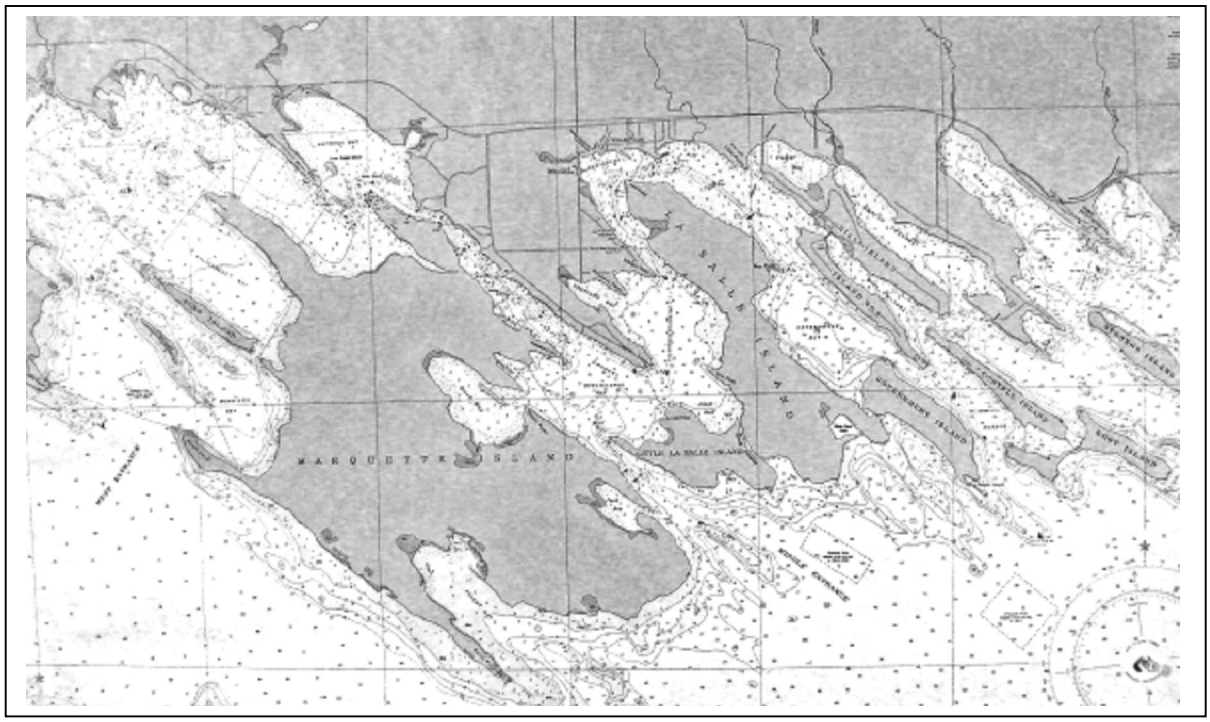


Recent trophic history of Les Cheneaux waters: 2001 – 2012.

R.A. Smith
Les Cheneaux Watershed Council
Jan 2013

Recent trophic history of Les Cheneaux waters: 2001 – 2012.

