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MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION
HELENA, MONTANA

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT

State of Montana

Project No. F-7-R-13 Name: Northwest Montana Fishery Study

Job No. III Title: Survey of Cutthroat Trout and Dolly Varden In The Flathead River and Tributaries Above Flathead Lake

Period: July 1, 1963 to June 30, 1964

Abstract:

The tagging of cutthroat trout and Dolly Varden was discontinued until techniques are developed to collect the older and mature fish in Flathead Lake. Major emphasis was placed in the establishment of water quality monitoring stations along the Flathead River.

Water samples were collected twice a month at three stations on the Flathead River and at the U.S.G.S. guage station on the South Fork of the Flathead River below Hungry Horse Dam. This water quality data illustrates the difference between water discharged from the bottom of a 500-foot high peaking power dam (without multigated outlet) and water in a free flowing river. These data will also be a basis for determining basic water quality for future industrial development along this river.

Data were collected on: water temperatures, dissolved oxygen concentration, pH, total alkalinity and specific conductance.

Discharges (taken at 285 and 325 feet) from the reservoir held water temperatures immediately below the dam near 39° F. throughout the year. The other water criteria measured, below the dam, showed a tempered effect compared to the free flowing water stations.

Twenty-five cutthroat trout and 10 Dolly Varden, tagged during 1961-1963 were recaptured. Time from tagging to recapturing varied from 2 - 24 months for the cutthroat and from 8 - 33 months for the Dolly Varden.

The longest movement recorded was for a cutthroat trout which traveled 102 miles downstream. It was tagged on the North Fork River near the Canadian border and was recaptured in Flathead Lake.

All Dolly Varden recaptures were from fish tagged in Flathead Lake. One return showed an upstream movement of 99 miles in 13 months. This fish was recaptured 44 miles up the Middle Fork of the Flathead River. All other returns were recaptured in Flathead Lake. Tagging results to date show that the Dolly Varden travel the entire shoreline of Flathead Lake, from the Narrows at the north end of the lake to the mouth of the Flathead River at the north end.

RECOMMENDATIONS:

It is recommended that intensive cutthroat trout and Dolly Varden tagging be discontinued until techniques are developed to collect the older and mature fish in Flathead Lake. Efforts should be made to recover tagged fish that move downstream in to Flathead Lake.

Emphasis should be shifted from the tagging phase of the fish movement study to monitoring water quality in the river system. Water quality information will aid in understanding fish movements.

TECHNIQUES USED:

The tagging of cutthroat trout and Dolly Varden was an incidental part of the project. Major emphasis was placed on the establishment of water quality stations. Standard water quality techniques were used to determine: 1. dissolved oxygen concentration; 2. total alkalinity; 3. standard conductance; 4. pH; 5. daily max-min water temperatures. Water discharges were determined at two stations from U.S.G.S. water guaging records. Samples were collected at two week intervals. The time of day data was collected from any one station never varied over one hour throughout the entire project period.

OBJECTIVES:

The Flathead River and tributary streams above Flathead Lake have provided an important fishery on cutthroat trout and Dolly Varden. Very little is known about the extent of fish recruitment from the upper tributaries to the larger river system and from the river system to the lake below. The objectives of this investigation are to determine distances involved in cutthroat trout and Dolly Varden spawning migration in this drainage, the timing of the migration, and the extent to which some of the major tributaries of the North and Middle Fork Rivers are used for spawning. A secondary objective is to obtain information on other fish species - particularly information that will aid in understanding fish production in these waters and the recruitment of the native fishes in the Flathead River system.

FINDINGS:

WATER QUALITY. Since the completion of Hungry Horse Dam in 1951, the annual upstream spawning migration of cutthroat trout and Dolly Varden from Flathead Lake has been confined to the North Fork and Middle Fork of the Flathead River and their tributaries. The peaking power demand at Hungry Horse Dam create violent fluctuations of water discharges into the Flathead River. Information is needed to further understand the effects of these rapid changes in water flows on fish, water temperatures and chemistry below Hungry Horse Dam and on the lower river and lake system.

In connection with this phase of the study, efforts are being made to establish water quality criteria for the Flathead River. Future industrial development in the valley will pose a threat to the water quality of the Flathead River. The construction of a ground wood fiber mill has been proposed at a site one mile south of Columbia Falls on Flathead River. Effluents from this plant could alter the physical and chemical characteristics of the water and affect aquatic life below the mill site. In cooperation with the State Board of Health and the U.S.G.S., water quality data have been collected above and below the proposed mill sire. This will be useful

in establishing water standards for the Flathead Valley.

