Water Quality Assessment Report 2012

Joe Musante
Water Resources Program
Environmental Department
Indian Township Tribal Government

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

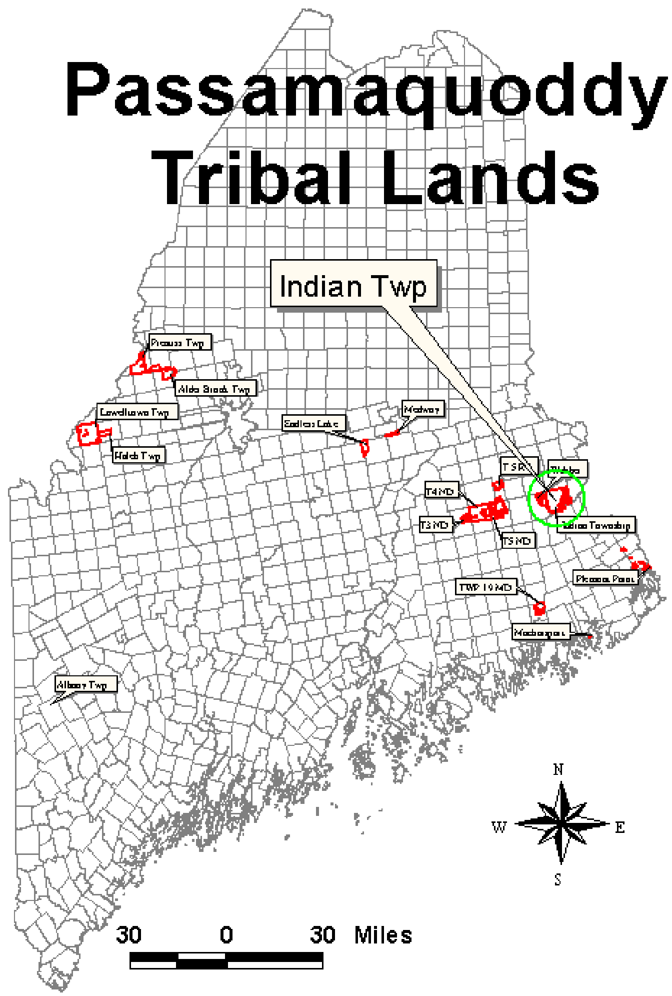


Figure 1: Location of Indian Township, Maine.

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 few 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.

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 2012 we decided to just try to keep up with the ambitious goals we set in 2011: bimonthly sampling of the same 18 regional lakes as 2011 and occasional sampling of the 3 Jackman area ponds.

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** (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 4 (Duncan, Hall, Mary Petuche, and Side Pistol) 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 June. 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.

The 2012 water quality field season started on May 1st with the sampling of Junior Lake. The following is the month to month breakdown of the field season in terms of sampling success and issues.

- May is typically an erratic weather month, however in 2012 we were able to collect samples from all sites, 36/36 (100%), with no equipment issues.
- The good weather continued into June for the most part with 35/39 (90%) sampled, including the Jackman ponds. The lost sites were due to a storm system at the end of the month combined with sampling the Jackman Ponds. We had one equipment issue of a faulty pH probe and lost about two weeks of pH data at the end of June into July.

- July started with numerous issues cropping up as we dropped sampling success down significantly from May and June: 26/36 (72%). The first half of the month included all sorts of issues: faulty pH probe, DO meter issues, and of all things US postal sample delivery issues to our testing lab in Augusta. Due to post office reorganization in northern Maine samples can no longer be mailed overnight from our location. What Chl-a and TP samples we were able to collect in the first half of July expired in the mail system and we decided to not have them tested. The second half of July had all samples taken successfully. We have had to change over to sending out lab samples through UPS at a significantly higher cost.
- August was by far our least successful month in sampling success 16/36 (44%) due primarily to a long stretch of bad weather in the second half of the month. We missed sampling Junior and Scraggly lake altogether in August, and were unable to sample any lakes in the second half of the month.
- September we had things turn around, with 36/39 (92%) sampling success. The 3 missed sites were a combination of weather issues and sampling in Jackman. There were no equipment issues in September, but we did have some staffing issues as our summer field assistant moved on at the end of August.

The last samples of the season were taken from the Jackman ponds on October 3rd, 2012. This ended the field portion of another successful season. This year we collected less data than we hoped to collect, 149/186 (80%) sites were successfully sampled, with 37 sites lost to bad weather/equipment issues or were skipped in order to sample the Jackman ponds. While I would prefer sampling upwards of 90% of sites in a season, considering the ambitious schedule, 80% is acceptable. To put it into perspective, just two years ago our sampling schedule consisted of 105 sampling sites per season compared to 180+ now.

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:** 141/186 (76%) We lost about 2 weeks of our ProDO YSI meter use in July. The cause of the issue has now been resolved, and we also plan to purchase a second unit to be used for backup in case of future issues. 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:** 140/186 (75%) In addition to the 37 missed sites, we lost an additional 8 Chl-a samples due to US postal service delivery issues to our lab. Due to cutbacks at the USPS, northern Maine's mail routing system has been changed and no longer delivers mail from our area to Augusta, ME over night. In order to correct this problem we were forced to use UPS for our lab sample shipping. One single sample from the lab came back as a non-detect, which we dropped assuming an error on one end or the other. Chla readings ranged from a low of 1.1ppb to a high of 5.6ppb.
- **Transparency/Secchi:** 149/186 (80%) No additional Secchi readings were lost. Secchi depth ranged from 3.15m in the shallowest to 12.15m at the deepest. No problems to report.

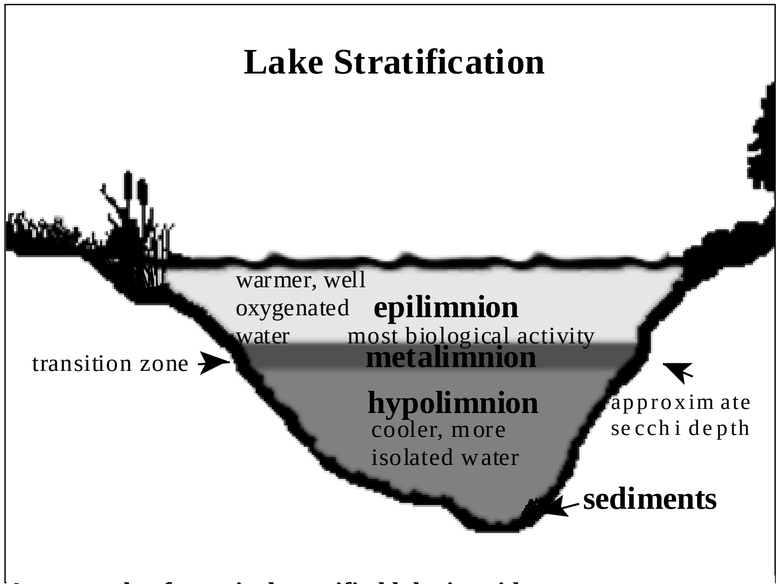
- **Total Phosphorus:** 141/186 (76%) The only additional TP samples that were lost were due to the USPS issue in July. Our TP range for 2012 was a low of 2ppb with a high of 13ppb.
- **pH:** 133/186 (72%) The only additional pH readings that were lost were at the end of June into July due to a faulty probe. The probe was under warranty and replaced. We'll also be purchasing a backup meter and probe this Spring for next year. This probe and meter has given us very reliable pH data. In addition of taking our standard integrated core pH reading, we also took surface pH readings this year. That data is not presented here but will be used in the future for a comparison. Our pH low for the season was 6.42 and a high of 7.19.
- **Alkalinity:** 149/186 (80%) No additional samples were lost. No problems to report. Our low alkalinity reading for the season was 4.0 mg/l of CaCO3 with a high of 10.0 mg/l of CaCO3.
- **Conductivity:** 148/186 (80%) Only 1 additional sample was lost due to a sampling error. No problems to report. In addition of taking our standard integrated core conductivity reading, we also took surface conductivity readings this year. That data is not presented here but will be used in the future for a comparison. Our low conductivity reading for 2012 was 12.2 UMHOS/cm with a high of 22.3 UMHOS/cm.
- **Color:** 149/186 (80%) No additional color samples were lost in 2012. We did have a few samples go over holding time from the Jackman ponds. Holding time is only 48 hours and these lakes are a day of travel from the office. In order to sample these ponds for the other parameters it is possible that we may have to sacrifice the color data from time to time. Other than this issue there were no problems to report.

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



An example of a typical stratified lake in midsummer.

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.

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

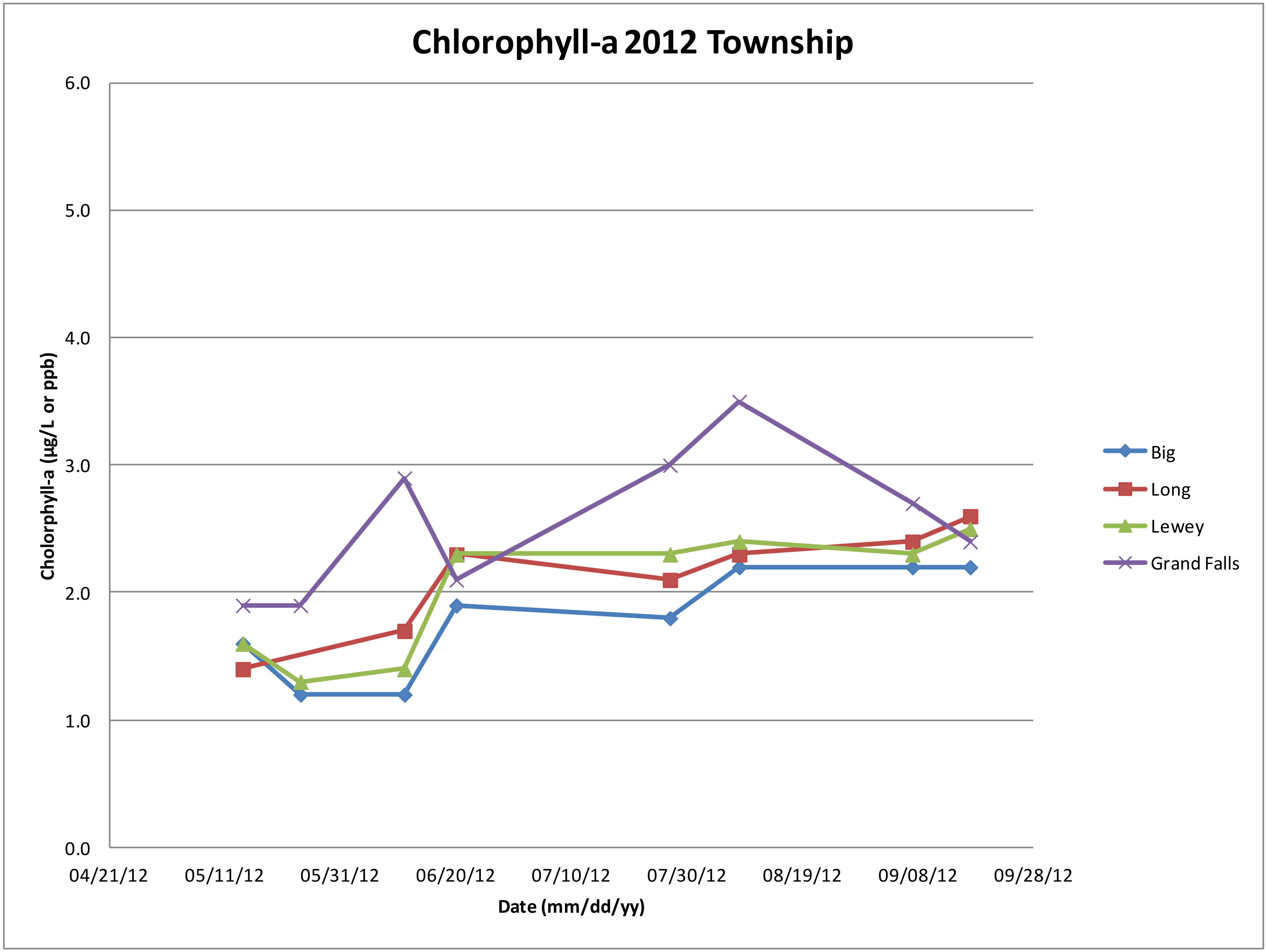
A simplified index of biological productivity in lakes, the Trophic State Index (TSI) was developed in 1977 by Robert Carlson as a means to be used for establishing a simple numerical scale for each of the three indicators of lake water quality that are commonly used to measure (directly or indirectly) 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.