Executive Summary

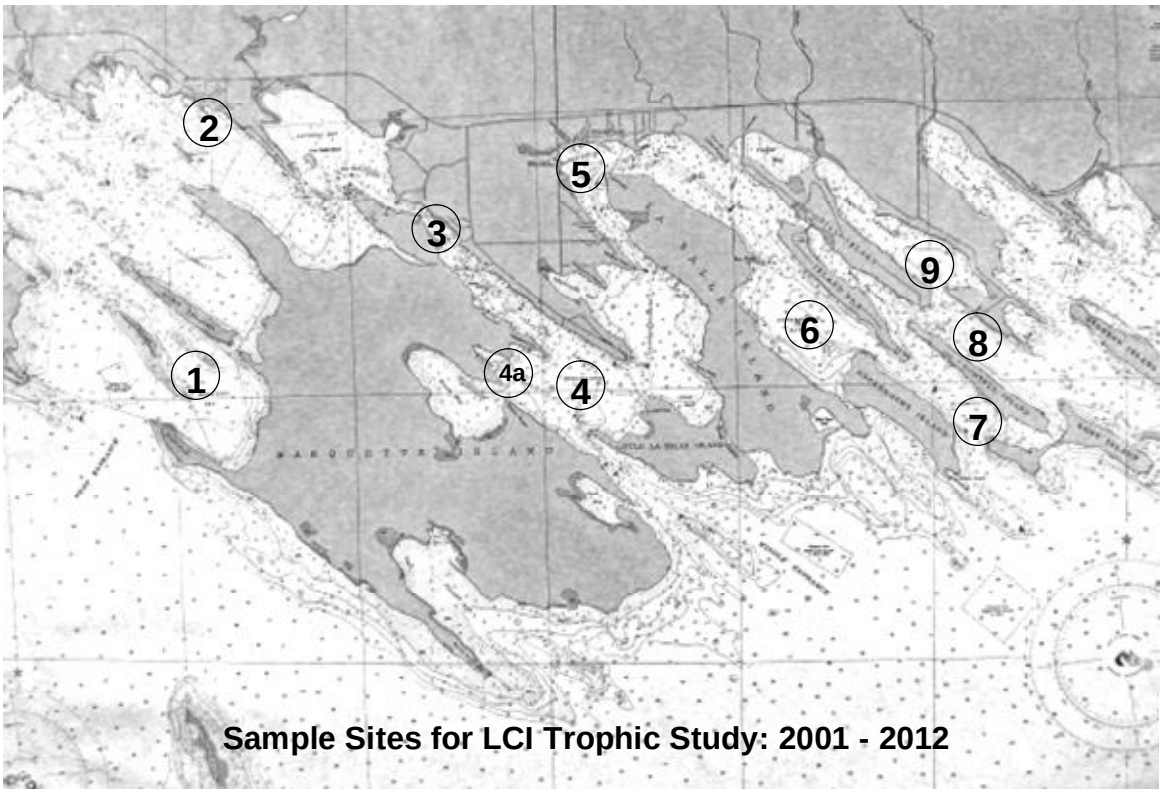
Summary: Factors that contribute to the growth of aquatic plants and affect recreational water quality have been studied by the Les Cheneaux Watershed Council and the Les Cheneaux Islands Association since 2001. During this survey period the recreational water quality has been classified as excellent according to limnology, or water scientist, criteria. The trophic state, or the potential of nutrients to support algal or plankton biomass, has remained essentially the same between 2001 and 2012.

This rating of Les Cheneaux waters is expected to continue for the next several years provided there are no intentional environmental perturbation or insults to our waters. Issues that may contribute to a measurable shift from our highly desirable 12-year water quality pattern include: continued low lake level, warmer annual temperatures, or adverse ecological impact from invasive species management practices.

A detailed technical report on these findings will be published during the first quarter of 2013.

Background: Ten sites within the islands were selected to represent a range of the varied nutrient, or trophic, zones commonly encountered. A map showing all sample sites is shown on the next page.

Low nutrient areas such as Marquette Bay and Scammon's Harbor would be expected to exhibit lower algae and weed growth than the higher nutrient areas such as Cedarville Bay and Snows Channel. Samples were collected by the Les Cheneaux Watershed Council (LCWC) and by the Les Cheneaux Islands Association (LCIA) members, analyzed at the Univ of Michigan laboratory at Douglas Lake and results reported either through LCIA newsletters, LCWC newsletters or formal reports. All past reports are available on the LCWC website: www.lescheneauxwatershed.org



Sample Sites for LCI Trophic Study: 2001 - 2012

Sample site description:

1. Marquette Bay. Depth ca 30 ft
2. Hessel Harbor: 600 ft outside of harbor mouth: Depth ca: 14 ft
3. Snows Channel: 100 ft off Dollar Island. Depth ca 8 ft
4. Muskie Bay: Depth ca 16 ft

4a. West Muskie Bay. An internal control point 2000 ft from site 4. Depth ca 7 ft

5. Cedarville Bay 200 ft off Ailes Pt. Depth ca 7 ft
6. Government Bay. Depth ca 25 ft
7. Scammons Harbor: Depth ca 35 ft
8. Strongs-Gravelly: Depth ca 35 ft
9. E. Mc Kay Bay: Depth ca 16 ft

