



PHOSPHORUS

Monitoring Procedures



Phosphorus is one of several essential nutrients that algae need to grow and reproduce. For most lakes in Michigan, phosphorus is the limiting factor for algal growth. The total amount of phosphorus in the water is used to predict the level of productivity and eutrophication in a lake. An increase in phosphorus over time is a measure of nutrient enrichment in a lake.

Phosphorus is a naturally occurring element that is found in rocks and soil. Humans use and dispose of phosphorus on a daily basis in common items such as fertilizers, foods, and cleaning agents. Lakes with developed watersheds often receive a portion of this human-generated phosphorus through runoff, septic leachate, and other sources.

Phosphorus is found in lakes in several forms that are in a constant state of flux as environmental conditions change and plants and animals live, die, and decompose in the lake. The various forms of phosphorus are constantly changing and are distributed in different locations of the lake with changing seasons. Because the forms of phosphorus are continuously changing and recycling, it is convenient to measure all of the forms of phosphorus together as total phosphorus.

The late summer phosphorus results, along with chlorophyll and Secchi disk transparency measurements, provide an estimate of the level of productivity, or trophic state, of your lake. These results are used to calculate a set of trophic state indices (i.e. Carlson TSI) for the lake. These indices provide a quantitative means of describing the stage of lake aging, or eutrophication. Using Carlson's TSI, we classify lakes according to their trophic state (i.e. oligotrophic, mesotrophic, eutrophic, etc.). Spring overturn, when the lake is generally well mixed from top to bottom, is an opportune time of the year to sample just the surface of the lake to obtain a representative sample for estimating the total amount of phosphorus in the lake. At other times of the year, more extensive water column sampling is needed to determine phosphorus levels in the lake.

Equipment Checklist

- boating safety equipment* and anchor*
- total phosphorus monitoring procedures
- total phosphorus data form
- pencil* or indelible ink pen*
- sample bottles (2)
- ice pack*
- total phosphorus sample labels (2)
- fine tip permanent black marker*
- towel* for drying hands
- insulated cooler bag* and freezer
- zip-lock freezer bag*

*(provided by volunteer)

Safety

As with all CLMP sampling, the phosphorus samples should be collected when the weather conditions are safe. Be sure to sample with all of your safety equipment onboard (life jackets, back-up oars, etc.) Collect your samples on the first available day that the weather is good. Sample with a partner, remain low in the boat when collecting samples, and do not lean over the side.

Sample Collection

Spring overturn and late summer total phosphorus samples are collected as grab samples (i.e. discrete samples) just below the surface of the lake over the deepest basin in the lake. During spring overturn, when the lake is completely mixed, the surface grab sample is a representative sample for the entire lake. During late summer, when the lake is thermally stratified (i.e. distinct temperature-defined water layers), the surface grab sample represents only the upper water layer (i.e. epilimnion) of the lake where most algal productivity occurs. These monitoring procedures should be followed carefully for both spring overturn and late summer total phosphorus sampling.

1. Organize sampling materials. Before proceeding to the sampling location use the equipment list, above, to organize all of the materials needed to obtain the total phosphorus samples. (**Note:** Along with these monitoring procedures, you should have received two 250 ml plastic bottles and labels for each sampling location for the spring overturn total phosphorus samples. Bottles for the late summer total phosphorus samples will be sent out during the summer. If you receive any bottles without the caps on them, please notify the DNRE (former DEQ) Lansing office immediately for replacement bottles (see Section F. Technical Support). **DO NOT** use sample bottles that arrive without the caps on them. **DO NOT** substitute any other containers for the total phosphorus sample bottles. If this is your late summer total phosphorus sampling event and you are enrolled in the chlorophyll monitoring program, you should also collect your final chlorophyll samples during this sampling event. Refer to the chlorophyll monitoring procedures for sampling this parameter.)
2. Fill out labels and attach to bottles. Before the bottles or labels get wet, use a fine tip permanent black marker to completely fill out the total phosphorus sample labels and

attach the labels to the sample bottles. This is an easily overlooked step- but labeling your samples *before* you go out to the water will prevent sample mix-ups.

