

PROVINCE LAKE

2019 SAMPLING HIGHLIGHTS

Station – 1 Deep

Wakefield, NH and Parsonsfield, ME



Extension

Blue = Oligotrophic

Yellow = Mesotrophic

Red = Eutrophic

Gray = No Data

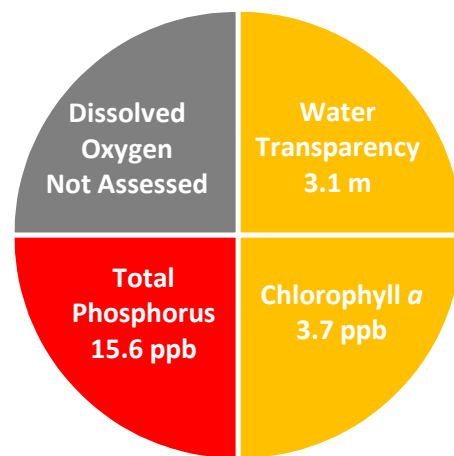


Figure 1. Province Lake Water Quality (2019)

Table 1. 2019 Province Lake Seasonal Averages and NH DES Aquatic Life Nutrient Criteria¹

| Parameter | Oligotrophic | Mesotrophic | Eutrophic | Province Lake Average (range) | Province Lake Classification |
|---|--------------|--------------|---------------|-------------------------------|------------------------------|
| Water Clarity (meters) | 4.0 – 7.0 | 2.5 - 4.0 | < 2.5 | 3.1 meters (2.2 – 4.2) | Mesotrophic |
| Chlorophyll <i>a</i> ¹ (ppb) | < 3.3 | > 3.3 – 5.0 | > 5.0 – 11.0 | 3.7 ppb (2.2 – 4.4) | Mesotrophic |
| Total Phosphorus ¹ (ppb) | < 8.0 | > 8.0 – 12.0 | > 12.0 – 28.0 | 15.6 ppb (12.1 – 18.0) | Eutrophic |
| Dissolved Oxygen (mg/L) | 5.0 – 7.0 | 2.0 – 5.0 | <2.0 | Not Assessed | Not Assessed |

* Dissolved oxygen criteria not assessed due to the lack of a deep cold water layer in Province Lake.

Table 2. 2019 Province Lake Seasonal Average Accessory Water Quality Measurements

| Parameter | Assessment Criteria | | | | | Province Lake Average (range) | Province Lake Classification |
|-------------------------------|--|--------------------------------|--|---|-----------------------|---------------------------------------|---|
| Color (color units) | < 10 uncolored | 10 – 20 slightly colored | 20 – 40 slightly tea colored | 40 – 80 tea colored | > 80 highly colored | 27.5 color units (range: 20.3 – 39.2) | Slightly tea colored |
| Alkalinity (mg/L) | < 0.0 acidified | 0.1 – 2.0 extremely vulnerable | 2.1 – 10 moderately vulnerable | 10.1 – 25.0 low vulnerability | > 25.0 not vulnerable | 6.4 mg/L (range: 5.6 – 7.1) | Moderately vulnerable |
| pH (std units) | < 5.5 suboptimal for successful growth and reproduction | | 6.5 – 9.0 optimal range for fish growth and reproduction | | | 7.2 standard units (range: 7.1 – 7.3) | Optimal range for fish growth and reproduction |
| Specific Conductivity (uS/cm) | < 50 uS/cm Characteristic of minimally impacted NH lakes | | 50-100 uS/cm Lakes with some human influence | > 100 uS/cm Characteristic of lakes experiencing human disturbances | | 57.9 uS/cm (range: 54.9 – 61.2) | Characteristic of lakes with some human influence |