This report will summarize data collected by Fish and Game personnel from January 1963 through December 1964. Water quality data have been collected at two week intervals from four stations in the Flathead River drainage above Flathead Lake. These stations are currently in operation, they are described as follows: (1) The Blankenship Bridge site on the Flathead River just below the confluence of the North and Middle Forks; (2) The U.S.G.S. guaging station on the South Fork a mile below Hungry Horse Reservoir; (3) The U.S.G.S. guaging station on the Flathead River at Columbia Falls and (4) The Old Holt Bridge on the Flathead River approximately three miles above Flathead Lake. Water samples were collected at each station to determine the dissolved oxygen concentration, total alkalinity, pH, and standard conductance. Water samples were collected in numerical sequence at each station at approximately the same time of day (within one hour) throughout the entire year.

During the June 1964 flood the thermograph installation at the Blankenship station was lost when the bridge washed away. This thermograph has not been replaced. Water samples were not collected two times (mid June - early July) because of inaccessibility to the station caused by the high water. Water information from Columbia Falls is incomplete due to the continual malfunction of the thermograph. Also, the accuracy of the readings obtained is questionable. Therefore the thermograph information from this station will not be referred to in this report. Water flow measurements at the Hungry Horse and Columbia Falls guaging stations were obtained from the U.S.G.S. records.

Water Temperatures. The daily maximum-minimum water temperatures recorded at the Blankenship Bridge, Hungry Horse and Holt Bridge stations are graphically shown in Appendix A and B. During the months of December, January and February 1963 water temperatures averaged about 32 degrees at the Blankenship Bridge station. Average temperatures at the Holt Bridge station for this period were 2 to 3 degrees warmer. About mid-February temperatures began to climb slowly reading an average of 40 degrees by late March and early April. By mid-August, temperatures reached their peak, 68 degrees at Holt Bridge and 63 degrees at the Blankenship Bridge station. From this point temperatures declined progressively, reading 40 degrees by early November. A greater range of daily temperature fluctuation was exhibited at the Blankenship Bridge station than at the Holt Bridge station.

Although data for 1964 is incomplete, temperature trends are believed to be similar. However, cool weather and late spring run-off kept water temperatures at an average of 2 to 3 degrees cooler during the summer months. A maximum temperature of 61 degrees was recorded in mid-August at the Holt Bridge.

Water temperatures at the Hungry Horse station are directly affected by water releases from Hungry Horse Dam. Water releases from the dam during the winter months tend to have a warming affect on water temperatures below; whereas summer water releases cool river water temperatures. Water releases for power are drawn from the reservoir at 285 and 325 feet below maximum pool elevation and year round temperatures are 39 degrees. In 1963 the maximum-minimum water temperatures over a 7½ month period (late October through May) showed a variation of only 4 degrees. With the exception of the months of November, March and brief periods in February, the continuous moderate to heavy water discharge from Hungry Horse Reservoir had a tempering effect on the river temperature.

Fluctuating water temperatures at Hungry Horse station in June and from late July through October were directly influenced by water releases from Hungry Horse Reservoir during peak power period of the day. Through this period, water temperatures varied from 1 to 18 degrees over a 24 hour period. The average maximum daily temperature fluctuation of 14.23 degrees occurred during the month of September. An example of water flows versus temperature over a two day period in September 1963 is shown in Figure 1.

Basically, the same general water flow-temperature pattern was evident during 1964 with possibly two exceptions. The heavy spring run-off increased water temperatures during the month of June, and water releases in the fall of the year began about a month earlier in mid-October and decreasing water temperatures to around 40 degrees.

At the crest of the June 9 flood, the maximum estimated flow was 140,000 cfs at the Columbia Falls station. Tremendous amounts of debris and silt were carried down the North Fork, Middle Fork and upper South Fork drainages. For the first time since the construction of Hungry Horse Dam water releases below the dam were running turbid. Turbid water releases from Hungry Horse Dam were evident for months later after the North and Middle Fork Rivers cleared. Flood waters carried tons of silt into Flathead Lake creating turbid conditions throughout the summer and fall.

