Water Quality Assessment Report
2016

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Water Resources Program
Environmental Department
Indian Township Tribal Government

March 2017

Indian Township Tribal Government
PO Box 301, Princeton ME, 04668

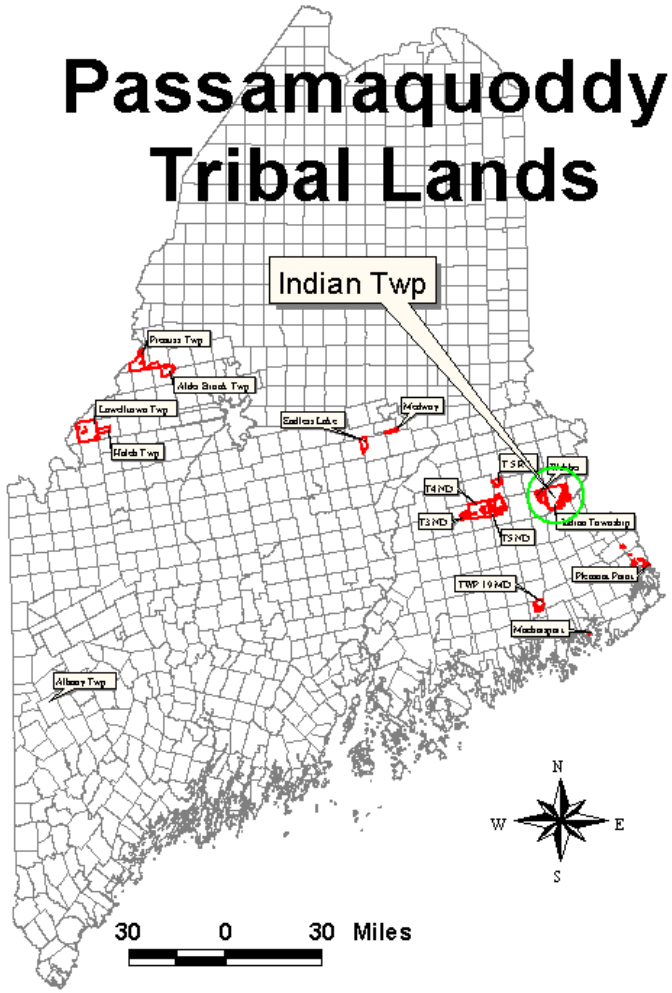


Figure 1: Location of Indian Township, Maine.

Introduction

Background

The Passamaquoddy Tribe at Indian Township began its Water Resources Planning and Inventory Program in April 1993 with funding from a Multi-Media grant from the U.S. Environmental Protection Agency (US EPA), and a Bureau of Indian Affairs (BIA) Water Resources contract. The US EPA requires a Quality Assurance Project Plan (QAPP) as a prerequisite for funding of monitoring programs. This plan details the program's procedures for field work, transportation, data use, laboratory and field protocols, and safety. For data to be useful, procedures must be consistent and reliable. This plan is submitted to, reviewed, and approved by the US EPA for each year of monitoring.

Indian Township has a wealth of water resources. Bordering the southern edge of the Reservation is part of a long series of reservoirs controlled by Woodland Pulp LLC as part of the St. Croix River drainage. The Reservation waters include Big Lake, Long Lake, Lewey Lake, Grand Falls Flowage and its tributary Tomah Stream. These water bodies make up a significant section of the 647 mi^2 West Branch of the St. Croix River basin. Reservoir water levels are controlled and used for power generation, mill effluent dilution, fisheries, and flood control. Indian Township's lake levels are controlled at the Grand Falls Dam in Woodland. In addition to Tribal land inside Indian Township, Passamaquoddy Tribe has in Trust over 115,000 acres distributed over 7 counties in the State of Maine. Water bodies adjacent to these trust lands have been subject to very little water quality testing in the past, but we have increased monitoring efforts there in the past ten years.

Purpose

The Indian Township Water Quality Monitoring Program was undertaken to compile baseline data for reservation water bodies. Water quality is the biological, chemical, and physical composition of the water in its natural state, taking into account any human inputs and alterations. In order to protect water quality in the future, one must have an idea of the current water quality, the sources of pollution currently entering the system, and the trends of the system. Determining trophic state and water quality trends are nearly impossible without data to back up those determinations. A reliable, long term monitoring program can help identify problems before the degradation of water quality is irreversible. To further complicate the water quality issue, watersheds cross municipal, state, tribal and national boundaries. Reliable data can also provide the necessary scientific backing to elicit the political will to address pollution sources.

General Program Summary

We restarted the Water Quality Sampling Program in 2008 with sampling the original four Township lakes: Big Lake, Long Lake, Lewey Lake, and Grand Falls Flowage. The 2009 season built on this foundation by continuing sampling of the Township lakes, as well as adding in monthly sampling of 13 other lakes and ponds, most of which had been regularly sampled in the past. The 2010 Water Quality Sampling Season continued on our 2009 season with sampling of the same 17 lakes and ponds. In 2011 we continued to build on 2010 by adding in 4 more lakes: East and West Musquash Lake, Pleasant Lake, and West Grand Lake. Now in 2015 we just try to keep up with the ambitious goals we set in 2011: bimonthly sampling of the same 18 regional lakes as 2011 and 2012 and occasional sampling of the 3 Jackman area ponds. We also added in sampling of a small pond known locally as Bassett Pond, which is evidently fishless, in the summer of 2013.

An updated look at our sampling lakes are as follows: **Duncan Pond**, **Hall Pond**, **Mary Petuche Pond** (the 3 Jackman area ponds), **Big Lake**, **Long Lake**, **Lewey Lake**, and **Grand Falls Flowage** (the original four lakes to be sampled) **Junior Lake**, **Pocumcus Lake**, **Scraggly Lake**, **Sysladobsis Lake, West Grand Lake** (5 major lakes upstream of the Township lakes), **Mill Privilege Lake** (tributary to Junior Lake), **Shaw Lake and Pleasant Lake** (tributary to Scraggly Lake), **Upper Chain Lake**, **Middle Chain Lake** (2 tributaries to Sysladobsis Lake), **East and West Musquash Lakes** (eventually drain into Big Lake) **Side Pistol Lake and Bassett Pond** (drains into the Passadumkeag River, and eventually the Penobscot River), and **Killman Pond** (drains into Upper Chain Lake). If looked at the watershed level, 17 of our lakes and ponds sampled are part of the St. Croix River watershed, while 5 (Duncan, Hall, Mary Petuche, Side Pistol, and Bassett) are included in the extensive Penobscot River watershed.

Starting in 2011, we increased our sampling schedule to do a full sampling regiment of each of the 18 local lakes every two weeks. In order to have enough time and staff for this large increase in sampling, we relegated the three Jackman area ponds (Duncan, Hall, and Mary Petuche) to an optional visit. We ended up sampling them once at the end of July and again at the end of September. Hall was not sampled in 2016 due to the boat at this remote pond being gone. A full sampling regiment includes the following: **Dissolved Oxygen** (DO), **Temperature**, **pH**, **Conductivity**, **Transparency** (Secchi depth), **Chlorophyll-a** (Chla), **Total Phosphorus** (TP), **Alkalinity**, and **True Color** analysis.

Monthly Program Summary

- **May 2016** Our weather station on the reservation recorded about 2.75in of rain for May 2016, compared to about 2.35in for 2015 and 3.25in for 2014, consistently dry lately. This past winter was very mild, in both temperature and snow fall amounts. Much of the season had little to no snow cover and above average temperatures. We had a long dry spring, so trees are leafing out more or less normally and the roads are in good condition. The 2016 field season started with the first samples on May 2th, 2016. The first half of May was quite windy or raining, as per usual, the second half seemed a bit less windy overall, and dry. Five lakes were lost to weather in the first half of the month and only one last in the second half with an overall sampling success rate of 32/38 (84%). Our pH probe and meter was working as well as can be expected until it suddenly stopped working on 5/25/16 between lakes.
- **June 2016** Our weather station on the reservation recorded about 2.80in of rain for June 2016, compared to about 6.80in for 2015 and 5.30in for 2014, quite the difference from the last two years. The first half of June had a fair bit of sampling weather, mostly with some windy days to deal with, the second half was similar. One lake was missed in the first half of the month: Shaw due to low water in the outlet-access from the drought and no beavers in the culvert. Only one lake was lost in the second half due to wind (Grand Falls Flowage) to end the month with 36/38 (95%) sampled. Our pH probe and meter is currently out of commission. Maine's VLMP director Scott Williams met with us on June 21st to recertify the program in Secchi disk readings and that the ProDO Meter was working correctly. It was good to speak with Scott, everything was working well.
- **July 2016** Our weather station on the reservation recorded about 3.80in of rain for July 2016, compared to about 2.15in for 2015 and 7.30in for 2014, quite the range those three years. The first half of July was very good with all 19 sites getting sampled. The second half of the month was also good with 4 regular sites being missed mostly due to making time to sample the Jackman area ponds giving us a 37/41 (90%) sampling success. The missed sites were as follows: West Grand due to wind, Shaw and Mill Privilege to make time for Jackman, and Hall Pond in Jackman was not sampled due to the remote boat being gone. Our pH probe and meter is currently out of commission.
- **August 2016** Our weather station on the reservation recorded about 3.25in of rain for August 2016, compared to about 4.95in for 2015 and 2.05in for 2014, again quite the range those three years. The first half of August was good with only one site, Killman Pond, being missed due to wind. The second half of the month was not so great with eight sites being lost due to some wind and rain days as well as staff being out for bereavement the end of the month. The following sites were missed in the second half: Sysladobsis, Pocumcus, West Grand, Upper and Middle Chain, Side Pistol, Bassett, and Killman leaving our sampling success for August at 29/38 (76%). Our pH probe and meter is still out of commission and we will have to figure pH out for 2017. The Chelmsford Lab met with us on Aug 2nd to talk about our program quality management plan which went well. There were no negative findings.

- **September 2016** Our weather station on the reservation recorded about 2.0in of rain for September 2016, compared to about 9.20in for 2015 (including a 7in rain event) and 1.75in for 2014. September ended up with a 33/41 (80%) sampling success rate as the first half of September was good with 17 sites getting sampled, losing out on West and East Musquash due to rain. The second half of the month was not as good with 6 regular sites being missed due to a combination of reasons. Potential sampling days were lost due to other work obligations, wind, rain, and mostly due to making time to sample the Jackman area ponds in the last week. The missed sites were as follows: Sysladobsis, Pleasant, Bassett, Shaw and Mill Privilege, and Hall Pond in Jackman were not sampled due to the remote boat being gone and being unable to replace it at this time. Our pH probe and meter is currently out of commission and will need to be dealt with for 2017.

The last sample of the season was taken from the Killman Pond on October 5th, 2016. This ended the field portion of another successful season. We were able to sample 167/196 (85%) sites this year. Hopefully next season we are able to produce results around what we did this season. To put it into perspective, five years ago our sampling schedule consisted of 105 sampling sites per season compared to almost 200 now.

Parameter Summary

In order to further measure our sampling success, the following shows each parameter sampled and its associated success rate (measured by valid samples taken/possible samples taken) not including quality control duplicate samples.

- **Dissolved Oxygen/Temperature Profiles:** 167/196 (85%) We had no issues what so ever with DO/Temp profile collection in 2016. The only missed data was when a lake site was missed. Scott Williams of VLMP met with us to successfully recertify our YSI ProDO meter on June 21st, 2016. This meter has shown to be extremely accurate in DO and Temp readings and having a 40m cable allows us to take readings to the bottom of even the deepest lakes in the area.
- **Chlorophyll-a:** 144/196 (73%) There were some issues with Chl-a data for May, and a few in the beginning of June. HETL had a failed QA test on the first two weeks of samples in May and reran samples that were well past the holding time, those values were omitted. There were a few samples in the second half of May and the first half of June that were tested past holding time and omitted, as well as a few that were only a day or two over so we felt (with input from Scott Williams (VLMP) and Linda Bacon (MEDEP)) they were worth including. We'll need to discuss possible BMP changes with HETL to help avoid this issue in the future. There were four valid samples that measured below the limit of 1.0 ppb, all Bassett Pond. Bassett commonly had readings below the limit in the past. Chl-a readings ranged from a low of <1.0 ppb (Bassett) to a high of 7ppb (Shaw Lake).
- **Transparency/Secchi:** 167/196 (85%) No additional Secchi readings were missed in 2016. Numerous times the Secchi disk hit the bottom on some lakes (Grand Falls Flowage 1x, Side Pistol Lake 3x, Mark Petuche Pond 2x, Bassett Pond 7/8) Secchi depth ranged from 3.65m (Middle Chain) in the shallowest to 11.45m (West Grand) at the deepest. This was the first time as far as I know that we hit bottom at Grand Falls Flowage.
- **Total Phosphorus:** 167/196 (85%) No additional Total Phosphorus samples were missed in 2016. Our TP range for 2016 was a low of 3ppb (Pocumcus, Sysladobsis, and West Grand Lakes) with a high of 24ppb (Bassett Pond).
- **pH:** 27/196 (14%) We started the year out with our same pH meter and probes after it finished 2015 well, however by the end of May it was no longer functioning correctly. We didn't collect any pH data for the rest of the season. We were at least able to get about 1 valid reading per lake in May though. Our pH low for the season was 6.24 (Bassett Pond) and a high of 7.28 (Big Lake).
- **Alkalinity:** 167/196 (85%) No additional samples were lost. No problems to report. Our low alkalinity reading for the season was 2.0 mg/l of CaCO3 (Bassett Pond) with a high of 13.0 mg/l of CaCO3 (Mary Petuche Pond). These readings are very stable from year to year it seems.
- **Conductivity:** 154/196 (79%) We were without a working conductivity meter for a couple of weeks as our regular meter is resting on the bottom of the lake due to a slight boat accident. Corrective actions have been taken to remedy the issue. No other

issues to report, our conductivity meter has always been very reliable. Our low conductivity reading for 2016 was 7.2 UMHOS/cm (Bassett Pond) with a high of 31.3 UMHOS/cm (Mary Petuche Pond).

- **Color:** 167/196 (85%) There were no problems to report for true color. Our lowest true color reading for 2016 was three readings for Bassett Pond: below the detection limit of 3 PCU, with a high reading of 65 PCU (Upper Chain).

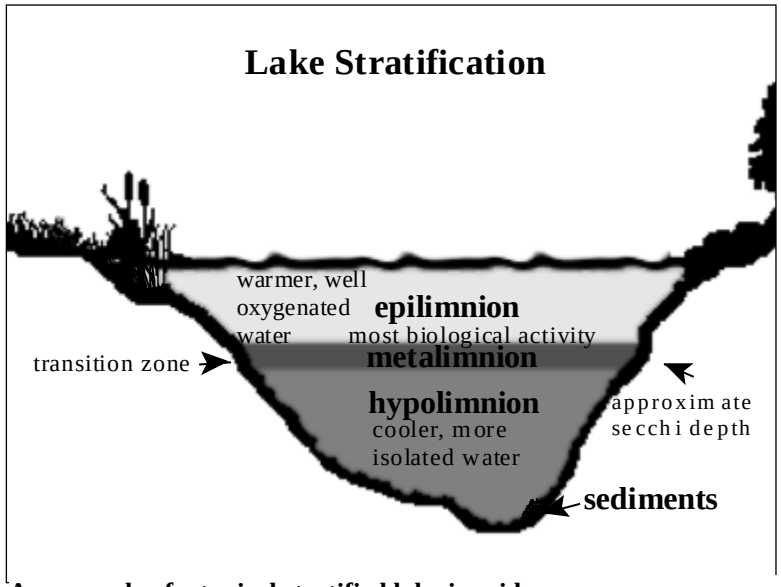
General Information

Stratification

Holdren et al (2001) defines stratification as a process in which several horizontal water layers of different density form in some lakes. These layers are classified as follows:

Epilimnion – the well-mixed and uniformly warm surface waters
Hypolimnion – the uniformly unmixed bottom waters
Metaliminion - zone of rapidly changing temperature and density separating the epilimnion and the hypolimnion

The lake is stratified when warm water, the epilimnion, floats on the significantly colder water, the hypolimnion. The metalimnion is formed in the region where the temperature gradient decreases markedly. This separation also allows little mixing of the upper layer with the bottom waters. After stratification, the hypolimnion has a finite quantity of oxygen until fall turnover.



An example of a typical stratified lake in midsummer.