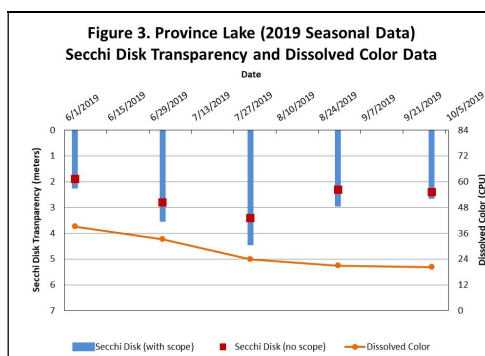
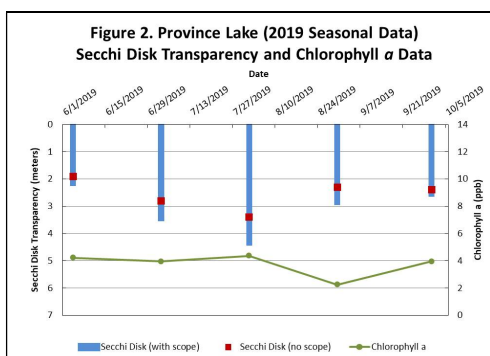


Figure 2 and 3. Seasonal Secchi Disk transparency, chlorophyll *a* concentrations and dissolved color concentrations. Figures 2 and 3 illustrate the interplay among Secchi Disk transparency, chlorophyll *a* and dissolved color. Shallower water transparency measurements oftentimes correspond to increases in chlorophyll *a* and/or color concentrations. Secchi Disk transparency data are reported for measurements collected with and without a viewing scope.

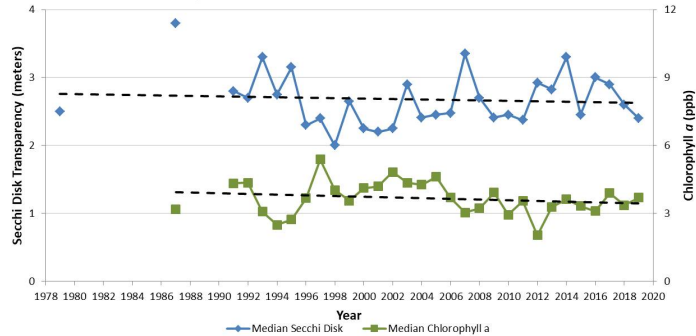
LONG-TERM TRENDS

WATER CLARITY: The Province Lake water clarity data, measured as Secchi Disk transparency, have oscillated among years and display a stable trend over a thirty-one year span of water quality monitoring (Figure 4). The long-term water clarity trend is based on the Secchi Disk transparency measurements that have been collected without a view scope.

CHLOROPHYLL: The Province Lake chlorophyll *a* concentrations, a measure of microscopic plant life within the lake, display a trend of decreasing concentrations over a thirty year span of water quality monitoring (Figure 4).

TOTAL PHOSPHORUS: The Province Lake total phosphorus concentrations, the nutrient most responsible for microscopic plant growth, display a trend of increasing nutrient concentrations over a thirty-one year span of water quality monitoring (Figure 5).

**Figure 4. Province Lake (1979-2019)
Long-term Secchi Disk and Chlorophyll *a* Data**



**Figure 5. Province Lake (1979-2019)
Long-term Total Phosphorus Data**

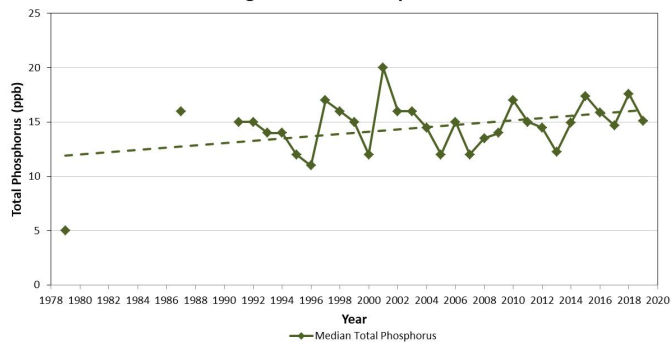


Table 3. Province Lake Steam Inlet and Outlet Seasonal Average Water Quality Inter-Site Comparison (2019)