The far reaching effects of the flood on aquatic life in the river and lake regions have not been determined. However, the heavy silt load carried into the lake could reduce the plankton and other aquatic life. The tributary streams, heavily scoured by the flood, may have had heavy losses of resident stream cutthroat.

Water Chemistry (1963-1964)

(pH) Over the two year period, the pH value ranged between 7.3 and 8.1 at the four stations. Readings at the Hungry Horse station generally averaged 0.2 to 0.3 below the other stations.

(Dissolved Oxygen). Dissolved oxygen readings at the four stations ranged from 9.1 to 14.2 during the two year sampling period. Dissolved oxygen concentration reached a peak in the late winter when cooler waters absorbed more free oxygen from the air. Oxygen readings recorded at the South Fork station were generally lower than at Flathead River stations. The samples taken from the Blankenship station were constantly highest in dissolved oxygen concentration.

(Alkalinity). Total alkalinity (0.00 ppm phenolphthalein) readings averaged between 80 and 85 ppm at the stations on the Flathead River. South Fork River (below dam) readings averaged somewhat less; about 70 ppm (range 55-75). Readings at the Flathead River stations ranged between 54 and 96 ppm. Total alkalinity values showed a general decline during the early summer months (April - mid-August).

(Standard Conductance). All water conductance readings were standardized to 77° F. Readings during September through mid-December could not be made due to power failure in the resistance meter. Conductance readings at the four stations ranged from 133 to 227. South Fork River (below dam) readings averaged 153 (range 135-179) whereas at the Blankenship Bridge station (control) they averaged 185. The readings at the other two stations

