Winnipesaukee
Winter Harbor

2016 SAMPLING HIGHLIGHTS

Station – 10 Museum

Tuftonboro, NH

Station 10 Museum (Figure 8) was used as a reference point to represent the overall Winter Harbor water quality. Water quality data displayed in Tables 1 and 2 are surface water measurements.

Blue = Excellent = Oligotrophic

Yellow = Fair = Mesotrophic

Red = Poor = Eutrophic

Gray = Not Assessed

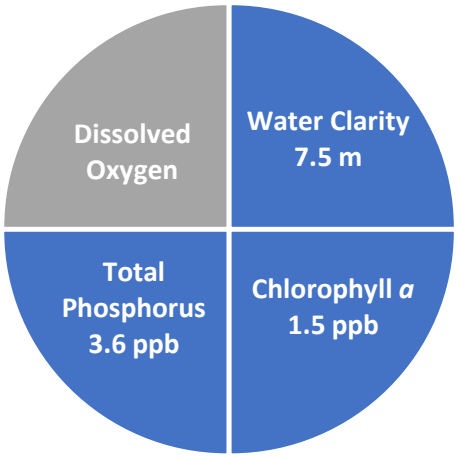


Figure 1. Winter Harbor Water Quality (2016)

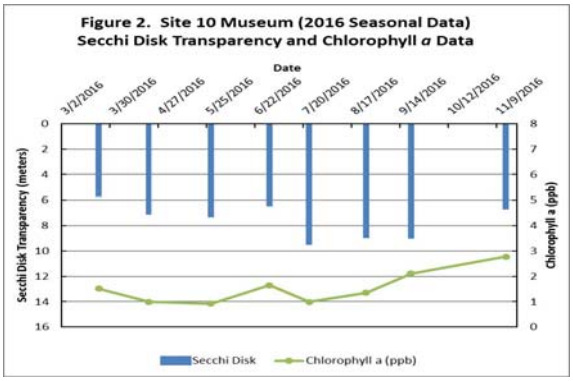
Table 1. 2016 Winter Harbor Seasonal Averages and NH DES Aquatic Life Nutrient Criteria[1]

Parameter	Oligotrophic "Excellent"	Mesotrophic "Fair"	Eutrophic "Poor"	10 Museum Average (range)	10 Museum Classification
Water Clarity (meters)	4.0 – 7.0	2.5 - 4.0	< 2.5	**7.5** meters (5.6 - 9.4)	**Oligotrophic**
Chlorophyll *a* [1] (ppb)	< 3.3	> 3.3 – 5.0	> 5.0 – 11.0	**1.5** ppb (0.9 - 2.8)	**Oligotrophic**
Total Phosphorus [1] (ppb)	< 8.0	> 8.0 – 12.0	> 12.0 – 28.0	**3.6** ppb (Single Value)	**Oligotrophic**
Dissolved Oxygen (mg/L)	5.0 – 7.0	2.0 – 5.0	<2.0	Not Assessed	Not Assessed

* Winter Harbor, Station 10 Museum, did not develop a deep water layer that is the basis for the dissolved oxygen classification criteria.

Table 2. 2016 Winter Harbor Seasonal Average Accessory Water Quality Measurements

Parameter	Assessment Criteria					10 Museum Average (range)	10 Museum Classification
Color (color units)	< 10 uncolored	10 – 20 slightly colored	20 – 40 lightly tea colored	40 – 80 tea colored	> 80 highly colored	**7.3** color units (range: 3.6 – 11.4)	Uncolored
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	**7.9** mg/L (Single Value)	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: 6.9 – 7.3)	Optimal range for fish growth and reproduction
Specific Conductivity (*u*S/cm)	< 50 *u*S/cm Characteristic of minimally impacted NH lakes		50-100 *u*S/cm Lakes with some human influence	> 100 *u*S/cm Characteristic of lakes experiencing human disturbances		**76.8** *u*S/cm (range: 76.5 – 77.0)	Characteristic of lakes with some human influence