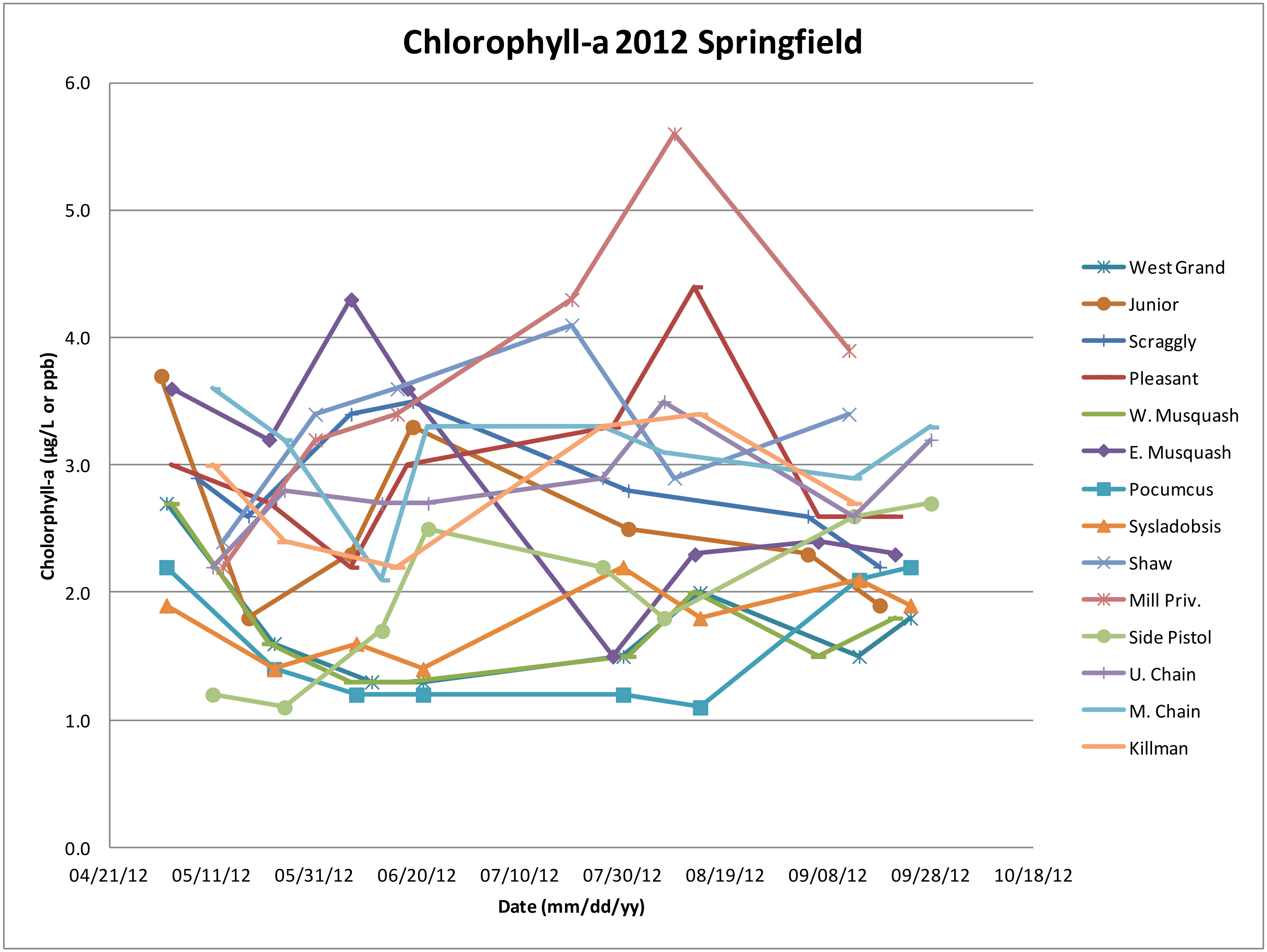
Chlorophyll-a

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-a concentrations found for our sample sites this year. The Chl-a results have been broken down into two general groups of lakes: the 4 Township lakes and the 14 Springfield area Trust Land lakes and ponds. These graphs are simple scatter plots of Chl-a concentrations found for each sampling event from May through September 2012. 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.



Chlorophyll-a 2012 Township
Cholorphyll-a (µg/L or ppb)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls



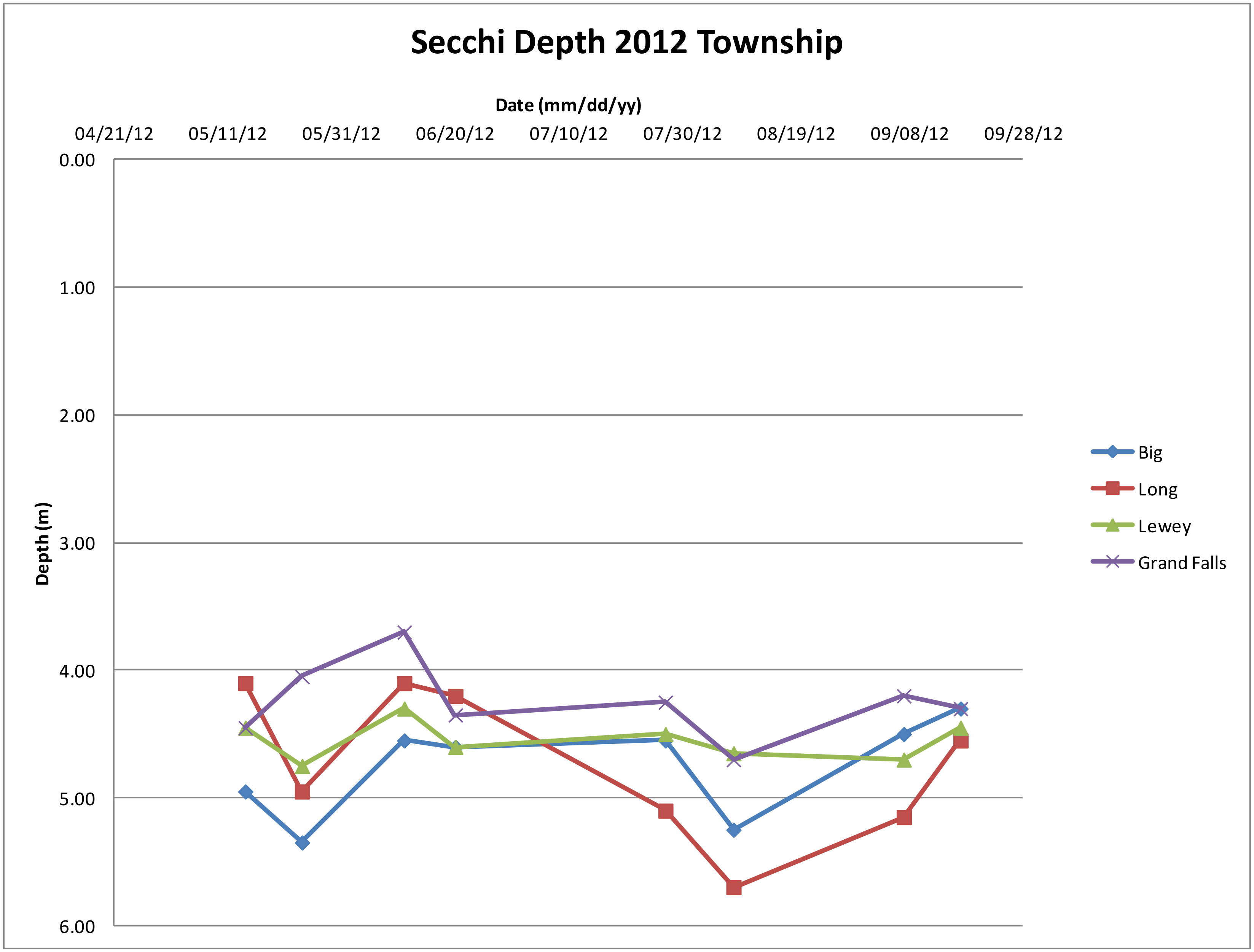
Chlorophyll-a 2012 Springfield
Cholorophyll-a (µg/L or ppb)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
10/18/12
Date (mm/dd/yy)
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Side Pistol
U. Chain
M. Chain
Killman

Transparency

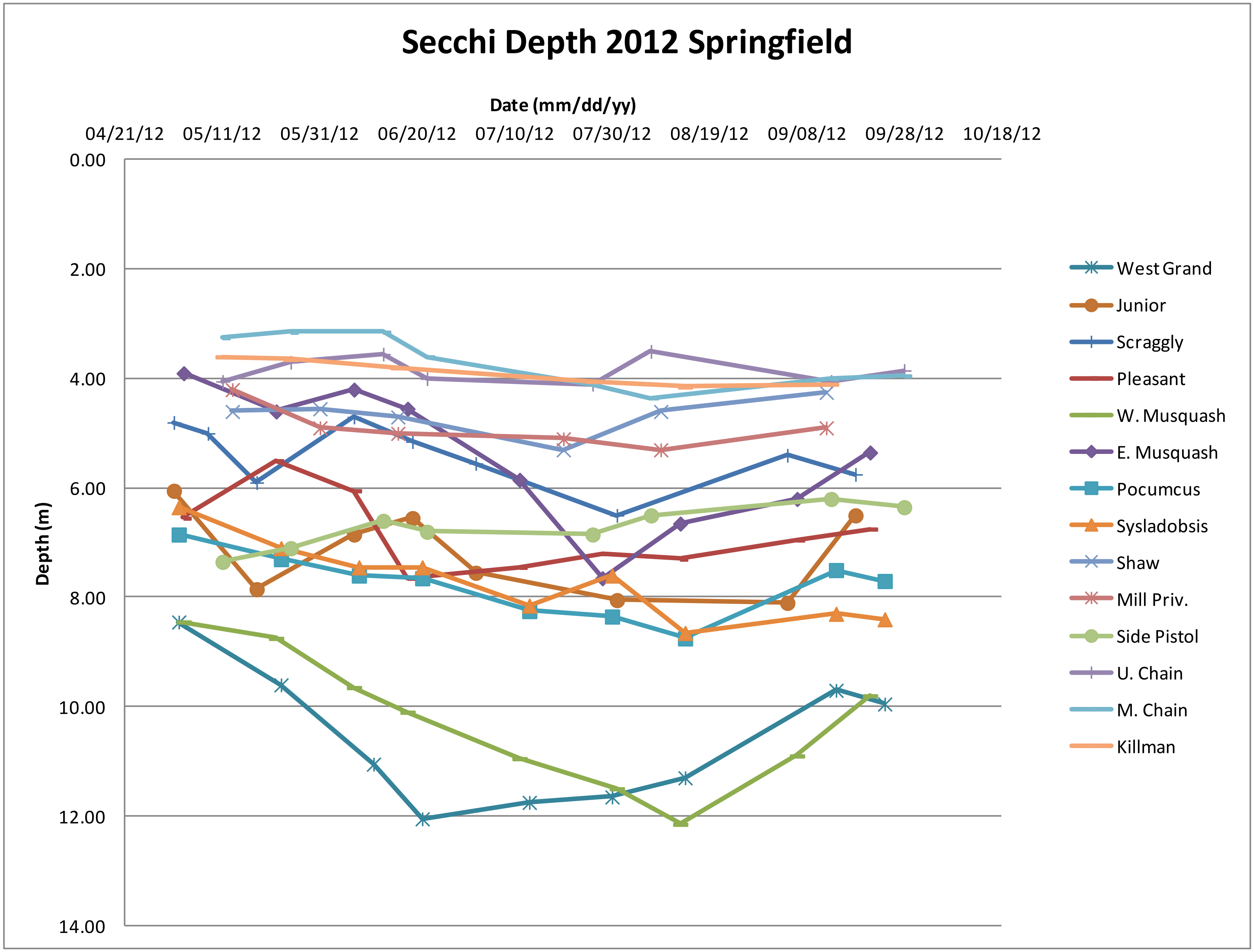
A measure of water clarity; the distance one can see down into the water column. Factors that affect transparency include algal growth, zooplankton, natural water color, and suspended silt particles. Because algae are the most abundant particles in most lakes, transparency indirectly measures algal growth. 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 14 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 2012. 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 2012 Township
Date (mm/dd/yy)
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Depth (m)
Big
Long
Lewey
Grand Falls

