MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana Title Flathead Lake Fisheries Studies

Project No. F-33-R-6 Title Seasonal measurement of basic water chemistry,

Job No. II-a plankton production and certain physical characteristics of Flathead Lake.

Segment (fiscal) Period July 1, 1971 through June 30, 1972

Report Period September 1, 1971 through June 30, 1972

Data collected July 1971 through September 1971, are included in the job progress report F-33-R-5, Job II-a.

ABSTRACT

The major zooplankton organisms and their relative seasonal abundance in the surface waters of Flathead Lake are described for 1967-71. Diaptomus ashlandi and Cyclops bicupsidatus are the two dominant planters in the surface waters of the lake. Large cladocera and copepodes do not appear in the surface waters until the summer and fall months.

A series of plankton was collected each fall and spring at eight stations to define the seasonal and depth variations in the plankton community. Sampling was done with the cooperation of the University of Montana, Yellow Bay Biological Station. Collections were made with a Clarke-Bumpus sampler at selected depths ranging from the surface to 250 feet. Water samples were taken concurrently and at the same depths as plankton and analyzed for the basic water chemical characteristics. Analysis of the plankton samples and the description of the various species and their seasonal distribution in the lake has been started but is not complete.

BACKGROUND

Basic limnological data are essential to determine the effects 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.

PROCEDURE

Plankton abundance was determined with a tow net which has a 45 cm diameter opening with 0.1061 mm mesh silk collecting bag and a 5-inch Clarke-Bumpus (C-B) automatic plankton sampler with a #12 mesh (0.0047 inch aperture or 130 microns) bag and collection bucket. Flow meters, mounted in the mouth of the net or built into the sampler measured the water velocity through the nets. Water volumes during the hauls were calculated. A two-minute haul was made with the tow net while a one-minute haul was ample with the C-B sampler. Data on plankton concentrations for a specific sample depth were expanded and expressed as the volume of total plankton per acre foot of water. The C-B sampler was provided by the University of Montana Biological Station at Yellow Bay.

Estimates of surface plankton concentrations were made by gravimetrically measuring total plankton collected. Estimates of the concentrations of zooplankton and phytoplankton 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.

Plankton nets were towed from the boom and winch system aboard the "Dolly Varden." A planing depressor was attached to the line below the C-B sampler to assist the device in maintaining a constant sample depth. Both nets were towed with a constant boat speed of approximately one meter per second (3.3 feet per second or 2.2 miles per hour). The C-B sampler strained approximately 151 gallons of water (570 liters) while the surface net sampled nearly 5,000 gallons. Samples were preserved with a solution of ethyl alcohol, acetic acid, formalin and water.

Water temperature profiles were made at each sampling station 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 where 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. Water analyses were made at all selected depths where plankton samples were collected. During the Fall-1971 series, water samples were taken on a separate line with a Kemmerer water bottle while during the Spring-1972 series a Van-Dorn type water bottle was used and attached to the line just below the C-B sampler and was tripped with the second messenger.

Water sample analysis was done as soon as possible after collection, generally within four hours. The pH reading 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 were assured by correcting the normality of the titrants with standard solutions at the time of measurements. Oxygen concentrations are expressed the percent of saturation at an elevation of 3,000 feet msl.

FINDINGS

Surface Plankton

Surface plankton collections have been made concurrent with most of the fish netting program since the project was initiated in 1967. These collections have been used to describe the variations and peaks of surface plankton concentrations, Hanzel, 1970, 1971 and 1972. To date, no attempt has been made to identify or quantify the samples other than by the gross expanded volumes. During 1971, the collection of surface plankton was loaned to graduate student, David S. Potter, University of Montana, Yellow Bay Biological Station. It provided a year-around reference collection of surface plankton. During his orientation and background work, he prepared an analysis of 93 samples collected during the years 1967 through 1971. This analysis is summarized and presented in Table 1. The analysis was based on the examination of the contents of a one milliliter aliquant obtained from a well mixed sample. The organisms were identified and a relative quantitative measurement was made, thus describing the seasonal occurrence and relative abundance. A species was considered common if it made up a major portion of each aliquant and contributed a major part of the samples taken during that season. Samples analyzed included collections during all months of the year except January and December.

The common occurrence of both Diaptomus and Cyclops illustrates their dominance in the surface planters of the lake. It was only in the summer months that they lost their predominance to the larger sized Cladocera (Bosmina, Letodora, and Daphnia sp.) and later in the summer to the large Copepode, Epischura. The only noticeable concentrations of rotifers in the surface waters occurred during the late fall months when Asplanchna were taken in large numbers.

Clark-Bumpus Plankton Series

A series of plankton collections was made in the fall and in the spring at eight stations with the aid of an automatic Clarke-Bumpus sampler. These stations represented all major ecological lake areas, except the very shallow area, south of the "Narrows" which was not included in either plankton series. The sample areas consisted of four "shallow" and four "deep" stations were located at established fish collection sites. A station where waters were less than 120' deep were considered "shallow" while an area with more than 200 feet was considered "deep".

The fall series was conducted September 14 through 29, 1971. Tows at the "shallow" stations were made at the surface and 25, 50, 70, and 100 feet below the surface. Additional tows at 120, 170, and 210 feet were made at the "deep" stations. The spring series was conducted from June 7 through 15, 1972, and were sampled at the same depths as the fall series with the addition of sampling depths of 10 and 250 feet.