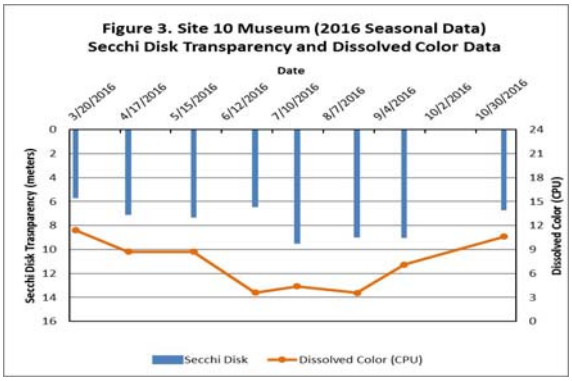


Figure 2 and 3. Seasonal Secchi Disk transparency, chlorophyll *a* and dissolved color concentrations. Figures 2 and 3 illustrate the interplay among Secchi Disk transparency, chlorophyll *a* and dissolved color. Shallower water transparency measurements oftentimes correspond to increases in chlorophyll *a* and/or color concentrations.

LONG-TERM TRENDS

WATER CLARITY: The Winter Harbor – Site 10 Museum water clarity measurements, measured as Secchi Disk transparency, have been collected over a span of eight sampling seasons. Due to the limited number of years sampled (less than ten) a trend analysis was not performed on the Secchi Disk transparency data.

CHLOROPHYLL: The Winter Harbor – Site 10 Museum chlorophyll *a* concentrations, a measure of microscopic plant life within the lake, have been collected over a span of eight sampling seasons. Due to the limited number of years sampled (less than ten) a trend analysis was not performed on the chlorophyll *a* data.

TOTAL PHOSPHORUS: The Winter Harbor – Site 10 Museum total phosphorus concentrations, the nutrient most responsible for microscopic plant growth, have been collected over a span of eight sampling seasons. Due to a limited number of years sampled (less than ten) a trend analysis was not performed on the total phosphorus data.

COLOR: Color is a result of naturally occurring "tea" color substances from the breakdown of soils and plant materials. Color data have been collected over a span of eight sampling seasons. Due to a limited number of years sampled (less than ten) a trend analysis was not performed on the color data.

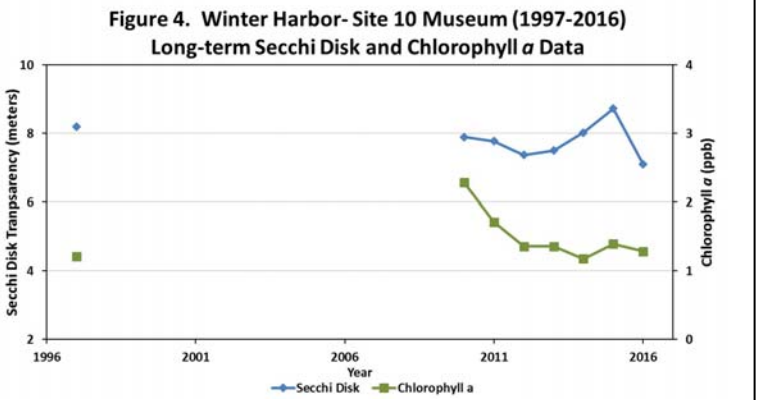


Figure 4. Winter Harbor- Site 10 Museum (1997-2016) Long-term Secchi Disk and Chlorophyll *a* Data

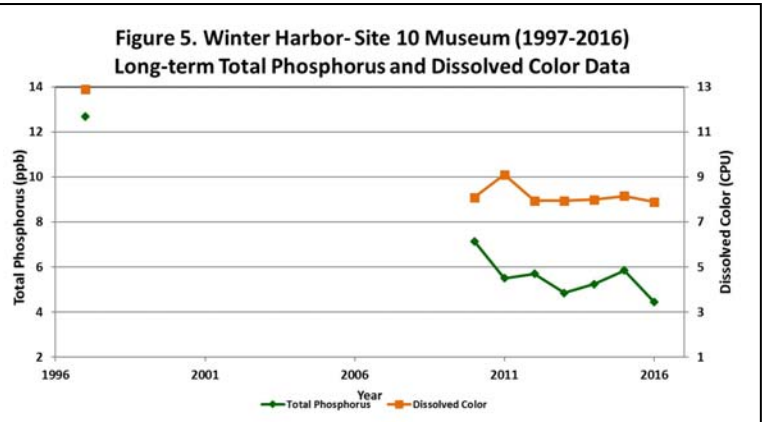


Figure 5. Winter Harbor- Site 10 Museum (1997-2016) Long-term Total Phosphorus and Dissolved Color Data