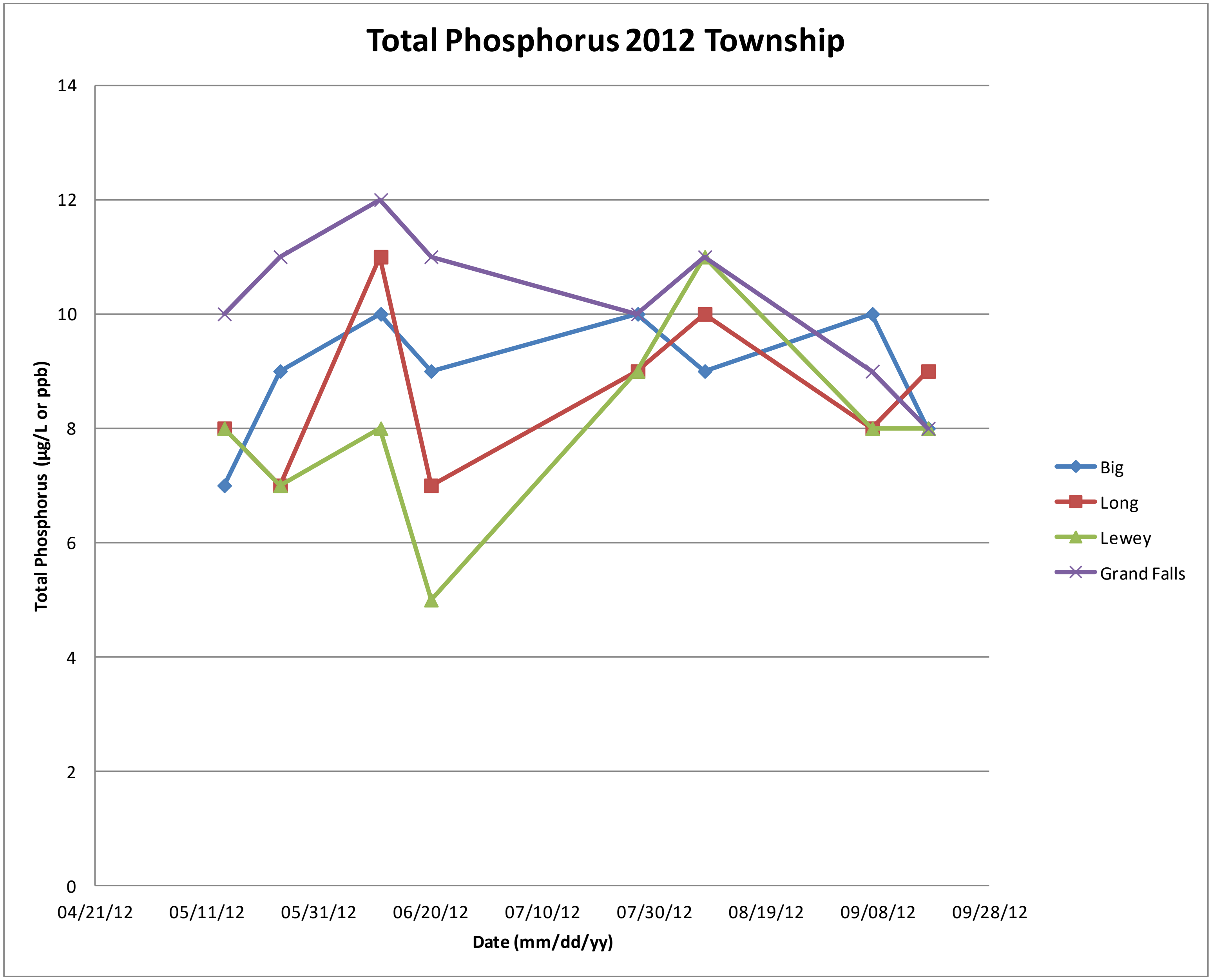

Secchi Depth 2012 Springfield
Date (mm/dd/yy)
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
10/18/12
Depth (m)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Side Pistol
U. Chain
M. Chain
Killman

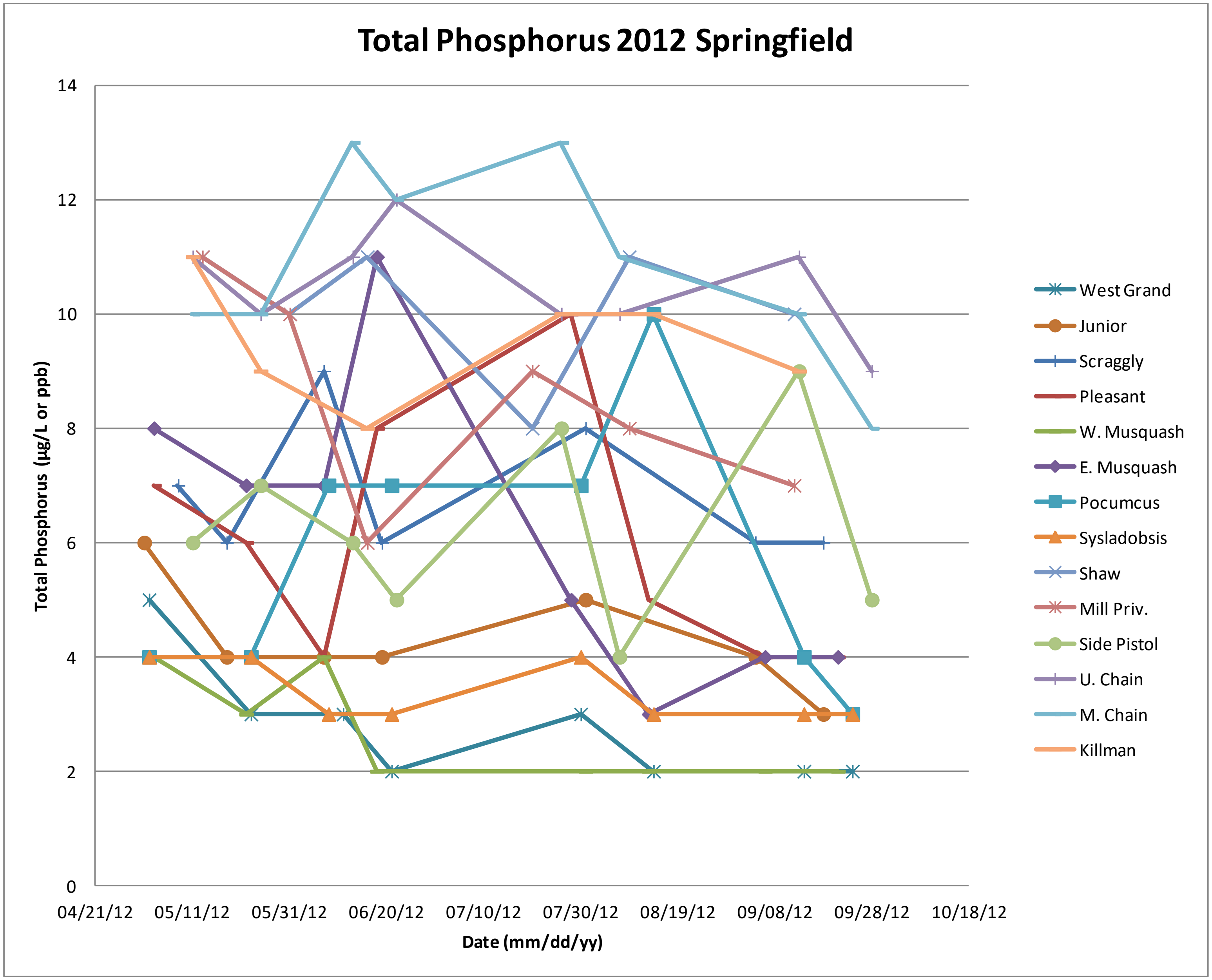
Total Phosphorous

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 general groups of lakes: the 4 Township lakes and the 14 Springfield area Trust Land lakes and ponds. These graphs are simple scatter plots of TP values found for each sampling event from May through September 2012. 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.

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


Total Phosphorus 2012 Township
Total Phosphorus (µg/L or ppb)
14
12
10
8
6
4
2
0
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls

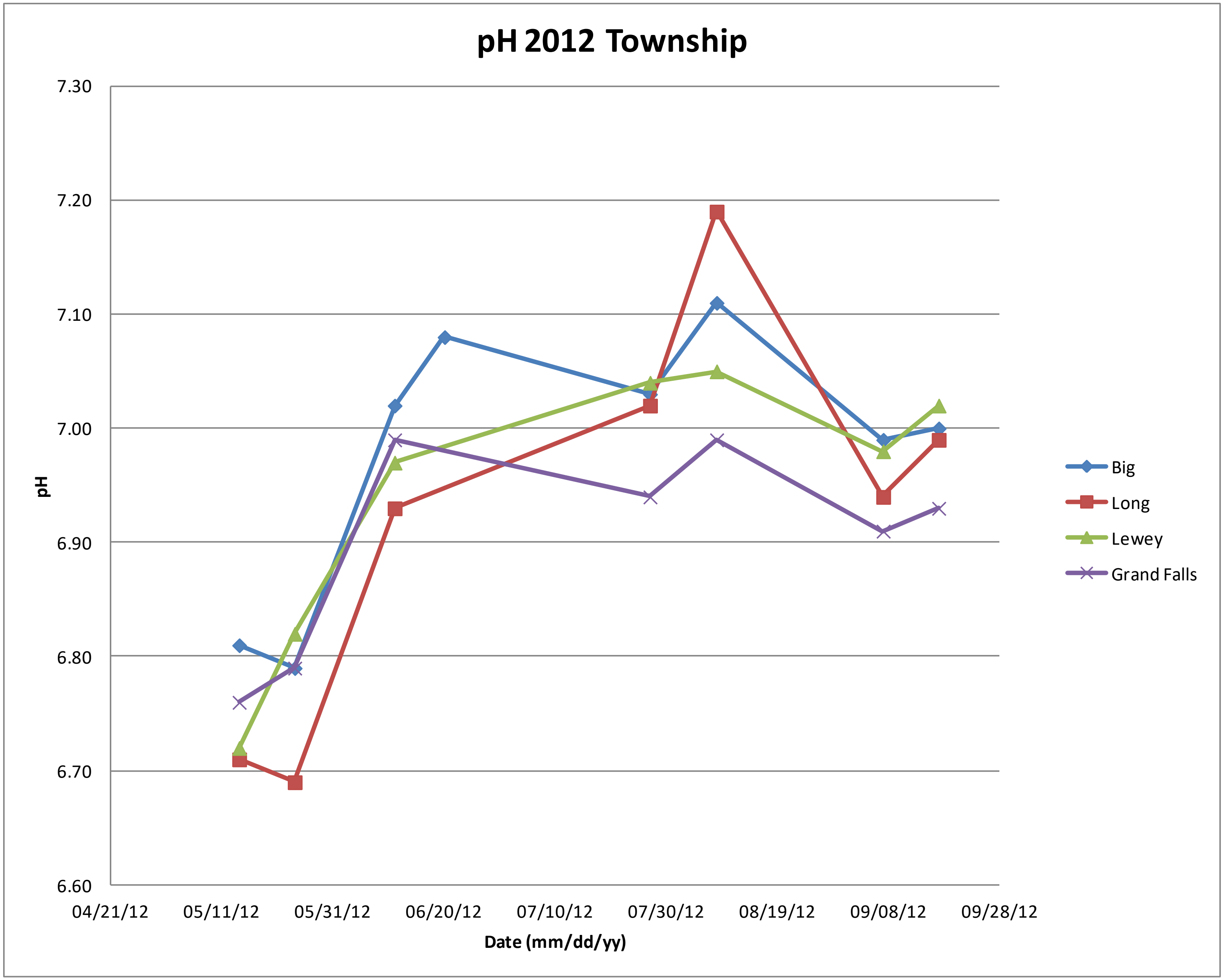

Total Phosphorus 2012 Springfield
Total Phosphorus (µg/L or ppb)
14
12
10
8
6
4
2
0
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
10/18/12
Date (mm/dd/yy)
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Side Pistol
U. Chain
M. Chain
Killman

