A SURVEY OF ALPINE LAKES IN GRAND TETON NATIONAL PARK

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Objectives

The major objective of the study in progress is to provide baseline data on 90 alpine (above 2700 m) lakes located within Grand Teton National Park. Such baseline data are required for park management and to assess possible future perturbations to the lakes (e.g., acid rain and other human impacts).

Another objective is to analyze the data in a manner that provides useful interpretations for other scientists and of park managers.

Methods

During the first field season (June - September, 1982) of this two year study 40 lakes were sampled. Twenty-six of the lakes were considered to be alpine lakes since their elevations were greater than 2700 meters. A heavy snow pack and late spring prevented our sampling the desired 45 lakes this summer.

Most of the lakes surveyed will not be precisely identified in this preliminary report. This is because most are not named and it would require too much space to accurately describe their locations. The named alpine lakes sampled were Amphitheater, Delta, Grizzly Bear, Holly, Mica, Solitude, Surprise, Talus and Taminah. Other alpine lakes sampled were those located in Paintbrush Canyon, upper Webb Canyon, lower Leigh Canyon, and the North Fork of Snowshoe Canyon.

Each lake was sampled by at least two people (Gulley and helper). Day trips were made to the lower altitude lakes and multi-day trips to the higher altitude lakes. The maximum length of multi-day trips was limited by the weight of equipment, food and supplies. Light weight chemical analysis kits and biological sampling devices were assembled to minimize the weight of the equipment and supplies required to sample the lakes.

A map of each lake to be surveyed was prepared prior to the field season. At each lake the accuracy of the lake outline on the map was verified and depth soundings were recorded. From these maps morphological parameters (e.g., volume, surface area, depth contours, shoreline length) were measured or calculated for each lake.

Values for all major ions were measured or calculated. The analyses of Cl^- and

SO_4^{2-} were performed using reagents obtained from the Hach Chemical Company. Their methods were modified to obtain greater sensitivity. These modifications included using syringes to deliver and measure volume of titrant, and using a special, long, "turbidity tube" to increase the sensitivity of the sulfate test.

Analyses for Ca^{2+}, hardness, Mg^{2+} (calculated from hardness and Ca^{2+}), Na^{+}, plus K^{+} (calculated from cation/anion balance and from data on measured-cation/conductivity-conversion), alkalinity, CO_2 performed according to Standard Methods for the Examination of Water Wastewater. Conductivity and pH were measured portable meters. All analyses were performed in the field.

Biological samples were collected at each lake. Phytoplankton were collected quantitatively by preserving measured volumes of lake water. Qualitative collections of zooplankton were made with a number 20 net towed vertically (bottom to surface) from a raft. Several tows were taken at each lake and pooled. Periphyton was collected by scraping the surface of submerged objects such as rocks and logs. Benthic invertebrates were collected with a drag sampler. The sampler had a scoop to scrape the bottom and looked somewhat like a weighted dip net without a handle. At each lake emergent and submergent macrophytes were collected and their distribution noted on the preliminary lake map. A representative of each species found was pressed and returned to the lab for identification.

Results and Discussion

Identification and enumeration of the biological specimens collected at each lake is currently in progress. Hence, these data will not be included in this preliminary report.

The chemical and morphological data for each alpine lake sampled are not presented due to space limitations. Instead, a summary of these data is presented in Tables 1 and 2.

The chemical data contained in Table 1 are typical of high elevation oligotrophic lakes. Concentrations of ions and conductivity readings are characteristically low. The nearly neutral pH values measured are also representative of high elevation lakes.

The morphological data (Table 2) are also typical of lakes at high elevations. Most of the lakes sampled were small and relatively shallow, however, several lakes were large and deep (e.g., Talus Lake).

Literature Cited

American Public Health Association. 1976. Standard methods for the examination of water and waste water. Public Health Association. 1193 pp.

Table 1. Descriptive statistics for chemical data of surface waters from 26 alpine lakes in Grand Teton National Park.

Chemical test	Minimum	Maximum	Mean	Standard Error	Standard deviation	Coefficient of variation (percent)
pH	6.4	8.0	7.4	0.1	0.5	7
Conductivity (μmhos at 25°C)	10.3	52.2	17.9	1.9	9.4	53
Total hardness (as ppm $CaCO_3$)	0.4	22.4	4.3	0.8	3.9	91
Ca^{2+} (ppm)	0.0	9.0	1.51	0.3	1.6	105
Mg^{2+} (ppm)	0.0	0.5	0.1	0.3	0.2	200
Alkalinity (as ppm $CaCO_3$)	0.9	29.8	5.7	1.2	6.0	107
SO_4^{2-} (ppm)	0.0	56.6	4.7	2.7	14.0	297
CO_2 (ppm)	0.1	3.3	0.7	0.2	0.8	124

Table 2. Descriptive statistics for morphological data from alpine lakes in Grand Teton National Park.

Morphological measurement	Minimum	Maximum	Mean	Standard error	Standard deviation	Coefficient of variation	Number of lakes in sample
Surface Area (m^2)	1,600	83,700	22,300	4,600	22,700	102	24
Volume (m^3)	600	1,414,600	153,600	68,500	313,900	204	21
Mean Depth (m)	0.3	16.9	3.8	0.8	3.8	102	21
Maximum Depth (m)	0.3	25.0	7.7	1.5	6.6	86	21
Volume development	0.7	3.0	1.6	0.2	0.7	42	21
Shoreline length (m)	160	1,200	570	71	341	61	23
Maximum length (m)	70	500	210	28	136	65	23
Maximum width (m)	30	270	130	15	73	59	23
Shoreline development	1.0	1.7	1.2	0.1	0.2	14	23

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