel census data collected at Kilbrennan Lake, 1966 through 1969

Contact Data				Expanded Data				
Year	Anglers	Fish	Catch per angler	Anglers	Fish	Angler 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

Fishing pressure for 1969, in terms of number of anglers, remained approximately the same as for the opening day of 1968 but the total catch decreased to 39.2 percent of the 1968 high. The decrease in the numbers of fish caught was partially offset by the increase in size. Brook trout in 1969 averaged 0.25 pounds greater and 1.0 inches longer than those caught in 1968. The catch per acre was the lowest since the opening day creel census was initiated in 1966.

Development of Boat Fry-Trap

During the winter of 1968-69 a mobile fry trap was constructed to capture kokanee fry returning to Flathead Lake in early spring. The fry trap operates from the bow of an 18-foot Jon boat propelled at slow speed by a 33 hp outboard motor. A small cable winch mounted to the boat raises and lowers the trap into the water. The trap frame is supported by two parallel steel bars, which are attached to each side of the boat by a bolt and cotter key. A frame which supports the weight of the fry trap during transit to sampling areas is mounted on the bow of the boat. The fry trap frame is approximately 4 feet square and is constructed of 1/4 inch soft iron bar. The trap bag is approximately 8 feet in length tapering down to a narrow bag cod end. The bag material is made of 1/4 inch mesh nylon netting. The cod end is lined with small mesh bobinett.

Three attempts were made to collect kokanee fry with the boat fry trap. Operation of the trap in 1969 was made in Blue Bay (May 8) and Bigfork Bay (April 28) areas of Flathead Lake and the Flathead River (April 21) above and below Holt Bridge. The fry trap was in operation during the evening hours from 8:00 to 11:00 P.M.. The trap was operated at depths ranging from surface to 4 feet below the surface. Surface water temperature during the collection periods ranged from 37° to 41° F.. All three attempts to locate kokanee fry were unsuccessful. It was recommended that future attempts to capture fry returning to the lake be attempted at an earlier date.

Field Bioassay Tests of Fintrol Concentrate and Partial Poisoning of Bull Lake

Field bioassay tests were conducted at Bull Lake on May 27, 28 and 29, 1969 using Fintrol solution (active ingredient Antimycin A) supplied by Ayerst Laboratories. Five tests were conducted on five species of fish using concentrations of Fintrol solution ranging from 2.5 to 20.0 ppb. The fish used in the field tests were captured with trap nets. Difficulty was experienced in collecting a satisfactory sample of each species to be tested. Because of the scarcity of fish species for bioassay tests, no control group was set up. These field tests were conducted to determine the concentration of Fintrol-5 needed to kill squawfish and largescale suckers.

Test fish were placed in plastic bags filled with 20 gallons of lake water to which the stock solution of Fintrol-5 was added. The bags were placed in the lake and anchored to rocks and debris along the shorelines. Observations of fish were made periodically during the tests. Surface water temperatures varied between 50° and 53° F.. A summary of the field bioassay tests is shown in Table 3.

All fish survived and appeared in good condition at the termination of test No's. 1, 2 and 5 using concentrations of 2.5, 5.0 and 2.5 ppb, respectively. In test No. 3 (concentration 10 ppb) the mountain whitefish began to lose its equilibrium after 5 hours and died after 10 hours. One largescale sucker was dead at 11 hours. The peamouth, northern squawfish and remaining largescale sucker, were alive and swimming vigorously at the termination of the test.

In test No. 4 (concentration of 20 ppb) one sucker began to lose its equilibrium after five hours. Two suckers were dead and one sucker and one squawfish were unstable after 10 hours. All test fish were dead 11 hours after the test was initiated.

From these results it was concluded that a concentration of 20 ppb of Fintrol 5 would be needed to test its effectiveness as a fish toxicant for squawfish and suckers.

Bull Lake, located approximately 12 miles south of Troy has an area of 1,250 surface acres with a maximum depth of about 64 feet and an average depth of 30 feet. Shoreline observations were made on May 19th to determine the inshore movement concentration of squawfish and suckers on to spawning areas. Large numbers of rough fish were observed. Nine gill nets were set along the shoreline in areas where concentrations of rough fish were sighted to determine

Table 3. A summary of the field bioassays conducted at Bull Lake - 1969

Test No.	Time initiated	Date	Time terminated	Total hours	Species* number tested	Approx. size (inches)	ML stock solution (Fintrol)	ppb Fintrol solution
Test #1	10:55	5/27/69	10:30-5/29	47 3/4	2-Sq 2-Cot	8 3	17.5	2.5
Test #2	10:50	5/27/69	10:30-5/29	47 3/4	2-Sq	8	35.0	5.0
Test #3	11:05	5/28/69	10:30-5/29	23 1/2	2-C Su 1-Wf 1-PM 1-Sq	14, 9 10 11 8	70.0	10.0
Test #4	11:12	5/28/69	10:00-5/28	11 1/4	3-C Su	14	140.0	20.0
Test #5	4:15	5/28/69	11:15-5/29	31	1-C Su	15	17.5	2.5

* Sq = Northern squawfish, Cot = sculpin, C Su = largescale sucker, PM = peamouth, Wf = mountain whitefish

the species of fish present and the progress of egg development. A total of 470 fish were netted of which 54 percent were peamouth, 29 percent squawfish, 6 percent largescale suckers and 4 percent longnose suckers. The remaining 7 percent in descending order were: mountain whitefish, Dolly Varden, rainbow trout, cutthroat trout and brook trout. Mature rough fish by species was 58 percent for squawfish, 96 percent for peamouth, and 79 percent for largescale suckers. Partial poisoning was delayed until more large rough fish moved into the shoal areas because of the relatively small number of mature squawfish and suckers in test nets.

Night light observations made on June 3 and 4 indicated a high density of squawfish and suckers concentrating along shore-gravel areas. Areas where large concentrations were observed were marked with flagging tape and treated with Pro-nox fish applied with pressure pump. Depths of the shore areas treated ranged from 1 to 10 feet.