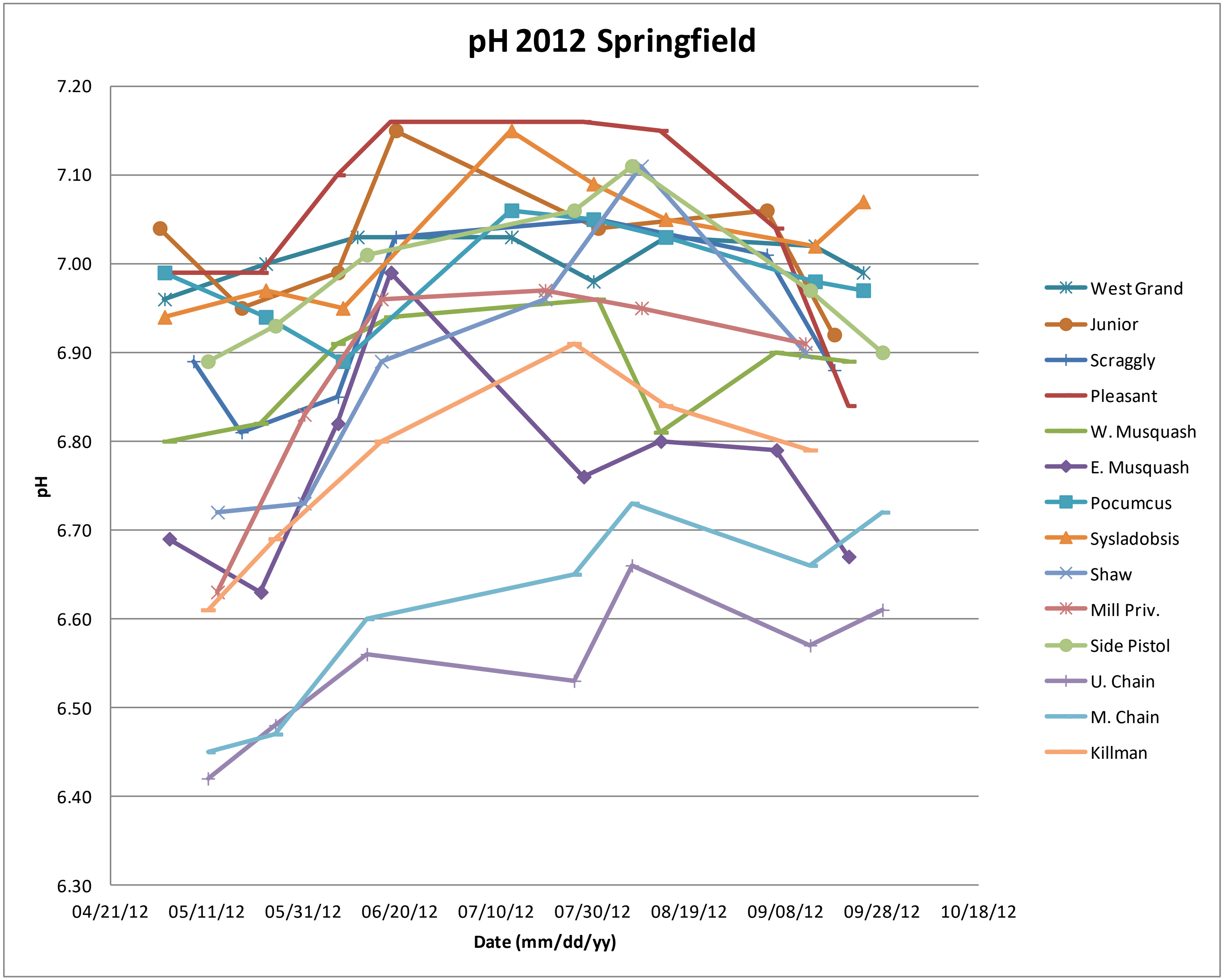
pH

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).

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

Below are two graphics displaying pH values found for our sample sites this year. The pH results have been broken down into two general groups of lakes: the 4 Township lakes and the 14 Springfield area Trust Land lakes and ponds. These graphs are simple scatter plots of pH values found for each sampling event from May through September 2012. 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.


pH 2012 Township
7.30
7.20
7.10
7.00
6.90
6.80
6.70
6.60
pH
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls

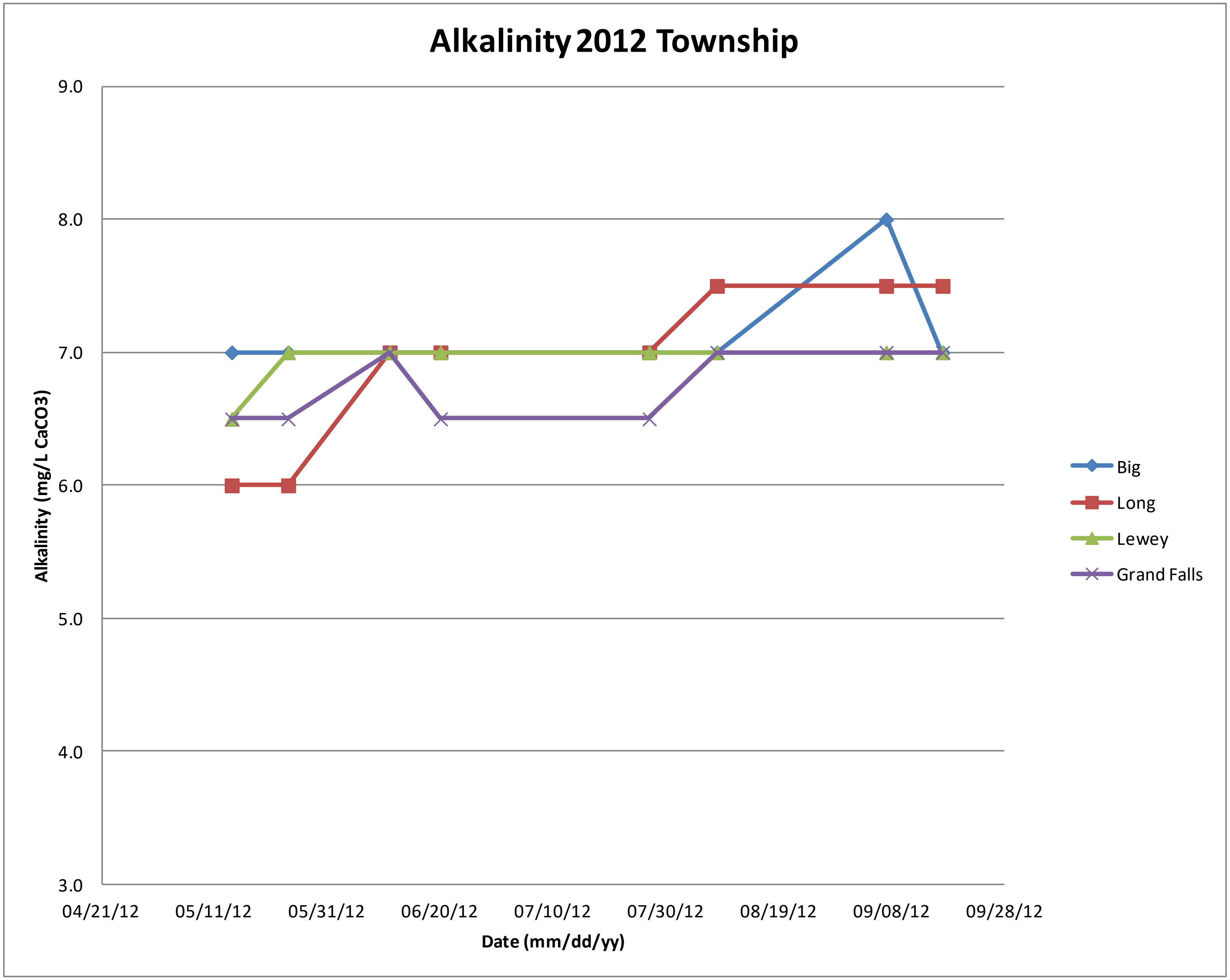

pH 2012 Springfield
7.20
7.10
7.00
6.90
6.80
6.70
6.60
6.50
6.40
6.30
pH
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
10/18/12
Date (mm/dd/yy)
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Side Pistol
U. Chain
M. Chain
Killman

Alkalinity

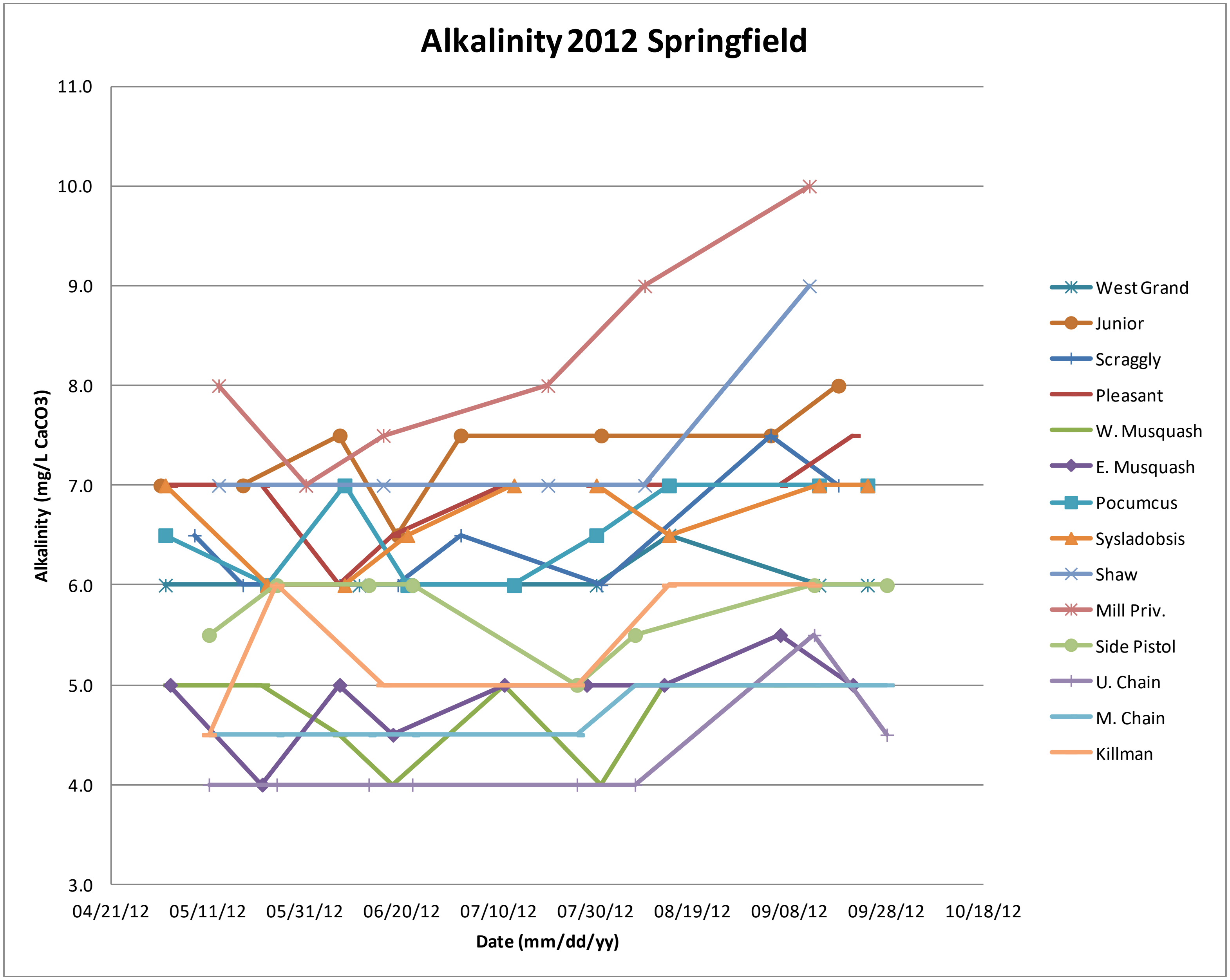
A measure of the capacity of water to neutralize acids, or buffer against changes in pH, alkalinity is also referred to as "buffering capacity." It is a measure primarily of naturally available bicarbonate, carbonate, and hydroxide ions in the water. Alkalinity is measured in milligrams per liter (mg/l) (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 14 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 2012. 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.

This beaver bit off more than it could chew. Photo courtesy of Haleigh White.