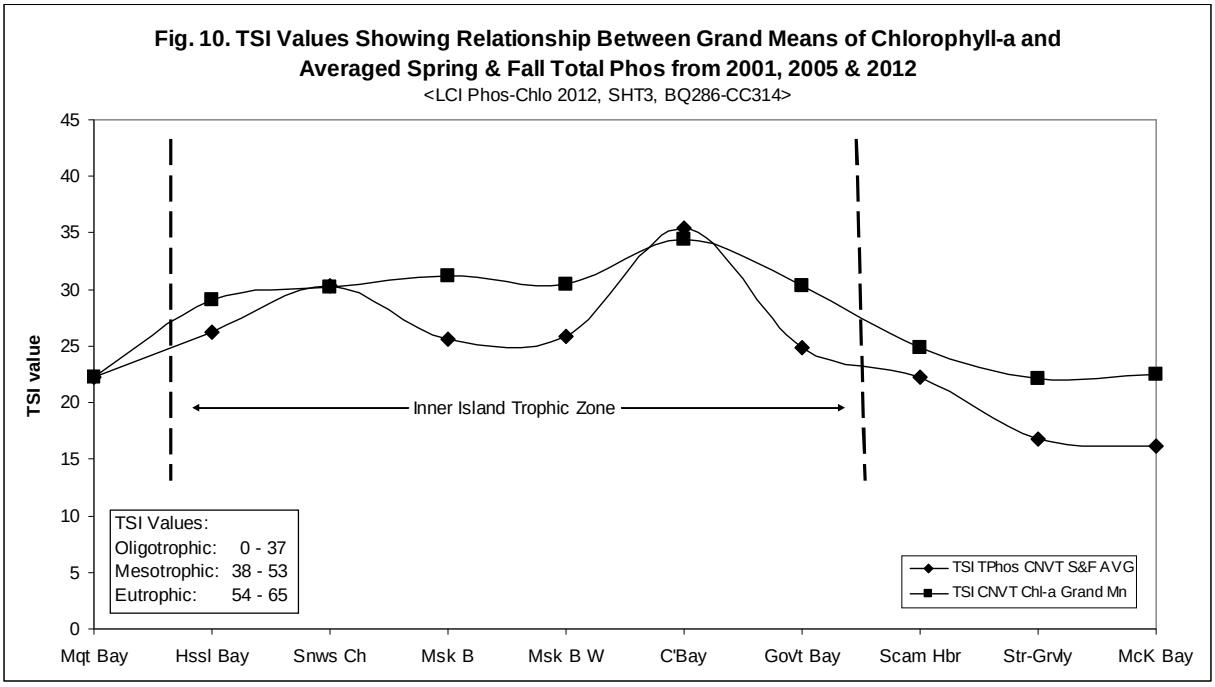
Results and Discussion: Phosphorus is the primary limiting nutrient in the Great Lakes and their associated waterways. Growth of planktonic (free-floating) algae is proportional to nutrient availability. Total phosphorus was one variable monitored throughout our studies as was chlorophyll-a. Chlorophyll-a was recovered from planktonic algae and, thus, represents the density of algal populations present at the time of monthly sampling.

The relation between total phosphorus and chlorophyll-a (Chl-a) measured during the 12 yr study is shown in Fig. 10. Values shown are expressed in TSI units, a measure developed by R. Carlson (Carlson, 1977) to normalize measurements for both variables (Fig. 7.). By converting phosphorus and Chl-a data both curves can be expressed on a single graph and the relationships compared.

Since algae grow in response to phosphorus concentrations, one would expect to see their respective growth curves roughly mirror one another. Such is the case over our 12 year study period for all ten LCI observations sites. What appear to be exceptions are at the Snows Channel and Cedarville Bay sites where phosphorus values were similar to the Chl-a values. It is likely that high volume boat traffic in both these areas contributed to excess phosphorus being churned from sediments into the water column from prop wash which resulted in skewed readings.

Fig. 10. TSI Values Showing Relationship Between Grand Means of Chlorophyll-a and Averaged Spring & Fall Total Phos from 2001, 2005 & 2012

<LCI Phos-Chlo 2012, SHT3, BQ286-CC314>



Water quality ratings per Carlson's criteria were within the desirable Oligotrophic (low nutrient) range for all Les Cheneaux sites monitored during our 12 year study. Although the range in TSI values was from 16 to 35 for phosphorus and from 22 to 35 for Chl-a, recreational water quality remains excellent.

A change of seven TSI points for chl-a represents an approximate doubling of algal biomass (Carlson, 1980, Wetzel, 2001). That is about the maximum shift observed for combined values from all sites over 12 years.

As reported earlier (Smith, 2006) Les Cheneaux waters appear to fall into two distinct nutrient zones. These two zones remain consistent through 2012 as shown by the more nutrient-rich inner island zone and a lower nutrient area (Fig. 10).

The trophic state of our Les Cheneaux waters has remained essentially the same for those years monitored between 2001 and 2012. Without intentional environmental perturbation or insult to Les Cheneaux waters this pattern is expected to continue for the next several years.

Factors that may contribute to a measurable shift from the observed consistent 12-year water quality pattern include:

a) Continued low or lower lake level.