A fish concentration area of 5 acres on the west side of the lake was treated with 5 pounds of granular Antimycin-A (Fintrol-5) at a rate of 20 ppb. The granular material was applied with a hand fertilizer spreader. In previous bioassay tests, this concentration level killed largescale suckers after 11 hours of exposure. The following day, about 35 dead fish (suckers and squawfish) were observed. The kill was considered very light and ineffective for partial treatment of rough fish species.

Liquid Pro-nox fish and powdered rotenone in small bags were applied during evening hours to spawning areas occupied by suckers and squawfish along the east and west shores of the lake. Varying success of kills were obtained.

Despite repeated treatment to east shore areas, few fish were killed. Post treatment observations indicated a return of suckers to spawning beds with no apparent effects from the toxicant. It is believed that ground water seepage along the east shore neutralized the effect of the toxicant.

Spot treatment with Pro-nox fish of sucker and squawfish spawning concentrations was much more successful along the west shore. The estimated number of fish killed was twice as great as those killed along the east shore.

In late June, further attempts were made to eliminate suckers and squawfish moving into the spawning beds. Again, treatment along the east shore was met with limited success.

The total count of dead fish observed by fisheries personnel and members of the Bull Lake Rod and Gun Club amounted to 960 fish. An age analysis of the rough fish species will be used to determine the effectiveness of removal of the mature spawning adults.

Lake Mary Ronan Dissolved Oxygen-Temperature Profile Study

The first evidence of dissolved oxygen deficiencies in the thermocline area of Lake Mary Ronan was noted in August of 1968. Concentrations of less than 2.0 ppm were recorded in the middle and lower portions of the thermocline within temperature ranges normally inhabitated by small kokanee during late

summer. Kokanee fry and fingerlings are not known to tolerate dissolved oxygen concentrations of less than 4.0 ppm or temperatures higher than 60° F. for an extended period of time.

In view of these findings, a study was initiated at Lake Mary Ronan in 1969 to determine temperature oxygen profile during the summer stagnation period. Dissolved oxygen-temperature profile data were collected at two week intervals from mid June through mid September. A vertical series of temperature and oxygen measurements were recorded at two stations, at depths of 47 feet (maximum lake depth) and 40 feet.

Dissolved oxygen concentrations in the lower part of the thermocline fell below 4.0 ppm by mid July, 1969. Mid August oxygen deficiencies were found in the upper part of the thermocline and remained deficient until the first part of September. By mid August the dissolved oxygen concentration fell below 4.0 ppm in the upper part of the thermocline. As the air temperature cooled, water temperatures in the well oxygenated epilimnion fell below 60° F. thus creating a larger zone of favorable habitat conditions for kokanee.

A relationship between the zone of suitable kokanee habitat to minimum dissolved oxygen (4.0 ppm) and maximum preferred temperatures is shown in Figure 1. From the middle of July through the 1st week of September, the availability of vertical kokanee habitat in Lake Mary Ronan varied from a maximum of 6 feet to a minimum of 1 foot and at a depth ranging from 25 to 31 feet below the surface of the water. Outside these limits it would appear that kokanee would be subject to the tolerance stresses of either maximum temperatures or minimum dissolved oxygen concentrations. If forced to live within these narrow range of tolerance limits, an increase of natural mortality or rate of predation by rainbow trout could be of significant in the survival of young kokanee. The recent decline in the kokanee fishing in Lake Mary Ronan could be attributed to either one or both of these factors.

Water Quality Monitoring

Flathead River

The annual upstream spawning migration of cutthroat trout and Dolly Varden has been restricted to the North and Middle Forks of the Flathead River since the completion of Hungry Horse Dam in 1951 on the South Fork of Flathead River. Demand for peaking power creates violent fluctuations of water discharges downstream. Information, is needed to further understand the effect of rapid changes in water flow, in relation to water temperatures and water chemistry and the influence of these changes on migration patterns of cutthroat trout, Dolly Varden and kokanee salmon.

Water quality data have been collected monthly from four stations on the Flathead River since July 1963. The location of sampling stations is as follows: Station 1, Blankenship Bridge (east bank) just below the confluence of the North Fork and Middle Fork of the Flathead River; Station 2, at the U.S.G.S. gauging station on the South Fork of the Flathead River below Hungry Horse Dam; Station 3, the U.S.G.S. gauging station at Columbia Falls; Station 4,

