**Priest Lake Water Quality: 2024 Summary**

**Chemical Conditions and Trophic Status**

Total Phosphorus is an important parameter for assessing lake water quality. Analysis of Total Phosphorus (TP) analysis is completed in almost all studies of lake trophic status. The extensive study of Priest Lake conducted by Idaho DEQ in the early to mid 1990’s was no exception. In that study, the TP analyses used a lower detection limit of 2µg TP/L. After the Selkirk Conservation Alliance (SCA) began its citizen volunteer monitoring program (CVMP), most of the TP analyses had a detection limit of 3.4µg TP/L. Because of the low levels of TP in the lake at this higher detection limit, precise phosphorus measurement was not possible. Comparing the historic with recent data it is difficult to draw valid conclusions. In 2023, SCA returned to an analytical method that has a 2µg TP/L detection limit.

The 1990’s work was well funded and took samples monthly from as many as 18 sites for as many as 8 months in a year. Due to time and financial constraints, SCA samples about 8 locations per year monthly during the “recreation” season: June, July, August, and September. Most of the 1990’s sites are tested by SCA once every two years. Since SCA began sampling two additional sites, a deep lake site in the south lake area. A second site just above the Outlet Dam, only randomly sampled in the 90’s have added to the permeant network. Because there is little or no data from the 90’s these, sites are not discussed in this report. Nor is the quality of the upper lake discussed here.

**Total Phosphorus Observations**

The average Total P concentration in 12 sites tested in1993 ranged from 4.0 µg TP/L to 5.8 µg TP/L with an average of 4.5 µg TP/L. For comparison in 2023 and 2024, SCA sampled a suite of these same sites (SCA samples only half of the sites done in the 90’s each year) yielded a range of Total Phosphorus from 3.3 µg TP/L to 6.5 µg TP/L with an average of 4.9 µg TP/L.

The entire range of Total Phosphorus concentrations and the averages fall well below the 12 µg TP/L upper limit for being an oligotrophic Lake. Though the average concentration of Total Phosphorus is very slightly higher in the 2023/24 testing, the increase is not a statically significant. Based on Total Phosphorus concentrations, Priest Lake is clearly oligotrophic.

**Other Trophic Status Indicators**

Table 1 summarizes several parameters commonly used to assess trophic status of lakes. In addition to Total Phosphorus, Secchi Depth and Chlorophyl a are used. SCA also tracks these indicators. For 2023/24 Secchi Depths ranged from 6 meters to over 10 meters. The lowest values on the Lake occur in June during Spring runoff. Any reading greater than 4 meters is indicative of an oligotrophic Lake; Priest easily meets this criterion. Similarly, for Chlorophyl a, readings less than 2.6 µg/L is indicative of an oligotrophic status. For the 2023/24 monitoring period SCA found an average of 1.2µg/L of chlorophyl a. The values ranged from 0.2 to 2.2 µg/L. Chlorophyl a is a measure of the green pigment in algae and tends to be highest later in the year when algae populations have had a chance to develop.

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| Table 1. Trophic Status Indicators | | | |
| **Trophic Status** | **Secchi Depth M** | **Total P µg/L** | **Chlorophyl a µg/L** |
| Oligotrophic | >8 – 4 | 0 - 12 | 0 – 2.6 |
| Mesotrophic | 4 – 2 | 12 - 24 | 2.6 – 7.3 |
| Eutrophic | 2 – 0.5 | 24 -96 | 7.3 – 56 |

**Temperature and Dissolved Oxygen**

In addition to the “chemistry” data described above the SCA team also does dissolved oxygen and temperature profiles at each of the monitoring sites. These observations produce some of the most interesting trends we see in the lake. In the 1990’s work done by IDEQ, lake surface temperatures reached maximums in the upper teens on the Celsius scale; that’s the low to mid 60’s on the Fahrenheit scale. In recent years the maximum temperatures have been in the low to mid 20’s on the Celsius scale; the mid to upper 70’s on the Fahrenheit scale.

The dissolved oxygen concentrations in Priest Lake are generally excellent. Concentrations are typically 8 mg DO/L throughout the water column, even in the warmest months. Cold water fish, like those common at Priest, don’t become stressed until the DO drops to around 6 mg DO/L.

For temperature comparison we look at July and August, the two warmest months. In 2024, for the seven north main lake sites the temperature averaged 23 degrees C in the top meter of the lake during July and August. This compares with the average of 22 degrees C found in 2023 for our south lake sites. The surface temperature of the lake this year was consistent with the 22 – 25 degrees C noted in July and August of the last few years.

Another important feature of the temperature profile is the condition at the bottom of the lake.

The SCA monitoring network has 6 “deep” lake, at least 35 meters (110 feet) deep, sites. These sites give a good indication of temperature throughout the lake

Two of the deep lake sites were monitored in 2024. They are and give a good indication of conditions near the bottom of the lake north of the narrows. In 2024 the bottom temperatures at these two sites averaged 6.1 degrees C. In 2023 two sites in the southern portion of the lake and one site north of the narrows were evaluated. The temperatures about one meter from the bottom at three sites averaged 4.9 degrees C. These temperatures are consistent with the 4 to 6 degrees C measured in the 1990’s

The large difference in near surface and deep lake temperatures at our deep lake sites occurs because the lake “stratifies” into a warmer surface layer (the epilimnion) and the colder lower layer (the hypolimnion). These “layers” are separated by a thin, rapidly cooling (greater than 1 degree C per meter) layer, the thermocline, in between. By June stratification is observed at around 5 or 6 meters. By July this has deepened to 10 to 12 meters and stays at that depth through September. As long as the lake is stratified warm water from the surface does not mix with that below the thermocline.

The consistently low bottom temperatures in the lake indicate that even though the surface of the lake has warmed several degrees in the surface layers during the last few decades, Winter cooling restores colder bottom water. The two temperature profiles below illustrate the winter cooling and the effect of stratification.

A graph of a temperature

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