Alkalinity 2012 Township
9.0
8.0
7.0
6.0
5.0
4.0
3.0
Alkalinity (mg/L CaCO3)
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls



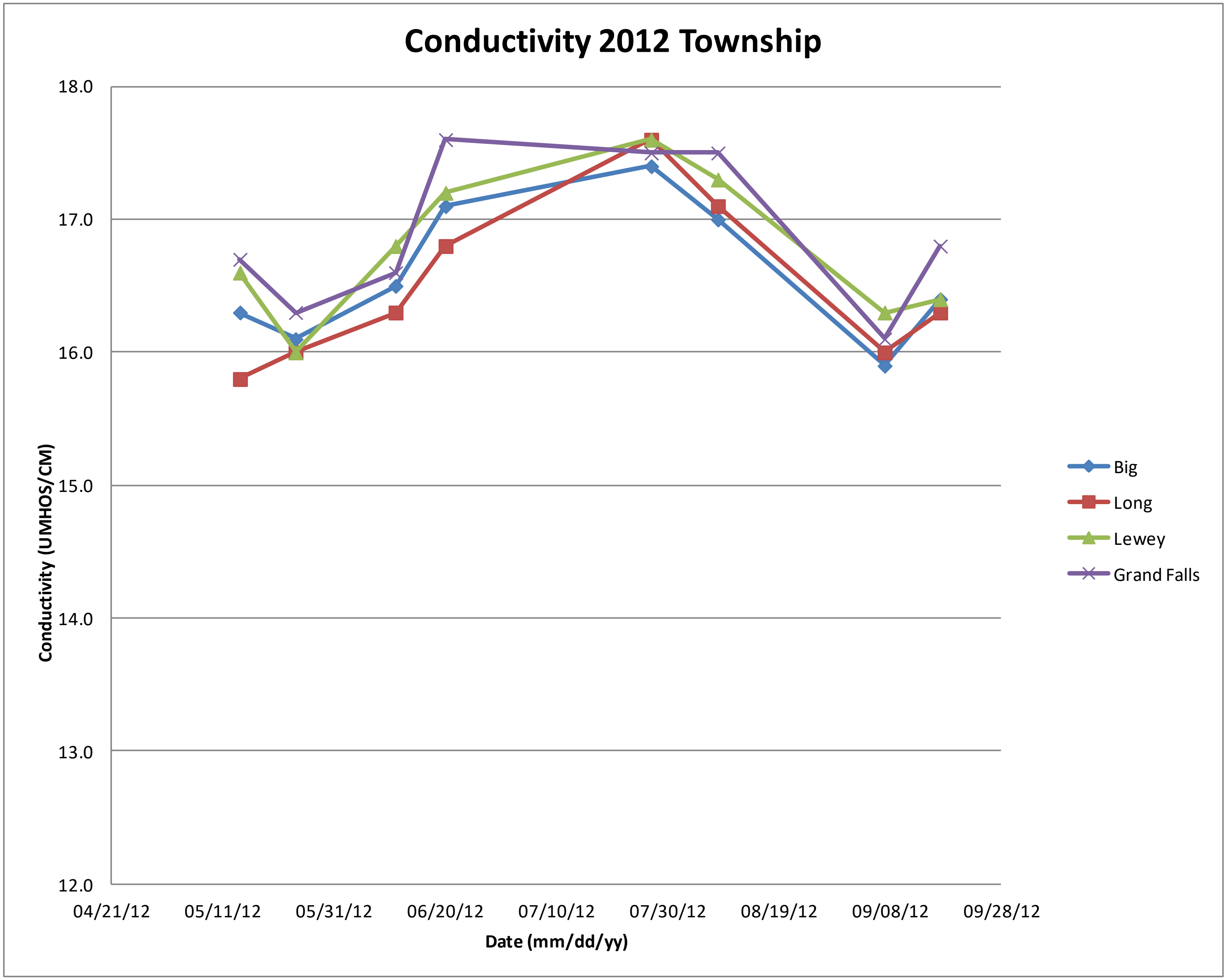
Alkalinity 2012 Springfield
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
Alkalinity (mg/L CaCO3)
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
10/18/12
Date (mm/dd/yy)
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Side Pistol
U. Chain
M. Chain
Killman

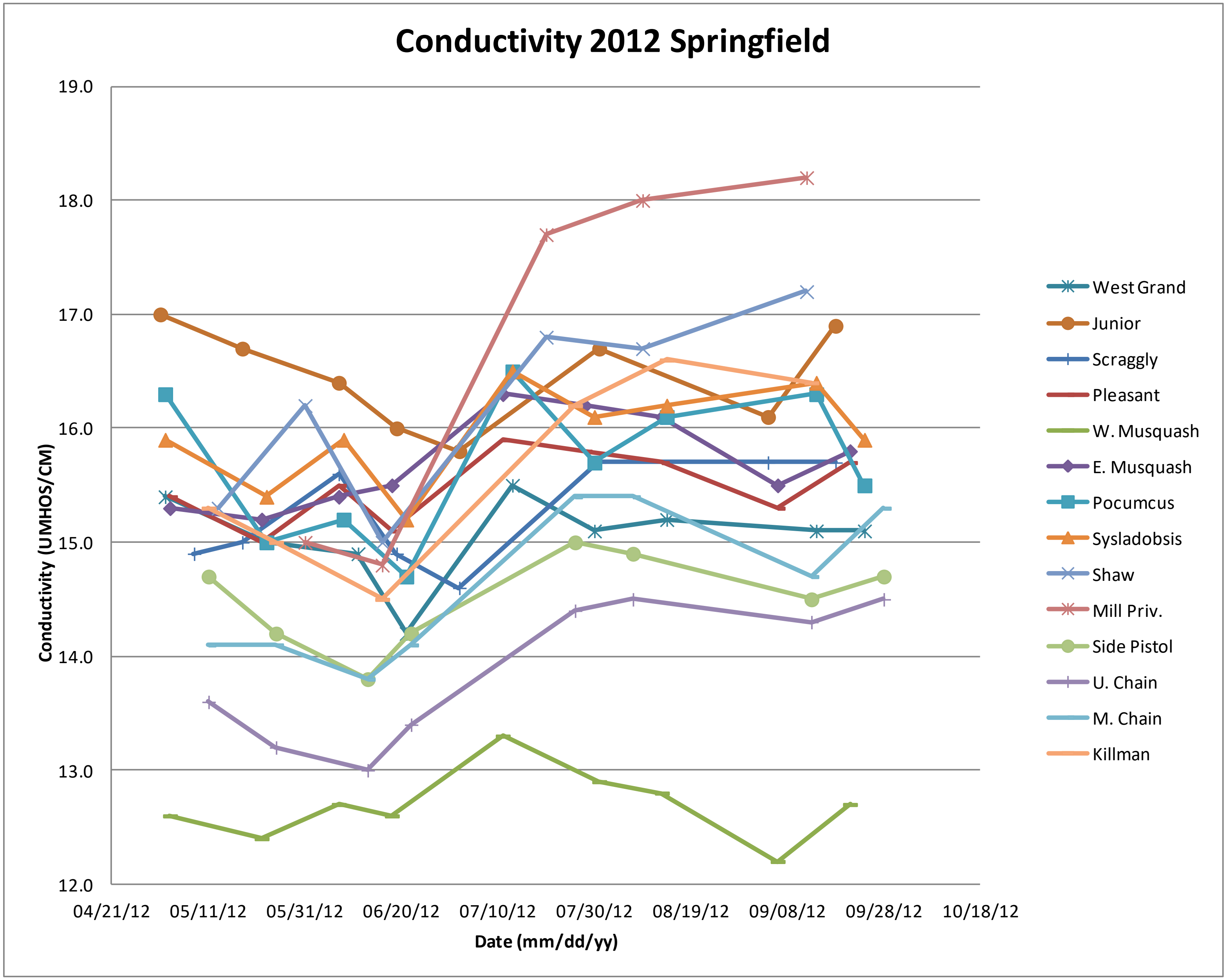
Specific Conductance

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 14 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 2012. 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.

Combine water and gravity and you can get something amazing, like this Australian waterfall. Photo courtesy of Erica Famous


Conductivity 2012 Township
18.0
17.0
16.0
15.0
14.0
13.0
12.0
Conductivity (UMHOS/CM)
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls



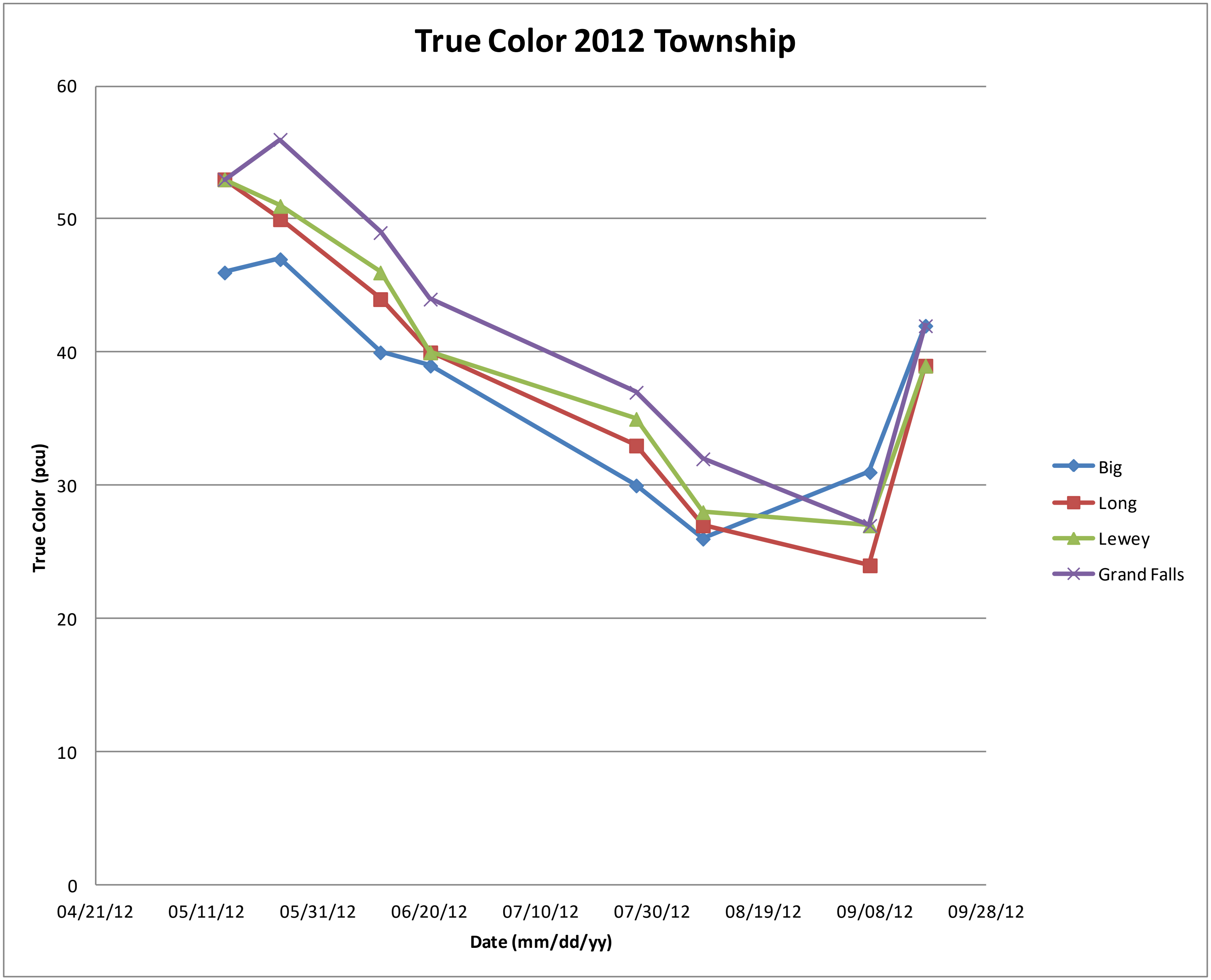
Conductivity 2012 Springfield
Conductivity (UMHOS/CM)
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
10/18/12
Date (mm/dd/yy)
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Side Pistol
U. Chain
M. Chain
Killman

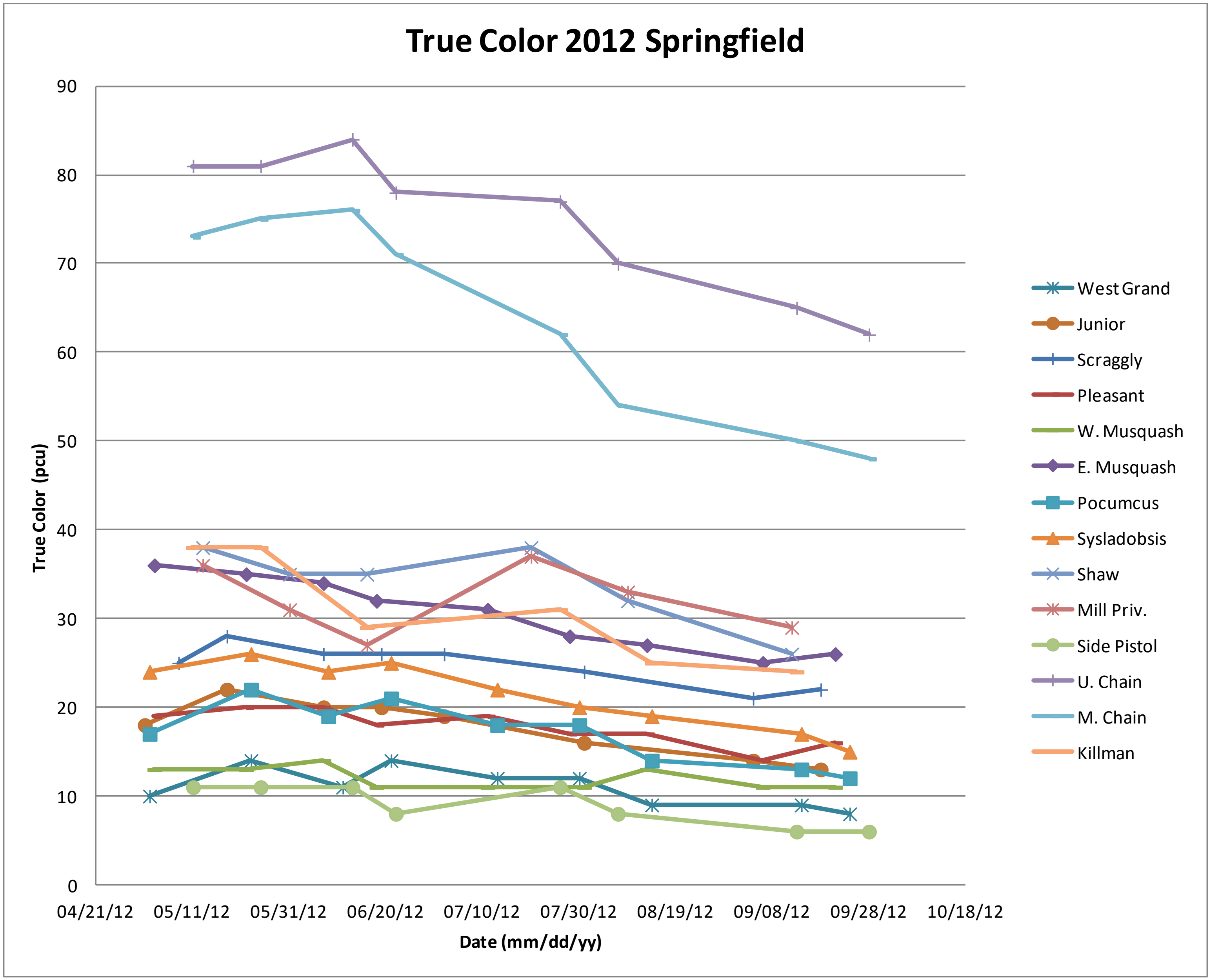
Color

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 14 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 2012. 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 2012 Township
60
50
40
30
20
10
0
True Color (pcu)
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
Date (mm/dd/yy)
Big
Long
Lewey
Grand Falls