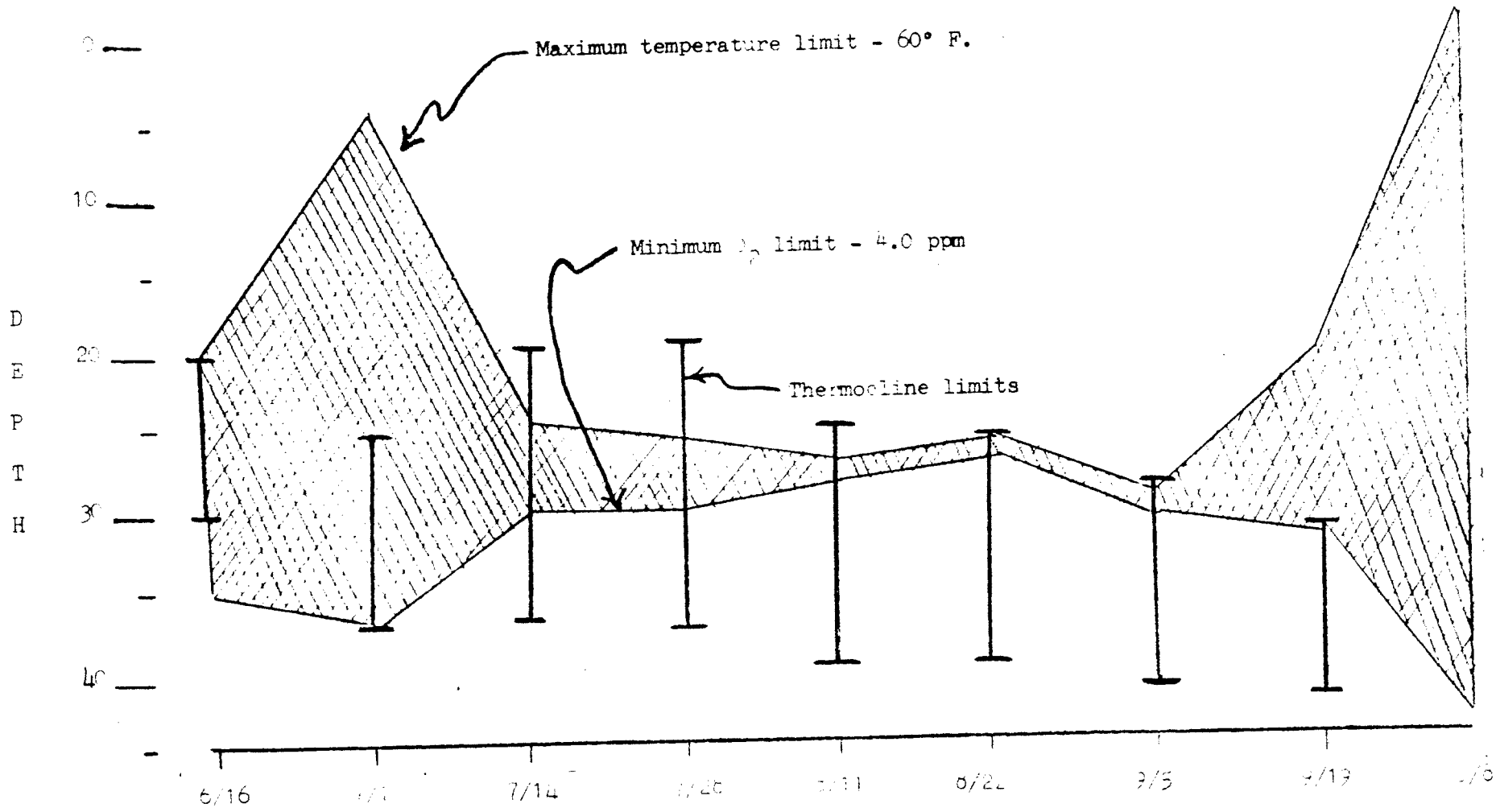

Figure 1. Vertical profile of kokanee habitat preference in relation to maximum temperature (60° F.) and minimum dissolved oxygen (4.0 ppm) during thermocline development at Station 1, Lake Mary Ronan, 1969.

the old Holt Bridge three miles above Flathead Lake. In February, 1969 a fifth sampling station designated as Station 1A was added. This station is located at Blankenship Bridge on the west bank, just below the confluence of the North and Middle Forks of the Flathead River. The flow at this station is largely influenced by the North Fork.

Daily water temperatures were recorded on a 30-day Taylor thermograph installed at Station 2 and 4. Water temperature data were recorded at Stations 1 and 3 until June 1964, when flood waters washed out these installations. The thermographs were not replaced. Water temperature records are for the most part continuous with the exception of brief periods when malfunctions of the thermograph occurred.

The water chemistry data collected include: dissolved oxygen concentration, total alkalinity, pH and standard conductance.

The data presented are summarizations of water quality records collected during the period of January, 1967 through December, 1970. A summarization of the water chemistry data are presented in Figures 2, 3, 4, 5 and 6. Data are presented in Completion Reports F-7-R-15, Job No. 3 and F-7-R-13, Job No. 3 for periods prior to 1967.

Total Alkalinity.- Total alkalinity readings recorded from the five stations ranged from 61 to 151 ppm. Total alkalinity generally decreased with increased runoff at all stations except Station 2. At Station 2 seasonal trends were not as discernable or as predictable probably because of the reservoir pool. Total alkalinity levels were generally the lowest at Station 2 and the highest at Station 1A.

pH.- pH values ranged between 7.2 and 8.2 at the five stations. There appeared to be a slight decrease in pH values in the late winter months as compared to other times of the year. pH values recorded at Station 2 were generally lower than those recorded at the other stations and seasonal variations were not as well pronounced. During low flow periods standard conductance readings at Station 1A were considerably higher than the readings taken at the other stations.

Dissolved Oxygen.- Dissolved oxygen concentrations were titrated with a standardized solution of sodium thiosulfate and converted to percent saturation at an elevation of 3,000 feet. The percent of dissolved oxygen varied between 85 and 95 percent saturation level. No seasonal or annual trends in dissolved oxygen levels could be established.

Water Temperature.- Daily maximum-minimum water temperatures at Station 2 (South Fork of the Flathead River below Hungry Horse Reservoir) and Station No. 4 (Flathead River at Holt Bridge, three miles above Flathead Lake) are graphically shown in Figures 7 and 8. Water temperature data collected prior to 1967 are presented in Job Completion Reports, F-7-R-13, Job No. 3 and F-7-R-15, Job No. 3.