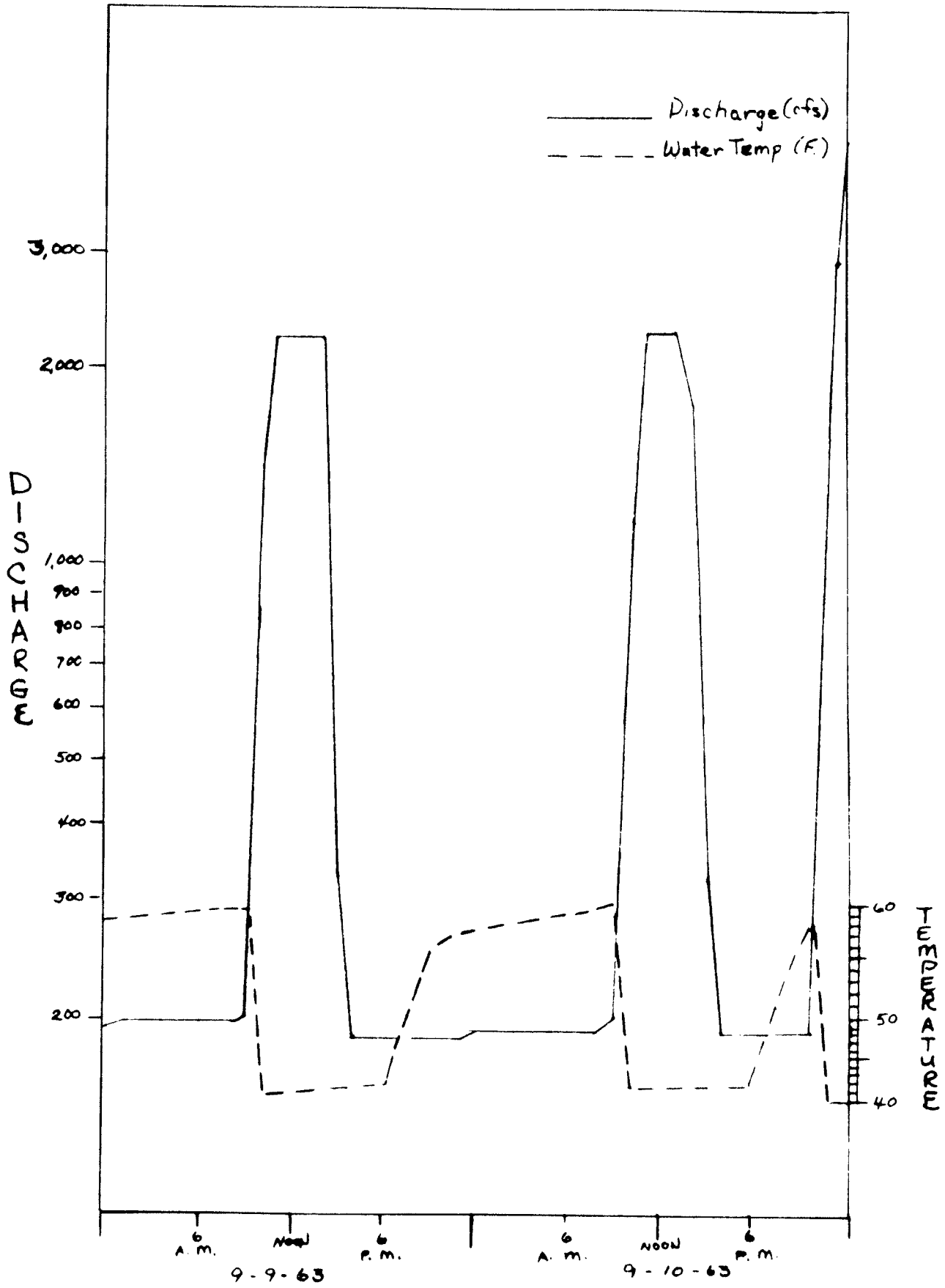

Figure 1. Hourly discharge (cfs) and water temperature (F.) on September 9th and 10th, 1963 recorded at U.S.G.S.guaging station below Hungry Horse Dam.

averaged 180 (Columbia Falls) and 178 (Holt Bridge). The conductance readings followed the same spring decline as total alkalinity (April - mid-August).

A comparison of water quality characteristics between the Flathead River (control station) at Blankenship Bridge to water released from Hungry Horse Reservoir are presented in Figure 2.

The monitoring of the water characteristics for the report period shows that water discharges from Hungry Horse Dam have a tempering effect on the lower Flathead River. Generally, in all measurements made of water quality, the South Fork discharges were found to have lower values and the seasonal variation (range) was less than the other stations. Temperature fluctuation appears to be the most significant characteristic that would affect fish habitation.

Tagging - Movements of Cutthroat Trout and Dolly Varden:

Wild cutthroat trout. The tagging of cutthroat trout and Dolly Varden in the Flathead River drainage was discontinued after two years of intensive work. Efforts on the tagging phase were limited to advertising for tag returns. The objective was to define the movements of the larger and older fish. The majority of tag return information, to date, has been from fish less than 10 inches (age group III+) that have been recaught within a 12 month period after tagging.

Twenty-five cutthroat trout recaptures were recorded during the report period.

A summary of these returns is as follows:

Tagging Area	No. of returns	Time tagging to recapture	MOVEMENTS				
			No. Up	Range (Miles)	No. Down	Range (Miles)	None Time Lapse (Mo.)
North Fork, Flathead River	10	2-24 mos.	1	23	8	2-102	1-(11)
Middle Fork, Flathead River	7	8-23 mos.	3	2-12	3	68-86	1-(23)
Flathead River	8	4-16 mos.	2	10-27	5	12-75	1-(10)

Four returns, tagged in the upper river system, were recaptured in Flathead Lake. Eight recaptures (5 North Fork River; 3 Middle Fork River), tagged in the two major tributary streams, were recaptured in the main Flathead River. The maximum downstream movement of a cutthroat trout has been 102 miles (tagged in the North Fork near the Canadian border, caught in Flathead Lake). Another interesting downstream journey was taken by a fish that traveled 35 miles down the Flathead River into Flathead Lake, then journeyed the maximum length of the lake, 28 miles, down the Flathead River, 3 miles to Kerr Dam, through this power structure and was caught ½ mile below the dam, for a total of 67 miles.

