

Volunteer Lake Monitoring Manual

Indiana Clean Lakes Program
School of Public & Environmental Affairs
Indiana University – Bloomington
April 2009

Background

Indiana has over 1,100 lakes. These lakes offer Hoosiers tremendous recreational opportunities, whether they are used for boating, fishing, swimming, or quiet enjoyment. The lakes also offer habitat for waterfowl and other wildlife. Many are used for drinking water supplies and flood control. In short, Indiana lakes are an integral part of our lives. Because they are so important, we all must insure that our lakes maintain their beauty and water quality. Unfortunately, keeping close track of the water quality of each lake would be a costly and difficult undertaking.

The time and expense of monitoring the water quality of all our publicly owned lakes has encouraged the Indiana Department of Environmental Management (IDEM) to sponsor the Volunteer Lake Monitoring Program as a part of its Clean Lakes Program. Through this program, you can learn more about your lake, and other lakes in Indiana, while helping to monitor your lake's water quality. The Volunteer Lake Monitoring Program is modeled closely after the successful citizen monitoring program in Wisconsin. Other states, including Illinois, Minnesota, Ohio, and New York, have similar citizen programs.

Who Runs the Program?

The Volunteer Lake Monitoring Program is a cooperative effort by three groups: the volunteers, IDEM, and Indiana University's School of Public and Environmental Affairs (SPEA). You, as a representative of the volunteers, are the crucial link in the operation of the Volunteer Lake Monitoring Program. You know your lake better than either of the other two groups. You know where to find the best fishing, what type of birds visit the lake, and where weeds are causing problems. You volunteered because of your concern for the lake. By collecting data for your lake, you can help IDEM and the School of Public and Environmental Affairs (SPEA) understand more about your lake. Using those data, we can help increase your understanding how your lake "works."

SPEA will assemble the data that you collect and will enter it into a computer database. At the end of the sampling season, we will send you a summary of your measurements and a summary of data from other volunteer's lakes. A statewide summary will allow you to compare the water quality of your lake to others. It will be presented in easy-to-understand graphs and written comments. The annual summaries will allow IDEM to closely monitor water quality changes and identify management needs at participating lakes.

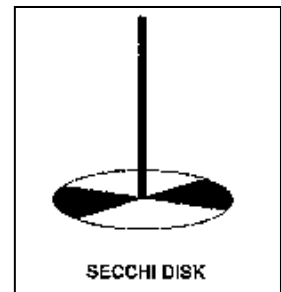
What is the Lake Monitoring Program?

Started in 1989, the Volunteer Lake Monitoring Program now includes over 100 Indiana lakes. More lakes are added to the program each year. Citizen volunteers like you donate about one hour of their time every two weeks to collect the necessary data. Your efforts provide a number of benefits not only for IDEM, but also for you:

- As a volunteer you will learn more about lake science (*limnology*).
- Not only will you learn about taking Secchi disk transparency readings (and possibly collecting total phosphorous and chlorophyll-a samples), but you will also learn about other water quality tests.
- By analyzing your samples and summarizing the information that you collect, we will be able to assess the changes in water quality at your lake. This is particularly important for lakes where little information has been gathered in the past.
- After we have summarized the data, we will be able to compare the water quality of lakes around the state. This information will allow us to better understand our Indiana lakes.
- Once we have several seasons' worth of data for a particular lake, we can begin to assess the long-term trends in the lake's water quality. Five years' worth of Secchi disk data is enough to begin to understand whether the lake is being degraded, is improving, or staying the same. One season of sampling is not enough to establish long-term trends.
- This assessment can identify which lakes should receive more intensive management and/or monitoring.

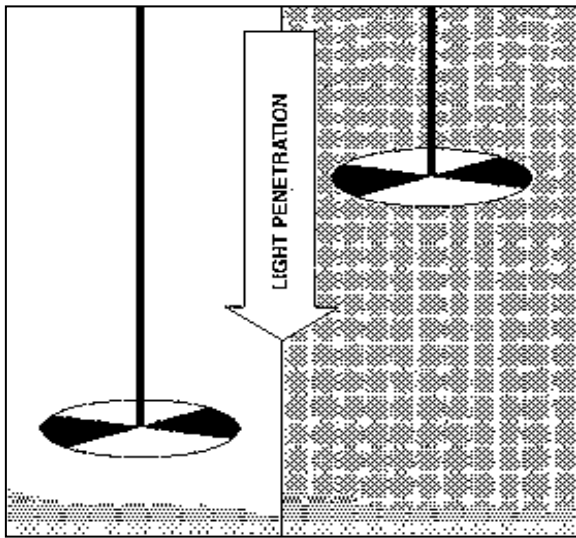
What Do These Measurements Say About Water Quality?

The Secchi disk that you received as part of your volunteer package is used to measure water clarity or transparency. It is one of the oldest and most basic tools used by limnologists around the world. The Secchi disk is an eight-inch diameter disk painted black and white in alternating quarters. It is attached to a fiberglass measuring tape marked in **tenths** of feet. Look at the tape carefully to see that the markings are NOT in inches! (Earlier Secchi disks used in this program were attached to nylon cords marked in one-foot intervals.)



Secchi disk measurements of water clarity can tell a great deal about the water quality of lakes. Water clarity is affected by two factors: algae and suspended sediments. Sediments may be introduced into the water by either runoff from the land or from sediments already on the bottom of the lake. Many activities may introduce sediments to lakes via runoff: examples include erosion from construction sites, agricultural lands, and riverbanks. Bottom-feeding fish such as carp may resuspend bottom sediments, or in shallow lakes, motor boats or strong winds may suspend sediments.