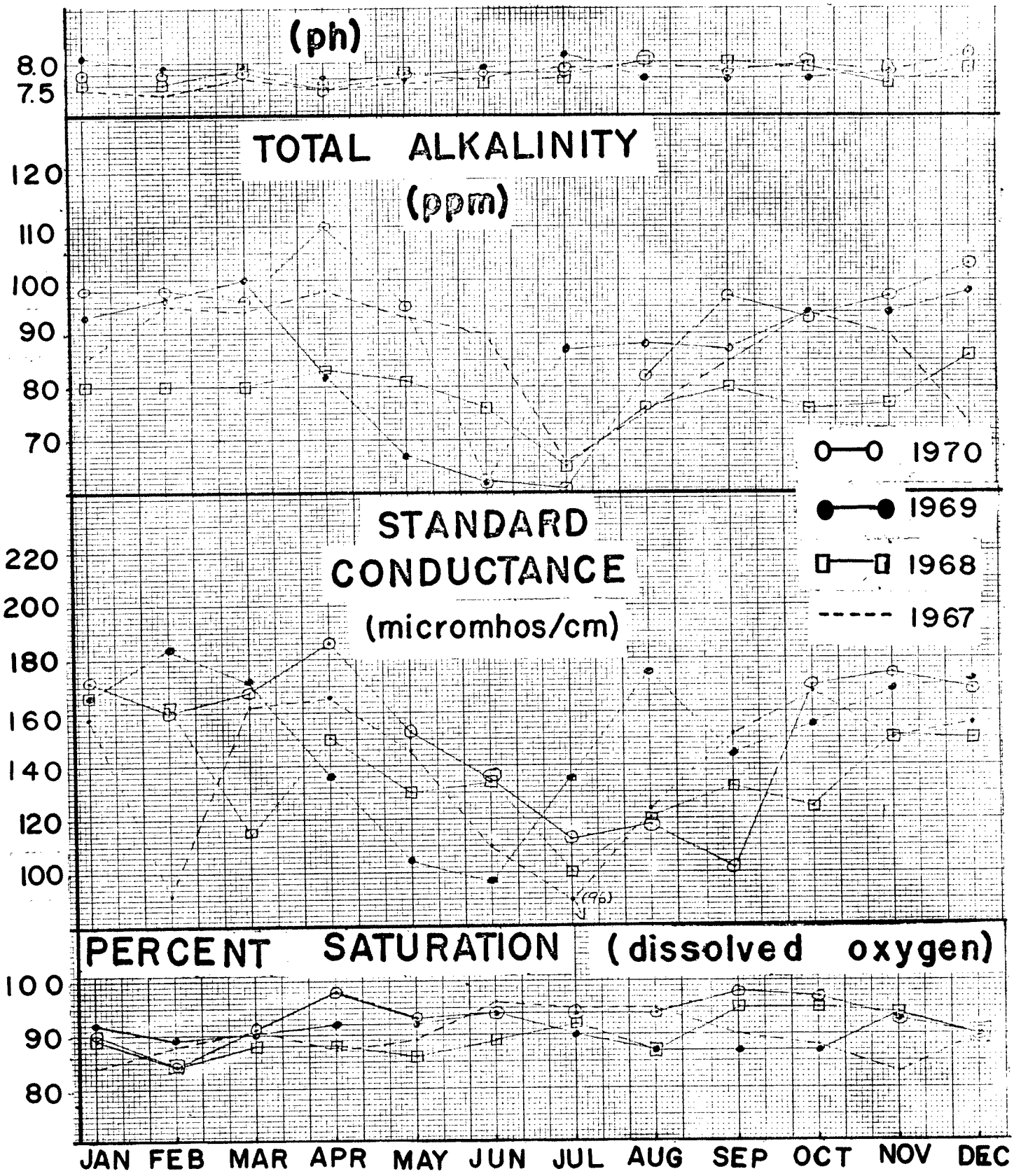

Figure 2. Monthly water quality measurements taken at Station 1, Blankenship Bridge on the Flathead River (east bank) from 1967 through 1970.