- with lower water, the propeller wash from boats suspends phosphorus-rich sediment making more nutrient available for algal and aquatic plant growth. The combination of low water and deeper sunlight penetration will promote more rapid weed growth. Therefore, more intense aquatic weed growth can be expected to develop if the level of Lake Huron remains low.

b) Continued early, warm spring seasons contribute to warmer waters for extended periods.

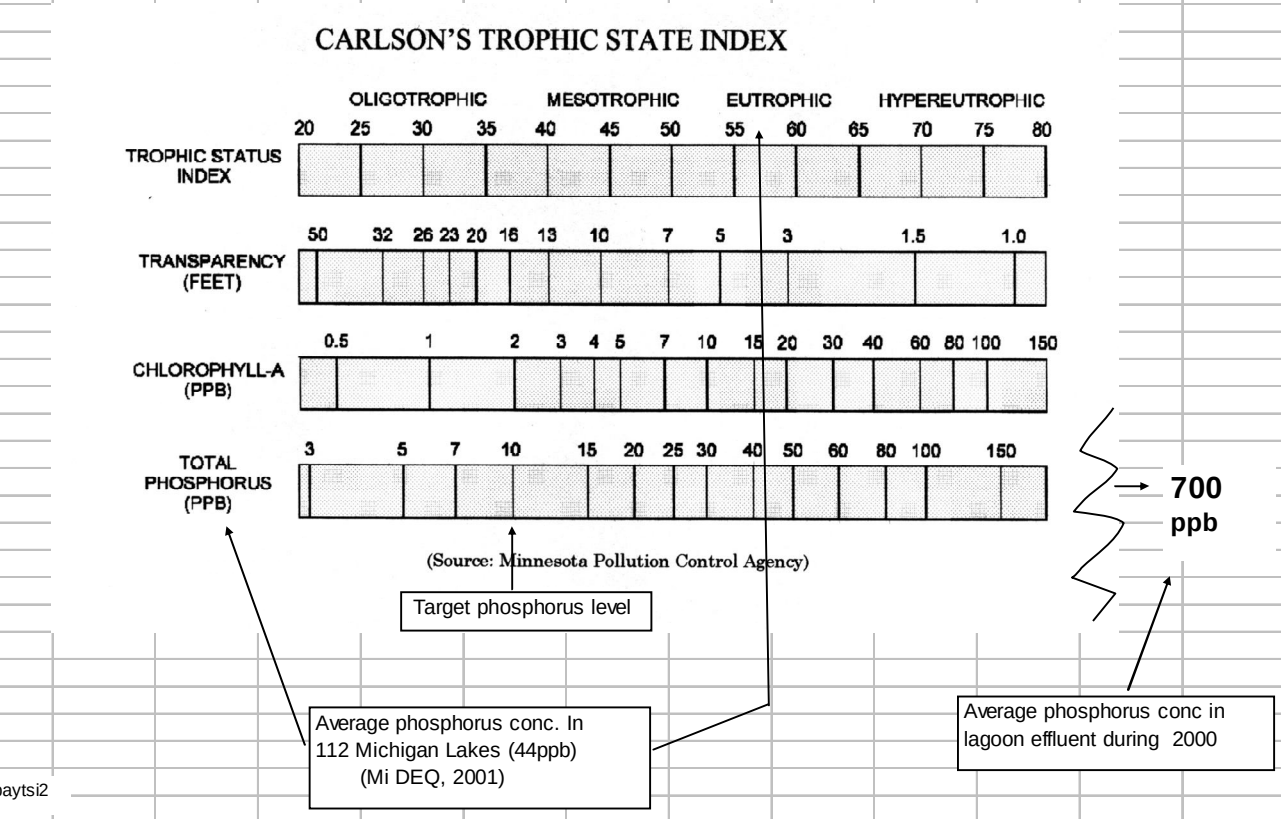
c) Adverse impact of Eurasian watermilfoil management practices may contribute to:

- shift in aquatic plant population diversity and/or density
- shift in water chemistry in milfoil management areas.

Sample frequency. Samples were collected monthly during each survey year from May through October. Samples were collected annually from 2001 through 2005 and again in 2012. Phosphorus samples were collected twice annually: Once in the spring and once in the fall. Chl-a samples were collected monthly along with data on temperature and water turbidity.

Although other variables were monitored, only phosphorus and Chl-a are reported in this document. Phosphorus values reflect the amount of plant nutrient in the water column. Chl-a is an indicator of the planktonic algal population present at any given time and algal populations fluctuate in response to available nutrients, especially phosphorus.

Fig. 7. Comparison of phosphorus concentration in Clark Township lagoons to DEQ measures of over 100 Michigan Lakes. Data from 2001.



Citations:

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