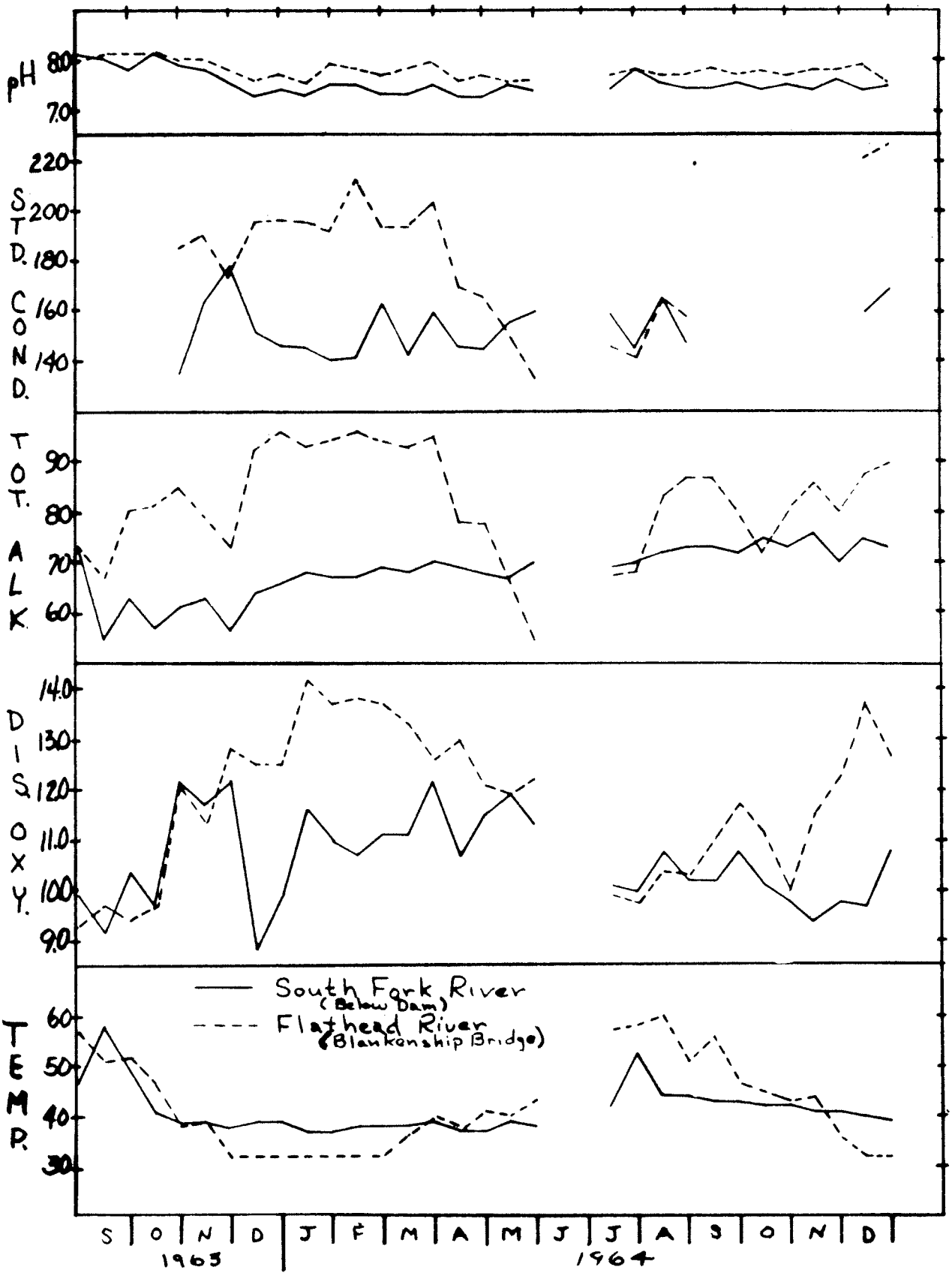

Figure 2. Comparison of water characteristics during 1963-1964 of Flathead River (Blankenship Bridge) to water releases from Hungry Horse Reservoir.

Hatchery Brood Cutthroat Trout: During 1961 and 1962, 898 tagged hatchery excess brood fish were released into the river system. There were no recaptures reported during the report period. The last return from these fish was received two weeks after each of the planting dates.

Dolly Varden: Ten recaptures, all from fish tagged in the Flathead Lake, were recorded during the report period. The time lapse between recaptures ranged from 8 to 33 months. One fish left the lake traveled 99 miles upstream (13 months) and was caught in the Middle Fork of the Flathead River near the mouth of Bear Creek. Of the nine recaptures within the lake, three were recaptured in general area where tagged, six showed movements that ranged from 3 to 18 miles. No general pattern was evident from the movements within the lake. Three were caught directly across the lake from the tagging point and three showed southerly movements from Angel Point to Dayton, Big Arm and Skidoo Bays.