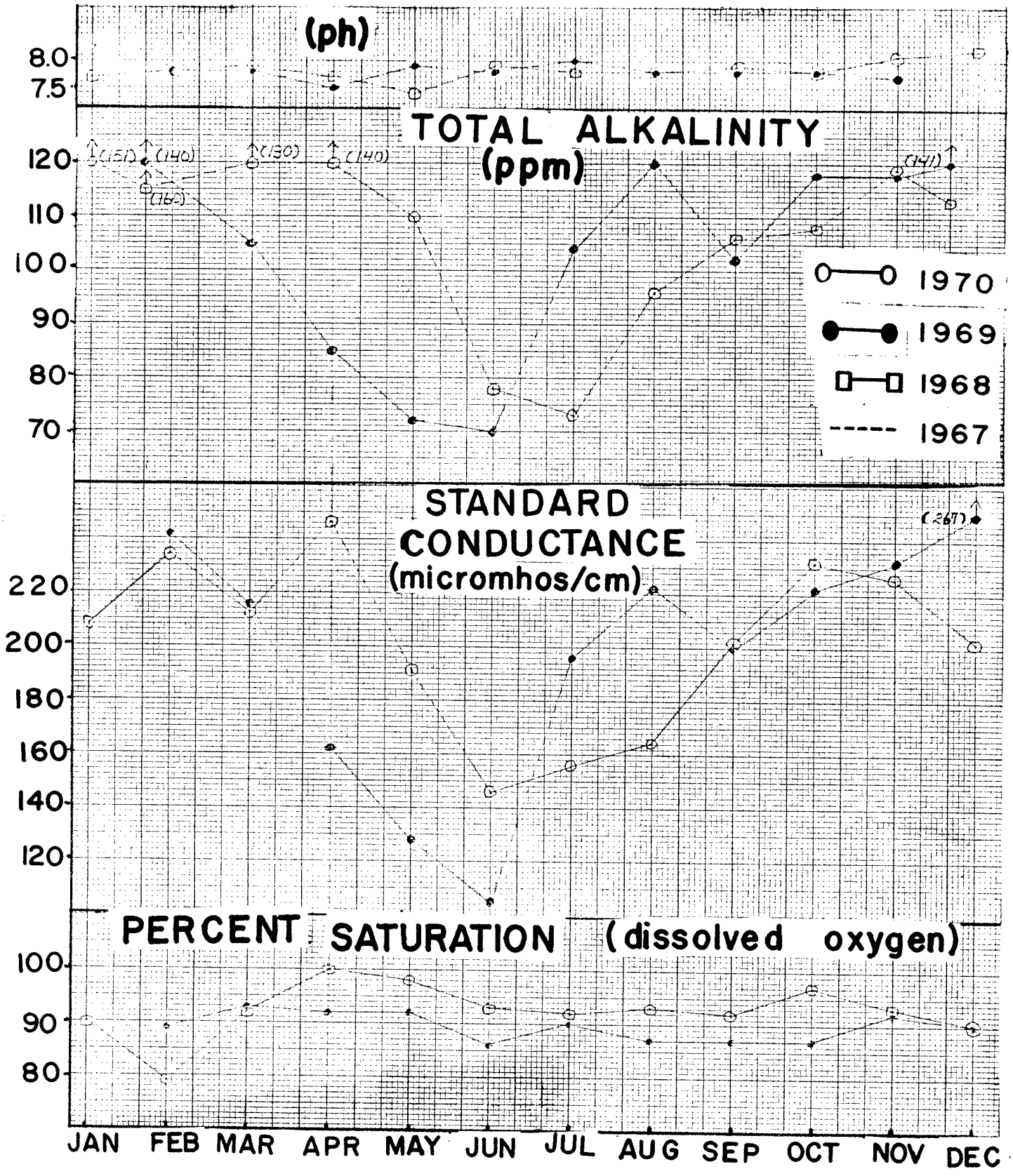

Figure 3. Monthly water quality measurements taken at Station 1A, Blankenship Bridge on the Flathead River (west bank) from 1967 through 1970.

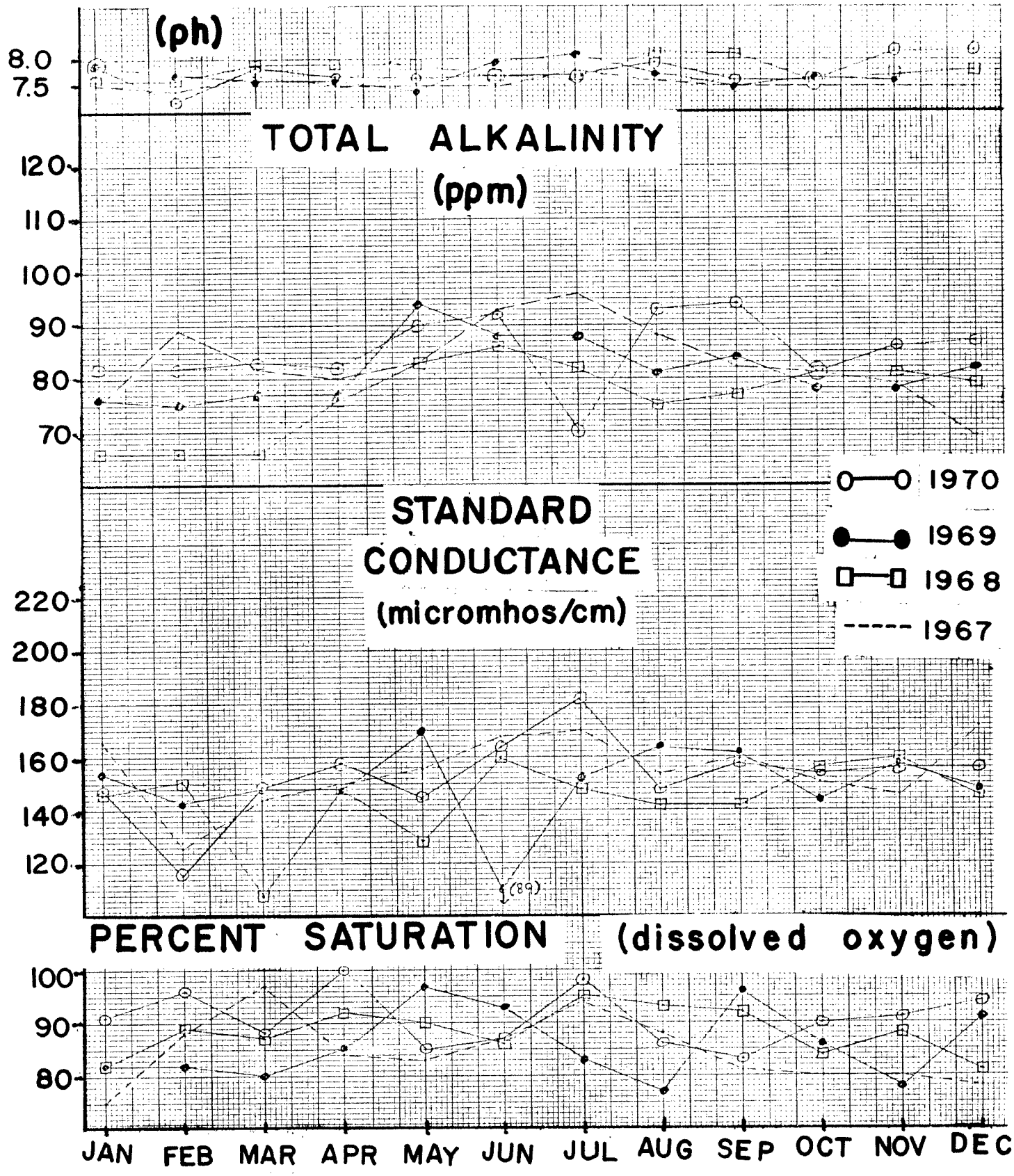

Figure 4. Monthly water quality measurements taken at Station 2, U.S.G.S. gauge station on South Fork of Flathead River, from 1967 through 1970.