The information on the label should include:

- Sampling Date
- Volunteer's Initials
- Location, which is your lake's name;
- Field ID, which is the Lake Sampling Site (Field ID) Number

Note: Use the Master List of Lake Sampling Site (Field ID) Numbers provided to find the correct number for your site. The Lake Sampling Site (Field ID) Number ensures that your data are entered correctly into the MiCorps online Data Exchange system and the CLMP Annual Report. Field ID's can be also found here:

http://www.micorps.net/documents/2010_SiteID_List.pdf

- Total phosphorus Analysis or Parameter Code, which is GA.
- Leave the Chemicals Added box blank; we will add the preservative and mark this box when we receive the samples in Lansing.
- For the second label, the Sampling Location should also include the letters “-REP” to designate it as the replicate, or duplicate, sample.

Also, begin filling out the phosphorus data form (provided with sample bottles) by including lake name, county, township, Lake Sampling Site (Field ID) Number, date of ice-out (for spring overturn sampling), and your name. (Note: Use a soft lead pencil, indelible ink pen, or fine tip permanent black marker when recording information on the data form. Avoid using inks that will fade or run when wet.)

Example Phosphorus Labels (attach to bottles prior to sampling)

Collector's Initials <i>TP</i>	Dept. of Environmental Quality	Date <i>4/25/03</i>
Field ID <i>Deep Basin ①</i>	Location <i>Dead Spider Lake</i>	
Analysis or Parameter Code <i>GA</i>	Chemicals Added	

Collector's Initials <i>TP</i>	Dept. of Environmental Quality	Date <i>4/25/03</i>
Field ID <i>Deep Basin ①</i>	Location <i>-REP Dead Spider Lake</i>	
Analysis or Parameter Code <i>GA</i>	Chemicals Added	

3. Proceed to your sampling location. During the scheduled sampling dates for your lake, boat out to the deepest basin of the lake to collect the total phosphorus samples. (**Note:**

Refer to the phosphorus sampling schedule enclosed with these monitoring procedures for appropriate sampling dates.) This should be the primary sampling site for all Cooperative Lakes Monitoring Program sampling events in your lake. Collect the samples on the first good day that will allow sampling during the scheduled dates. **BE SAFE!** Bad weather may make sampling dangerous. Do not put off sampling to the last day of the designated dates, if avoidable. (**Note:** If weather conditions are hazardous during the entire scheduled sampling period, it is best to skip sampling rather than to risk your safety. **DO NOT** take the samples from the end of your dock or from shore just to get a sample.)

