Ontario

Ministry of the
Environment

Limnology & Toxicity Section,
Water Resources Branch,
P.O. Box 213, Rexdale,
Ont. M9W 5L1

Dear Sir:

On behalf of the Ministry of the Environment I would like to thank you for volunteering your time to assist us in our "Secchi disc - chlorophyll a Self-Help Programme".

The data which you will provide will be extremely useful in developing comparative assessments of aquatic enrichment in recreational lakes throughout Ontario. As indicated earlier, this can be achieved by a relatively simple programme involving the collection of information on water clarity and abundance of algae as reflected by chlorophyll measurements. The data gathered will be invaluable in assessing any changes in water quality which may materialize owing to present and future development schemes.

At the termination of the 1974 summer sampling programme, a report will be prepared for public release. If you have any questions or comments relative to the study, methodology, etc., please feel free to contact Mr. G.W. Robinson of our Limnology and Toxicity Section (telephone 416-248-3058).

I have appended a brief outline on methodology for your review.

Yours truly,

Dr. T. Brydges,
Supervisor.

Encl.

SECCHI DISC - CHLOROPHYLL *a*

SELF-HELP PROGRAMME

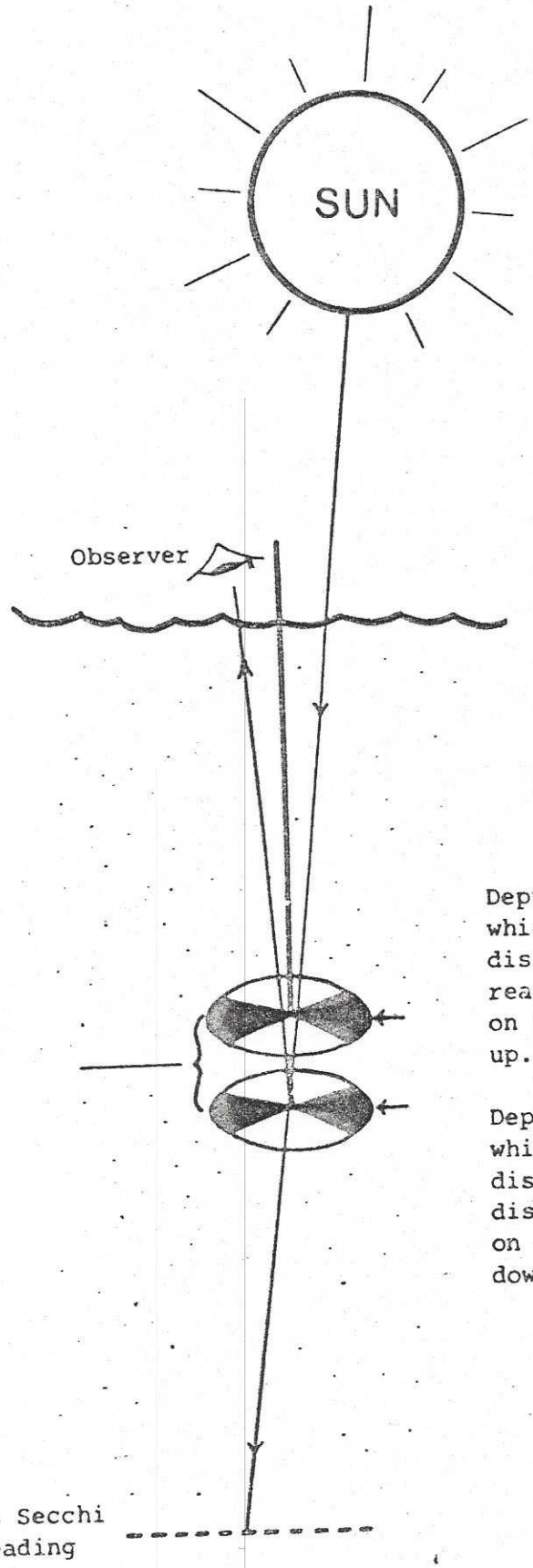
Coupled with accelerating cottage development is an increasing awareness of and concern for problems of pollution in recreational lakes. Many individual cottagers, cottage associations and permanent shoreline residents are requesting that complete water quality evaluations be carried out to assess the degree of pollution in lakes. Exhaustive physical, chemical and biological evaluations for a large number of lakes are beyond the financial and logistical capabilities of personnel involved in water management programmes, and in light of recent studies, are not necessary in order to classify the enrichment status of recreational waters. A practical but effective evaluation programme is suggested which may be carried out by local residents and cottagers.

Information on water clarity and samples for the measurement of chlorophyll (the green pigment in microscopic plants called algae) can be obtained relatively easily by personnel participating in the study and such data can be interpreted by biologists to obtain an assessment of the lake's condition.