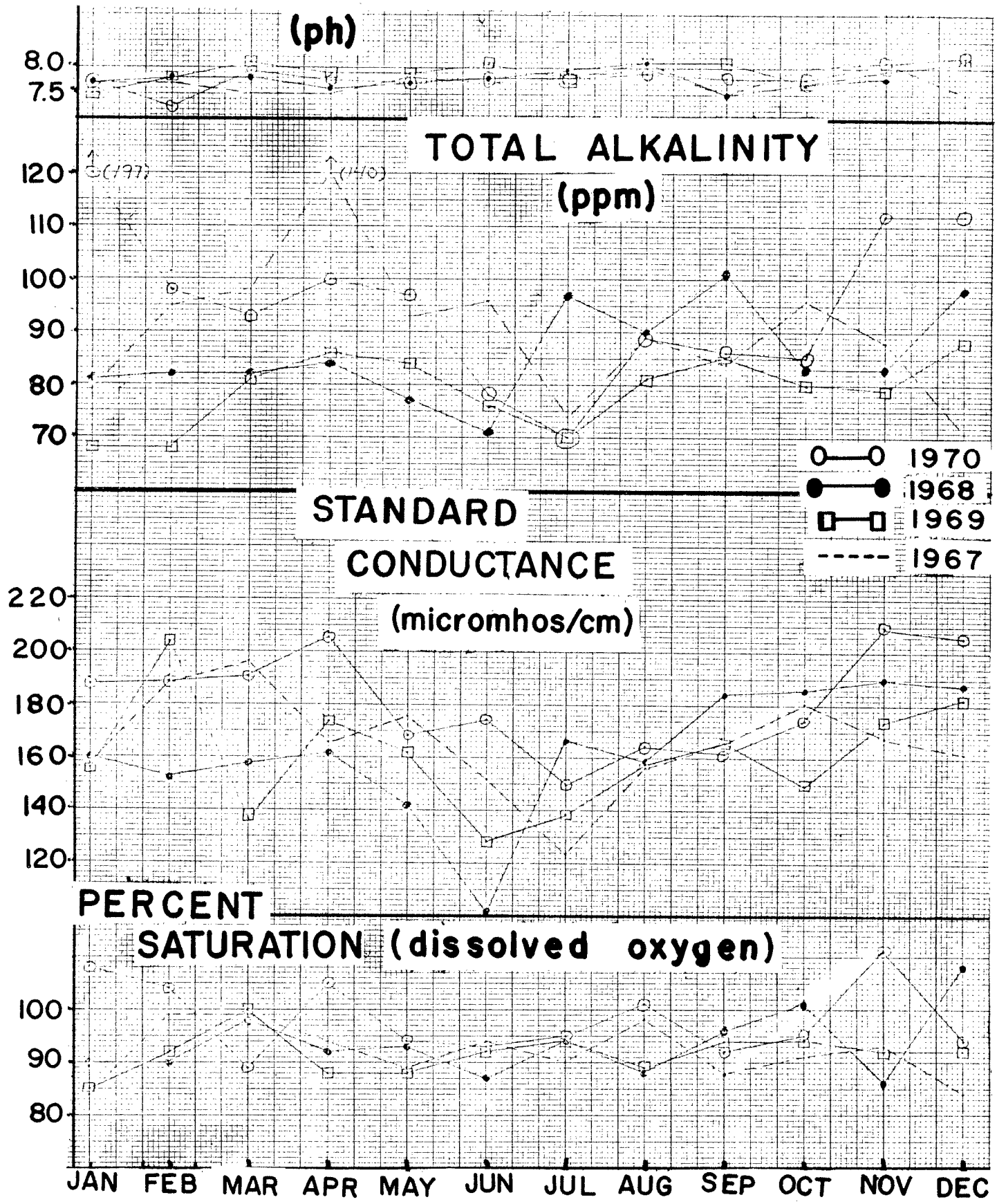

Figure 5. Monthly water quality measurements taken at Station 3, U.S.G.S. gauge station at Columbia Falls on the Flathead River, from 1967 through 1970.