4. **Orient boat for sampling.** Approach the sampling location from the upwind direction. Turn off boat motor and drift over the deepest point in the lake. Make sure motor exhaust or fuel leaks will not contaminate the samples. (**Note:** For windy days, you may need to anchor the boat to stay over the deepest point in the lake while sampling. Lower the anchor and allow the boat to drift over the sampling location before securing the anchor line. This allows you to sample outside the area where sediments may be re-suspended when the anchor hits bottom.) When in position, take out the phosphorus data form (provided with sample bottles) and record the date, time, weather conditions, and any unusual lake conditions. Also, on the back of the phosphorus data form, draw an outline of your lake and mark the approximate sampling location.
5. **Prepare bottles for sampling.** At the sampling location, take a bottle and unscrew the cap, holding the cap between two of your fingers, touching only the outside of the cap. (**Note:** If you touch the inside of the cap, or the cap gets dirty, dip the cap in the lake to clean. Do not wipe the cap clean or try to dry it off. Also, if you use tobacco products, do not smoke during sampling and make sure your hands and fingers are clean. Tobacco products contain phosphorus which may contaminate the samples.) Rinse bottle twice with lake water and shake out any residual water after the second rinse. (**Note:** **BE SAFE!** Keep in mind that you will be leaning over the side of the boat to take the samples. Be sure to wear a life jacket for the entire time you are out on the lake. Take every safety precaution to protect yourself. Keep low in the boat when reaching over the side to collect the samples. Always sample with a partner. Your sampling partner can help counter-balance the weight in the boat as you reach over the side to collect the samples. **DO NOT** sample if you are not feeling well or the weather is bad. **DO NOT** put yourself in a dangerous situation. Your safety should always be your primary consideration. Since the water will be very cold at spring overturn, bring a towel to dry off your hands and arm after sampling.)
6. **Collect total phosphorus sample.** After rinsing, grab the bottle around the base with tips of all fingers and thumb of one hand (i.e. the “dead-spider” grip). Turn the bottle upside down so the bottle mouth is pointed in a downward direction. Lower the bottle into the lake approximately one foot below the surface (about to your elbow). Turn the bottle sideways (i.e. horizontal) with the bottle mouth pointing in the direction the boat is drifting. (**Note:** **DO NOT** collect the samples near the motor.) When almost full, turn the bottle right-side up underwater to fill completely before lifting it out of the water. Since the sample will expand when frozen, spill out a small amount of water from the bottle so it is about three-quarters full. Cap the bottle and tighten cap firmly. Use your towel to dry the outside of the sample bottle before storing it in the zip-lock bag.

7. Collect second total phosphorus sample. Repeat steps 5 and 6 at the same location for the second (i.e. replicate) total phosphorus sample. (**Note:** The replicate sample will serve as a backup for the first sample should any problems occur in handling, transporting, or analyzing the sample; and for some lakes (chosen randomly) the replicate sample will be used for quality assurance/quality control purposes.)
8. Prepare to return to shore. Congratulations, you have now completed the sample collection phase of the phosphorus monitoring procedure. Store your samples in the zip-lock bag in an insulated cooler bag with freezer ice pack- the ice pack will slow down the biological action that could potentially change your results. This is an often overlooked step, so be sure you do it. Pull up anchor, if used; and return to shore. (**Note:** If this is your late summer total phosphorus sampling event and you are enrolled in the chlorophyll monitoring program, you should collect your last chlorophyll sample for the summer before returning to shore. Refer to the chlorophyll monitoring procedures for sampling this parameter.)

Sample Handling

After returning to shore, place the zip-lock bag with sample bottles in your freezer immediately. Store the samples in the freezer until you take the frozen samples to the designated DNRE (former DEQ) District office on the designated turn-in date, as described in the following section.

Submitting Data to the MiCorps Data Exchange Network

The MiCorps Data Exchange Network is an internet-based database designed to store data collected by volunteer monitors. This network allows you to enter data as well as to view data already entered into the database. As a new component to the CLMP program, we are asking volunteers to enter their own data directly into the MiCorps Data Exchange Network. The data entry web address is <http://www.micorps.net/data/enter>. While the laboratory will process your samples and provide those results to the MiCorps Data Exchange Network, you can enter the field data from your data form into the network.

To enter data you will need your own username and password. To receive your username and password, email MiData@glc.org or call Anne Sturm at 734-971-9135. As soon as you have your username and password, you can begin entering your data into the MiCorps Data Exchange Network at the following website: <http://www.micorps.net/data/enter>. After logging in, the website provides you with easy-to-follow steps for entering your data. If at any time you have questions or run into problems please email MiData@glc.org or call Anne Sturm at 734-971-9135.

In order to be included in the MiCorps data files or presented in the CLMP Annual Report, **all data must be entered into the database no later than October 30th**. You may enter your data after each sampling event or at the end of the sampling season, but remember you must deliver your original data forms with your frozen samples (see Sample Delivery, below).