Dissolved Oxygen

Dissolved Oxygen (D.O.) is the measure of the amount of oxygen dissolved in the water. All living organisms, except for certain types of bacteria, need oxygen to survive. Organisms living in the water have the ability to use the oxygen dissolved in the water to breathe. Too little oxygen severely reduces the diversity and population of aquatic communities. Therefore the amount of D.O.in the water is very important to aquatic life. Low oxygen can directly kill or stress organisms such that they will not be able to successfully reproduce or grow. Water with less than 1 part per million (ppm) of oxygen is considered anoxic (no oxygen present); less than 5 ppm of oxygen is generally considered so stressful that most coldwater fish will avoid these areas. Anoxic conditions can also promote TP release from sediments (VLMP, 2008 Maine Lakes Report).

Trophic State Index

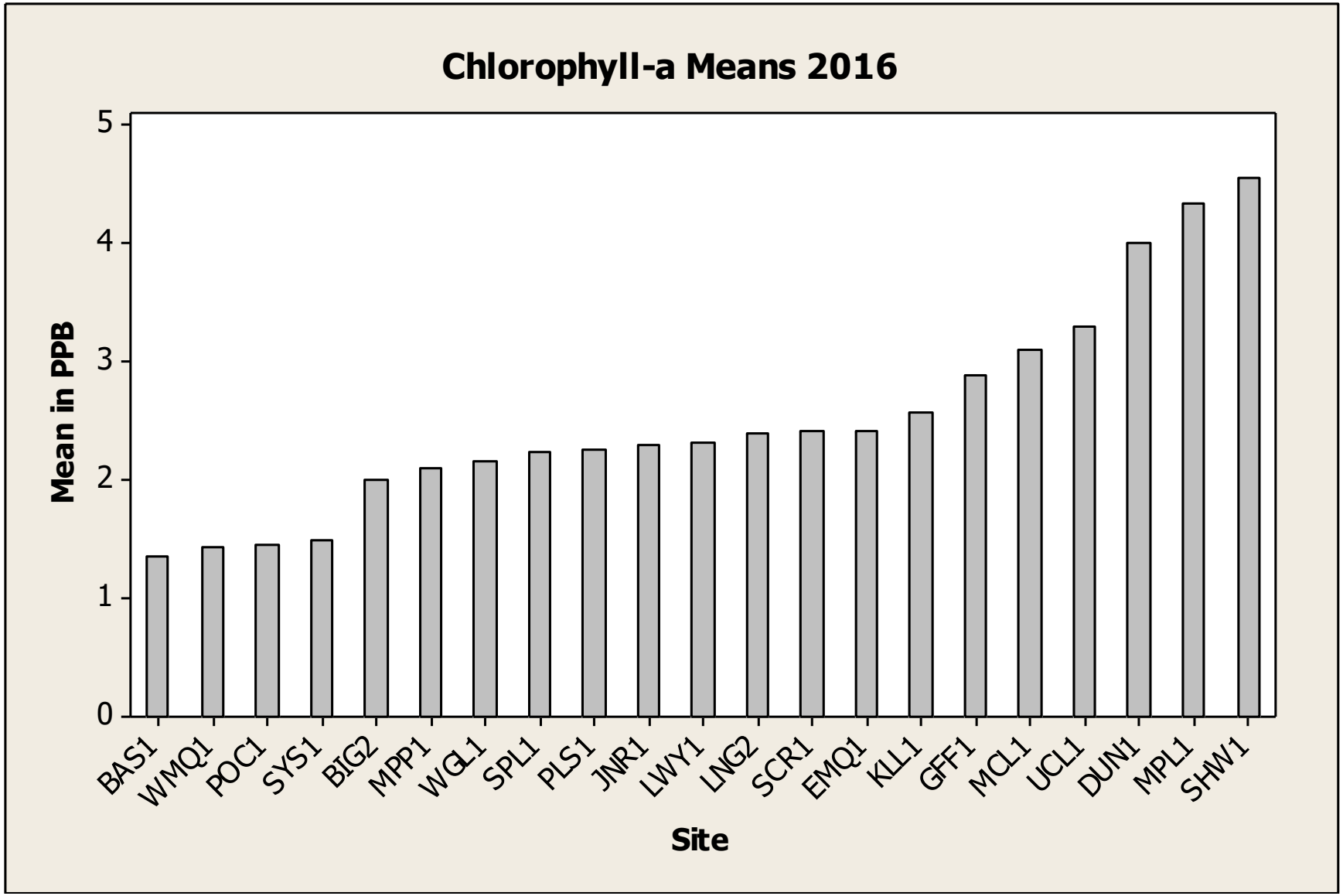
A simplified index of biological productivity in lakes, the Trophic State Index (TSI) was developed in 1977 by Robert Carlson as a means to be used for establishing a simple numerical scale for each of the three indicators of lake water quality that are commonly used to measure (directly or indirectly) lake productivity. Because the units of measurement and scale for Secchi disk transparency, total phosphorus and chlorophyll-a differ, the TSI provides a convenient means by which the three indicators can be compared. The TSI converts raw data from each of the three indicators to standard numerical scales that range from 0 to over 100, with higher numbers representing increasing productivity, and typically poorer water quality. The TSI models developed by Carlson have been modified for Maine lakes, based on historical data for each indicator (VLMP, 2008 Maine Lakes Report).

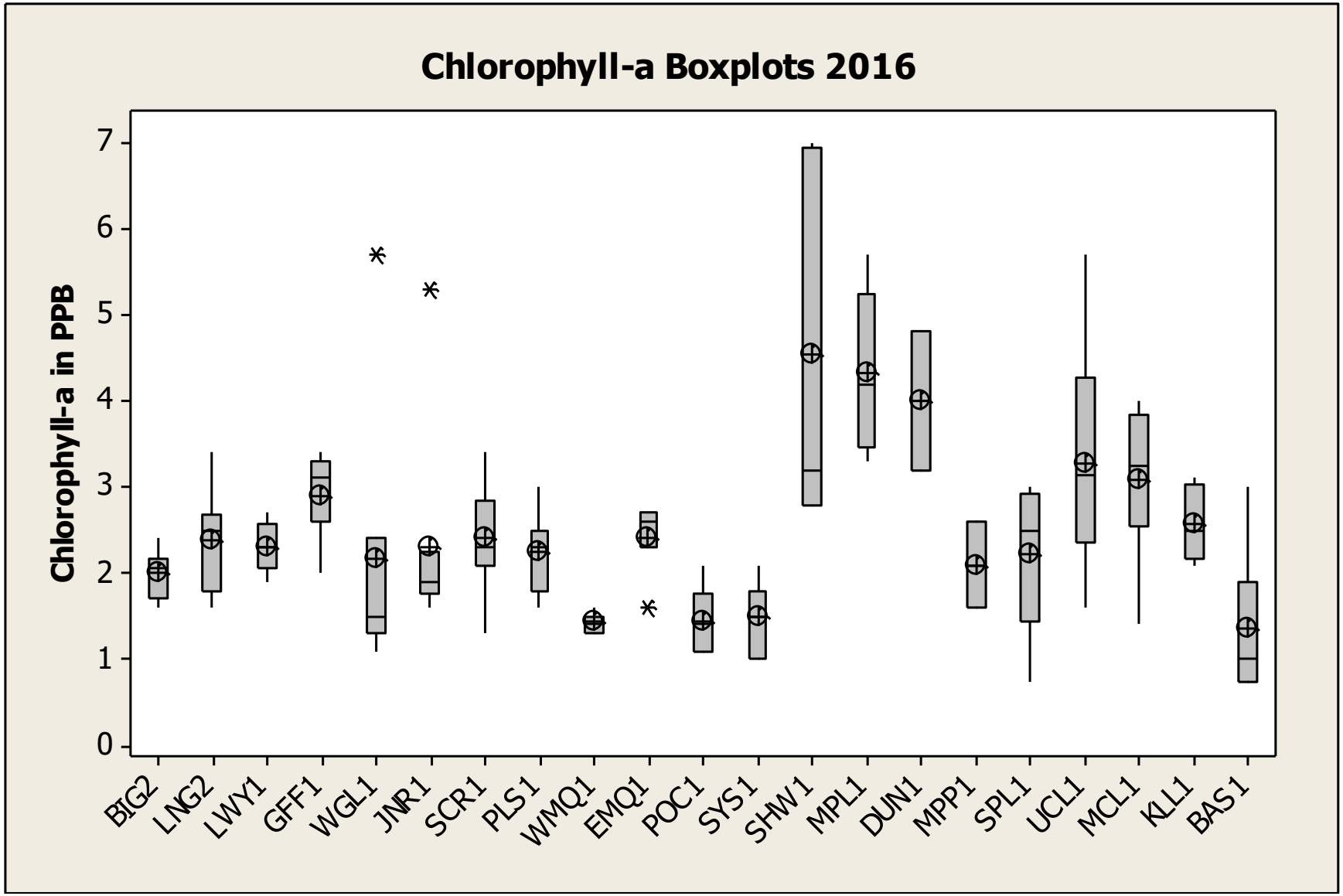
Chlorophyll is what makes plants green, whether they be on land or water. It's how they convert sunlight into a more useable form of energy. Photo courtesy of Haleigh White.

Chlorophyll-a

A pigment found in algae and other plants used to estimate biological productivity of lake ecosystems. By measuring the concentration of Chl-a in lake water, the algae population can be estimated. Chl-a is measured in parts per billion (ppb). Chlorophyll-a samples are generally obtained from an integrated water column sample because the greatest concentration of algal growth typically occurs from the surface of the lake to the bottom of the epilimnion or the top of the thermocline (VLMP, 2008 Maine Lakes Report).

Below are two graphics displaying Chlorophyll-concentrations found for our sample sites for 2016. The Chl-a results have been broken down into two different graphs. The first graph is a simple bar chart showing the mean, or average, of each lake. The second is a chart of box plots for the lakes, adding in a bit more information like range, median, etc which helps show a visual of the range of values we see on Tribal waters. *DUN1 and MPP1 only have 2 values.


Chlorophyll-a Means 2016
Mean in PPB
0
1
2
3
4
5
BAS1
WMQ1
POC1
SYS1
BIG2
MPP1
WGL1
SPL1
PLS1
JNR1
LWY1
LNG2
SCR1
EMQ1
KLL1
GFF1
MCL1
UCL1
DUN1
MPL1
SHW1
Site

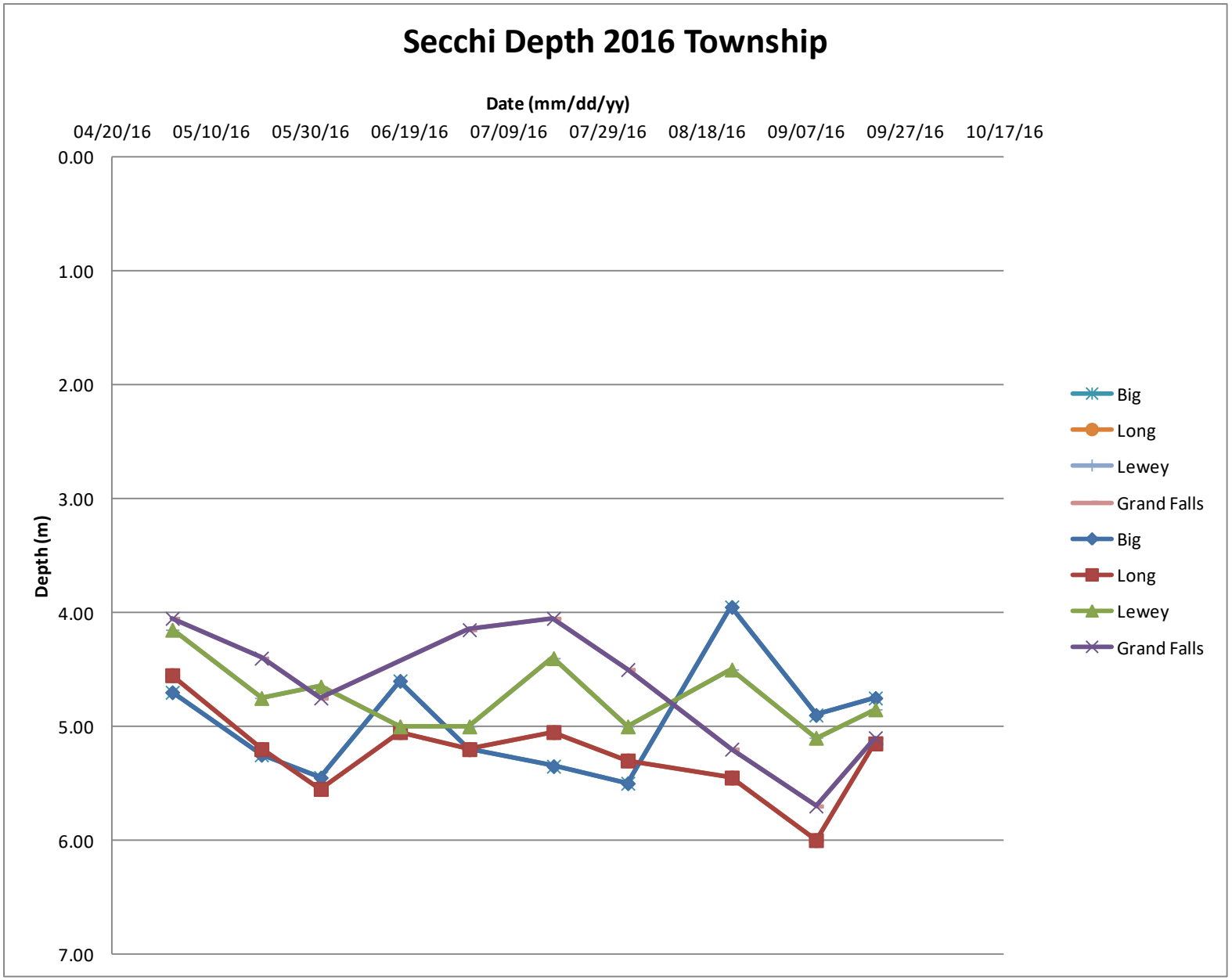

Chlorophyll-a Boxplots 2016
Chlorophyll-a in PPB
0
1
2
3
4
5
6
7
BIG2
LNG2
LWY1
GFF1
WGL1
JNR1
SCR1
PLS1
WMQ1
EMQ1
POC1
SYS1
SHW1
MPL1
DUN1
MPP1
SPL1
UCL1
MCL1
KLL1
BAS1

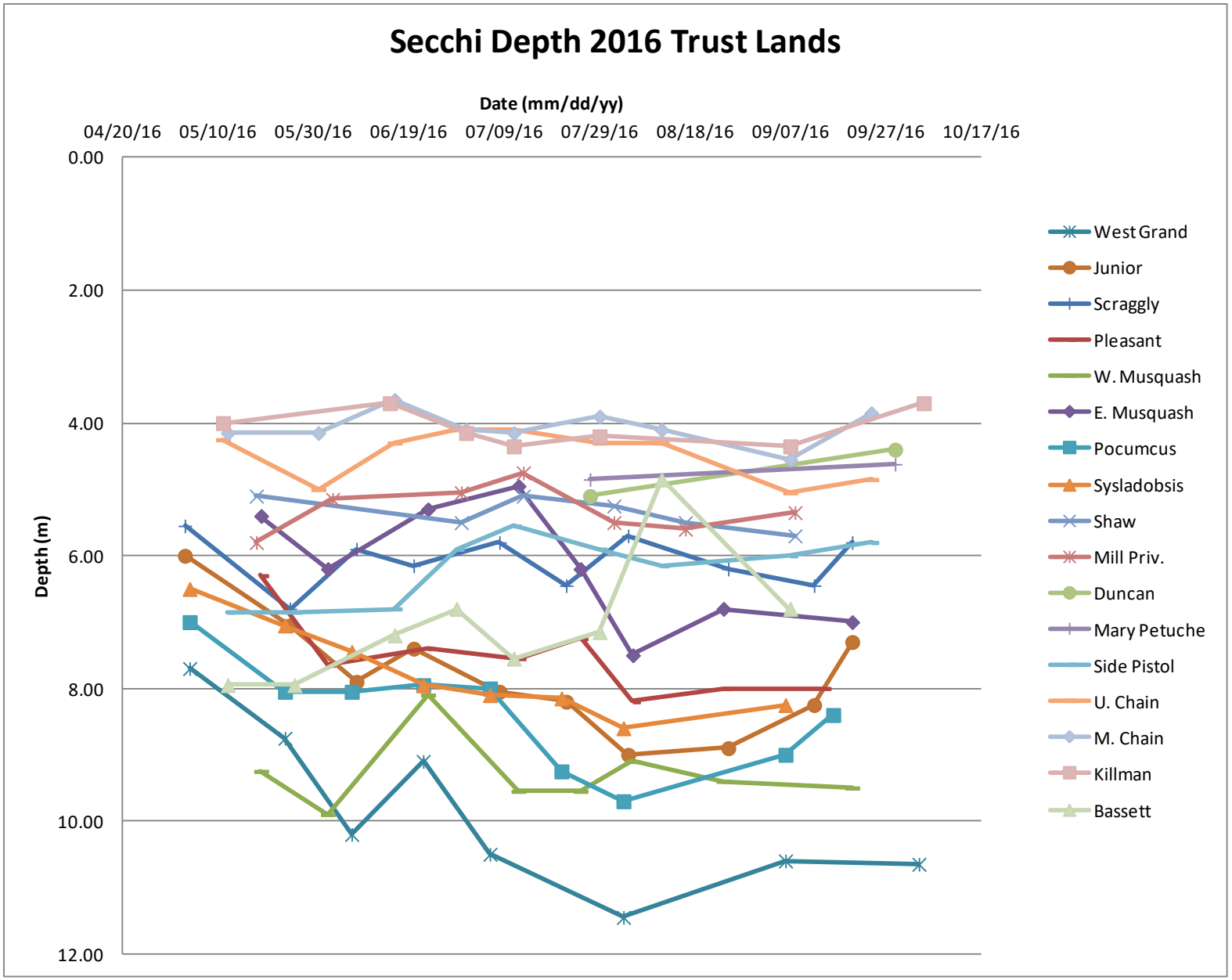
Transparency

A measure of water clarity; the distance one can see down into the water column. Factors that affect transparency include algal growth, zooplankton, natural water color, and suspended silt particles. Because algae are the most abundant particles in most lakes, transparency indirectly measures algal growth. Transparency values vary widely in Maine lakes. Unless a lake is highly colored or turbid from suspended sediment, transparency readings of 2 meters or less generally indicates a severe algal bloom (VLMP, 2008 Maine Lakes Report).