True Color 2012 Springfield
True Color (pcu)
0
10
20
30
40
50
60
70
80
90
04/21/12
05/11/12
05/31/12
06/20/12
07/10/12
07/30/12
08/19/12
09/08/12
09/28/12
10/18/12
Date (mm/dd/yy)
West Grand
Junior
Scraggly
Pleasant
W. Musquash
E. Musquash
Pocumcus
Sysladobsis
Shaw
Mill Priv.
Side Pistol
U. Chain
M. Chain
Killman

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, and West Grand Lake.** 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 readings during the summer of 2010.

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
Big	Big	Big	Big	Big (2)	No	Big	Big	Big
Long	Long	Long	Long	Long	sampling	Long	Long	Long
Lewey	Lewey	Lewey	Lewey	Lewey	done	Lewey	Lewey	Lewey
Grand Falls	Grand Falls	Grand Falls	Grand Falls	Grand Falls (2)	these	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
	*Upper Chain	Upper Chain	Upper Chain	Upper Chain		*Upper Chain	Upper Chain	Upper Chain
		Duncan	Duncan	Duncan		*Duncan	Duncan	*Duncan
		Junior	Junior	Junior			Junior	Junior
		Killman	Killman	Killman		*Killman	Killman	Killman
		Mill Privilege	Mill Privilege	Mill Privilege			Mill Privilege	Mill Privilege
		Pocumcus	Pocumcus	Pocumcus			Pocumcus	Pocumcus
		Scraggly	Scraggly	Scraggly			Scraggly	Scraggly
		Shaw	Shaw	Shaw			Shaw	Shaw
		Sysladobsis	Sysladobsis	Sysladobsis			Sysladobsis	Sysladobsis
				Mary Petuche		*Mary Petuche	Mary Petuche	*Mary Petuche
						*Hall	Hall	*Hall
				East Grand			Middle Chain	Middle Chain
								West Grand
								Pleasant
								East Musquash
								West Musquash

*Only sampled once or twice this year

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 48 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 2012 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 2012 season. A historic comparison will be illustrated in a future report in the Spring of 2013.

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 2012.

2012 Big Lake			Site: BIG2				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/14/12	1.6	7	4.95	7.0	6.81	16.3	46
05/24/12	1.2	9	5.35	7.0	6.79	16.1	47
May Avg	**1.4**	**8**	**5.15**	**7.0**	**6.80**	**16.2**	**47**
06/11/12	1.2	10	4.55	7.0	7.02	16.5	40
06/20/12	1.9	9	4.60	7.0	7.08	17.1	39
June Avg	**1.6**	**10**	**4.58**	**7.0**	**7.05**	**16.8**	**40**
07/27/12	1.8	10	4.55	7.0	7.03	17.4	30
July Avg	**1.8**	**10**	**4.55**	**7.0**	**7.03**	**17.4**	**30**
08/08/12	2.2	9	5.25	7.0	7.11	17.0	26
Aug Avg	**2.2**	**9**	**5.25**	**7.0**	**7.11**	**17.0**	**26**
09/07/12	2.2	10	4.50	8.0	6.99	15.9	31
09/17/12	2.2	8	4.30	7.0	7.00	16.4	42
Sept Avg	**2.2**	**9**	**4.40**	**7.5**	**7.00**	**16.2**	**37**
Year Mean:	**1.8**	**9**	**4.79**	**7.1**	**7.00**	**16.7**	**36**
Maximum:	**2.2**	**10**	**5.25**	**7.5**	**7.11**	**17.4**	**47**
Minimum:	**1.4**	**8**	**4.40**	**7.0**	**6.80**	**16.2**	**26**
Stand Dev:	**0.37**	**0.74**	**0.39**	**0.22**	**0.12**	**0.53**	**8.04**
TSI:	***28**	**40**	**51**				
***Only valid TSI value due to Color Year Mean > 25 PCU.**							

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 2012. 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 2012.

2012 Long Lake			Site: LNG2				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/14/12	1.4	8	4.10	6.0	6.71	15.8	53
05/24/12	NONE	7	4.95	6.0	6.69	16.0	50
May Avg	**1.4**	**8**	**4.53**	**6.0**	**6.70**	**15.9**	**52**
06/11/12	1.7	11	4.10	7.0	6.93	16.3	44
06/20/12	2.3	7	4.20	7.0	NONE	16.8	40
June Avg	**2.0**	**9**	**4.15**	**7.0**	**6.93**	**16.6**	**42**
07/27/12	2.1	9	5.10	7.0	7.02	17.6	33
July Avg	**2.1**	**9**	**5.10**	**7.0**	**7.02**	**17.6**	**33**
08/08/12	2.3	10	5.70	7.5	7.19	17.1	27
Aug Avg	**2.3**	**10**	**5.70**	**7.5**	**7.19**	**17.1**	**27**
09/07/12	2.4	8	5.15	7.5	6.94	16.0	24
09/17/12	2.6	9	4.55	7.5	6.99	16.3	39
Sept Avg	**2.5**	**9**	**4.85**	**7.5**	**6.97**	**16.2**	**32**
Year Mean:	**2.1**	**9**	**4.87**	**7.0**	**6.96**	**16.7**	**37**
Maximum:	**2.5**	**10**	**5.70**	**7.5**	**7.19**	**17.6**	**52**
Minimum:	**1.4**	**8**	**4.15**	**6.0**	**6.70**	**15.9**	**27**
Stand Dev:	**0.42**	**0.91**	**0.59**	**0.61**	**0.18**	**0.69**	**9.77**
TSI:	***31**	**40**	**50**				
***Only valid TSI value due to Color Year Mean > 25 PCU.**							

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 2012. 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 2012.

2012 Lewey Lake			Site: LWY1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/14/12	1.6	8	4.45	6.5	6.72	16.6	53
05/24/12	1.3	7	4.75	7.0	6.82	16.0	51
May Avg	**1.5**	**8**	**4.60**	**6.8**	**6.77**	**16.3**	**52**
06/11/12	1.4	8	4.30	7.0	6.97	16.8	46
06/20/12	2.3	5	4.60	7.0	NONE	17.2	40
June Avg	**1.9**	**7**	**4.45**	**7.0**	**6.97**	**17.0**	**43**
07/27/12	2.3	9	4.50	7.0	7.04	17.6	35
July Avg	**2.3**	**9**	**4.50**	**7.0**	**7.04**	**17.6**	**35**
08/08/12	2.4	11	4.65	7.0	7.05	17.3	28
Aug Avg	**2.4**	**11**	**4.65**	**7.0**	**7.05**	**17.3**	**28**
09/07/12	2.3	8	4.70	7.0	6.98	16.3	27
09/17/12	2.5	8	4.45	7.0	7.02	16.4	39
Sept Avg	**2.4**	**8**	**4.58**	**7.0**	**7.00**	**16.4**	**33**
Year Mean:	**2.1**	**8**	**4.56**	**7.0**	**6.97**	**16.9**	**38**
Maximum:	**2.4**	**11**	**4.65**	**7.0**	**7.05**	**17.6**	**52**
Minimum:	**1.5**	**7**	**4.45**	**6.8**	**6.77**	**16.3**	**28**
Stand Dev:	**0.42**	**1.71**	**0.08**	**0.11**	**0.11**	**0.57**	**9.42**
TSI:	***31**	**37**	**53**				
	***Only valid TSI value due to Color Year Mean > 25 PCU.**						

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 2012. 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 2012.

2012 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)
05/14/12	1.9	10	4.45	6.5	6.76	16.7	53
05/24/12	1.9	11	4.05	6.5	6.79	16.3	56
May Avg	**1.9**	**11**	**4.25**	**6.5**	**6.78**	**16.5**	**55**
06/11/12	2.9	12	3.70	7.0	6.99	16.6	49
06/20/12	2.1	11	4.35	6.5	NONE	17.6	44
June Avg	**2.5**	**12**	**4.03**	**6.8**	**6.99**	**17.1**	**47**
07/27/12	3.0	10	4.25	6.5	6.94	17.5	37
July Avg	**3.0**	**10**	**4.25**	**6.5**	**6.94**	**17.5**	**37**
08/08/12	3.5	11	4.70	7.0	6.99	17.5	32
Aug Avg	**3.5**	**11**	**4.70**	**7.0**	**6.99**	**17.5**	**32**
09/07/12	2.7	9	4.20	7.0	6.91	16.1	27
09/17/12	2.4	8	4.30	7.0	6.93	16.8	42
Sept Avg	**2.6**	**9**	**4.25**	**7.0**	**6.92**	**16.5**	**35**
Year Mean:	**2.7**	**10**	**4.30**	**6.8**	**6.92**	**17.0**	**41**
Maximum:	**3.5**	**12**	**4.70**	**7.0**	**6.99**	**17.5**	**55**
Minimum:	**1.9**	**9**	**4.03**	**6.5**	**6.78**	**16.5**	**32**
Stand Dev:	**0.60**	**1.15**	**0.25**	**0.25**	**0.09**	**0.52**	**9.38**
TSI:	***37**	**42**	**56**				
***Only valid TSI value due to Color Year Mean > 25 PCU.**							

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 2012. 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 2012

2012 Duncan Pond			Site: DUN1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
10/03/12	4.2	6	4.65	10.00	7.14	17.4	*20

Table 6 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color for Duncan Pond in 2012. Duncan was sampled only once in early October in order to focus more on water bodies closer to Indian Township. The color sample was tested out of its holding time. 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 for 8 years. Some of these years however have only been partial. Having 10 years of data is suggested in order to generate any statistically significant trends. 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 2012

2012 Hall Pond			Site: HLL1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
06/28/12	2.4	11	4.50	9.00	NONE	16.3	48
10/03/12	2.4	12	4.80	10.00	6.98	20.0	*32
Year Mean:	**2.4**	**12**	**4.65**	**9.50**	**6.98**	**18.2**	**40**

Table 7 shows this year's Chl-*a*, TP, Secchi, Alkalinity, pH, Conductivity, and True Color for Hall Pond in 2011. Hall was sampled twice in 2012 in late June and early October, in order to focus more on water bodies closer to Indian Township. 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 for 5 seasons. This pond is heavily stratified once summer arrives. Much more sampling is needed before any trend data can be calculated.

Junior Lake, Penobscot County, Maine

Table 8, Junior Lake 2012.

2012 Junior Lake			Site: JNR1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/01/12	3.7	6	6.05	7.0	7.04	17.0	18
05/18/12	1.8	4	7.85	7.0	6.95	16.7	22
May Avg	**2.8**	**5**	**6.95**	**7.0**	**7.00**	**16.9**	**20**
06/07/12	2.3	4	6.85	7.5	6.99	16.4	20
06/19/12	3.3	4	6.55	6.5	7.15	16.0	20
June Avg	**2.8**	**4**	**6.70**	**7.0**	**7.07**	**16.2**	**20**
07/02/12	NONE	NONE	7.55	7.5	NONE	15.8	19
07/31/12	2.5	5	8.05	7.5	7.04	16.7	16
July Avg	**2.5**	**5**	**7.80**	**7.5**	**7.04**	**16.3**	**18**
09/04/12	2.3	4	8.10	7.5	7.06	16.1	14
09/18/12	1.9	3	6.50	8.0	6.92	16.9	13
Sept Avg	**2.1**	**4**	**7.30**	**7.8**	**6.99**	**16.5**	**14**
Year Mean:	**2.5**	**4**	**7.19**	**7.3**	**7.02**	**16.5**	**18**
Maximum:	**2.8**	**5**	**7.80**	**7.8**	**7.07**	**16.9**	**20**
Minimum:	**2.1**	**4**	**6.70**	**7.0**	**6.99**	**16.2**	**14**
Stand Dev:	**0.32**	**0.75**	**0.48**	**0.38**	**0.04**	**0.30**	**3.07**
TSI:	**35**	**21**	**31**				
All TSI Values Invalid due to only 4 months of samples.							

