Limnological studies on Bighorn Lake (Yellowtail Dam) and its tributaries
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Abstract:
The phytoplankton community of Bighorn Lake in relation to its physical and chemical environment was studied during 1968, 1969 and 1970. Samples and in situ measurements were taken at six permanent sampling stations on the reservoir during 56 cruises.

Characterization of the influent and effluent waters of the reservoir revealed that Bighorn Lake was fertilized by the Bighorn and Shoshone Rivers. The relationships of conductivity, turbidity, nitrogen and phosphate to tributary discharge have been examined.

Under average conditions total visible light was reduced to 1% of surface intensity at a depth of approximately 10 meters near the dam, but only 1 meter at station 5 (80.5 km upstream from the dam). Various effects of light penetration on chlorophyll a. and phytoplankton standing crops have been discussed. A turbidity current was established at the depth of the power penstock during 1968. A nitrate nitrogen and ortho-phosphate maxima as well as the oxygen and pH minima were associated with the turbidity current.

Temperature and conductance in Bighorn Lake are described with respect to both the seasonal and longitudinal distribution of heat and electrolytes. The spring warming process is depicted. The development of a distinct thermodine for any given year of sampling was not detected.

Results of chemical analyses showed Bighorn Lake to be predominantly a calcium-sodium-sulfate-bicarbonate water. Nitrate nitrogen and ortho-phosphate as well as the other chemical constituents determined were relatively high and appeared not to be limiting.

Standing crops of the phytoplankton taxa were determined by direct count. Fragilaria crotonensis, Cryptomonas ovata, Stephano-discus niagarae and Asterionella formosa reached the largest standing crops according to absolute mean cell volumes, whereas Rhodomonas lacustris, Cryptomonas ovata, Asterionella formosa and Fragilaria crotonensis were more important bn a presence basis. Mean total algal standing crops for the reservoir ranged from 2.3 to 23.2 mm3/l. Measurements of mean chlorophyll a. for the reservoir ranged from 0.6 to 10.4 mg/m3.

The chlorophyll to algal cell volume ratio was 3.4 µg chlorophyll a. to 1.0 mm3 of algal cells. A definite algal succession was observed for all three years.

Net primary productivity was calculated and a mean for all stations showed a range of 0.51 g C/m2/day to 1.42 g C/m2/day during 1968 and 1970, respectively.