Below are two graphics displaying Secchi Depth (SD) values measuring transparency for our sample sites this year. The SD results have been broken down into two general groups of lakes: the 4 Township lakes and the 15 Springfield area Trust Land lakes and ponds. These graphs are simple scatter plots of SD depth values found for each sampling event from May through September 2016. These graphics are useful to see the corresponding seasonal variations between water bodies, and also gives a visual of the range of values we see on Tribal waters.

Being able to see down into water really makes lakes and ponds more aesthetically pleasing, and makes for some beautiful scenery. Photo courtesy of Haleigh White.


Secchi Depth 2016 Township
Date (mm/dd/yy)
04/20/16
05/10/16
05/30/16
06/19/16
07/09/16
07/29/16
08/18/16
09/07/16
09/27/16
10/17/16
Depth (m)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
Big
Long
Lewey
Grand Falls
Big
Long
Lewey
Grand Falls

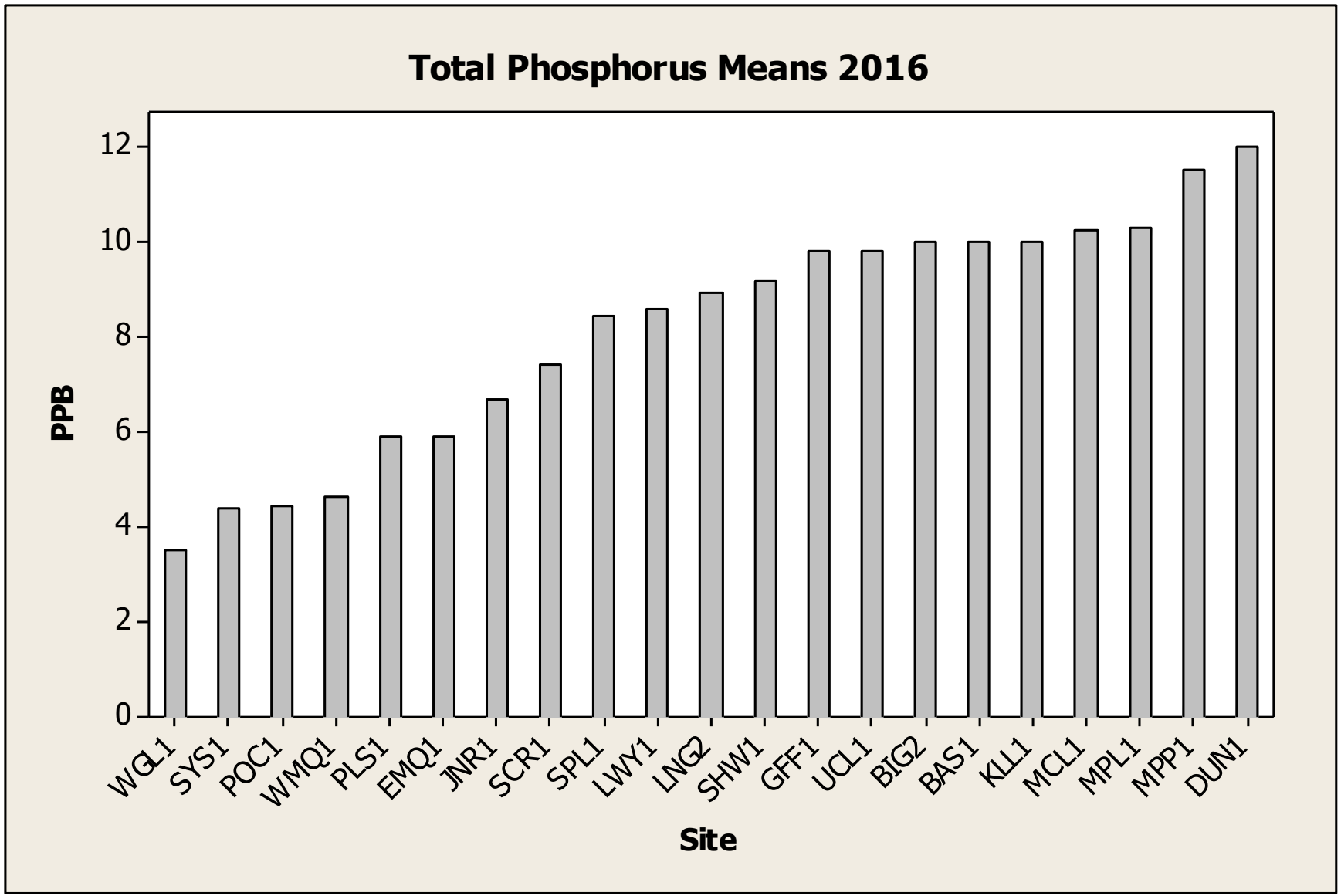

Secchi Depth 2016 Trust Lands
Date (mm/dd/yy)
04/20/16
05/10/16
05/30/16
06/19/16
07/09/16
07/29/16
08/18/16
09/07/16
09/27/16
10/17/16
Depth (m)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Duncan
Mary Petuche
Side Pistol
U. Chain
M. Chain
Killman
Bassett

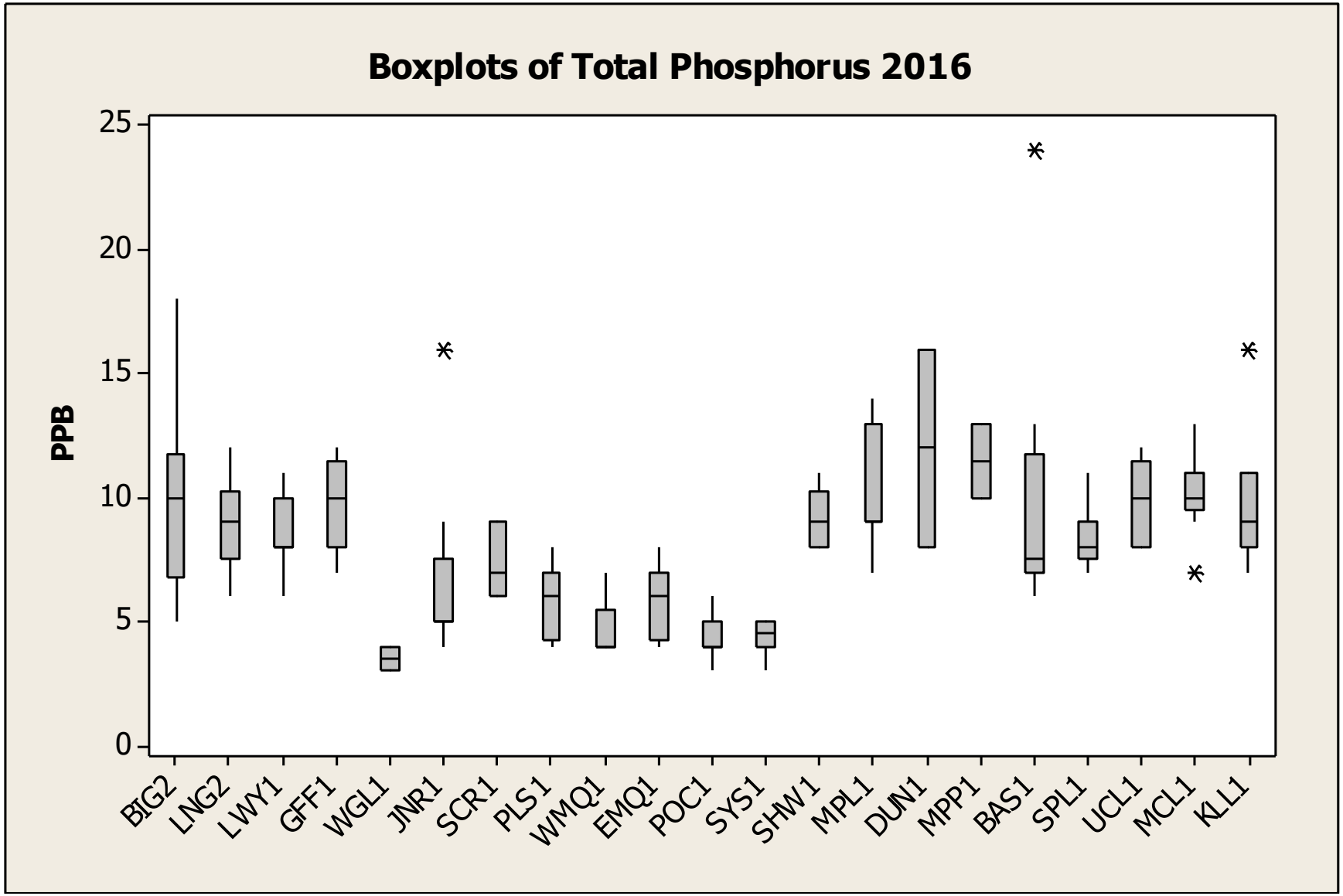
Total Phosphorous

A measure of all forms of phosphorus (organic and inorganic) in the water. Phosphorus is one of the major nutrients needed for plant growth. Because its natural occurrence in lakes is very small, phosphorus "limits" the growth of algae in lake ecosystems. Small increases in phosphorus in lake water can cause substantial increases in algal growth. Phosphorus is measured in parts per billion (ppb). Phosphorus concentrations may be based on samples taken from the surface of the lake or from discrete samples taken at specific depths, or from an integrated water column (epilimnetic core) sample (VLMP, 2008 Maine Lakes Report).

Below are two graphics displaying Total Phosphorus values found for our sample sites this year. The TP results have been broken down into two different graphs. The first graph is a simple bar chart showing the mean, or average, of each lake. The second is a chart of box plots for the lakes, adding in a bit more information like range, median, etc which helps show a visual of the range of values we see on Tribal waters. *DUN1 and MPP1 only have 2 values.

A pair of eggs in a loon nest on Pocumcus Lake on a floating bog mat island, Spring 2010. Joe Musante


Total Phosphorus Means 2016
PPB
0
2
4
6
8
10
12
WGL1
SYS1
POC1
WMQ1
PLS1
EMQ1
JNR1
SCR1
SPL1
LWY1
LNG2
SHW1
GFF1
UCL1
BIG2
BAS1
KLL1
MCL1
MPL1
MPP1
DUN1
Site

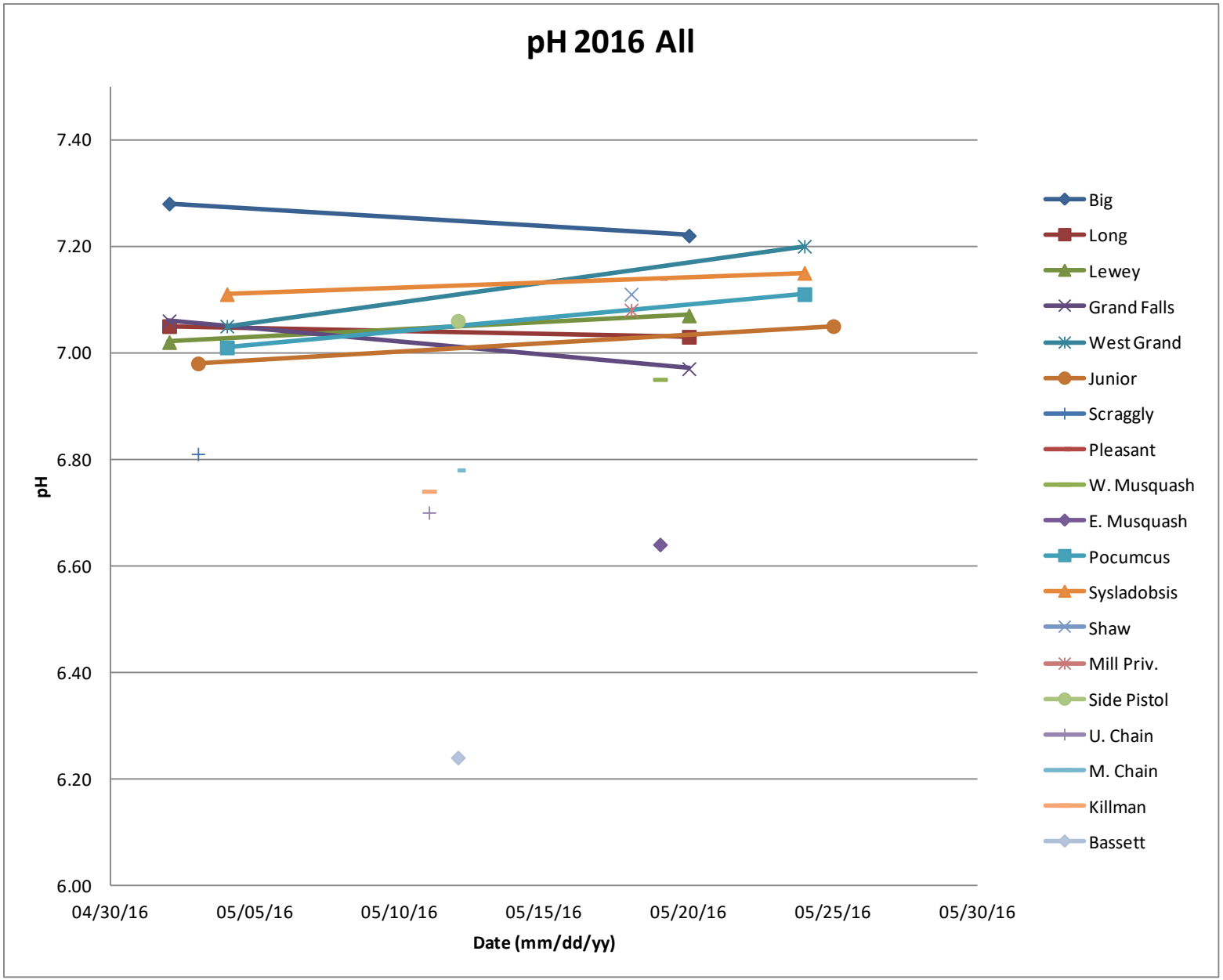

Boxplots of Total Phosphorus 2016
PPB
25
20
15
10
5
0
BIG2
LNG2
LWY1
GFF1
WGL1
JNR1
SCR1
PLS1
WMQ1
EMQ1
POC1
SYS1
SHW1
MPL1
DUN1
MPP1
BAS1
SPL1
UCL1
MCL1
KLL1

pH

A measure of the relative acid-base status of lake water, pH helps determine which plant and animal species can live in the lake, and it governs biochemical processes that take place. The pH scale ranges from 0-14, with 7 being neutral. Water is increasingly acidic below 7, and increasingly alkaline above 7. A one unit change in pH represents a tenfold change in acidity or alkalinity. The pH scale is the inverse log of the hydrogen ion concentration (VLMP, 2008 Maine Lakes Report).