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 2012. 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 now for 8 seasons.

Killman Pond, Hancock County, Maine

Table 9, Killman Pond 2012

2012 Killman Pond			Site: KLL1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/11/12	3.0	11	3.60	4.5	6.61	15.3	38
05/25/12	2.4	9	3.65	6.0	6.69	15.0	38
May Avg	**2.7**	**10**	**3.63**	**5.3**	**6.65**	**15.2**	**38**
06/16/12	2.2	8	3.80	5.0	6.80	14.5	29
June Avg	**2.2**	**8**	**3.80**	**5.0**	**6.80**	**14.5**	**29**
07/26/12	3.3	10	4.05	5.0	6.91	16.2	31
July Avg	**3.3**	**10**	**4.05**	**5.0**	**6.91**	**16.2**	**31**
08/14/12	3.4	10	4.15	6.0	6.84	16.6	25
Aug Avg	**3.4**	**10**	**4.15**	**6.0**	**6.84**	**16.6**	**25**
09/13/12	2.7	9	4.10	6.0	6.79	16.4	24
Sept Avg	**2.7**	**9**	**4.10**	**6.0**	**6.79**	**16.4**	**24**
Year Mean:	**2.9**	**9**	**3.95**	**5.5**	**6.80**	**15.8**	**29**
Maximum:	**3.4**	**10**	**4.15**	**6.0**	**6.91**	**16.6**	**38**
Minimum:	**2.2**	**8**	**3.63**	**5.0**	**6.65**	**14.5**	**24**
Stand Dev:	**0.49**	**0.89**	**0.22**	**0.51**	**0.10**	**0.90**	**5.59**
TSI:	***39**	**40**	**61**				
***Only valid TSI value due to Color Year Mean > 25 PCU.**							

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 2012. 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 in some degree for 9 seasons now. More sampling is needed before reliable trend data can be calculated.

Mary Petuche Pond, Somerset County, Maine

Table 10, Mary Petuche Pond 2012

2012 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)
06/28/12	2.5	11	4.15	9.00	NONE	18.0	53
10/03/12	1.3	10	5.00	11.00	7.11	22.3	*39
Year Mean:	**1.9**	**11**	**4.58**	**10.00**	**7.11**	**20.2**	**46**

Table 10 shows this year's Chl-*a,* TP, Secchi, Alkalinity, pH, Conductivity, and True Color values for Mary Petuche Pond in 2012. Mary Petuche was sampled twice in 2012 in late June and early October in order to focus more on water bodies closer to Indian Township. 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 in some form for 6 seasons. This pond is heavily stratified once summer arrives. Much more sampling is needed before any trend data can be calculated.

Middle Chain Lake, Hancock County, Maine

Table 11, Middle Chain Lake 2012

2012 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)
05/11/12	3.6	10	3.25	4.5	6.45	14.1	73
05/25/12	3.2	10	3.15	4.5	6.47	14.1	75
May Avg	**3.4**	**10**	**3.20**	**4.5**	**6.46**	**14.1**	**74**
06/13/12	2.1	13	3.15	4.5	6.60	13.8	76
06/22/12	3.3	12	3.60	4.5	NONE	14.1	71
June Avg	**2.7**	**13**	**3.38**	**4.5**	**6.60**	**14.0**	**74**
07/26/12	3.3	13	4.10	4.5	6.65	15.4	62
July Avg	**3.3**	**13**	**4.10**	**4.5**	**6.65**	**15.4**	**62**
08/07/12	3.1	11	4.35	5.0	6.73	15.4	54
Aug Avg	**3.1**	**11**	**4.35**	**5.0**	**6.73**	**15.4**	**54**
09/13/12	2.9	10	4.00	5.0	6.66	14.7	50
09/28/12	3.3	8	3.95	5.0	6.72	15.3	48
Sept Avg	**3.1**	**9**	**3.98**	**5.0**	**6.69**	**15.0**	**49**
Year Mean:	**3.1**	**11**	**3.80**	**4.7**	**6.63**	**14.8**	**63**
Maximum:	**3.4**	**13**	**4.35**	**5.0**	**6.73**	**15.4**	**74**
Minimum:	**2.7**	**9**	**3.20**	**4.5**	**6.46**	**14.0**	**49**
Stand Dev:	**0.27**	**1.67**	**0.49**	**0.27**	**0.10**	**0.70**	**11.27**
TSI:	***41**	**45**	**63**				
***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 2012. 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 last winter, 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. This year was the 4th year of sampling for this lake. 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 2012

2012 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)**
05/13/12	2.2	11	4.20	8.0	6.63	NONE	36
05/31/12	3.2	10	4.90	7.0	6.83	15.0	31
May Avg	**2.7**	**11**	**4.55**	**7.5**	**6.73**	**15.0**	**34**
06/16/12	3.4	6	5.00	7.5	6.96	14.8	27
June Avg	**3.4**	**6**	**5.00**	**7.5**	**6.96**	**14.8**	**27**
07/20/12	4.3	9	5.10	8.0	6.97	17.7	37
July Avg	**4.3**	**9**	**5.10**	**8.0**	**6.97**	**17.7**	**37**
08/09/12	5.6	8	5.30	9.0	6.95	18.0	33
Aug Avg	**5.6**	**8**	**5.30**	**9.0**	**6.95**	**18.0**	**33**
09/12/12	3.9	7	4.90	10.0	6.91	18.2	29
Sept Avg	**3.9**	**7**	**4.90**	**10.0**	**6.91**	**18.2**	**29**
Year Mean:	**4.0**	**8**	**4.97**	**8.4**	**6.90**	**16.7**	**32**
Maximum:	**5.6**	**11**	**5.30**	**10.0**	**6.97**	**18.2**	**37**
Minimum:	**2.7**	**6**	**4.55**	**7.5**	**6.73**	**14.8**	**27**
Stand Dev:	**1.1**	**2**	**0.28**	**1.1**	**0.10**	**1.7**	**4**
TSI:	***47**	**37**	**49**				
***Only valid TSI value due to Color Year Mean > 25 PCU.**							

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 2012. 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 for 8 years in some capacity.

Pocumcus Lake, Washington County, Maine

Table 13, Pocumcus Lake 2012

2012 Pocumcus Lake			Site: POC1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/02/12	2.2	4	6.85	6.5	6.99	16.3	17
05/23/12	1.4	4	7.30	6.0	6.94	15.0	22
May Avg	**1.8**	**4**	**7.08**	**6.3**	**6.97**	**15.7**	**20**
06/08/12	1.2	7	7.60	7.0	6.89	15.2	19
06/21/12	1.1	10	7.65	6.0	NONE	14.7	21
June Avg	**1.2**	**9**	**7.63**	**6.5**	**6.89**	**15.0**	**20**
07/13/12	NONE	NONE	8.25	6.0	7.06	16.5	18
07/30/12	2.1	4	8.35	6.5	7.05	15.7	18
July Avg	**2.1**	**4**	**8.30**	**6.3**	**7.06**	**16.1**	**18**
08/14/12	2.2	3	8.75	7.0	7.03	16.1	14
Aug Avg	**2.2**	**3**	**8.75**	**7.0**	**7.03**	**16.1**	**14**
09/14/12	2.3	3	7.50	7.0	6.98	16.3	13
09/24/12	2.2	3	7.70	7.0	6.97	15.5	12
Sept Avg	**2.3**	**3**	**7.60**	**7.0**	**6.98**	**15.9**	**13**
Year Mean:	**1.9**	**5**	**7.87**	**6.6**	**6.98**	**15.7**	**17**
Maximum:	**2.3**	**9**	**8.75**	**7.0**	**7.06**	**16.1**	**20**
Minimum:	**1.2**	**3**	**7.08**	**6.3**	**6.89**	**15.0**	**13**
Stand Dev:	**0.45**	**2.29**	**0.66**	**0.38**	**0.06**	**0.48**	**3.37**
TSI:	**29**	**26**	**27**				
			All TSI Values 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 2012. 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 for 8 seasons.

Scraggly Lake, Penobscot County, Maine

Table 14, Scraggly Lake 2012

2012 Scraggly Lake			Site: SCR1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/08/12	2.9	7	5.00	6.5	6.89	14.9	25
05/18/12	2.6	6	5.90	6.0	6.81	15.0	28
May Avg	**2.8**	**7**	**5.45**	**6.3**	**6.85**	**15.0**	**27**
06/07/12	3.4	9	4.70	6.0	6.85	15.6	26
06/19/12	3.5	6	5.15	6.0	7.03	14.9	26
June Avg	**3.5**	**8**	**4.93**	**6.0**	**6.94**	**15.3**	**26**
07/02/12	NONE	NONE	5.55	6.5	NONE	14.6	26
07/31/12	2.8	8	6.50	6.0	7.05	15.7	24
July Avg	**2.8**	**8**	**6.03**	**6.3**	**7.05**	**15.2**	**25**
09/04/12	2.6	6	5.40	7.5	7.01	15.7	21
09/18/12	2.2	6	5.75	7.0	6.88	15.7	22
Sept Avg	**2.4**	**6**	**5.58**	**7.3**	**6.95**	**15.7**	**22**
Year Mean:	**2.9**	**7**	**5.49**	**6.4**	**6.95**	**15.3**	**25**
Maximum:	**3.5**	**8**	**6.03**	**7.3**	**7.05**	**15.7**	**27**
Minimum:	**2.4**	**6**	**4.93**	**6.0**	**6.85**	**15.0**	**22**
Stand Dev:	**0.44**	**0.91**	**0.45**	**0.55**	**0.08**	**0.32**	**2.25**
TSI:	**39**	**33**	**44**				
All TSI values are invalid due to only 4 months of data.							

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 2012. 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 now sampled this lake for 8 seasons.

Shaw Lake, Penobscot County, Maine

Table 15, Shaw Lake 2012

2012 Shaw Lake			Site: SHW1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/13/12	2.4	11	4.60	7.0	6.72	15.3	38
05/31/12	3.4	10	4.55	7.0	6.73	16.2	35
May Avg	**2.9**	**11**	**4.58**	**7.0**	**6.73**	**15.8**	**37**
06/16/12	3.6	11	4.70	7.0	6.89	15.0	35
June Avg	**3.6**	**11**	**4.70**	**7.0**	**6.89**	**15.0**	**35**
07/20/12	4.1	8	5.30	7.0	6.96	16.8	38
July Avg	**4.1**	**8**	**5.30**	**7.0**	**6.96**	**16.8**	**38**
08/09/12	2.9	11	4.60	7.0	7.11	16.7	32
Aug Avg	**2.9**	**11**	**4.60**	**7.0**	**7.11**	**16.7**	**32**
09/12/12	3.4	10	4.25	9.0	6.90	17.2	26
Sept Avg	**3.4**	**10**	**4.25**	**9.0**	**6.90**	**17.2**	**26**
Year Mean:	**3.4**	**10**	**4.69**	**7.4**	**6.92**	**16.3**	**34**
Maximum:	**4.1**	**11**	**5.30**	**9.0**	**7.11**	**17.2**	**38**
Minimum:	**2.9**	**8**	**4.25**	**7.0**	**6.73**	**15.0**	**26**
Stand Dev:	**0.51**	**1.24**	**0.38**	**0.89**	**0.14**	**0.90**	**4.56**
TSI:	***43**	**42**	**52**				
***Only valid TSI value due to Color Year Mean > 25 PCU.**							

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 2012. 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 for 8 seasons now.

