# Interpretation of TP and Secchi Results

The following information will assist with interpreting Lake Partner Program total phosphorus and Secchi results. These results are posted each year in separate tables on the webpage. Since 2002, total phosphorus analyses have been conducted at the Dorset Environmental Science Centre (DESC), low-level laboratory. These data are approximately ten times more precise than data collected before 2002. With the DESC results, the average difference between identical samples is approximately 0.7 µg/L compared to those collected previously which were different by approximately 6 to 10 µg/L. Total phosphorus results collected before 2002 are found in the **Pre-2002 Total Phosphorus Means** table and are expressed as annual means of all data collected. By averaging several years of these data, we can describe average concentrations prior to 2002 but the data should not be used to examine trends through time.

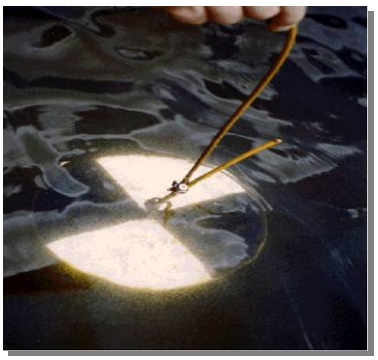
### *Total Phosphorus*

Total phosphorus concentrations are ideally used to interpret nutrient status since phosphorus is the element that controls the growth of algae in most Ontario lakes. Increases in phosphorus will decrease water clarity by stimulating algal growth. In extreme cases, algal blooms will affect the aesthetics of the lake and/or cause taste and odour problems in the water.

Many limnologists place lakes into three broad categories with respect to nutrient status. Lakes with less that 10 µg/L TP are considered oligotrophic. These are dilute, unproductive lakes that rarely experience nuisance algal blooms. Lakes with TP between 10 and 20 µg/L are termed mesotrophic and are in the middle with respect to trophic status. These lakes show a broad range of characteristics and can be clear and unproductive at the bottom end of the scale or susceptible to moderate algal blooms at concentrations near 20 µg/L. Lakes over 20 µg/L are classed as eutrophic and may exibit persistent, nuisance algal blooms.

Note: Tea stained lakes, with high dissolved organic carbon (DOC), are called dystrophic lakes and do not share the algal/TP relationships described above. Generally there can be more TP in a dystrophic lake without the occurrence of algal blooms. The chemistry of these lakes is quite complex.

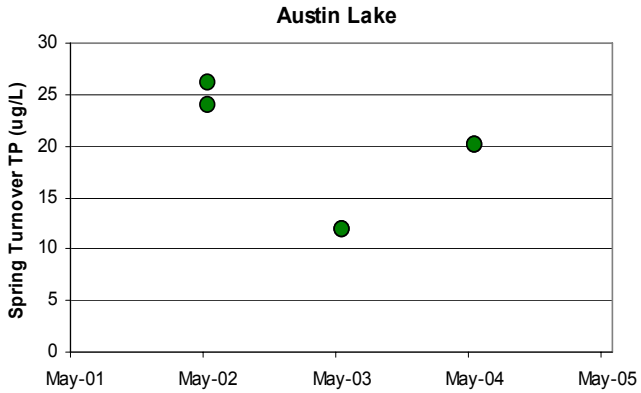
### *Water Clarity – Secchi Depth readings*

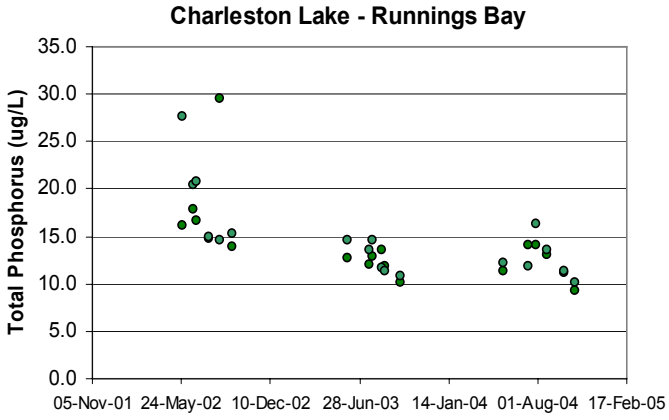


As we know, increases in phosphorus will decrease water clarity by stimulating algal growth. This is not to say, however, that water clarity can be used to infer nutrient status. Light penetration in the lake can be controlled by DOC or by non-biological turbidity. Water clarity can also be altered by invading species such as zebra mussels. It is always best, therefore, to use total phosphorus to evaluate the nutrient status of the lake. Water clarity readings nonetheless are valuable to track changes in the lake that might be occurring that would not be noticed by monitoring TP concentrations alone, e.g. zebra mussel invasions.