Tag return information with the lake, thus far, has shown that the Dolly Varden travel the entire shoreline area from the Narrows at the south end to the mouth of the Flathead River at the north end.

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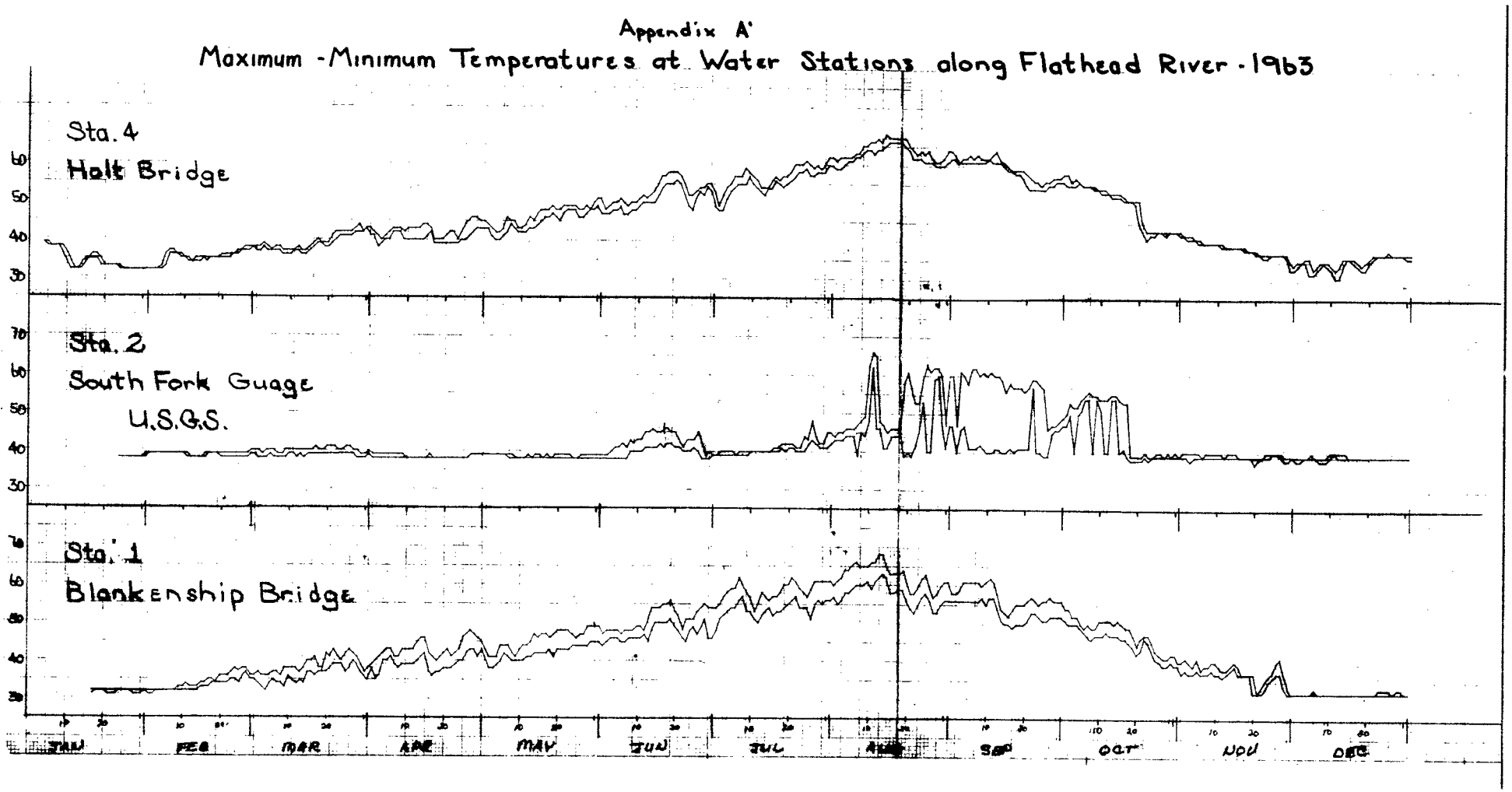
Approved by: Gerry D. Holton

Date: June 9, 1965

Appendix A'

Maximum - Minimum Temperatures at Water Stations along Flathead River - 1963



Appendix B

Maximum - Minimum Temperatures at Water Stations along Flathead River - 1964