Below are two graphics displaying pH values found for our sample sites this year. The pH results have been broken down into two different graphs. The first graph is a simple bar chart showing the mean, or average, of each lake. The second is a chart of box plots for the lakes, adding in a bit more information like range, median, etc which helps show a visual of the range of values we see on Tribal waters. *DUN1 and MPP1 only have 2 values.

Round-leaved sundews have adapted to low pH, low nutrient environments by capturing insects. Joe Musante

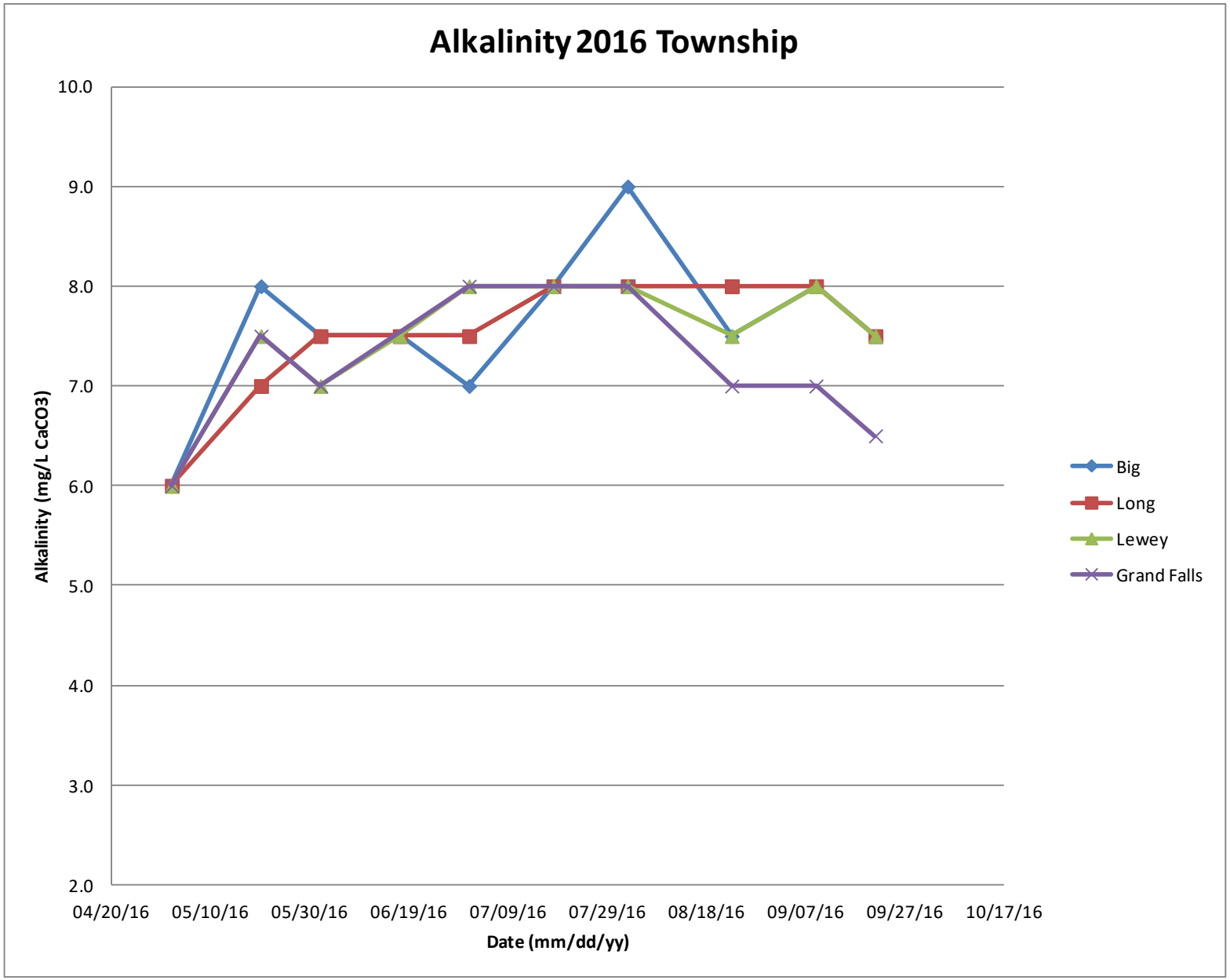

pH 2016 All
7.40
7.20
7.00
6.80
6.60
6.40
6.20
6.00
pH
04/30/16
05/05/16
05/10/16
05/15/16
05/20/16
05/25/16
05/30/16
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Side Pistol
U. Chain
M. Chain
Killman
Bassett

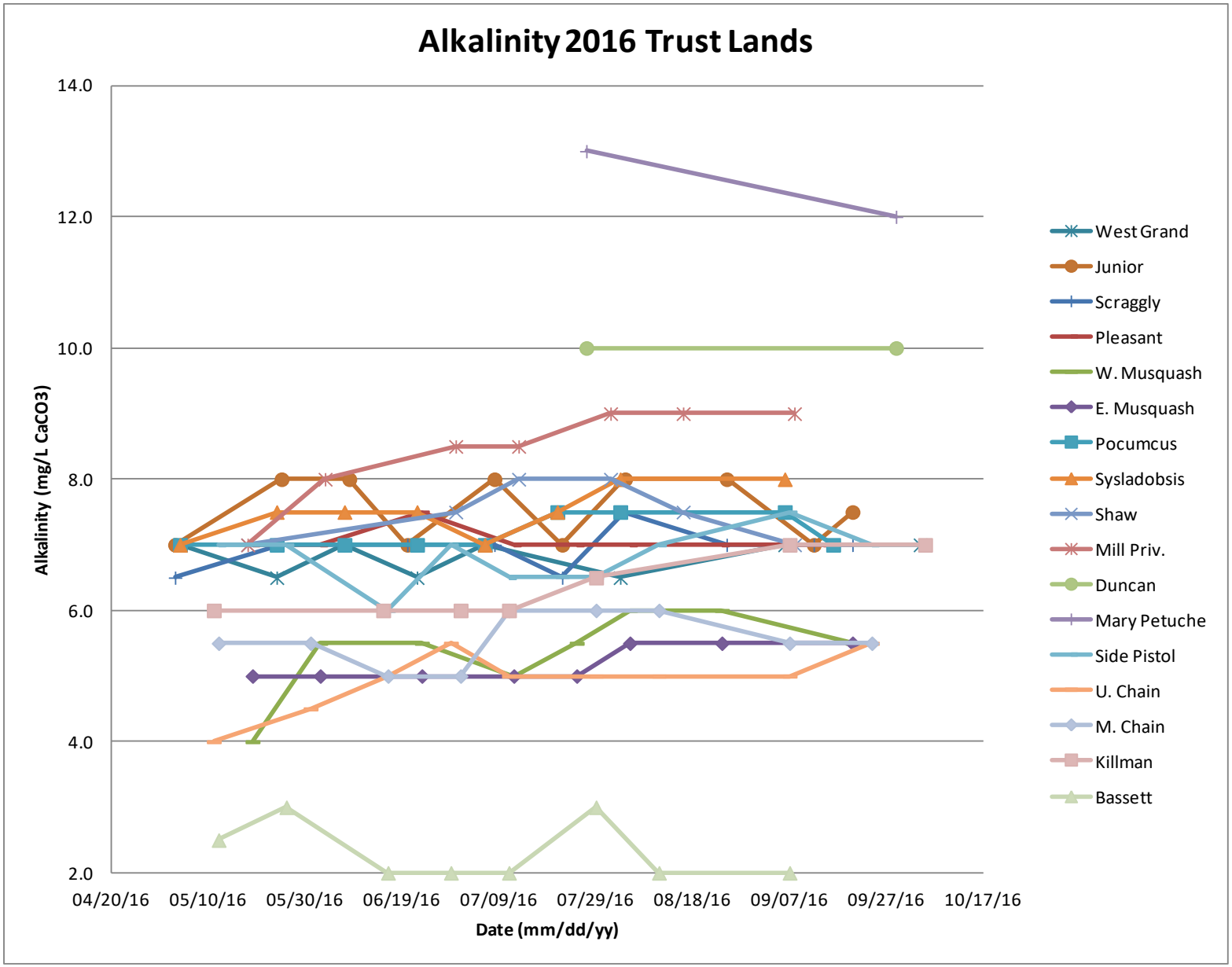
Jack taking an integrated Core sample, May 2016.

Alkalinity

A measure of the capacity of water to neutralize acids, or buffer against changes in pH, alkalinity is also referred to as "buffering capacity." It is a measure primarily of naturally available bicarbonate, carbonate, and hydroxide ions in the water. Alkalinity is measured in milligrams per liter (mg/l) (VLMP, 2008 Maine Lakes Report).

Below are two graphics displaying Alkalinity values found for our sample sites this year. The Alkalinity results have been broken down into two general groups of lakes: the 4 Township lakes and the 15 Springfield area Trust Land lakes and ponds. These graphs are simple scatter plots of Alkalinity values found for each sampling event from May through September 2016. These graphics are useful to see the corresponding seasonal variations between water bodies, and also gives a visual of the range of values we see on Tribal waters.


Alkalinity 2016 Township
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
Alkalinity (mg/L CaCO3)
04/20/16
05/10/16
05/30/16
06/19/16
07/09/16
07/29/16
08/18/16
09/07/16
09/27/16
10/17/16
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls

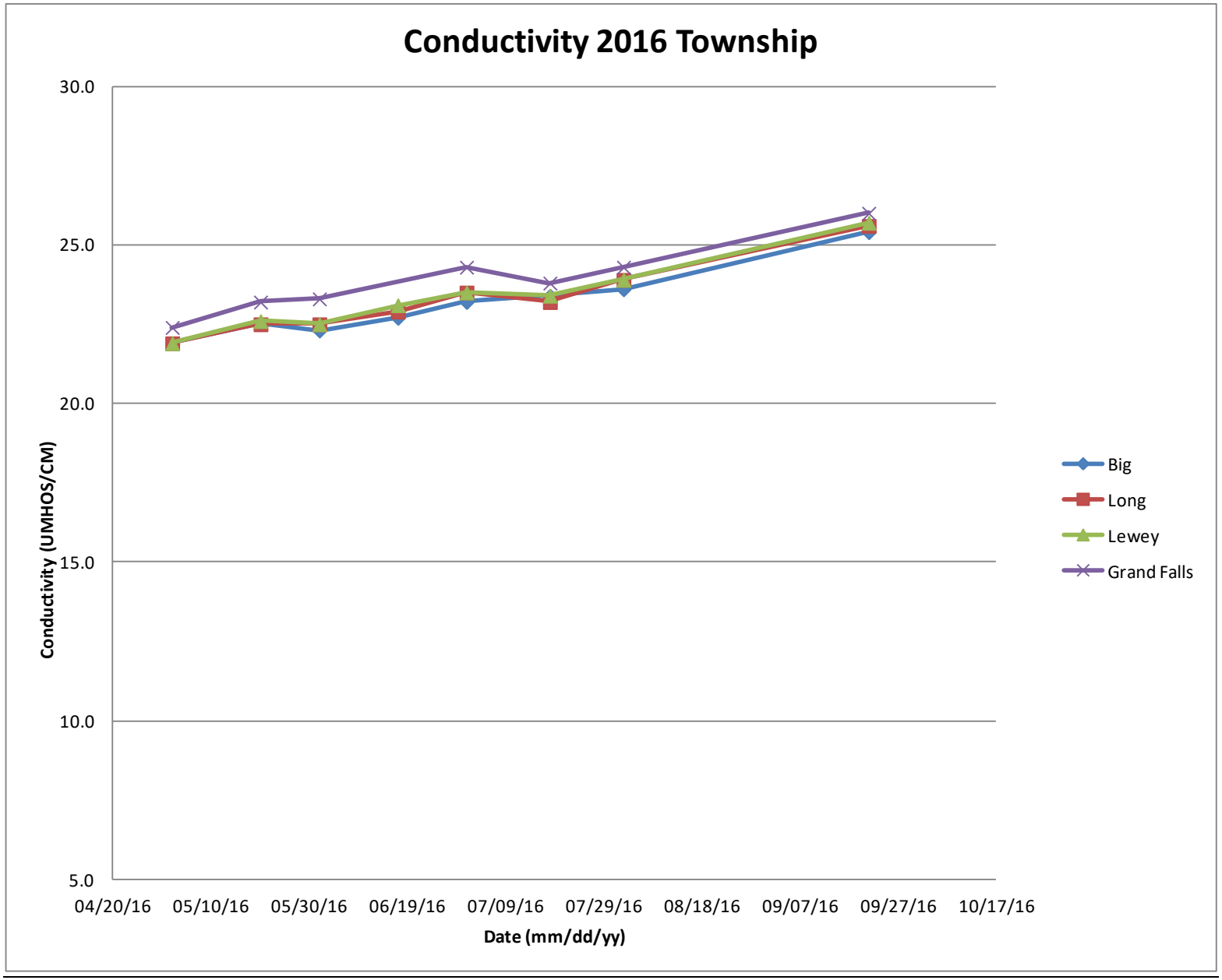

Alkalinity 2016 Trust Lands
14.0
12.0
10.0
8.0
6.0
4.0
2.0
Alkalinity (mg/L CaCO3)
04/20/16
05/10/16
05/30/16
06/19/16
07/09/16
07/29/16
08/18/16
09/07/16
09/27/16
10/17/16
Date (mm/dd/yy)
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Duncan
Mary Petuche
Side Pistol
U. Chain
M. Chain
Killman
Bassett

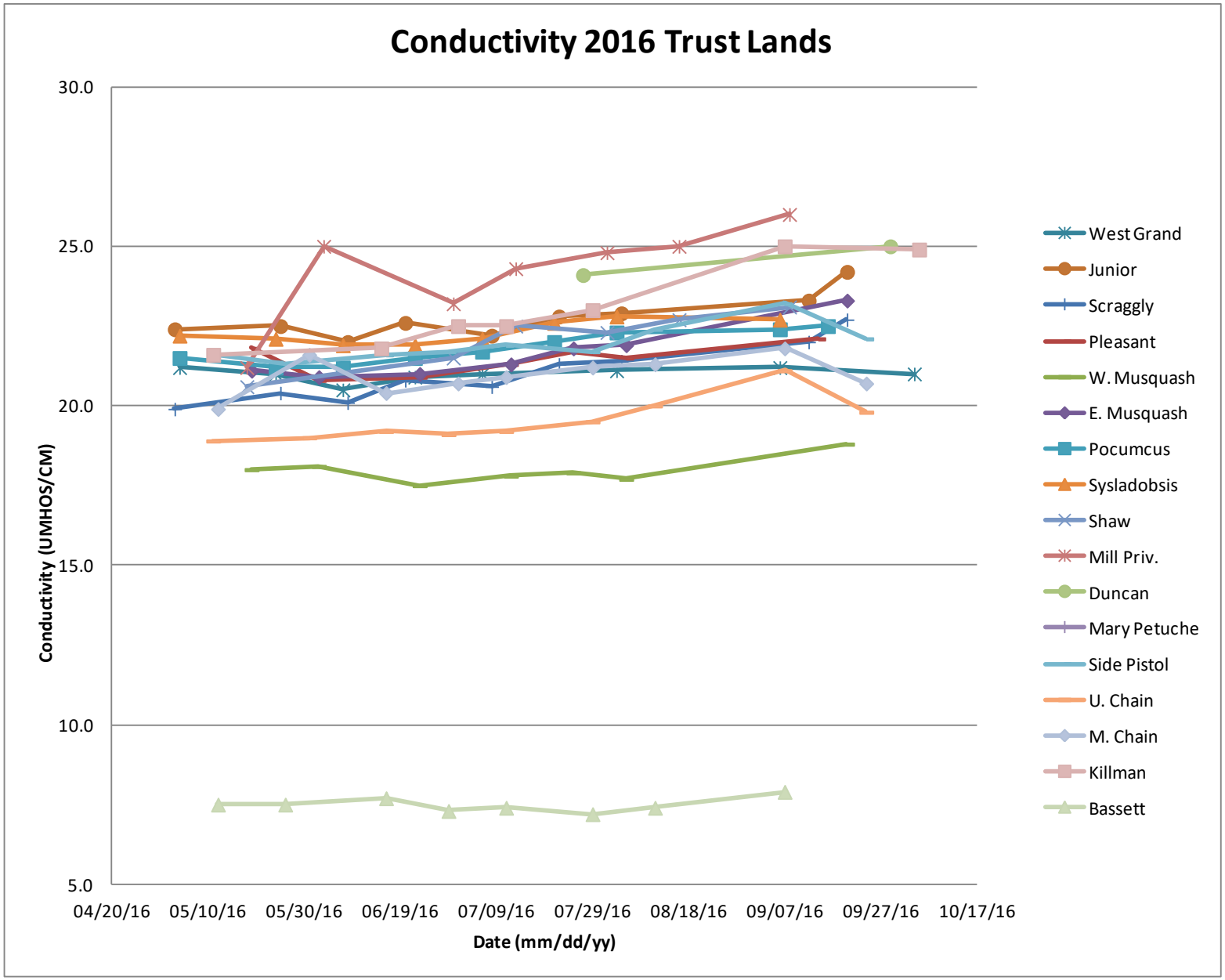
Specific Conductance

A measure of the ability of water to carry an electrical current, conductivity is directly related to the level of dissolved ions in the water. Conductivity levels will generally increase if there is an increase in the concentration of pollutants in the water. Conductivity is measured in micro-siemens per centimeter (µS/cm) or micro-mhos per centimeter (or µmhos/cm) (VLMP, 2008 Maine Lakes Report).