If you do not have access to a computer with internet access, please plan to use the public computers available at your local library. If due to access issues or your personal comfort level with computers, you are unable to enter your own data into the MiCorps Data Exchange Network, please email MiData@glc.org or call Anne Sturm at 734-971-9135 to make alternate arrangements for entering your data into the database.

Sample Delivery

Deliver the frozen total phosphorus samples and data sheet to the designated DNRE (former DEQ) District office on the designated turn-in date. (**Note:** Refer to the enclosed phosphorus sampling schedule for the turn-in date and drop-off location for your samples. If you have a conflict with the scheduled turn-in date, you may deliver your frozen samples prior to the turn-in date.) Fill in the sample turn-in date on the phosphorus data form and place the completed data form in the zip-lock bag with your frozen total phosphorus samples. **Your total phosphorus samples must be frozen when you drop them off at the DNRE (former DEQ) District office and you must include your data form with the samples.** (**Note:** Your insulated cooler bag with freezer ice pack can be used to keep your samples frozen while transporting them to the designated DNRE District office.) **Your frozen samples must be received no later than noon of the scheduled turn-in date at your designated DNRE (former DEQ) District office.** Samples turned in late or not frozen will not be accepted or will be thrown out. Due to recent events, packages can not be left at the door. Therefore volunteers must deliver samples to the DNRE (former DEQ) District offices during normal business hours.

(**Note:** It is very important that a trained back-up sampler can substitute for you in case you are unable to collect the total phosphorus samples during the designated sampling days. Samples should only be taken during the scheduled sampling dates. If you are unable to drop off your samples at the designated DNRE (former DEQ) District office on the specified turn-in date (or day prior), you may deliver or express ship (i.e. next day shipping) the frozen samples to Jo Latimore at Michigan State University, within two days of the designated turn-in date. Dr. Latimore's address is provided below. If you are next day shipping the samples it will be necessary for you to pack the frozen samples in an insulated container with a freezer pack to keep the samples frozen. **Samples that have thawed during shipment will not be analyzed.**)

Training

There is no required onsite training for this parameter. However, the Michigan Lake and Stream Associations, Inc. will be hosting training sessions for this and other parameters in late April at the annual spring conference. Attending this conference at least once is highly recommended to assure quality data collection and to develop relationships among other volunteers and resource people. Training may also be offered at other locations in the weeks immediately following the conference. Contact one of the individuals listed in the Technical Support section below for information on alternative training sites.

Quality Assurance/Quality Control

As part of the quality assurance/quality control (QA/QC) process for the Cooperative Lakes Monitoring Program, DNRE staff will conduct side-by-side sampling for selected lakes enrolled in the total phosphorus monitoring programs. If your lake is selected for the QA/QC process, you will be contacted prior to the scheduled sampling dates to arrange coordination of the side-by-side sampling. For some lakes (chosen randomly), the replicate total phosphorus sample will also be analyzed as part of the QA/QC process.

Technical Support

Should you have any questions or comments about the phosphorus monitoring procedures or problems during sampling, sample handling, or sample delivery, please contact:

Ralph Bednarz, CLMP Coordinator
Dept. of Natural Resources & Environment
Water Bureau
Constitution Hall – 2nd Floor South
525 West Allegan Street
Lansing, Michigan 48933

Phone: 517-335-4211 (desk)
517-241-1300 (office)
FAX: 517-335-4381
Email bednarz@michigan.gov

or, you may contact:
Jo Latimore
Lake and Stream Outreach Specialist
Department of Fisheries and Wildlife
332 Natural Resources Building
Michigan State University
East Lansing, MI 48824-1222
Phone: 517-432-1491
FAX: 517-432-1699
Email: latimor1@msu.edu

Should you have questions or comments regarding entering or retrieving your data from the MiCorps Data Exchange Network please contact:

Anne Sturm
Great Lakes Commission
2805 South Industrial Hwy., Suite 100
Ann Arbor, MI 48104

Phone: 734-971-9135
FAX: 734-971-9150
Email: MiData@glc.org