



pennsylvania
DEPARTMENT OF ENVIRONMENTAL
PROTECTION

BUREAU OF CLEAN WATER

CHLOROPHYLL A SAMPLING METHOD IN LAKES, PONDS and RESERVOIRS

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INTRODUCTION

Chlorophyll-a is the primary pigment produced by algae in our freshwater lakes and an important water quality parameter by which to assess algal productivity. We use chlorophyll-a as one of four parameters to indicate trophic state of the lake. Chlorophyll-a is measured via a field-filtered water grab sample obtained from either 1) a Van Dorn or Kemmerer sampler deployed, set, and retrieved from specific depth(s) or 2) a 2-m depth integrated sampler such as the one used in the EPA National Lakes Surveys, made from a 2m long by 1.24" (inside diameter) PVC tube (EPA 2017). Each method was found to yield very similar results (chlorophyll-a concentrations (ug/L) within 10%). Phaeophyton, an ancillary algal pigment, can be analyzed from the same sample (see below).

A minimum of six chlorophyll samples are collected on each lake using the normal sampling protocol (taken during spring, summer, and fall, two stations each event). Chlorophyll-a is linked to primary productivity of a lake and can often be tied to total phosphorus (TP) concentrations. Phaeophyton is a breakdown product of chlorophyll and can be used to help determine if a plankton bloom is declining. A separate Trophic State Index (Carlson 1977) is calculated from chlorophyll-a and is used in comparison with indices calculated for TP, total nitrogen (TN), and Secchi depth to assess lake status (see below).

FIELD COLLECTION AND SAMPLE PROCESSING METHOD

Remember that each water grab sampling device used in lakes must have an equipment blank on record for the sampling season. An equipment blank is collected prior to the first sample of the year. Rinse your Van Dorn/Kemmerer/integrated sampler with DI water, shake, and empty it through both valves. Refill the sampler with DI or MQ water from the Lab, and collect your blank sample from it, running it through the valve/nozzle just as you would for a sample. Rinse each collection bottle three times with DI/MQ water from the sampler before filling with the blank sample to be analyzed. Use a SAC that analyzes for metals (to test for seal leachate) plus nutrients, such as SAC 083.

Each lake requires one filter blank at the beginning of the data set for the year. This sample is collected and treated as a normal sample except for using DI or MQ water from the Lab for filtering. Collect this sample first thing, either onshore or in the boat, using the protocol below. Label as a unique sample. Duplicates should be collected at the rate of one per 10 samples for that lake, or at least one per year's set of samples for each lake, preferably from the summer set.

1. Anchor boat over sampling location and record the following information on the Lake/Reservoir Field Data Sheet (3800-FM-BPNPSM0050), available at the end of various lake method and assessment documents and attached below.

Lake Name	County & Municipality
Station Number /visual location	Latitude and Longitude
Date	Meteorological conditions:

Time	Air temperature
Water depth	Wind speed/direction
Water transparency (Secchi Disk)	Percent cloud cover
	Water surface disturbance (wave height, type))