Below are two graphics displaying Specific Conductance values found for our sample sites this year. These results have been broken down into two general groups of lakes: the 4 Township lakes and the 15 Springfield area Trust Land lakes and ponds. These graphs are simple scatter plots of the conductivity values found for each sampling event from May through September 2016. These graphics are useful to see the corresponding seasonal variations between water bodies, and also gives a visual of the range of values we see on Tribal waters.

Our remote floating lake 'lab' hard at work. Testing around the West Branch of the St Croix every summer.


Conductivity 2016 Township
30.0
25.0
20.0
15.0
10.0
5.0
Conductivity (UMHOS/CM)
04/20/16
05/10/16
05/30/16
06/19/16
07/09/16
07/29/16
08/18/16
09/07/16
09/27/16
10/17/16
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls

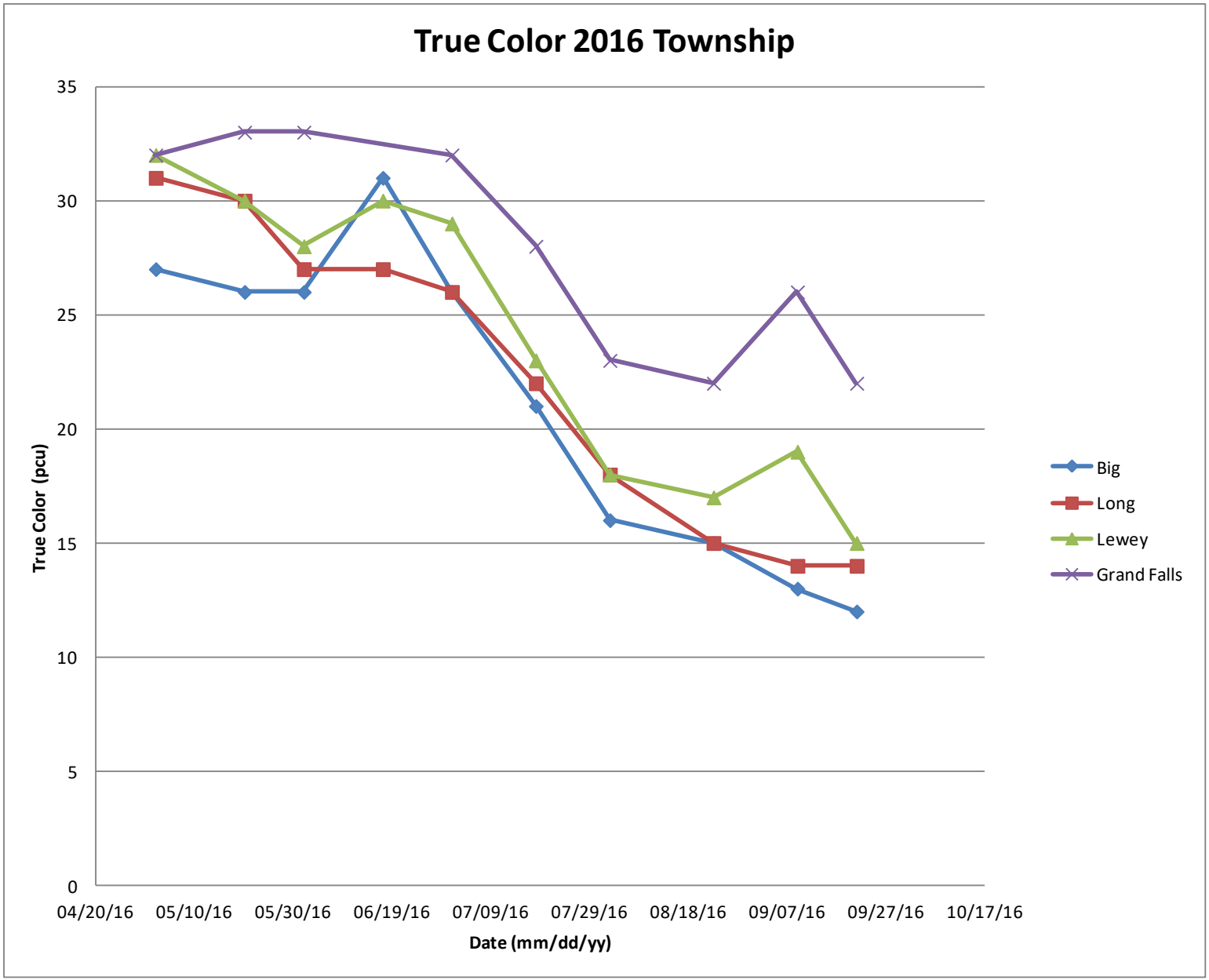

Conductivity 2016 Trust Lands
30.0
25.0
20.0
15.0
10.0
5.0
Conductivity (UMHOS/CM)
04/20/16
05/10/16
05/30/16
06/19/16
07/09/16
07/29/16
08/18/16
09/07/16
09/27/16
10/17/16
Date (mm/dd/yy)
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Duncan
Mary Petuche
Side Pistol
U. Chain
M. Chain
Killman
Bassett

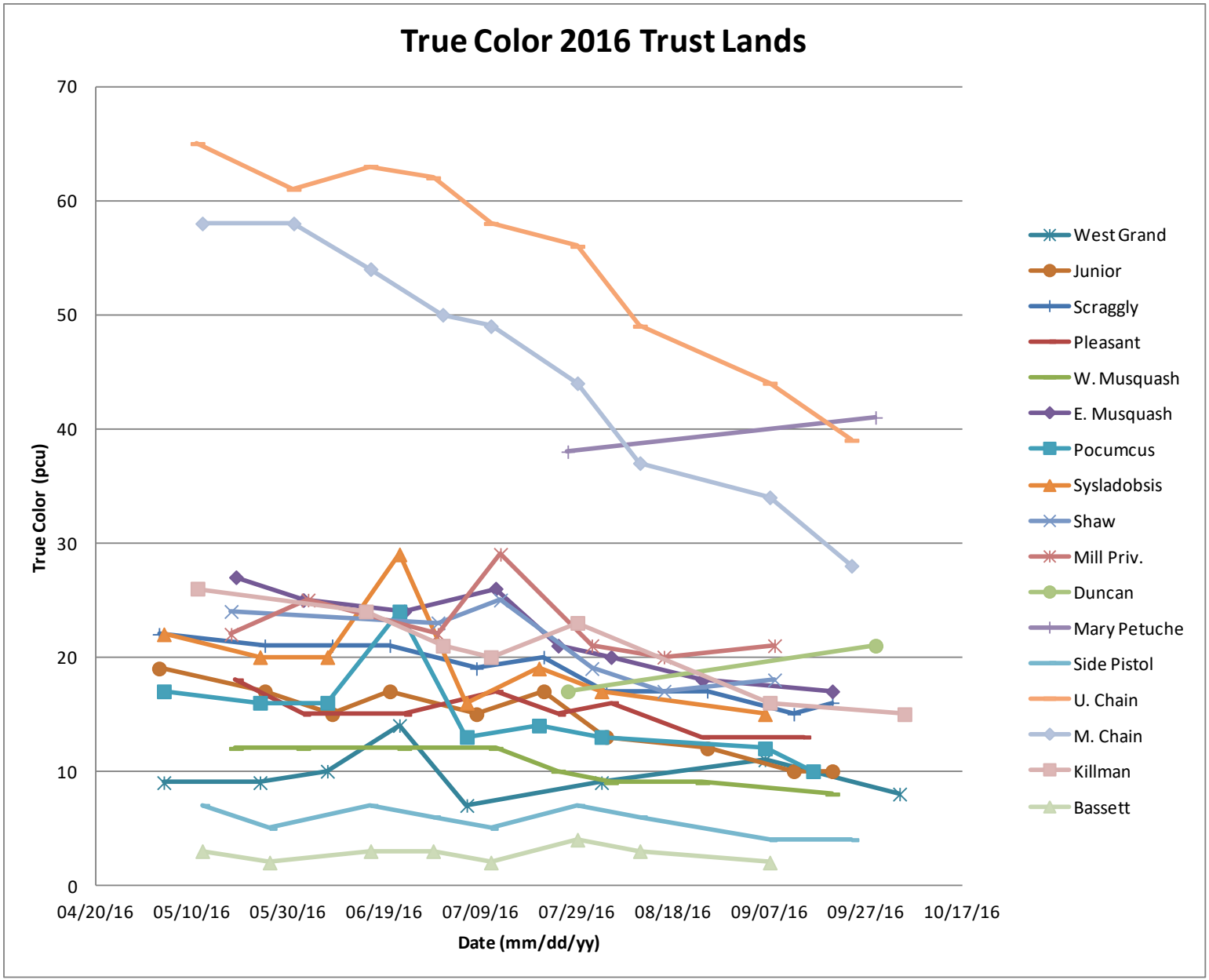
Color

The concentration of natural, dissolved, humic acids in lake water, organic "Humic" acids leach from vegetation in the lake watershed. Color is measured in Standard Platinum Units (SPU). Lakes with color levels greater than 25 SPU are considered to be colored. This can cause transparency to be reduced, and phosphorus levels to be elevated. The water in highly colored lakes often has the appearance of tea. When lakes are highly colored, the best indicator of algal growth is chlorophyll-a (VLMP, 2008 Maine Lakes Report).

Some striking colors in nature from a coastal salt marsh. Photo courtesy of Joe Musante.

Below are two graphics displaying true (filtered) color values found for our sample sites this year. These results have been broken down into two general groups of lakes: the 4 Township lakes and the 15 Springfield area Trust Land lakes and ponds. These graphs are simple scatter plots of the color values found for each sampling event from May through September 2016. These graphics are useful to see the corresponding seasonal variations between water bodies, and also gives a visual of the range of values we see on Tribal waters.


True Color 2016 Township
35
30
25
20
15
10
5
0
True Color (pcu)
04/20/16
05/10/16
05/30/16
06/19/16
07/09/16
07/29/16
08/18/16
09/07/16
09/27/16
10/17/16
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls


True Color 2016 Trust Lands
True Color (pcu)
70
60
50
40
30
20
10
0
04/20/16
05/10/16
05/30/16
06/19/16
07/09/16
07/29/16
08/18/16
09/07/16
09/27/16
10/17/16
Date (mm/dd/yy)
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Duncan
Mary Petuche
Side Pistol
U. Chain
M. Chain
Killman
Bassett

Methods

Site Selection

Lakes on or near tribal lands to be included in the monitoring program were selected according to accessibility by road. Bathymetric maps were obtained from the Maine Department of Inland Fisheries and Wildlife for the following water bodies: **Duncan Pond, Hall Pond, Junior Lake, Killman Pond, Mary Petuche Pond, Middle Chain Lake, Mill Privilege Lake, Pocumcus Lake, Scraggly Lake, Shaw Lake, Side Pistol Lake, Sysladobsis Lake, Upper Chain Lake**, **Pleasant Lake, West Musquash Lake, East Musquash Lake, West Grand Lake, and Bassett Pond.** These were all incorporated into the monitoring program along with the 4 lakes on Indian Township: **Big Lake, Long Lake, Lewey Lake, Grand Falls Flowage**. See Table 1 for summary of water bodies sampled each season. Site location maps are also included in appendix A.

Joe taking a Secchi disk reading, Upper Chain Lake May 2016.

Table 1. Waterbodies included in ITTG Monitoring Program

Waterbodies Sampled in the ITTG Water Quality Program by Year									
93-'99	**00-'02**	**2002**	**03-'04**	**2005**	**06-'07**	**2008**	**09-'10**	**11-'12**	**13-'16**
Big	Big	Big	Big	Big (2)	No	Big	Big	Big	Big
Long	Long	Long	Long	Long	sampling	Long	Long	Long	Long
Lewey	Lewey	Lewey	Lewey	Lewey	done	Lewey	Lewey	Lewey	Lewey
Grand Falls	Grand Falls	Grand Falls	Grand Falls	Grand Falls(2)	these	Grand Falls	Grand Falls	Grand Falls	Grand Falls
			Tomah Str.	Tomah Str	two	Tomah Str	Tomah Str		
	*Side Pistol	Side Pistol	Side Pistol	Side Pistol	years.		Side Pistol	Side Pistol	Side Pistol
	*Upper Chain	Upper Chain	Upper Chain	Upper Chain		*Upper Chain	Upper Chain	Upper Chain	Upper Chain
		Duncan	Duncan	Duncan		*Duncan	Duncan	*Duncan	*Duncan
		Junior	Junior	Junior			Junior	Junior	Junior
		Killman	Killman	Killman		*Killman	Killman	Killman	Killman
		Mill Privilege	Mill Privilege	Mill Privilege			Mill Privilege	Mill Privilege	Mill Privilege
		Pocumcus	Pocumcus	Pocumcus			Pocumcus	Pocumcus	Pocumcus
		Scraggly	Scraggly	Scraggly			Scraggly	Scraggly	Scraggly
		Shaw	Shaw	Shaw			Shaw	Shaw	Shaw
		Sysladobsis	Sysladobsis	Sysladobsis			Sysladobsis	Sysladobsis	Sysladobsis
				Mary Petuche		*Mary Petuche	Mary Petuche	*Mary Petuche	*Mary Petuche
						*Hall	Hall	*Hall	*Hall
				East Grand			Middle Chain	Middle Chain	Middle Chain
								West Grand	West Grand
								Pleasant	Pleasant
								E. Musquash	E. Musquash
								W. Musquash	W. Musquash
*Only sampled once or twice this year									Bassett

Sample Collection and Field Measurements

Samples were collected and *in situ* measurements were taken according to procedures outlined in *Maine Department of Environmental Protection's 1993 Standard Field Methods for Lake Water Quality Monitoring by Judy Potvin and Linda Bacon.* Detailed Standard Operating Procedures for the monitoring program are included in Appendix B.

Laboratory Analysis

Alkalinity samples were typically titrated within 48 hours of collection by staff in the office, some however are tested later, but well within the 14 day holding time. True color samples were processed by staff in the office within 48 hours of collection. Chl *a* samples were filtered within 24 hours using a hand held filter apparatus. The filter is then stored in the freezer waiting to be sent to the Health and Environmental Testing Lab in Augusta (HETL) to be processed. TP samples were immediately placed in the fridge. Within the appropriate time period (generally 1-2 weeks) Chl a and TP samples were mailed to HETL for analysis. The holding time for Chl-a and TP samples to be processed by the lab (assuming the Chl-a has been filtered and frozen) is 28 days. Sending samples every two weeks gives the lab an additional 2-3 weeks of time to process. See Appendix B for Standard Operating Procedures for all Lab analysis.

Statistical Analysis

The formulas for calculating the Carlson Trophic State Index values for Secchi disk, chlorophyll *a*, and total phosphorus are presented below. Also presented is a table that lists the trophic state values and the corresponding measurements of the three parameters. Ranges of trophic state index values are often grouped into trophic state classifications. The range between 40 and 50 is usually associated with mesotrophy (moderate productivity). Index values greater than 50 are associated with eutrophy (high productivity). Values less than 40 are associated with oligotrophy (low productivity).

All 2015 samples were organized by water body and sampling site. For each parameter, mean, max, min, standard deviation, and TSI values were calculated. Historic data has not been included in this report, this data is only from the 2016 season. A historic comparison will be illustrated in a future report.