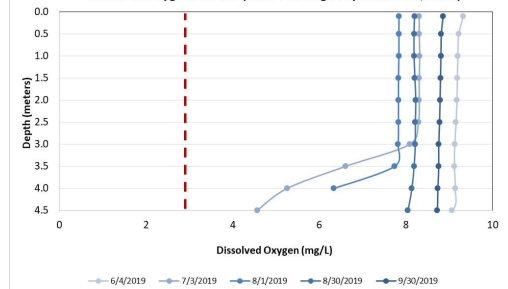
| Site Name | Average (range) Total Phosphorus (ppb) | Average (range) Specific Conductivity (uS/cm) | Average (range) Alkalinity (mg/L) | Average (range) pH (standard units) |
|--------------------------|---|--|--------------------------------------|--|
| Campground Inlet PROEFFC | 7.8 ppb (5.1 – 9.3) | 36.6 uS/cm (30.4 – 43.3) | 8.1 mg/L (5.9 – 9.9) | 6.9 units (6.9 – 7.0) |
| Golf Course PROEFFGC | No flowing water – samples were not collected | | | |
| Island Inlet PROEFFI | 17.2 ppb (10.0 – 23.5) | 53.1 uS/cm (48.5 – 55.6) | 14.5 mg/L (13.5 – 16.1) | 6.5 units (6.5 – 6.6) |
| Outlet PROEFFO | 16.4 ppb (11.2 – 20.6) | 58.0 uS/cm (54.3 – 61.5) | 6.5 mg/L (5.8 – 7.1) | 7.2 units (7.1 – 7.2) |
| Rt. 153 Inlet PROEFFR | 26.4 ppb (15.1 – 37.7) | 41.0 uS/cm (38.1 – 44.4) | 7.9 mg/L (5.7 – 10.0) | 6.2 units (6.2 – 6.3) |

Note: The data displayed in Table 3 represent the regularly sampled streams during dry weather (non-storm) sampling events.

Figures 4 and 5. Changes in the Province Lake water clarity (Secchi Disk depth), chlorophyll *a* and total phosphorus concentrations measured between 1979 and 2019. **These data illustrate the relationship between microscopic plant growth and water clarity. Total phosphorus data are also displayed and are oftentimes correlated with the amount of plant growth.** Long-term trends are based on the analysis of annual median values.

Figure 6. Monthly Province Lake dissolved oxygen profiles collected between June 4 and September 30, 2019. The vertical red line indicates the oxygen concentration commonly considered the threshold for successful growth and reproduction of warm water fish such as bass and perch.

**Figure 6. Province Lake - Site 1 Deep
Dissolved Oxygen Profiles (June 4 through September 30, 2019)**



Recommendations

Review the “Province Lake Watershed Management Plan” that provides background information and offers potential solutions to existing water quality problems. Homeowners within the Province Lake watershed should consider implementing Best Management Practices to minimize the adverse impacts of polluted runoff and erosion on Province Lake. Homeowners can also refer to “Landscaping at the Water’s Edge: An Ecological Approach” and “New Hampshire Homeowner’s Guide to Stormwater Management: Do-It-Yourself Stormwater Solutions for Your Home”. Both self-help documents offer relatively simple solutions to reduce nutrient loading caused by overland run-off while the Acton Wakefield Watersheds Alliance also offers technical assistance to help design and implement erosion control projects that protect your property and improve water quality.

- https://provincelake.org/cms/wp-content/uploads/2014/12/E-version_ProvinceLakeWatershedPlan_14Oct14_FINALSmall.pdf
- https://extension.unh.edu/resources/files/Resource004159_Rep5940.pdf
- <https://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf>
- <https://awwatersheds.org/healthy-lakes/conservation-practices-for-homeowners/>

Figure 7. Province Lake

Wakefield, NH and Parsonsfield, ME

2018 Lake and Stream sampling locations with seasonal average water clarity