Figures 4 and 5. Changes in the Winter Harbor water clarity (Secchi Disk depth), chlorophyll *a*, dissolved color and total phosphorus concentrations measured between 1997 and 2016. **These data illustrate the relationship among plant growth, water color and water clarity. Total phosphorus data are also displayed and are oftentimes correlated with the amount of plant growth.**

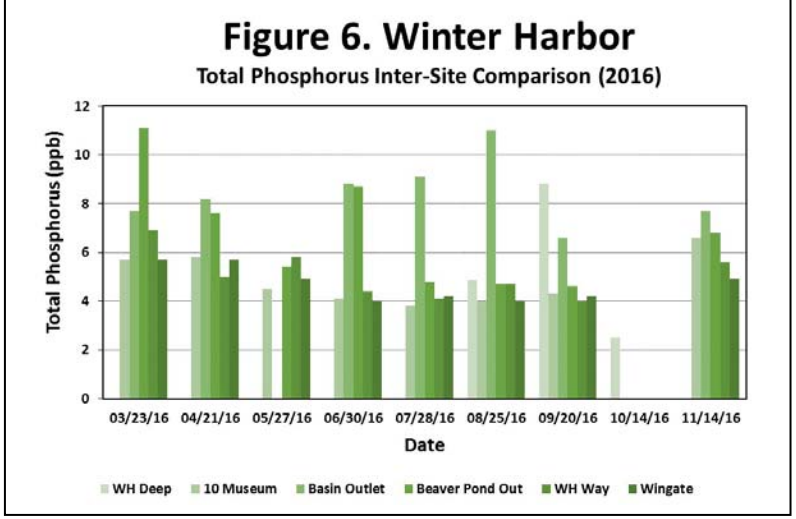
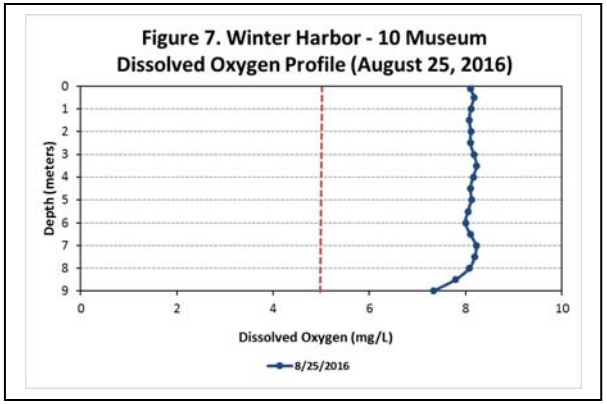


Figure 6. Winter Harbor surface water total phosphorus inter-site comparison. *Notice the difference in total phosphorus concentrations among sampling locations.*

Figure 7. Winter Harbor dissolved oxygen profile collected on August 25, 2016. The vertical red line indicates the dissolved oxygen concentration commonly considered the threshold for successful growth and reproduction of cold water fish such as trout and salmon.



Reccomendations

Implement Best Management Practices within the Lake Winnipesaukee watershed to minimize the adverse impacts of polluted runoff and erosion into Winter Harbor. 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" for more information on how to reduce nutrient loading caused by overland run-off.

- http://extension.unh.edu/resources/files/Resource004159_Rep5940.pdf
- http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf

Figure 8. Lake Winnipesaukee - Winter Harbor

Tuftonboro and Wolfeboro, NH

2016 sampling sites and seasonal average water clarity

Aerial Orthophoto Source: NH GRANIT
Site location GPS coordinates collected by the UNH Center for Freshwater Biology

NH Extension