Maine DEP Lake Assessment Criteria for Calculating Valid TSIs

1. Samples are to be taken from open water.
2. Five months of data are necessary; one reading per month is acceptable, but 2 readings per month are preferred.
3. Sampling period is May through November.
4. It is not permissible to be missing any 2 consecutive months of data.

5. The mean used in the equations shall be calculated as the mean of the monthly means in order that all months be equally weighted in the calculation.
6. Integrated cores should be taken to a depth equal to that of the late summer epilimnion or to the 2.0 mg/l D.O. level, whichever is less.
7. Secchi Transparency readings must not have hit the lake bottom.

Formulas

All lakes: TSIc = 70 log (mean Chlorophyll a in ppb + 0.71)

Lakes having color less than or equal to 25 Standard Platinum Units:

TSIp = 70 log (0.33 mean total phosphorus in ppb + 0.7)

TSIsd = 70 log [(105 / mean Secchi transparency^2) + 0.7]

Note: Secchi transparency in meters

TSI Table

TSI	Chlorophyll a (ppb)	Secchi Transparency (m)	Total Phosphorus (ppb)
0	0.3	18.7	0.9
10	0.7	12.3	2.1
20	1.2	9.2	3.1
30	2.0	7.3	6.0
40	3.0	5.9	9.2
50	4.5	4.8	13.6
60	6.5	4.0	19.7
70	9.3	3.4	28.2
80	13.2	2.8	40
90	18.6	2.4	56.4
100	26.1	2.0	79.2

Note: Avoid making comparisons using raw data for the various parameters; the criteria assure that the TSIs are representative of the water quality for the open water season of May through November.

Results: Reservation Waters

Big Lake, Washington County, Maine

Table 2, Big Lake 2016.

2016 Big Lake			Site: BIG2				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/02/16	NONE	5	4.70	6.0	7.28	21.9	27
05/20/16	NONE	6	5.25	8.0	7.22	22.5	26
May Avg	**NONE**	**6**	**4.98**	**7.0**	**7.25**	**22.2**	**27**
06/01/16	1.6	7	5.45	7.5	NONE	22.3	26
06/17/16	2.0	10	4.60	7.5	NONE	22.7	31
June Avg	**1.8**	**9**	**5.03**	**7.5**	**NONE**	**22.5**	**29**
07/01/16	2.1	11	5.20	7.0	NONE	23.2	26
07/18/16	2.0	14	5.35	8.0	NONE	23.4	21
July Avg	**2.1**	**13**	**5.28**	**7.5**	**NONE**	**23.3**	**24**
08/02/16	2.1	10	5.50	9.0	NONE	23.6	16
08/23/16	2.2	18	3.95	7.5	NONE	NONE	15
Aug Avg	**2.2**	**14**	**4.73**	**8.3**	**NONE**	**23.6**	**16**
09/09/16	1.6	9	4.90	8.0	NONE	NONE	13
09/21/16	2.4	10	4.75	7.5	NONE	25.4	12
Sept Avg	**2.0**	**10**	**4.83**	**7.8**	**NONE**	**25.4**	**13**
Year Mean:	**2.0**	**10**	**4.97**	**7.6**	**7.25**	**23.4**	**21**
Maximum:	**2.4**	**18**	**5.50**	**9.0**	**7.28**	**25.4**	**31**
Minimum:	**1.6**	**5**	**3.95**	**6.0**	**7.22**	**21.9**	**12**
Stand Dev:	**0.28**	**3.83**	**0.48**	**0.8**	**0.04**	**1.08**	**6.80**
TSI:	***30.3**	**42**	**49**				
			***Chla TSI not valid due to only 4 months of values.**				

Table 2 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color mean, max, min, standard deviations, and TSI values for Big Lake in 2016. Big Lake is about 10,300 acres, with a max depth of 70 feet (21m) and is part of the St. Croix River watershed. Our sample site is in a shallower basin of 30 feet (9m). Sampling has been done on this lake since 1993.

Long Lake, Washington County, Maine

Table 3, Long Lake 2016.

2016 Long Lake			Site: LNG2				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/02/16	NONE	6	4.55	6.0	7.05	21.9	31
05/20/16	NONE	6	5.20	7.0	7.03	22.5	30
May Avg	**NONE**	**6**	**4.88**	**6.5**	**7.04**	**22.2**	**31**
06/01/16	1.7	8	5.55	7.5	NONE	22.5	27
06/17/16	1.6	9	5.05	7.5	NONE	22.9	27
June Avg	**1.7**	**9**	**5.30**	**7.5**	**NONE**	**22.7**	**27**
07/01/16	2.5	9	5.20	7.5	NONE	23.5	26
07/18/16	2.5	12	5.05	8.0	NONE	23.2	22
July Avg	**2.5**	**11**	**5.13**	**7.8**	**NONE**	**23.4**	**24**
08/02/16	3.4	11	5.30	8.0	NONE	23.9	18
08/23/16	2.7	9	5.45	8.0	NONE	NONE	15
Aug Avg	**3.1**	**10**	**5.38**	**8.0**	**NONE**	**23.9**	**17**
09/09/16	2.1	9	6.00	8.0	NONE	NONE	14
09/21/16	2.6	10	5.15	7.5	NONE	25.6	14
Sept Avg	**2.4**	**10**	**5.58**	**7.8**	**NONE**	**25.6**	**14**
Year Mean:	**2.4**	**9**	**5.25**	**7.5**	**7.04**	**23.6**	**22**
Maximum:	**3.4**	**12**	**6.00**	**8.0**	**7.05**	**25.6**	**31**
Minimum:	**1.6**	**6**	**4.55**	**6.0**	**7.03**	**21.9**	**14**
Stand Dev:	**0.58**	**1.91**	**0.38**	**0.6**	**0.01**	**1.14**	**6.69**
TSI:	***34.4**	**40**	**46**				
***Chla TSI not valid due to only 4 months of values.**							

Table 3 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Long Lake in 2016. Long Lake is about 595 acres, and is part of the St. Croix River watershed. It has been sampled since 1993. It also should be noted in Long Lake that from June to late August the hypoliminion becomes anoxic. This results in an increase of anaerobic bacteria and production of hydrogen sulfide. Water collected from the hypolimnion typically has a rotten egg odor when anoxic. Numerous seasonal and year round residences and camps occur on its western and southern shores.

Lewey Lake, Washington County, Maine

Table 4, Lewey Lake 2016.

2016 Lewey Lake			Site: LWY1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/02/16	NONE	6	4.15	6.0	7.02	21.9	32
05/20/16	NONE	8	4.75	7.5	7.07	22.6	30
May Avg	**NONE**	**7**	**4.45**	**6.8**	**7.05**	**22.3**	**31**
06/01/16	2.2	8	4.65	7.0	NONE	22.5	28
06/17/16	1.9	8	5.00	7.5	NONE	23.1	30
June Avg	**2.1**	**8**	**4.83**	**7.3**	**NONE**	**22.8**	**29**
07/01/16	2.2	8	5.00	8.0	NONE	23.5	29
07/18/16	2.4	11	4.40	8.0	NONE	23.4	23
July Avg	**2.3**	**10**	**4.70**	**8.0**	**NONE**	**23.5**	**26**
08/02/16	2.5	8	5.00	8.0	NONE	23.9	18
08/23/16	2.6	10	4.50	7.5	NONE	NONE	17
Aug Avg	**2.6**	**9**	**4.75**	**7.8**	**NONE**	**23.9**	**18**
09/09/16	2.0	9	5.10	8.0	NONE	NONE	19
09/21/16	2.7	10	4.85	7.5	NONE	25.7	15
Sept Avg	**2.4**	**10**	**4.98**	**7.8**	**NONE**	**25.7**	**17**
Year Mean:	**2.3**	**9**	**4.74**	**7.5**	**7.05**	**23.6**	**24**
Maximum:	**2.7**	**11**	**5.10**	**8.0**	**7.07**	**25.7**	**32**
Minimum:	**1.9**	**6**	**4.15**	**6.0**	**7.02**	**21.9**	**15**
Stand Dev:	**0.29**	**1.43**	**0.31**	**0.6**	**0.04**	**1.15**	**6.40**
TSI:	***33.4**	**40**	**51**				
***Chla TSI not valid due to only 4 months of values.**							

Table 4 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Lewey Lake in 2016. Lewey Lake is about 447 acres, and is part of the St. Croix River watershed. It has been sampled since 1993. It is very populated along its eastern and southern shores, Indian Township and Princeton respectively.

Grand Falls Flowage, Washington County, Maine

Table 5, Grand Falls Flowage 2016.

2016 Grand Falls Flowage			Site: GFF1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/02/16	NONE	7	4.05	6.0	7.06	22.4	32
05/20/16	NONE	7	4.40	7.5	6.97	23.2	33
May Avg	**NONE**	**7**	**4.23**	**6.8**	**7.02**	**22.8**	**33**
06/01/16	2.0	9	4.75	7.0	NONE	23.3	33
June Avg	**2.0**	**9**	**4.75**	**7.0**	**NONE**	**23.3**	**33**
07/01/16	3.3	10	4.15	8.0	NONE	24.3	32
07/18/16	3.1	12	4.05	8.0	NONE	23.8	28
July Avg	**3.2**	**11**	**4.10**	**8.0**	**NONE**	**24.1**	**30**
08/02/16	3.4	12	4.50	8.0	NONE	24.3	23
08/23/16	2.6	11	5.20	7.0	NONE	NONE	22
Aug Avg	**3.0**	**12**	**4.85**	**7.5**	**NONE**	**24.3**	**23**
09/09/16	2.6	10	5.70	7.0	NONE	NONE	26
09/21/16	3.2	10	5.10	6.5	NONE	26.0	22
Sept Avg	**2.9**	**10**	**5.40**	**6.8**	**NONE**	**26.0**	**24**
Year Mean:	**2.8**	**10**	**4.67**	**7.2**	**7.02**	**24.1**	**28**
Maximum:	**3.4**	**12**	**5.70**	**8.0**	**7.06**	**26.0**	**33**
Minimum:	**2.0**	**7**	**4.05**	**6.0**	**6.97**	**22.4**	**22**
Stand Dev:	**0.50**	**1.86**	**0.58**	**0.7**	**0.06**	**1.14**	**4.78**
TSI:	***38.2**	**42**	**52**				
No Valid TSI due to high color and missing Chla data.							

Table 5 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Grand Falls Flowage in 2016. Grand Falls Flowage expands to 6,691 acres of mostly shallow coves due to the impoundment of the dam. Not far below the dam does this watershed finally meet the St. Croix River. Maximum depth is listed at 29 feet (9 m), but our sampling site is located at 20 feet (6m). There are numerous seasonal and year-round residences along its shores, primarily to the south.

Results: Trust Lands Waters

Duncan Pond, Somerset County, Maine

Table 6, Duncan Pond 2016

2016 Duncan Pond			Site: DUN1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
07/27/16	3.2	16	5.10	10.0	NONE	24.1	17
09/29/16	4.8	8	4.40	10.0	NONE	25.0	21
Year Mean:	**4.0**	**12**	**4.75**	**10.00**	**NONE**	**24.6**	**19**
Maximum:	**4.8**	**16**	**5.10**	**10.00**	**NONE**	**25.0**	**21**
Minimum:	**3.2**	**8**	**4.40**	**10.00**	**NONE**	**24.1**	**17**
Stand Dev:	**1.13**	**5.66**	**0.49**	**0.00**	**NONE**	**0.64**	**2.83**
TSI:							
***Non-valid TSI value due to having less than 5 months of sample data, reference only.**							

Table 6 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color for Duncan Pond in 2016. Duncan Pond is a large remote 'pond', but resembles a lake at approximately 138 acres and is part of the Penobscot River Watershed. This pond has about half a dozen seasonal camps and one small boat launch. It is surprisingly deep, with the known deep hole at 56 feet (17 meters), and cold. This site has been sampled now in some form in most years since 2002. Special care needs to be taken when sampling this site, as this pond gets rough with wind easily, and must be sampled via canoe. Sampling it first off in the morning has been found to be most reliable.

Hall Pond, Somerset County, Maine

Table 7, Hall Pond 2016

2016 Hall Pond			Site: HLL1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
Year Mean:			No Data taken here in 2016				
Maximum:							
Minimum:							
Stand Dev:							
TSI:							

*Non-valid TSI value due to having less than 5 months of sample data, reference only.
TP and Secchi TSI values non-valid due to Color > 25 PCU.

Table 7 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color for Hall Pond in 2016. Hall Pond is a small, remote pond at approximately 23 acres and is part of the Penobscot River Watershed. Hall has no camps or structures on its shores, and its deepest spot is about 27 feet (8m). Hall is located due north from Duncan Pond, and flows into Duncan via a small stream. Due to its remoteness, Hall has only been sampled in some form since 2008. This pond is heavily stratified once summer arrives. Hall was not sampled in 2016 due to a missing boat from its shores.

Junior Lake, Penobscot County, Maine

Table 8, Junior Lake 2016.

2016 Junior Lake			Site: JNR1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/03/16	NONE	5	6.00	7.0	6.98	22.4	19
05/25/16	5.3	5	7.05	8.0	7.05	22.5	17
May Avg	**5.3**	**5**	**6.53**	**7.5**	**7.02**	**22.5**	**18**
06/08/16	1.6	5	7.90	8.0	NONE	22.0	15
06/20/16	1.7	7	7.40	7.0	NONE	22.6	17
June Avg	**1.7**	**6**	**7.65**	**7.5**	**NONE**	**22.3**	**16**
07/08/16	1.9	5	8.05	8.0	NONE	22.2	15
07/22/16	1.9	16	8.20	7.0	NONE	22.8	17
July Avg	**1.9**	**11**	**8.13**	**7.5**	**NONE**	**22.5**	**16**
08/04/16	2.4	9	9.00	8.0	NONE	22.9	13
08/25/16	2.1	4	8.90	8.0	NONE	NONE	12
Aug Avg	**2.3**	**7**	**8.95**	**8.0**	**NONE**	**22.9**	**13**
09/12/16	1.8	5	8.25	7.0	NONE	23.3	10
09/20/16	2.0	6	7.30	7.5	NONE	24.2	10
Sept Avg	**1.9**	**6**	**7.78**	**7.3**	**NONE**	**23.8**	**10**
Year Mean:	**2.6**	**7**	**7.81**	**7.6**	**7.02**	**22.8**	**15**
Maximum:	**5.3**	**16**	**9.00**	**8.0**	**7.05**	**24.2**	**19**
Minimum:	**1.6**	**4**	**6.00**	**7.0**	**6.98**	**22.0**	**10**
Stand Dev:	**1.15**	**3.56**	**0.90**	**0.5**	**0.05**	**0.66**	**3.14**
TSI:	**36**	**33**	**27**				
			All TSI Values are Valid.				

Table 8 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Junior Lake in 2016. Junior Lake is a large lake in the St. Croix River watershed at approximately 3866 acres. Junior has seasonal camps primarily dotting the north and western shores, and its deepest spot is about 64 feet (19.5m). Up lake from Junior is Scraggly Lake, and down lake via Junior Stream is Junior Bay and West Grand Lake. Junior has been sampled most years since 2002.

Killman Pond, Hancock County, Maine

Table 9, Killman Pond 2016

2016 Killman Pond			Site: KLL1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/11/16	NONE	8	4.00	6.0	6.74	21.6	26
May Avg	**NONE**	**8**	**4.00**	**6.0**	**6.74**	**21.6**	**26**
06/15/16	2.1	9	3.70	6.0	NONE	21.8	24
June Avg	**2.1**	**9**	**3.70**	**6.0**	**NONE**	**21.8**	**24**
07/01/16	2.2	11	4.15	6.0	NONE	22.5	21
07/11/16	3.1	16	4.35	6.0	NONE	22.5	20
July Avg	**2.7**	**14**	**4.25**	**6.0**	**NONE**	**22.5**	**21**
07/29/16	2.5	11	4.20	6.5	NONE	23.0	23
Aug Avg	**2.5**	**11**	**4.20**	**6.5**	**NONE**	**23.0**	**23**
09/07/16	2.5	7	4.35	7.0	NONE	25.0	16
10/05/16	3.0	8	3.70	7.0	NONE	24.9	15
Sept Avg	**2.8**	**8**	**4.03**	**7.0**	**NONE**	**25.0**	**16**
Year Mean:	**2.5**	**10**	**4.04**	**6.3**	**6.74**	**22.8**	**22**
Maximum:	**3.1**	**16**	**4.35**	**7.0**	**6.74**	**25.0**	**26**
Minimum:	**2.1**	**7**	**3.70**	**6.0**	**6.74**	**21.6**	**15**
Stand Dev:	**0.41**	**3.06**	**0.28**	**0.5**	**NONE**	**1.38**	**4.07**
TSI:	**35**	**42**	**60**				
***Chla TSI not valid due to only 4 months of values.**							

Table 9 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Killman Pond in 2016. Killman Pond is a small pond of about 17 acres flowing into Upper Chain Lake via a small stream. It is part of the St. Croix River watershed. There are no camps or structures along its shores, but it does have a maintained dirt road within 100 feet along its north shore, which undoubtedly adds runoff and sediments. The boat launch is only accessible to canoes and the like. This pond is strongly stratified most of the field season, and is about 23 feet (7m) at its deepest. This pond has been sampled most years since 2002.