Side Pistol Lake, Hancock County, Maine

Table 16, Side Pistol Lake 2012

2012 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)
05/11/12	1.2	6	7.35	5.5	6.89	14.7	11
05/25/12	1.1	7	7.10	6.0	6.93	14.2	11
May Avg	**1.2**	**7**	**7.23**	**5.8**	**6.91**	**14.5**	**11**
06/13/12	1.7	6	6.60	6.0	7.01	13.8	11
06/22/12	2.5	5	6.80	6.0	NONE	14.2	8
June Avg	**2.1**	**6**	**6.70**	**6.0**	**7.01**	**14.0**	**10**
07/26/12	2.2	8	6.85	5.0	7.06	15.0	11
July Avg	**2.2**	**8**	**6.85**	**5.0**	**7.06**	**15.0**	**11**
08/07/12	1.8	4	6.50	5.5	7.11	14.9	8
Aug Avg	**1.8**	**4**	**6.50**	**5.5**	**7.11**	**14.9**	**8**
09/13/12	2.6	9	6.20	6.0	6.97	14.5	6
09/28/12	2.7	5	6.35	6.0	6.90	14.7	6
Sept Avg	**2.7**	**7**	**6.28**	**6.0**	**6.94**	**14.6**	**6**
Year Mean:	**2.0**	**6**	**6.71**	**5.7**	**7.01**	**14.6**	**9**
Maximum:	**2.7**	**8**	**7.23**	**6.0**	**7.11**	**15.0**	**11**
Minimum:	**1.2**	**4**	**6.28**	**5.0**	**6.91**	**14.0**	**6**
Stand Dev:	**0.56**	**1.52**	**0.36**	**0.42**	**0.08**	**0.40**	**2.13**
TSI:	**30**	**30**	**34**				
			All TSI Values Valid				

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 2012. 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 for 9 seasons now.

Sysladobsis Lake, Hancock County, Maine

Table 17, Sysladobsis Lake 2012

2012 Sysladobsis Lake			Site: SYS1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/02/12	1.9	4	6.35	7.0	6.94	15.9	24
05/23/12	1.4	4	7.10	6.0	6.97	15.4	26
May Avg	**1.7**	**4**	**6.73**	**6.5**	**6.96**	**15.7**	**25**
06/08/12	1.6	3	7.45	6.0	6.95	15.9	24
06/21/12	1.4	3	7.45	6.5	NONE	15.2	25
June Avg	**1.5**	**3**	**7.45**	**6.3**	**6.95**	**15.6**	**25**
07/13/12	NONE	NONE	8.15	7.0	7.15	16.5	22
07/30/12	2.2	4	7.60	7.0	7.09	16.1	20
July Avg	**2.2**	**4**	**7.88**	**7.0**	**7.12**	**16.3**	**21**
08/14/12	1.8	3	8.65	6.5	7.05	16.2	19
Aug Avg	**1.8**	**3**	**8.65**	**6.5**	**7.05**	**16.2**	**19**
09/14/12	2.1	3	8.30	7.0	7.02	16.4	17
09/24/12	1.9	3	8.40	7.0	7.07	15.9	15
Sept Avg	**2.0**	**3**	**8.35**	**7.0**	**7.05**	**16.2**	**16**
Year Mean:	**1.8**	**3**	**7.81**	**6.7**	**7.02**	**16.0**	**21**
Maximum:	**2.2**	**4**	**8.65**	**7.0**	**7.12**	**16.3**	**25**
Minimum:	**1.5**	**3**	**6.73**	**6.3**	**6.95**	**15.6**	**16**
Stand Dev:	**0.28**	**0.55**	**0.76**	**0.34**	**0.07**	**0.34**	**3.78**
TSI:	**28**	**16**	**27**				
			All TSI Values 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 2012. 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. 8 years of sampling has occurred so far.

Upper Chain Lake, Hancock County, Maine

Table 18, Upper Chain Lake 2012

2012 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)
05/11/12	2.2	11	4.05	4.0	6.42	13.6	81
05/25/12	2.8	10	3.70	4.0	6.48	13.2	81
May Avg	**2.5**	**11**	**3.88**	**4.0**	**6.45**	**13.4**	**81**
06/13/12	2.7	11	3.55	4.0	6.56	13.0	84
06/22/12	2.7	12	4.00	4.0	NONE	13.4	78
June Avg	**2.7**	**12**	**3.78**	**4.0**	**6.56**	**13.2**	**81**
07/26/12	2.9	10	4.10	4.0	6.53	14.4	77
July Avg	**2.9**	**10**	**4.10**	**4.0**	**6.53**	**14.4**	**77**
08/07/12	3.5	10	3.50	4.0	6.66	14.5	70
Aug Avg	**3.5**	**10**	**3.50**	**4.0**	**6.66**	**14.5**	**70**
09/13/12	2.6	11	4.05	5.5	6.57	14.3	65
09/28/12	3.2	9	3.85	4.5	6.61	14.5	62
Sept Avg	**2.9**	**10**	**3.95**	**5.0**	**6.59**	**14.4**	**64**
Year Mean:	**2.9**	**10**	**3.84**	**4.2**	**6.56**	**14.0**	**75**
Maximum:	**3.5**	**12**	**4.10**	**5.0**	**6.66**	**14.5**	**81**
Minimum:	**2.5**	**10**	**3.50**	**4.0**	**6.45**	**13.2**	**64**
Stand Dev:	**0.37**	**0.65**	**0.22**	**0.45**	**0.08**	**0.63**	**7.62**
TSI:	***39**	**42**	**63**				
***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 2012. 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. The pH and alkalinity of both Upper and Middle Chain were among the lowest on average of all the other lakes sampled in 2011 and 2012. Sampling here has occurred for 10 years in some form.

West Grand Lake, Washington County, Maine

Table 19, West Grand Lake 2012

2012 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)
05/02/12	2.7	5	8.45	6.0	6.96	15.4	10
05/23/12	1.6	3	9.60	6.0	7.00	15.0	14
May Avg	**2.2**	**4**	**9.03**	**6.0**	**6.98**	**15.2**	**12**
06/11/12	1.3	3	11.05	6.0	7.03	14.9	11
06/21/12	1.3	2	12.05	6.0	NONE	14.2	14
June Avg	**1.3**	**3**	**11.55**	**6.0**	**7.03**	**14.6**	**13**
07/13/12	NONE	NONE	11.75	6.0	7.03	15.5	12
07/30/12	1.5	3	11.65	6.0	6.98	15.1	12
July Avg	**1.5**	**3**	**11.70**	**6.0**	**7.01**	**15.3**	**12**
08/14/12	2.0	2	11.30	6.5	7.03	15.2	9
Aug Avg	**2.0**	**2**	**11.30**	**6.5**	**7.03**	**15.2**	**9**
09/14/12	1.5	2	9.70	6.0	7.02	15.1	9
09/24/12	1.8	2	9.95	6.0	6.99	15.1	8
Sept Avg	**1.7**	**2**	**9.83**	**6.0**	**7.01**	**15.1**	**9**
Year Mean:	**1.7**	**3**	**10.68**	**6.1**	**7.01**	**15.1**	**11**
Maximum:	**2.2**	**4**	**11.70**	**6.5**	**7.03**	**15.3**	**13**
Minimum:	**1.3**	**2**	**9.03**	**6.0**	**6.98**	**14.6**	**9**
Stand Dev:	**0.35**	**0.84**	**1.19**	**0.22**	**0.02**	**0.30**	**1.89**
TSI:	**27**	**16**	**15**				
			All TSI Values 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 2012. 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 100ft 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. Much more sampling is needed to generate reliable trend data.

Pleasant Lake, T6R1 Washington County, Maine

Table 20, Pleasant Lake 2012

2012 Pleasant Lake			Site: PLS1				
Date	Chl-a (µg/L)	TP (µg/L)	Secchi (m)	Alka (mg/l CaCO3)	pH	Cond (UMHOS/CM)	Color (PCU)
05/03/12	3.0	7	6.55	7.0	6.99	15.4	19
05/22/12	2.7	6	5.50	7.0	6.99	15.0	20
May Avg	**2.9**	**7**	**6.03**	**7.0**	**6.99**	**15.2**	**20**
06/07/12	2.2	4	6.05	6.0	7.10	15.5	20
06/18/12	3.0	8	7.65	6.5	7.16	15.1	18
June Avg	**2.6**	**6**	**6.85**	**6.3**	**7.13**	**15.3**	**19**
07/11/12	NONE	NONE	7.45	7.0	NONE	15.9	19
07/28/12	3.3	10	7.20	7.0	7.16	15.8	17
July Avg	**3.3**	**10**	**7.33**	**7.0**	**7.16**	**15.9**	**18**
08/13/12	4.4	5	7.30	7.0	7.15	15.7	17
Aug Avg	**4.4**	**5**	**7.30**	**7.0**	**7.15**	**15.7**	**17**
09/06/12	2.6	4	6.95	7.0	7.04	15.3	14
09/21/12	2.6	4	6.75	7.5	6.84	15.7	16
Sept Avg	**2.6**	**4**	**6.85**	**7.3**	**6.94**	**15.5**	**15**
Year Mean:	**3.2**	**6**	**6.87**	**6.9**	**7.07**	**15.5**	**18**
Maximum:	**4.4**	**10**	**7.33**	**7.3**	**7.16**	**15.9**	**20**
Minimum:	**2.6**	**4**	**6.03**	**6.3**	**6.94**	**15.2**	**15**
Stand Dev:	**1.33**	**2.28**	**0.53**	**0.38**	**0.10**	**0.27**	**1.79**
TSI:	**41**	**30**	**33**				
			All TSI Values Valid				

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 2012. This was our second year sampling Pleasant Lake, so much more sampling is needed to generate reliable trend data. 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 2012

2012 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)
05/03/12	3.6	8	3.90	5.0	6.69	15.3	36
05/22/12	3.2	7	4.60	4.0	6.63	15.2	35
May Avg	**3.4**	**8**	**4.25**	**4.5**	**6.66**	**15.3**	**36**
06/07/12	4.3	7	4.20	5.0	6.82	15.4	34
06/18/12	3.6	11	4.55	4.5	6.99	15.5	32
June Avg	**4.0**	**9**	**4.38**	**4.8**	**6.91**	**15.5**	**33**
07/11/12	NONE	NONE	5.85	5.0	NONE	16.3	31
07/28/10	1.5	5	7.65	5.0	6.76	16.2	28
July Avg	**1.5**	**5**	**6.75**	**5.0**	**6.76**	**16.3**	**30**
08/13/12	2.3	3	6.65	5.0	6.80	16.1	27
Aug Avg	**2.3**	**3**	**6.65**	**5.0**	**6.80**	**16.1**	**27**
09/06/12	2.4	4	6.20	5.5	6.79	15.5	25
09/21/12	2.3	4	5.35	5.0	6.67	15.8	26
Sept Avg	**2.4**	**4**	**5.78**	**5.3**	**6.73**	**15.7**	**26**
Year Mean:	**2.7**	**6**	**5.56**	**4.9**	**6.77**	**15.7**	**30**
Maximum:	**4.0**	**9**	**6.75**	**5.3**	**6.91**	**16.3**	**36**
Minimum:	**1.5**	**3**	**4.25**	**4.5**	**6.66**	**15.3**	**26**
Stand Dev:	**0.97**	**2.49**	**1.20**	**0.29**	**0.09**	**0.42**	**4.14**
TSI:	***37**	**30**	**43**				
***Only valid TSI value due to Color Year Mean > 25 PCU.**							

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 2012. This was our second year sampling East Musquash Lake, so much more sampling is needed to generate reliable trend data. 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 2012

2012 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)
05/03/12	2.7	4	8.45	5.0	6.80	12.6	13
05/22/12	1.6	3	8.75	5.0	6.82	12.4	13
May Avg	**2.2**	**4**	**8.60**	**5.0**	**6.81**	**12.5**	**13**
06/07/12	1.3	4	9.65	4.5	6.91	12.7	14
06/18/12	1.3	2	10.10	4.0	6.94	12.6	11
June Avg	**1.3**	**3**	**9.88**	**4.3**	**6.93**	**12.7**	**13**
07/11/12	NONE	NONE	10.95	5.0	NONE	13.3	11
07/31/12	1.5	2	11.50	4.0	6.96	12.9	11
July Avg	**1.5**	**2**	**11.23**	**4.5**	**6.96**	**13.1**	**11**
08/13/12	2.0	2	12.15	5.0	6.81	12.8	13
Aug Avg	**2.0**	**2**	**12.15**	**5.0**	**6.81**	**12.8**	**13**
09/06/12	1.5	2	10.90	5.0	6.90	12.2	11
09/21/12	1.8	2	9.80	5.0	6.89	12.7	11
Sept Avg	**1.7**	**2**	**10.35**	**5.0**	**6.90**	**12.5**	**11**
Year Mean:	**1.7**	**3**	**10.44**	**4.8**	**6.88**	**12.7**	**12**
Maximum:	**1.3**	**4**	**12.15**	**5.0**	**6.96**	**13.1**	**13**
Minimum:	**2.2**	**2**	**8.60**	**4.3**	**6.81**	**12.5**	**11**
Stand Dev:	**0.35**	**0.71**	**1.35**	**0.35**	**0.07**	**0.26**	**1.02**
TSI:	**27**	**16**	**15**				
			All TSI Values Valid				

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 2012. This was our second year sampling West Musquash Lake, so much more sampling is needed to generate reliable trend data. 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.

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