David S. Potter, a graduate student at the University of Montana located at the Yellow Bay Biological Station is presently analyzing the plankton collections and will describe species, area and depth distribution in his doctoral thesis. Although sample analysis is incomplete, Potter (1972) made some preliminary indications of seasonal occurrences and notable abundances. He found winter distribution to be essentially homogenous though the greater percentage of individuals occur in the upper 15 meters (50 feet) of the water column.

Table 1. A list of major zooplankton organisms and their relative abundance, by months, found in the surface waters of Flathead Lake, 1967-71 1/

Name	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Asplanchna sp.	*	*	*	*	*	*	*	*	C	C
Conochilus unicornis		*	*	*						
Kellicottia longispina				*	*	*				
Keratella cochlearis		*			*	*				
Bosmina longirostris	*	*	*	C	C	C	C	C	C	C
Daphina Longiremis		*	C	*	C	C		*	*	*
Daphina rosea	*	*	*	C	*	C	*	C	*	*
Daphnia thorata	*			*	C	C	C	C	C	C
Leptodora kindtii				*	*	*	*	*		
Scapholeberis kingi						*	*	*		
Sida crystallina						*	*	*	*	
Cyclops bicuspidatus	*	C	C	C	*	C	C	C	C	*
Diatomus ashlandi	C	C	C	C	C	C	C	C	C	C
Epischura nevadensis	*				C	C	C	C	C	*
Total monthly samples	1	9	9	8	15	28	5	9	8	1

1/ Identification and relative abundance made by David S. Potter
* Presence confirmed; blank indicates absence from monthly samples
C Species common in sample and for that season

Plankton concentrations, as expressed in volume per surface acre, during the fall showed considerable variation with depth and their composition (Figure 1). The most productive area was found 50 feet below the surface and consisted of a layer primarily of phytoplankton. This layer contained more than 9 times the volume of the minimum concentration found at 210 feet. Oxygen concentration determinations made at the 50-foot level were found to be 105 percent of saturation. Surface and bottom oxygen concentration at this station were 95 and 87 percent, respectively. The zooplankton concentration here occurred in the upper 25 feet of the water column.

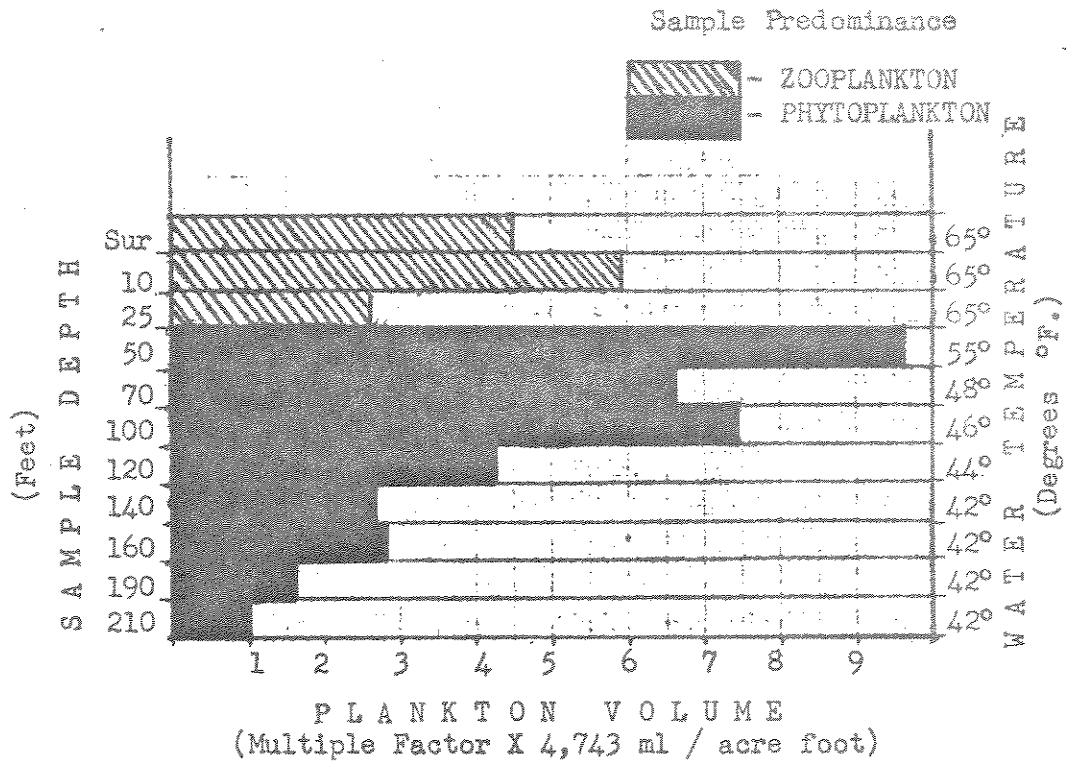

Figure 1. Plankton volumes collected at selected depths from the surface to 210 feet, and the corresponding water temperatures at a mid-lake station, Flathead Lake on September 9, 1971. Secchi disc reading measured 24 feet. Volumes are expressed as a multiple of the minimum concentration, 4,743 ml/acre foot, occurring at 210 feet.

Physical and water chemical data collected with each plankton sample did show station, depth and seasonal changes but were similar to the pattern and trends described by Hanzel, 1970 and 1971. These data are available for future correlation with individual species and seasonal distribution.

RECOMMENDATIONS

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

LITERATURE CITED

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Potter, David S. 1972. Flathead Lake Plankton Study. Preliminary Progress Report, University of Montana, mimeograph, 8pp.

Prepared by Delano A. Hanzel

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Waters Referred to:

7-6400