Mary Petuche Pond, Somerset County, Maine

Table 10, Mary Petuche Pond 2016

2016 Mary Petuche Pond			Site: MPP1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
07/27/16	1.6	10	4.85	13.0	NONE	30.6	38
09/29/16	2.6	13	4.62	12.0	NONE	31.3	41
Year Mean:	**2.1**	**12**	**4.74**	**12.5**	**NONE**	**31.0**	**40**
Maximum:	**2.6**	**13**	**4.85**	**13.0**	**NONE**	**31.3**	**41**
Minimum:	**1.6**	**10**	**4.62**	**12.0**	**NONE**	**30.6**	**38**
Stand Dev:	**0.71**	**2.12**	**0.16**	**0.7**	**NONE**	**0.49**	**2.12**
TSI:							
****Non-valid TSI value due to having less than 5 months of sample data, reference only. Both Secchi's hit bottom barely so the results should be a bit higher.**							

Table 10 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color values for Mary Petuche Pond in 2016. Mary Petuche Pond is a small remote pond of about 10 acres, and is part of the Penobscot River Watershed. There are no camps or structures on its shores, and its deepest known point is 18 feet (5.5m). A beaver dam present at the outlet is adding at least 2-3 feet in depth to this small pond. Through this outlet, Mary Petuche flows into Hall Pond maybe ¼ mile due south. Due to its remoteness, Mary Petuche has only been sampled somewhat since 2005. This pond is heavily stratified once summer arrives.

Middle Chain Lake, Hancock County, Maine

Table 11, Middle Chain Lake 2016

2016 Middle Chain Lake			Site: MCL1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/12/16	NONE	7	4.15	5.5	6.78	19.9	58
05/31/16	1.4	11	4.15	5.5	NONE	21.6	58
May Avg	**1.4**	**9**	**4.15**	**5.5**	**6.78**	**20.8**	**58**
06/16/16	2.4	10	3.65	5.0	NONE	20.4	54
June Avg	**2.4**	**10**	**3.65**	**5.0**	**NONE**	**20.4**	**54**
07/01/16	4.0	9	4.10	5.0	NONE	20.7	50
07/11/16	3.4	11	4.15	6.0	NONE	20.9	49
July Avg	**3.7**	**10**	**4.13**	**5.5**	**NONE**	**20.8**	**50**
07/29/16	3.3	11	3.90	6.0	NONE	21.2	44
08/11/16	3.2	10	4.10	6.0	NONE	21.3	37
Aug Avg	**3.3**	**11**	**4.00**	**6.0**	**NONE**	**21.3**	**41**
09/07/16	3.0	10	4.55	5.5	NONE	21.8	34
09/24/16	4.0	13	3.85	5.5	NONE	20.7	28
Sept Avg	**3.5**	**12**	**4.20**	**5.5**	**NONE**	**21.3**	**31**
Year Mean:	**2.9**	**10**	**4.03**	**5.5**	**6.78**	**20.9**	**47**
Maximum:	**4.0**	**13**	**4.55**	**6.0**	**6.78**	**21.8**	**58**
Minimum:	**1.4**	**7**	**3.65**	**5.0**	**6.78**	**19.9**	**28**
Stand Dev:	**0.86**	**1.64**	**0.25**	**0.4**	**NONE**	**0.60**	**10.78**
TSI:	**39**	**42**	**60**				
	***Chla Only valid TSI value due to Color Year Mean > 25 PCU.**						

Table 11 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Middle Chain Lake in 2016. Middle Chain Lake is about 220 acres, and flows downstream into Lower Chain Lake, and eventually into the large lake of Sysladobsis. These are all part of the St. Croix River watershed. Middle Chain had one camp along its shores that burned down recently, and also did have a small wood mill on the northern shore in the past, with remnant saw dust piles. Maximum depth found was 20 feet (6m). The lake strongly stratifies in the summer, and also is very colored. A new boat launch was constructed recently, allowing easy boat access. Middle Chain has been sampled regularly since 2009. It is recommended that in order to see a reliable trend in water quality data, ten years of sampling needs to occur.

Mill Privilege Lake, Penobscot County, Maine

Table 12, Mill Privilege Lake 2016

2016 Mill Privilege Lake			Site: MPL1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/18/16	NONE	13	5.80	7.0	7.08	21.2	22
May Avg	**NONE**	**13**	**5.80**	**7.0**	**7.08**	**21.2**	**22**
06/03/16	3.3	9	5.15	8.0	NONE	25.0	25
06/30/16	4.3	9	5.05	8.5	NONE	23.2	22
June Avg	**3.8**	**9**	**5.10**	**8.3**	**NONE**	**24.1**	**24**
07/13/16	5.7	11	4.75	8.5	NONE	24.3	29
July Avg	**5.7**	**11**	**4.75**	**8.5**	**NONE**	**24.3**	**29**
08/01/16	4.1	9	5.50	9.0	NONE	24.8	21
08/16/16	3.5	14	5.60	9.0	NONE	25.0	20
Aug Avg	**3.8**	**12**	**5.55**	**9.0**	**NONE**	**24.9**	**21**
09/08/16	5.1	7	5.35	9.0	NONE	26.0	21
Sept Avg	**5.1**	**7**	**5.35**	**9.0**	**NONE**	**26.0**	**21**
Year Mean:	**4.6**	**10**	**5.31**	**8.4**	**7.08**	**24.1**	**23**
Maximum:	**5.7**	**14**	**5.80**	**9.0**	**7.08**	**26.0**	**29**
Minimum:	**3.3**	**7**	**4.75**	**7.0**	**7.08**	**21.2**	**20**
Stand Dev:	**0.9**	**2**	**0.36**	**0.7**	**NONE**	**1.6**	**3**
TSI:	***50.8**	**42**	**45**				

***Non-valid TSI value due to having less than 5 months of sample data, reference only.**

Table 12 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Mill Privilege Lake in 2016. Mill Privilege Lake is about 110 acres, with a maximum depth of 29 feet (9m). Mill Privilege's outlet stream goes directly into Junior Lake, making it part of the St. Croix River watershed. There are a few camps dotting the shores, as well as a maintained dirt road to the north. The only boat access is for canoes or from camps. This lake also stratifies during the summer months. Mill Privilege has been sampled now 2002 in some capacity. There has been significant tree harvesting in the watershed in the last couple year likely causing some sedimentation and nutrient enrichment.

Pocumcus Lake, Washington County, Maine

Table 13, Pocumcus Lake 2016

2016 Pocumcus Lake			Site: POC1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/04/16	NONE	4	7.00	7.0	7.01	21.5	17
05/24/16	1.1	4	8.05	7.0	7.11	21.2	16
May Avg	**1.1**	**4**	**7.53**	**7.0**	**7.06**	**21.4**	**17**
06/07/16	1.4	5	8.05	7.0	NONE	21.2	16
06/22/16	1.4	4	7.95	7.0	NONE	21.5	24
June Avg	**1.4**	**5**	**8.00**	**7.0**	**NONE**	**21.4**	**20**
07/06/16	1.1	5	8.00	7.0	NONE	21.7	13
07/21/16	1.6	5	9.25	7.5	NONE	22.0	14
July Avg	**1.4**	**5**	**8.63**	**7.3**	**NONE**	**21.9**	**14**
08/03/16	1.8	6	9.70	7.5	NONE	22.3	13
Aug Avg	**1.8**	**6**	**9.70**	**7.5**	**NONE**	**22.3**	**13**
09/06/16	1.1	3	9.00	7.5	NONE	22.4	12
09/16/16	2.1	4	8.40	7.0	NONE	22.5	10
Sept Avg	**1.6**	**4**	**8.70**	**7.3**	**NONE**	**22.5**	**11**
Year Mean:	**1.5**	**5**	**8.51**	**7.2**	**7.06**	**21.9**	**15**
Maximum:	**2.1**	**6**	**9.70**	**7.5**	**7.11**	**22.5**	**24**
Minimum:	**1.1**	**3**	**7.00**	**7.0**	**7.01**	**21.2**	**10**
Stand Dev:	**0.37**	**0.88**	**0.82**	**0.3**	**0.07**	**0.51**	**4.03**
TSI:	**24**	**26**	**23**				
			All TSI Values are Valid				

Table 13 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Pocumcus Lake in 2016. Pocumcus Lake is a large lake of 2200 acres in the St. Croix River watershed. Upstream is Sysladobsis Lake, and downstream is West Grand Lake. Numerous camps, including a campground, dot its shores, particularly the southern shore. The campground has a good boat launch where you can launch any reasonably sized motor boat, the launch is shallow however. Maximum depth of this lake is 44 feet (13.5m) and it does not strongly stratify every year. The lake is cool and clear. Pocumcus Lake has been sampled now since 2002.

Scraggly Lake, Penobscot County, Maine

Table 14, Scraggly Lake 2016

2016 Scraggly Lake			Site: SCR1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/03/16	NONE	6	5.55	6.5	6.81	19.9	22
05/25/16	1.3	6	6.80	7.0	NONE	20.4	21
May Avg	**1.3**	**6**	**6.18**	**6.8**	**6.81**	**20.2**	**22**
06/08/16	2.3	8	5.90	7.0	NONE	20.1	21
06/20/16	2.1	7	6.15	7.0	NONE	20.8	21
June Avg	**2.2**	**8**	**6.03**	**7.0**	**NONE**	**20.5**	**21**
07/08/16	2.7	9	5.80	7.0	NONE	20.6	19
07/22/16	3.4	9	6.45	6.5	NONE	21.3	20
July Avg	**3.1**	**9**	**6.13**	**6.8**	**NONE**	**21.0**	**20**
08/04/16	3.0	7	5.70	7.5	NONE	21.4	17
08/25/16	2.5	6	6.20	7.0	NONE	NONE	17
Aug Avg	**2.8**	**7**	**5.95**	**7.3**	**NONE**	**21.4**	**17**
09/12/16	2.3	7	6.45	7.0	NONE	22.0	15
09/20/16	2.1	9	5.80	7.0	NONE	22.7	16
Sept Avg	**2.2**	**8**	**6.13**	**7.0**	**NONE**	**22.4**	**16**
Year Mean:	**2.3**	**7**	**6.08**	**7.0**	**6.81**	**21.1**	**19**
Maximum:	**3.4**	**9**	**6.80**	**7.5**	**6.81**	**22.7**	**22**
Minimum:	**1.3**	**6**	**5.55**	**6.5**	**6.81**	**19.9**	**15**
Stand Dev:	**0.60**	**1.26**	**0.40**	**0.3**	**NONE**	**0.92**	**2.25**
TSI:	**33**	**33**	**38**				
			All TSI Values are Valid				

Table 14 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Scraggly Lake in 2016. Scraggly Lake is the furthest lake upstream to be affected by the impoundment by the dam at Sysladobsis Lake, all part of the St. Croix River watershed. Measuring up at 2758 acres, this lake is sizeable, with a channel running through the center of it at about 42 feet (13m) at its deepest. Shallow coves line the north, south, and eastern shores. There are a few seasonal camps along its shores, and has a small boat launch at Hasty Cove where small trailered boats can be launched. This lake stratifies each summer as well. We have sampled this lake since 2002.

Shaw Lake, Penobscot County, Maine

Table 15, Shaw Lake 2016

2016 Shaw Lake			Site: SHW1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/18/16	NONE	8	5.10	7.0	7.11	20.6	24
May Avg	**NONE**	**8**	**5.10**	**7.0**	**7.11**	**20.6**	**24**
06/30/16	6.9	10	5.50	7.5	NONE	21.5	23
June Avg	**6.9**	**10**	**5.50**	**7.5**	**NONE**	**21.5**	**23**
07/13/16	7.0	11	5.10	8.0	NONE	22.5	25
July Avg	**7.0**	**11**	**5.10**	**8.0**	**NONE**	**22.5**	**25**
08/01/16	2.8	9	5.25	8.0	NONE	22.3	19
08/16/16	2.8	9	5.50	7.5	NONE	22.7	17
Aug Avg	**2.8**	**9**	**5.38**	**7.8**	**NONE**	**22.5**	**18**
09/08/16	3.2	8	5.70	7.0	NONE	23.1	18
Sept Avg	**3.2**	**8**	**5.70**	**7.0**	**NONE**	**23.1**	**18**
Year Mean:	**5.0**	**9**	**5.36**	**7.5**	**7.11**	**22.0**	**22**
Maximum:	**7.0**	**11**	**5.70**	**8.0**	**7.11**	**23.1**	**25**
Minimum:	**2.8**	**8**	**5.10**	**7.0**	**7.11**	**20.6**	**17**
Stand Dev:	**2.21**	**1.17**	**0.25**	**0.4**	**NONE**	**0.91**	**3.41**
TSI:	***53**	**40**	**45**				
***Non-valid TSI value due to having less than 5 months of sample data, reference only.**							

Table 15 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Shaw Lake in 2016. Shaw Lake is a small lake of about 211 acres, with a max depth of 31 feet (9.5m). Most of the lake however is only 10-20' deep. Neither camps, nor real boat launches occur on this lake. Canoe access can be found via the outlet that crosses the road to the south, or off an old woods road at the northwestern corner. This outlet dumps directly into Scraggly Lake, and is thus part of the St. Croix River watershed. Shaw stratifies every summer, and can become fairly warm, and is somewhat colored. Water quality data has been collected here since 2002.

Side Pistol Lake, Hancock County, Maine

Table 16, Side Pistol Lake 2016

2016 Side Pistol Lake			Site: SPL1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/12/16	NONE	9	6.85*	7.0	7.06	21.6	7
05/26/16	1.0	7	6.85*	7.0	NONE	21.3	5
May Avg	**1.0**	**8**	**6.85**	**7.0**	**7.06**	**21.5**	**6**
06/16/16	1.2	7	6.80*	6.0	NONE	21.6	7
06/29/16	2.5	9	5.90	7.0	NONE	21.7	6
June Avg	**2.5**	**9**	**6.35**	**7.0**	**NONE**	**21.7**	**6**
07/11/16	3.0	8	5.55	6.5	NONE	21.9	5
07/29/16	2.2	9	5.90	6.5	NONE	21.7	7
July Avg	**2.6**	**9**	**5.73**	**6.5**	**NONE**	**21.8**	**6**
08/11/16	2.5	8	6.15	7.0	NONE	22.4	6
Aug Avg	**2.5**	**8**	**6.15**	**7.0**	**NONE**	**22.4**	**6**
09/07/16	2.7	8	6.00	7.5	NONE	23.2	4
09/24/16	3.0	11	5.80	7.0	NONE	22.1	4
Sept Avg	**2.9**	**10**	**5.90**	**7.3**	**NONE**	**22.7**	**4**
Year Mean:	**2.3**	**9**	**6.20**	**7.0**	**7.06**	**22.0**	**6**
Maximum:	**3.0**	**11**	**6.85**	**7.5**	**7.06**	**23.2**	**7**
Minimum:	**1.0**	**7**	**5.55**	**6.0**	**7.06**	**21.3**	**4**
Stand Dev:	**0.77**	**1.24**	**0.41**	**0.4**	**NONE**	**0.57**	**1.22**
TSI:	**33**	**40**	**37**				
All TSI Values are Valid, some secchi hit bottom, TSI should be a bit lower.							
***Secchi hit bottom.**							

Table 16 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Side Pistol Lake in 2016. Side Pistol Lake is a small lake of 147 acres in a series of small lakes known as the Pistol's. Maximum depth of the lake is 26 feet (8m). There are only a few seasonal camps on this lake, as well as a small boat launch able to handle small trailered boats. This lake is mostly sand bottomed near the launch (NE corner), and is very clear, almost blue-green colored. This lake chain is the only lake sampled in the Springfield or Township area that isn't part of the St. Croix River watershed; it flows into the Passadumkeag River, and finally the Penobscot River. There is some level of stratification here in the summer. Side Pistol Lake has been sampled in differing degrees since 2000.