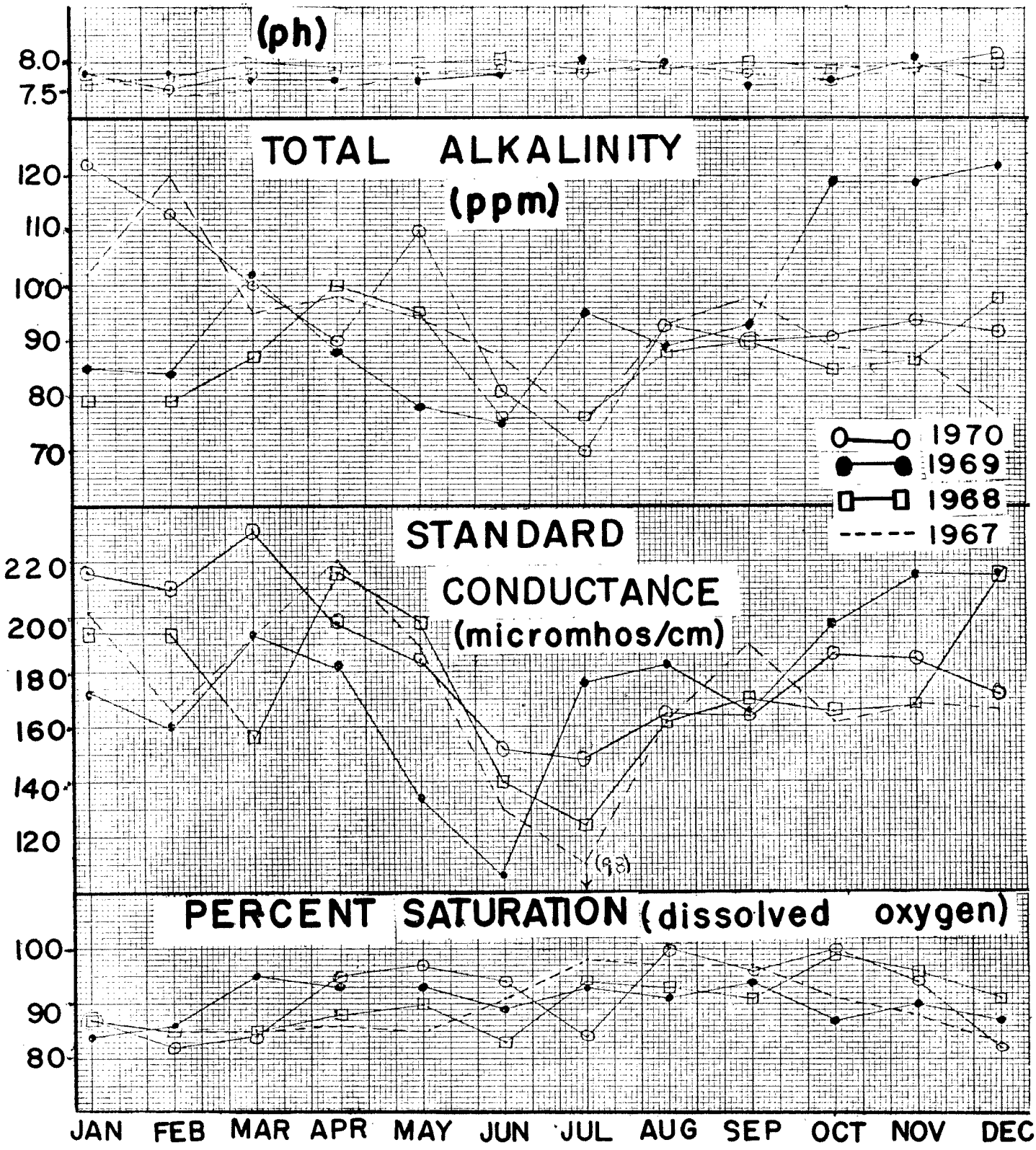

Figure 6. Monthly water quality measurements taken at Station 4, Holt Bridge on the Flathead River, from 1967 through 1970.

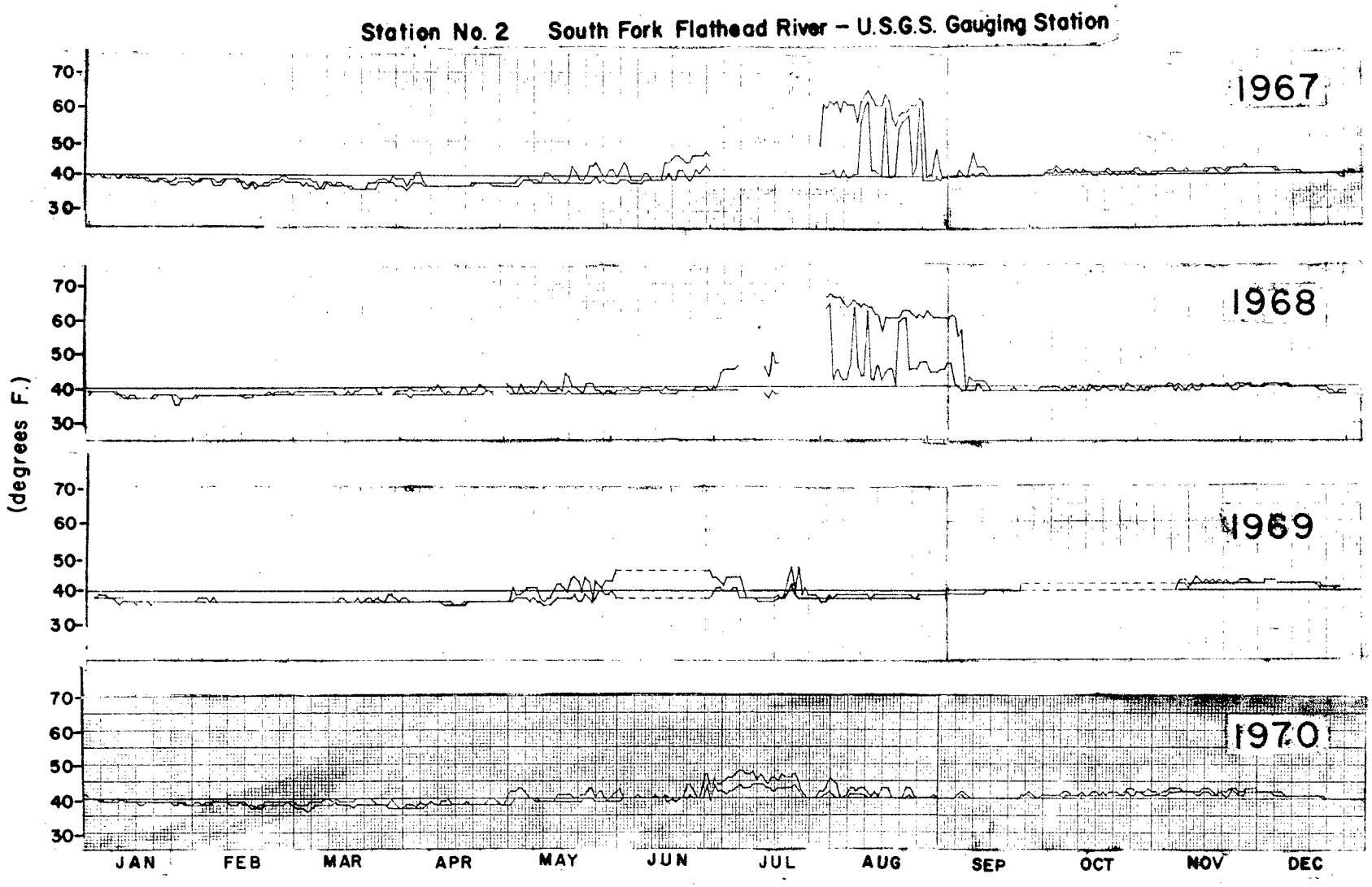

Figure 7. Daily maximum-minimum water temperatures at Station No. 2, South Fork of Flathead River from 1967 through 1970.