### *Between-year differences in TP concentrations*

Now that we have several years of data, volunteers will naturally want to examine their results for trends through time. Three years of data is the minimum number of years required to establish a reliable, long-term mean. In other words, the average of the last three years of data is a useful measure of the current nutrient status of the lake, but there is still not enough data to examine trends. There are some lakes that show relatively large differences between years (see Austin Lake graph) but unless there are tangible reasons for these differences, e.g. large differences in rainfall between years, it is more likely that further data collection will identify one (or two) of these years as anomalies. Most lakes do not usually show large, between-year differences but this is the reason why we collect annual data; so that we can identify what the actual between-year differences should be. It is enough to know that even though the three years of data may show distinct increases or decreases, the trends are probably due to normal between-year variability. It will be interesting to see if some of the trends, such as the slight downward trend noted for Charleston Lake, (see Charleston Lake graph) maintain themselves through time.



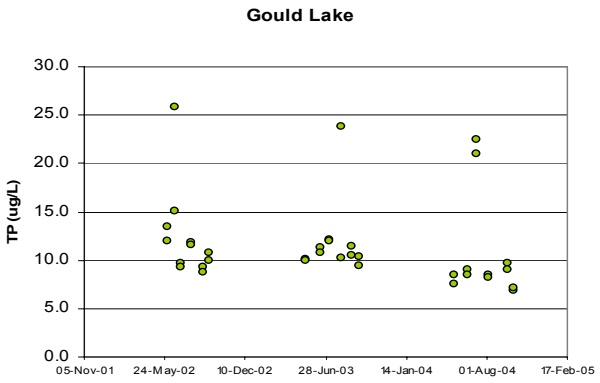



### *Seasonal differences in total phosphorus concentrations*

Lakes that are off the Canadian Shield are sampled monthly because they are more likely to show seasonal differences in TP concentrations. In cases where concentrations increase towards the late summer, it is important to ascertain whether or not these concentrations could contribute to late summer algal blooms. In many cases, especially in the Kawartha Lakes there are considerable increases in TP concentrations as the ice-free season progresses. In many cases, the concentrations span two or even all three of the classic trophic status categories. Many of the complex seasonal processes in these lakes would be difficult to assess without the data that volunteers collect on a monthly basis.

### *Anomalous data points*

Now that we have several years of data, it is **less** likely that anomalous data points will interfere with our interpretation of the data. These "outliers" can be the result of sample contamination and may be the results of a single zooplankton that was left in the tube after rinsing with unfiltered surface water. In any event, these samples represent a small percentage of the total number of samples and are easy to identify, especially after several years of data have been collected. In some lakes, there may be a consistent source of contamination (high zooplankton densities) that affect some samples but they should not have an effect on the overall data set. This situation can be seen in the Gould Lake (see Gould Lake graph) dataset which shows excellent seasonal patterns and slight between-year trends in the lake. In addition, we can see that there are four outliers. This is an excellent data set that cannot likely be improved through any change in methods. We know that the percentage of outliers is approximately the same (2-5%) whether professionals or volunteers collect these data.




### *Here are some common questions people ask about total phosphorus analysis.*

**What are TP1 & TP2?** We submit two separate samples for TP analysis. This is a contingency against one sample being lost. Also, if one sample is contaminated, we can retest using water from the PET jar. If we analysed just one sample we would not suspect (for a new lake) that the sample was contaminated and we would lose the data for that year.

**Why are we filtering water samples?** Large zooplankton will add disproportionate amounts of TP to a sample. For example, if your lake is 10 µg/L, a single zooplankton can increase the reading to 35 µg/L. Filtering the samples removes this source of contamination. Normally there are very few large zooplankton in a water sample, however, the incidence of contaminated samples has dropped significantly since we began filtering samples in 2003.

Questions? please call 1-800-470-8322 or email lakepartner@ontario.ca