Water clarity is one of the most important parameters used in defining water quality. The Secchi disc is a simple device which measures the transparency of water. This disc is divided into black and white alternating quadrants and is lowered into the water on a graduated line until the quadrants cannot be distinguished. The depth at which the disc just disappears is termed the Secchi disc depth. This depth can be utilized to calculate a depth which approximates the extent of light penetration in a lake and hence the depth to which algae grow (called the euphotic zone). Generally, twice the Secchi disc depth is considered to approximate the lower limit of the euphotic zone. Subsequently, a composite sample of water from the entire euphotic zone can be collected for chlorophyll analysis. The amount of chlorophyll provides a rough indication of the quantity of algae present in a lake since it is regulated by all of the combined physical, chemical and biological factors which affect algal production. The composite sample (Figure 1) is collected by lowering a narrow-mouthed bottle (946 ml capacity) through twice the Secchi disc depth (lower limit of euphotic zone). By prior trial and error, the bottle is lowered and raised at such a rate that it should fill completely just as it ascends to the surface of the water. Specific details are provided

The "Secchi Disc Reading" is obtained by averaging the depth at which a 20cm (8") dia. black and white plate, lowered into the lake just disappears from view and the depth where it reappears as it is pulled up.

Most of the free-floating algae are suspended in the illuminated region between the lake surface and 2 times the Secchi disc reading.



Clear, algae-free lake: Secchi disc readings tend to be greater than 3m (9 feet).

Turbid or algae-rich lake: Secchi disc readings tend to be less than 3m (9 feet).

Figure 1: Diagram illustrating the use of a Secchi disc to measure water clarity.

METHODOLOGY

Secchi disc reading

1. Secchi disc readings and chlorophyll samples are taken once a week, preferably between 9.00 a.m. and 3.00 p.m. Readings should be done during sunny or intermittent cloud or light cloudy conditions. For persons collecting samples on weekends, Sunday is preferable to Saturday regardless of weather conditions. To the extent possible, samples should be collected at a convenient time for shipping or delivering to Toronto to minimize sample transit time.

2. The sampling location should be in the deep, open-water area of the lake away from islands, docks or projecting shorelines.

3. Secchi disc measurements are made by lowering the black and white disc into the water on the shaded side of the boat. The observer should lean over the side of the boat so that his eyes are directly over the disc as it is lowered. When the disc just disappears, the depth is measured. The Secchi disc is then raised slowly until the black and white segments are just visible. A second reading is taken. The point halfway between these two readings is the Secchi disc depth. Reading should be to the nearest half meter. For example:

    (1) lowered until the disc just disappears - 3 m.
    (2) raised until the black and white quadrants just reappear - 2.5 m.
    (3) point halfway between (2.75 m) is the Secchi disc depth.

    The Secchi disc reading may vary from one day to another.

Chlorophyll sample

1. After determining the Secchi disc depth, measure out twice this amount of rope and mark it with a clip or a knot. This is the depth of the euphotic zone through which the water sample for chlorophyll will be collected. If the Secchi disc depth is greater than 5.0 m it will be necessary to add extra rope to the rope provided in order that the water sample may be collected through the entire euphotic zone.

2. Label water sample bottle with lake name, date, depth and the word "Chlorophyll".

3. Place sample bottle in sample bucket and secure it by jamming bottle cap into space between bucket and bottle.

4. Lower the sampler as rapidly as possible down to the measured sampling depth and then raise again as rapidly as possible. If the bottle is not full repeat this operation until it is full or adjust the speed of lowering and raising so that the bottle is full when it reaches the surface. The object is to collect water from all depths of the measured sampling column. In the case of very transparent lakes (Secchi disc depth greater than 4.0 ~~ft~~ m) it may be necessary to reduce the size of the opening in the bottle; otherwise, the bottle will always be filled before it reaches the surface. This may be done by utilizing one of the extra caps which is provided with a ½" hole. Secure the cap firmly on the bottle prior to sampling and then replace it with the original cap prior to shipping.

   In very transparent, shallow lakes where twice the Secchi disc depth would be deeper than the bottom, collect the water sample to within 1 meter above the bottom. Be careful not to disturb the bottom sediment. Make a note of the bottom depth on the information form. Do not collect water samples if the Secchi disc is visible on the bottom.

5. The small brown dropper bottle contains a 2% suspension of magnesium carbonate. Shake thoroughly each time prior to using. Add 10 - 15 drops of this suspension to the water sample immediately after collection.

6. For each sampling date, complete one of the enclosed information forms (MAKE CERTAIN THAT THE INFORMATION ON THE BOTTLE IS ALSO RECORDED ON THE FORM). If it is not possible to deliver the samples personally, one of the following methods can be used:

   1. C.N. or C.P. Express.
   2. Trucking or courier service.
   3. Bus (avoid if possible).

   The shipping address should include the following:

   Water Resources Branch,
   Limnology & Toxicity Section,
   Ministry of the Environment,
   Resources Road,
   Highway 401 and Islington Ave.,
   Toronto, Ontario.

A map is enclosed for persons who wish to make deliveries of samples to the laboratory in person. Samples may be left with the security guard on weekends or after regular working hours - i.e. between 4:30 p.m. and 8:15 a.m. If at all possible samples should be shipped or delivered so as to reach the laboratory within 48 hours of sample collection.