Sysladobsis Lake, Hancock County, Maine

Table 17, Sysladobsis Lake 2016

2016 Sysladobsis Lake			Site: SYS1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/04/16	NONE	3	6.50	7.0	7.11	22.2	22
05/24/16	1.0	5	7.05	7.5	7.15	22.1	20
May Avg	**1.0**	**4**	**6.78**	**7.3**	**7.13**	**22.2**	**21**
06/07/16	1.5	4	7.45	7.5	NONE	21.9	20
06/22/16	1.4	4	7.95	7.5	NONE	21.9	29
June Avg	**1.5**	**4**	**7.70**	**7.5**	**NONE**	**21.9**	**25**
07/06/16	1.8	5	8.10	7.0	NONE	22.1	16
07/21/16	2.1	5	8.15	7.5	NONE	22.6	19
July Avg	**2.0**	**5**	**8.13**	**7.3**	**NONE**	**22.4**	**18**
08/03/16	1.0	5	8.60	8.0	NONE	22.8	17
Aug Avg	**1.0**	**5**	**8.60**	**8.0**	**NONE**	**22.8**	**17**
09/06/16	1.6	4	8.25	8.0	NONE	22.7	15
Sept Avg	**1.6**	**4**	**8.25**	**8.0**	**NONE**	**22.7**	**15**
Year Mean:	**1.4**	**4**	**7.89**	**7.6**	**7.13**	**22.4**	**19**
Maximum:	**2.1**	**5**	**8.60**	**8.0**	**7.15**	**22.8**	**29**
Minimum:	**1.0**	**3**	**6.50**	**7.0**	**7.11**	**21.9**	**15**
Stand Dev:	**0.40**	**0.71**	**0.70**	**0.3**	**0.03**	**0.36**	**4.40**
TSI:	**23**	**21**	**26**				
			All TSI Values are Valid				

Table 17 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Sysladobsis Lake in 2016. Sysladobsis Lake is a large lake of 5376 acres in the St. Croix River watershed. Maximum lake depth found was 65 feet (20m). Numerous camps dot the shoreline and islands of this large lake. There is a small boat launch at the southern end, as well as a state run public launch on the northern end of the lake. This lake can get rough easily with just a little wind. Early morning sampling on the calmest of days is recommended. Sampling has occurred here since 2002.

Upper Chain Lake, Hancock County, Maine

Table 18, Upper Chain Lake 2016

2016 Upper Chain Lake			Site: UCL1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/11/16	NONE	11	4.25	4.0	6.70	18.9	65
05/31/16	1.6	10	5.00	4.5	NONE	19.0	61
May Avg	**1.6**	**11**	**4.63**	**4.3**	**6.70**	**19.0**	**63**
06/16/16	2.3	8	4.30	5.0	NONE	19.2	63
06/29/16	3.3	12	4.10	5.5	NONE	19.1	62
June Avg	**2.8**	**10**	**4.20**	**5.3**	**NONE**	**19.2**	**63**
07/11/16	3.3	9	4.10	5.0	NONE	19.2	58
07/29/16	5.7	12	4.30	5.0	NONE	19.5	56
July Avg	**4.5**	**11**	**4.20**	**5.0**	**NONE**	**19.4**	**57**
08/11/16	4.6	8	4.30	5.0	NONE	20.0	49
Aug Avg	**4.6**	**8**	**4.30**	**5.0**	**NONE**	**20.0**	**49**
09/07/16	2.5	8	5.05	5.0	NONE	21.1	44
09/24/16	3.0	10	4.85	5.5	NONE	19.8	39
Sept Avg	**2.8**	**9**	**4.95**	**5.3**	**NONE**	**20.5**	**42**
Year Mean:	**3.3**	**10**	**4.46**	**5.0**	**6.70**	**19.6**	**55**
Maximum:	**5.7**	**12**	**5.05**	**5.5**	**6.70**	**21.1**	**65**
Minimum:	**1.6**	**8**	**4.10**	**4.0**	**6.70**	**18.9**	**39**
Stand Dev:	**1.31**	**1.64**	**0.38**	**0.5**	**NONE**	**0.69**	**9.16**
TSI:	**42**	**42**	**54**				
	***Chla only valid TSI value due to Color Year Mean > 25 PCU.**						

Table 18 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Upper Chain Lake in 2016. Upper Chain Lake is about 717 acres with a maximum depth of 30 feet (9m). This lake eventually flows into Sysladobsis Lake, and thus is part of the St. Croix River watershed. There are only a few camps along the north, east, and southern shores. There is a public boat launch able to take small boat trailers at the northern end of the lake. Also here is a group of tribally run tenting campsites and a year-round residence. The lake strongly stratifies in the summer, and also is very colored. Sampling here has occurred since 2000 in some form.

West Grand Lake, Washington County, Maine

Table 19, West Grand Lake 2016

2016 West Grand Lake			Site: WGL1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/04/16	NONE	3	7.70	7.0	7.05	21.2	9
05/24/16	5.7	4	8.75	6.5	7.20	21.0	9
May Avg	**5.7**	**4**	**8.23**	**6.8**	**7.13**	**21.1**	**9**
06/07/16	1.1	4	10.20	7.0	NONE	20.5	10
06/22/16	1.3	4	9.10	6.5	NONE	20.9	14
June Avg	**1.2**	**4**	**9.65**	**6.8**	**NONE**	**20.7**	**12**
07/06/16	1.5	3	10.50	7.0	NONE	21.0	7
July Avg	**1.5**	**3**	**10.50**	**7.0**	**NONE**	**21.0**	**7**
08/03/16	2.4	3	11.45	6.5	NONE	21.1	9
Aug Avg	**2.4**	**3**	**11.45**	**6.5**	**NONE**	**21.1**	**9**
09/06/16	1.3	3	10.60	7.0	NONE	21.2	11
10/04/16	1.8	4	10.65	7.0	NONE	21.0	8
Sept Avg	**1.6**	**4**	**10.63**	**7.0**	**NONE**	**21.1**	**10**
Year Mean:	**2.5**	**3**	**10.09**	**6.8**	**7.13**	**21.0**	**9**
Maximum:	**5.7**	**4**	**11.45**	**7.0**	**7.20**	**21.2**	**14**
Minimum:	**1.1**	**3**	**7.70**	**6.5**	**7.05**	**20.5**	**7**
Stand Dev:	**1.62**	**0.53**	**1.24**	**0.26**	**0.11**	**0.22**	**2.13**
TSI:	**35**	**16**	**17**				
			All TSI Values are Valid				

Table 19 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for West Grand Lake in 2016. West Grand Lake is a large lake, at about 14,340 acres with numerous islands. Most of the shoreline is forested with few camps, the only built up area is along the dam in the Southeastern corner. Our sampling location of about 110ft near a supposed 127ft hole that could not be located. West Grand is part of the West Branch of the St. Croix Watershed and is considered one of the more premier fishing and recreation lakes in the area.

Pleasant Lake, T6R1 Washington County, Maine

Table 20, Pleasant Lake 2016

2016 Pleasant Lake			Site: PLS1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/19/16	NONE	6	6.30	7.0	7.14	21.8	18
May Avg	**NONE**	**6**	**6.30**	**7.0**	**7.14**	**21.8**	**18**
06/02/16	2.1	8	7.65	7.0	NONE	20.8	15
06/23/16	2.5	7	7.40	7.5	NONE	20.9	15
June Avg	**2.3**	**8**	**7.53**	**7.3**	**NONE**	**20.9**	**15**
07/12/16	2.3	6	7.55	7.0	NONE	21.3	17
07/25/16	3.0	7	7.25	7.0	NONE	21.7	15
July Avg	**2.7**	**7**	**7.40**	**7.0**	**NONE**	**21.5**	**16**
08/05/16	2.4	4	8.20	7.0	NONE	21.5	16
08/24/16	1.8	4	8.00	7.0	NONE	NONE	13
Aug Avg	**2.1**	**4**	**8.10**	**7.0**	**NONE**	**21.5**	**15**
09/14/16	1.6	5	8.00	7.0	NONE	22.1	13
Sept Avg	**1.6**	**5**	**8.00**	**7.0**	**NONE**	**22.1**	**13**
Year Mean:	**2.2**	**6**	**7.47**	**7.1**	**7.14**	**21.6**	**15**
Maximum:	**3.0**	**8**	**8.20**	**7.5**	**7.14**	**22.1**	**18**
Minimum:	**1.6**	**4**	**6.30**	**7.0**	**7.14**	**20.8**	**13**
Stand Dev:	**0.46**	**1.46**	**0.60**	**0.2**	**NONE**	**0.48**	**1.75**
TSI:	**32**	**30**	**29**				
***Chla TSI not valid due to only 4 months of values.**							

Table 20 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Pleasant Lake in 2016. Pleasant Lake is a moderately sized lake at 1,574 acres, with a max depth of 92ft. Two campgrounds are located on this lake, a public one with boat launch on the Southern shore, as well as a private business with a few rentable cabins and sites on the North shore. There are few, if any, other camps along its shores. Pleasant Lake outlet flows out of the Southwest part of the lake into Scraggly Lake, making it part of the St. Croix Watershed.

East Musquash Lake, Washington County, Maine

Table 21, East Musquash Lake 2016

2016 East Musquash Lake			Site: EMQ1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/19/16	NONE	6	5.40	5.0	6.64	21.1	27
May Avg	**NONE**	**6**	**5.40**	**5.0**	**6.64**	**21.1**	**27**
06/02/16	1.6	7	6.20	5.0	NONE	20.9	25
06/23/16	2.6	8	5.30	5.0	NONE	21.0	24
June Avg	**2.1**	**8**	**5.75**	**5.0**	**NONE**	**21.0**	**25**
07/12/16	2.6	7	4.95	5.0	NONE	21.3	26
07/25/16	2.7	6	6.20	5.0	NONE	21.8	21
July Avg	**2.7**	**7**	**5.58**	**5.0**	**NONE**	**21.6**	**24**
08/05/16	2.3	4	7.50	5.5	NONE	21.9	20
08/24/16	2.7	5	6.80	5.5	NONE	NONE	18
Aug Avg	**2.5**	**5**	**7.15**	**5.5**	**NONE**	**21.9**	**19**
09/20/16	2.4	4	7.00	5.5	NONE	23.3	17
Sept Avg	**2.4**	**4**	**7.00**	**5.5**	**NONE**	**23.3**	**17**
Year Mean:	**2.4**	**6**	**6.18**	**5.2**	**6.64**	**21.8**	**22**
Maximum:	**2.7**	**8**	**7.50**	**5.5**	**6.64**	**23.3**	**27**
Minimum:	**1.6**	**4**	**4.95**	**5.0**	**6.64**	**20.9**	**17**
Stand Dev:	**0.39**	**1.46**	**0.90**	**0.26**	**NONE**	**0.84**	**3.77**
TSI:	**34**	**30**	**38**				
***Chla TSI not valid due to only 4 months of values.**							

Table 21 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for East Musquash Lake in 2016. East Musquash, located right alongside of Rt 6, in Topsfield, is about 806 acres. Rt. 6 runs along most of the Southern shore of the lake with numerous camps and year round residences. There is also a public boat launch and rest area (with restrooms) here. The outlet is located on the southeastern corner of the lake and eventually flows into Big Lake, including it in the St. Croix Watershed.

West Musquash Lake, Washington County, Maine

Table 22, West Musquash Lake 2016

2016 West Musquash Lake			Site: WMQ1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/19/16	NONE	4	9.25	4.0	6.95	18.0	12
May Avg	**NONE**	**4**	**9.25**	**4.0**	**6.95**	**18.0**	**12**
06/02/16	1.3	4	9.90	5.5	NONE	18.1	12
06/23/16	1.4	6	8.10	5.5	NONE	17.5	12
June Avg	**1.4**	**5**	**9.00**	**5.5**	**NONE**	**17.8**	**12**
07/12/16	1.3	4	9.55	5.0	NONE	17.8	12
07/25/16	1.5	4	9.55	5.5	NONE	17.9	10
July Avg	**1.4**	**4**	**9.55**	**5.3**	**NONE**	**17.9**	**11**
08/05/16	1.6	4	9.10	6.0	NONE	17.7	9
08/24/16	1.5	4	9.40	6.0	NONE	NONE	9
Aug Avg	**1.6**	**4**	**9.25**	**6.0**	**NONE**	**17.7**	**9**
09/20/16	1.4	7	9.50	5.5	NONE	18.8	8
Sept Avg	**1.4**	**7**	**9.50**	**5.5**	**NONE**	**18.8**	**8**
Year Mean:	**1.4**	**5**	**9.31**	**5.3**	**6.95**	**18.0**	**10**
Maximum:	**1.6**	**7**	**9.90**	**6.0**	**6.95**	**18.8**	**12**
Minimum:	**1.3**	**4**	**8.10**	**4.0**	**6.95**	**17.5**	**8**
Stand Dev:	**0.11**	**1.19**	**0.54**	**0.6**	**NONE**	**0.42**	**1.69**
TSI:	**23**	**26**	**20**				

***Chla TSI not valid due to only 4 months of values.**

Table 22 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for West Musquash Lake in 2016. This lake can be accessed off of the Pleasant Lake Road, south of Rt. 6. The shores of this lake are primarily undeveloped, except for a few camps on the Eastern shores. Numerous public boat access only campsites are available on the west end of the lake with great sand beaches. This lake has beautiful clear and cold water. The outlet is located on the eastern end of the lake and eventually flows into Big Lake, including it in the St. Croix Watershed.

Bassett Pond, T4 ND Hancock County, Maine

Table 23, Bassett Pond 2016

2016 BASSETT POND (FISHLESS)			Site: BAS1				
Date	Chl-a(µg/L)	TP(µg/L)	Secchi(m)	Alka(mg/l CaCO3)	pH	Cond(UMHOS/CM)	Color (PCU)
05/12/16	NONE	7	7.95	2.5	6.24	7.5	3
05/26/16	<1.0	8	7.95	3.0	NONE	7.5	2
May Avg	**<1.0**	**8**	**7.95**	**2.8**	**6.24**	**7.5**	**3**
06/16/16	<1.0	6	7.20	2.0	NONE	7.7	3
06/29/16	<1.0	7	6.80	2.0	NONE	7.3	3
June Avg	**<1.0**	**7**	**7.00**	**2.0**	**NONE**	**7.5**	**3**
07/11/16	1.0	7	7.55	2.0	NONE	7.4	2
07/29/16	1.9	13	7.15	3.0	NONE	7.2	4
July Avg	**1.5**	**10**	**7.35**	**2.5**	**NONE**	**7.3**	**3**
08/11/16	3.0	8	4.85	2.0	NONE	7.4	3
Aug Avg	**3.0**	**8**	**4.85**	**2.0**	**NONE**	**7.4**	**3**
09/07/16	1.3	24	6.80	2.0	NONE	7.9	2
Sept Avg	**1.3**	**24**	**6.80**	**2.0**	**NONE**	**7.9**	**2**
Year Mean:	***1.5**	**11**	**6.79**	**2.3**	**6.24**	**7.5**	**3**
Maximum:	**3.0**	**24**	**7.95**	**3.0**	**6.24**	**7.9**	**4**
Minimum:	**<1.0**	**6**	**4.85**	**2.0**	**6.24**	**7.2**	**2**
Stand Dev:	**NONE**	**6.05**	**0.99**	**0.5**	**NONE**	**0.22**	**0.71**
TSI:	**NONE**	**45**	**33**				
***Chl-a year mean approximate due to values under reporting limits.**							
All Secchi's hit bottom other than 8/11/16 so Secchi values are should be higher.							

Table 23 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color; mean, max, min, standard deviations, and TSI values for Bassett Pond in 2016. Bassett Pond is an 18 acre pond located about ¼ miles to the northwest of Side Pistol Lake. Bassett has been rumored by Tribal members to be fishless, so we decided to collect some water quality data on it. We have yet to see any fish in it, but it does support an amphibian population and an abundant aquatic insect population (pointing to fishless). The water is a beautiful blue-green color and incredibly clear, being able to easily see the bottom at its deepest point from 7-8 meters. Most months there is very little zooplankton to be seen in the water column. The bottom is boulder strewn with aquatic plants. The shoreline around the lake supports all acid loving trees and shrubs. The outlet stream does not seem to flow year round, and empties into the northwest corner of Side Pistol Lake. There are no camps or structures on the lake; it is accessed by an overgrown road off of

the Pistol Lake Road. The water chemistry of this Pond is an extreme outlier in all the parameters we measure other than total phosphorus. Sampling was first done in earnest in 2013. More studies should be done on this waterbody to determine the cause.

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