- Starting at the surface, record dissolved oxygen, temperature, pH and conductivity profiles at each 1-meter increment of water depth to lake bottom (or in 0.5 m increments in shallow lakes), using a calibrated Hydrolab or equivalent multiparameter probe.
- Set and retrieve the Kemmerer or Van Dorn or other similar discrete grab sampling device at the desired depth (normally 1-m below the surface). If using a tube-integrated sampler, lower the open-ended tube vertically and completely into the water until the top opening is at the waterline, and set stopper. When retrieving, once the lower end of the tube is near the surface, close the bottom valve to contain the water column. If the lake station is shallower than 2m, the integrated tube method would not be appropriate. If tube collecting, transfer the sample into a pre-rinsed dark 2-L bottle. For all types of grab samplers, plankton is only one of various samples that will be taken out, so be sure to homogenize the sample before pouring off the chlorophyll sample. Proceed with filtration immediately; if filtering on shore because of adverse weather/waves, place chlorophyll-a water into a dark brown plastic pre-rinsed collection bottle, and place on ice.
- Assemble the filtering device, rinse with DI water before placing filter. With forceps, place a new 47 mm diameter glass fiber filter (GF/F) such as Whatman or Gelman TypeA/E onto the unit, rough side up, grid side down.
- Rinse an appropriate sized graduated cylinder (50 or 100 ml) with lake water. Immediately before taking an aliquot, homogenize the sample by inverting or shaking the Van Dorn or collection bottle, then pour about 50ml in the graduated cylinder. Pour this measured amount into the filtration funnel and record this volume (it can be + or – 50 ml up to 100 ml, but record the exact amount used on the field sheet). Vacuum-pump the water through the filter. Target filtrate amount is 50 ml, filtered within 30 mins of collection. Do not allow vacuum pressure to exceed 7 “Hg. The filter does NOT need to be stained green or brown (new Methodology EPA LG404). When the last 10 ml remains in the filtration unit, add 10 drops (1/2 ml) of saturated MgCO₃ solution to the sample and finish filtering. Rinse filtration funnel with DI water to wash down any remaining algal cells. Record volume of sample water filtered.
- Remove filter from unit with forceps. Fold filter in half, upon itself. Place filter in a plastic petri dish or small plastic vial or directly on a precut square of aluminum foil. Wrap petri dish or vial in aluminum foil to shield from light; or, with filter directly on foil square, fold up the sides/ends of the foil, careful not to fold the filter inside any more than the original half. Place wrapped sample in a labeled envelope or small zip bag then place in a labeled manila envelope. All chlorophyll-a samples for the day, individually labeled with collection number, volume filtered, and date, can be placed in one manila envelope marked with lake name and date. Finally, place the labeled envelope in a whirl-pack bag. If shipping by courier, use two whirl-pack baggies to definitively seal out melt water. Immediately place on wet or

dry ice; if not shipping immediately to the lab, freeze in a -20C degree freezer. Filters may be held in the freezer for up to 2 weeks, and sent as a batch to the Bureau of Labs.

7. Forward samples in a cooler packed with wet or dry ice to the Bureau of Laboratories in Harrisburg via courier service. Use the Dry Ice shipping label on the cooler if using dry ice. Samples must be accompanied by a completed Lab "Sample Submission Sheet" with Chain of Custody information. Forms are available on the BOL website. The Standard Analysis Code (SAC code) for the new chlorophyll-a method is B029.
8. If you desire phaeophytin results also, ask for SAC B019 on the same Sample Submission Sheet as SAC B029.
9. Field observations, including weather, the Secchi depth, temperature and dissolved oxygen profile, should be recorded on the Field Data Sheet. Enter the field data into SIS within 14 days of collection.

Reference:

US EPA. 2017. National Lakes Assessment 2017. Field Operations Manual. EPA 841-B-16-002. U.S. Environmental Protection Agency, Washington, D.C. 95pp.



LAKE/RESERVOIR FIELD DATA SHEET

Lake Name _____ County _____
 Station _____ Lat. _____ Long _____
 Date _____ Time _____ Collectors _____
 Weather _____
 Cloud Cover (%) 0 25 50 75 100 Comments (Hazy/Foggy) _____
 Wind Conditions: None Light Moderate Heavy Direction _____
 Rain Conditions: None Drizzle Light Moderate Heavy _____
 Surface Turbulence _____ Air Temperature (°C) _____
 Station Depth (meters) _____
 SECCHI DISK READING (TENTHS OF A METER) _____

FIELD MEASUREMENTS

DEPTH (meter)	TEMP (°C)	D.O. (ppm)	pH	Sp. Cond. (Umhos)	DEPTH (meter)	TEMP (°C)	D.O. (ppm)	pH	Sp. Cond. (Umhos)
surface					11M				
1M					12M				
2M					13M				
3M					14M				
4M					15M				
5M					16M				
6M					17M				
7M					18M				
8M					19M				
9M					20M				
10M									

SAMPLES COLLECTED

TYPE/DEPTH	SAC	VOLUME FILTERED	TIME COLL.	COLLECTION NUMBER
WATER QUALITY (Top)				
WATER QUALITY (Bottom) Depth of Sample:				
CHLOROPHYLL A				
OTHER (blank/dup.)				
PLANKTON TOW (2x _____ m net diameter = _____")				

COMMENTS:
