MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana Title Flathead Lake Fisheries Study

Project F-33-R-5 Title Seasonal Measurements of Basic Water Chemistry, Plankton Production and Certain Physical Characteristics of Flathead Lake, Montana

Job No. II-a

Period covered October, 1970 through September, 1971

ABSTRACT

Surface plankton, water chemistry, light penetration and water temperature were measured concurrently with the fish sampling program on this lake to assist in determining the quality of the aquatic habitat and to note changes that might influence movement, distribution and growth.

During July, 1971 volumes of total surface plankton reached the highest peak since the study was initiated. A secondary peak, principally phytoplankton, occurred during February, 1971.

The annual pattern of thermal warming of the lake water differed from the norm during a cool, wet and windy spring of 1971. Complete thermal stratification did not occur until late July, 1971.

A series of eight water samples, taken from the surface to 270 feet, were analyzed completely for cation-anion concentrations and will provide basic water characteristics references for future water chemistry investigations.

BACKGROUND

Basic limnological data are essential in a study to determine the effect of environmental changes in fish growth, movement and distribution.

OBJECTIVES

The objectives of this job are to measure the basic chemical, physical and biological characteristics of the lake and to sample fish in the same general areas. These data will be used for assessing the factors that influence the movement of fish and their distribution.

PROCEDURES

Plankton abundance was determined with a tow net which had a 45 cm diameter opening with 0.1061 mm mesh silk collecting bag. A flow meter, mounted in the mouth of the net, measured the water velocity through the net. Water volumes were then calculated for each two minute haul. The data on plankton concentrations were expanded and are expressed as the volume of total surface plankton per acre foot (ml/AF) of water. The samples were preserved for future reference.

Estimates of surface plankton concentrations were made by gravimetrically measuring total surface plankton collected in a tow net. Estimates of the concentrations of zooplankton (large crustceans) and phytoplankton (diatoms) were also made gravimetrically on the settleable portions of each group. The differential settling rates is caused by the varying densities of these two groups.

Water temperature profiles were made by using a resistance thermometer coupled to a depth sensor unit (Bathythermonitor). Water depths in feet were recorded for each 1° F. change in water temperature and compiled into station profiles. Secchi disc readings were made wherever temperature data were taken.

Water quality determinations based on "Standard Methods for the Examination of Water and Wastewater" (Am. Pub. Health Assoc., 1965), were made for the following characteristics: total alkalinity (phenolphthalein and methyl-orange), dissolved oxygen, pH and specific conductance. Analyses were made on samples collected from the surface and at levels from 50 to 65 feet below the surface.

Water sample analysis was done as soon as possible after collection, generally within four hours. The pH readings were made with a line-operated electric pH meter that was calibrated with a standard buffer. Conductance readings were made on a battery operated resistance meter. Specific readings were standardized to 77° F. (25° C) and are expressed in micromhos/cm. Uniformity in dissolved oxygen and alkalinity determinations are assured by correcting the normality of the titrants with standard solutions at the time of measurements. Oxygen concentrations are expressed in ppm and by the percent of saturation at an elevation of 3,000' msl.

FINDINGS

Surface Plankton

Plankton collections were made to assess the conditions during the period of fish collections, October, 1970 through September, 1971, to determine annual trends in total surface plankton production and to assist with other plankton studies being conducted by graduate students working at the Yellow Bay Biological Station, University of Montana. These collections are a continuation of the work described by Hanzel, (1971). Surface plankton had two production peaks during the sample period. These occurred in February and July, 1971 (Figure 1). The first peak was primarily a bloom in phytoplankton while the second and highest peak reflected increases of both

the zoo- and phytoplankton populations. The monthly mean of 11,000 ml/AF in July was the highest since sampling was initiated in 1967.

Water Temperature and Chemistry

Monitoring of the basic water chemistry and physical characteristics was continued during the sample period but was not accomplished on a seasonal sampling schedule. Water chemistry data were collected during the sample period only when fish or plankton were sampled.

Warming of Flathead Lake waters was recorded periodically by making a total of 140 measurements of water temperature profiles. Waters warmed quite slowly during the spring season and more rapidly in mid-July to reach the normal summer temperatures. A thermocline usually forms over the entire lake in late June; however, this did not occur in 1971 as the spring was abnormally cool, wet and windy. It was only after a period of calm, dry and hot weather in mid-July that the thermocline became firmly established. The upper limit of this thermocline was formed at 55 feet below the surface which was deeper than usual. In previous years the upper limits formed at depths between 20 to 30 feet. The thermocline levels continued to drop during the summer months and reached its deepest level, between 88 and 96 feet below the surface, in Skidoo Bay on September 21, 1971. Maximum surface water temperature of 75° F. was reached on August 14, 1971.

Monthly surface water temperatures and the water transparency measurements were plotted with the plankton production in Figure 1. for a direct comparison. The water transparency measurements were made with the secchi disc. A maximum secchi disc reading of 36 feet was observed near Yellow Bay on September 14, 1971. Minimum readings of two feet were recorded during May 1971, the period of heavy spring run-off.

Water chemical analysis conducted during the period showed no major changes from the patterns or norms described by Hanzel (1970 and 1971). On August 4th, after the thermocline had become established, a vertical series of eight water samples were collected at a mid-lake station at depths ranging from the surface to 270 feet. This series was taken to provide a record of the present basic water chemical characteristics of the lake for future reference. After field measurements of water chemistry were made, the series was sent to a water analysis laboratory for complete cation-anion determinations. This laboratory is located in Butte, Montana at the Bureau of Mines and Geology. The analysis included the determinations of: calcium, magnesium, sodium, potassium, total iron, manganese, silica, bicarbonate, carbonate, hydroxide, chloride, sulfate, nitrate, floride and phospate. Analysis was performed on samples from the following depths: surface, 20 feet, 50 feet, 100 feet, 150 feet, 180 feet, 220 feet and 270 feet. The results are on file at the Montana Fish and Game District Headquarters in Kalispell and are stored in a computor data bank in Butte. The laboratory reference numbers for this series are 71-423 through 71-430.

RECOMMENDATIONS

It is recommended that monitoring the basic water chemistry and physical characteristics of the lake and the assessing of plankton production be continued to augment the fisheries investigations. It is through accumulation

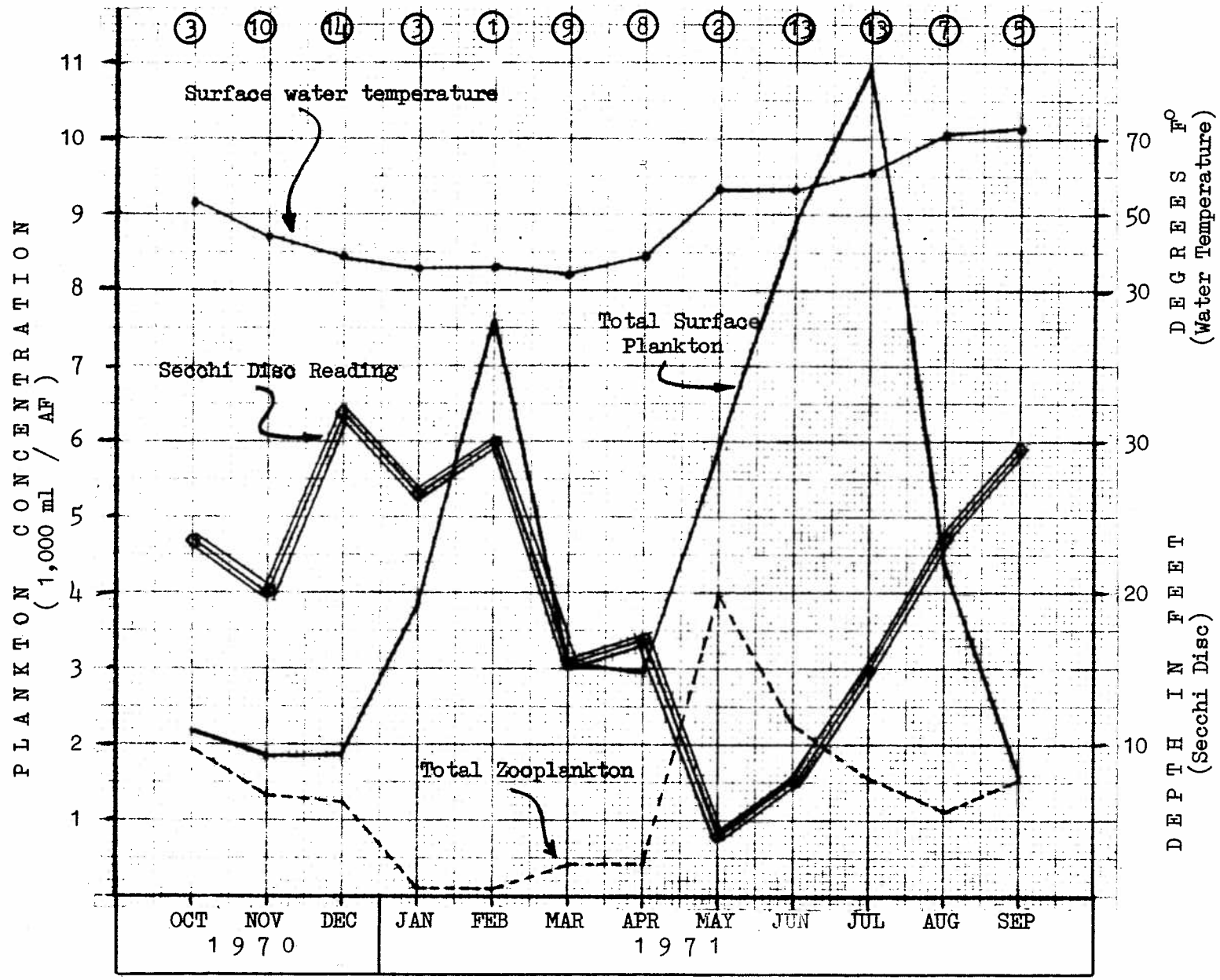

Figure 1. Monthly mean total surface and total zooplankton concentrations and associated surface water temperature and water transparency levels from Flathead Lake, October 1970 through September 1071. Plankton volumes expressed in 1,000 ml/AF. Circled numbers indicate number of plankton samples contained in monthly mean.

of these background data that accurate assessment can be made of the relationship of environmental changes to fish growth, movement and distribution.

Prepared by Delano A. Hanzel

Date June 12, 1972

Water referred to:

7-6400

LITERATURE CITED

Hanzel, Delano A. 1970. Flathead Lake investigation of its fish populations and its chemical and physical characteristics. Comp. Report, Mont. Fish and Game Dept., F-33-R-3, Job I, multility.

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