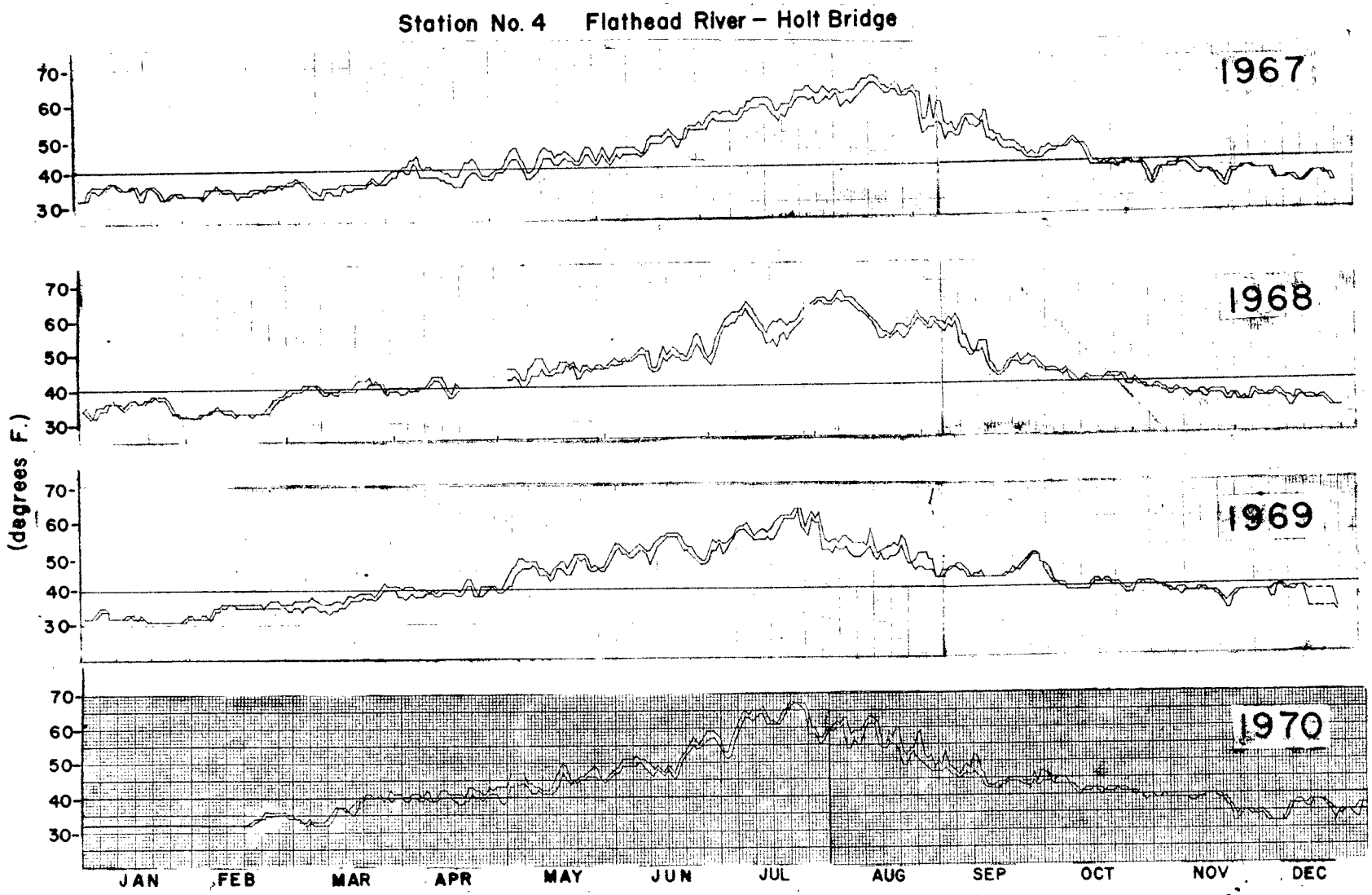

Figure 8. Daily maximum-minimum water temperatures at Station No. 4, Flathead River, from 1967 through 1970.

Daily water temperature fluctuations measured at Station 2 are directly influenced by the time and volume of discharge flows from Hungry Horse Dam. Water temperature readings at Station 2 are relatively constant varying only a few degrees, between 38° and 42° F. throughout the year. During reservoir discharge periods, winter flows from the reservoir tend to have a moderating effect on Flathead River temperatures below the confluence of the South Fork of the Flathead River. In winter, temperatures below the confluence of the South Fork (Station 3) tend to be from 2° to 6° F. warmer than those recorded above the confluence of the South Fork (Stations 1 and 1A) during heavy reservoir discharge. Conversely, in late summer water temperature at Stations 1 and 1A were up to 10° warmer than those at Station 3 as the result of heavy reservoir discharge.

Daily water temperature fluctuation at Station 2 varied only a few degrees in the winter and late fall during 1967 through 1970. Greater water temperature fluctuations occurred in the late spring and summer months. In 1967 and 1968 water temperature fluctuations varied as much as 24° F. in a single day as compared to an 8° F. variation in 1969 and 1970. The smaller variation in daily water temperatures in the summers of 1969 and 1970 is probably due to an increase in power production and subsequent cold water releases. The highest temperature recorded at Station 2 from 1967 through 1970 was 67° F. on August 3, 1968.

Fluctuations at Station 4, (Holt Bridge) although somewhat influenced by Hungry Horse flows, varied as much as 9° F. within a single day during the four year period. This is in contrast to the more extreme daily maximum-minimum temperatures recorded at Station 2.

Maximum-minimum daily water temperatures from 1967 through 1970 at Station 4 varied from 0° to 3° F. with the exception of the late summer months. During the summer months warmer day time temperatures increased the daily water temperature fluctuation.

Gradual warming of water temperatures began about mid April with temperatures ranging from 39° to 44° F. increasing to a maximum of 60° to 68° by mid July or August and then gradually declining to the low of 35° to 33° by late December. The maximum water temperature recorded at Station 4 from 1967 through 1970 was 68° on July 20, 1970.

RECOMMENDATIONS

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

Prepared by Robert Domrose

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Waters referred to:

7-7700-03
7-1560-01
7-7154-01
11-8040-03
11-8640-03