Aquatic Food Chain

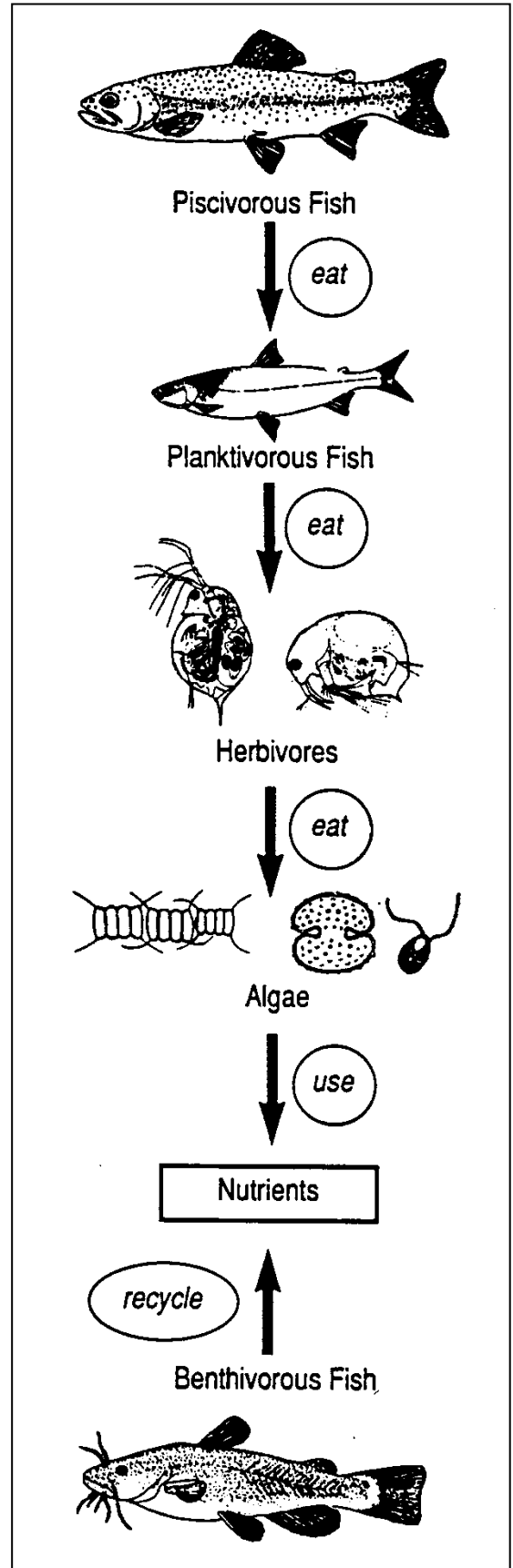


Clear Lake Turbid Lake

Algae are a natural component of the food chain in lakes. They are food for microscopic animals (zooplankton), which are, in turn eaten by fish. We are usually only aware of algae when they become overly abundant. Algae are microscopic plants that grow like plants; they need sufficient light and nutrients to survive. When there are too many nutrients in the lake, the algae multiply enough to cause a decrease in water clarity. The decrease will be seen when you take the Secchi disk transparency reading.

Of course, algae and suspended sediments are not the only factors that will affect your Secchi disk reading. Other factors that may affect your reading are the color of the water, wind, waves, sunlight, and even your eyesight. Some lakes have a natural brown color. In this case, the color is not an indication of pollution or suspended sediments, but of tannic acids produced by decaying plants. Light does not penetrate as deeply in these darkened waters, so these brown lakes will generally have fewer algae than clear lakes.

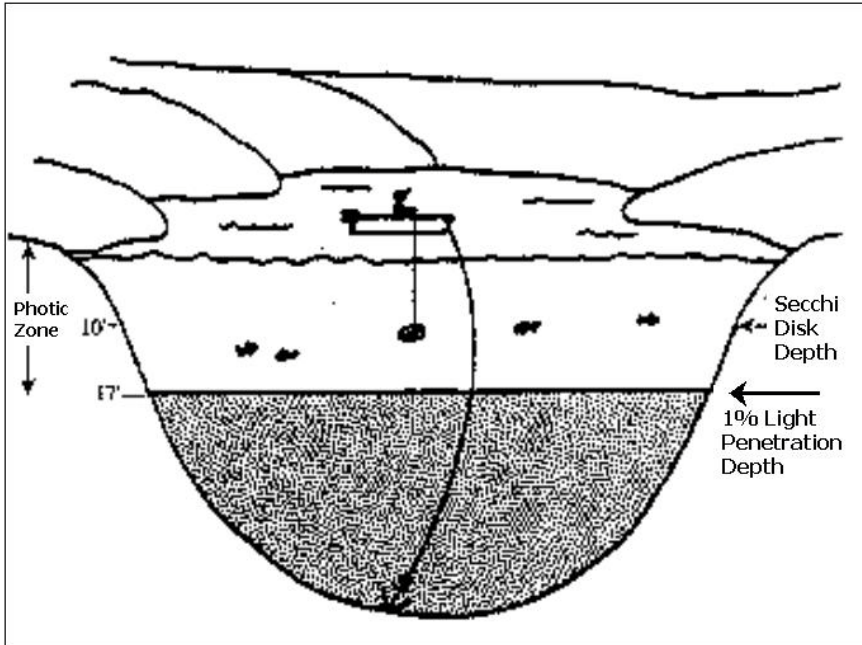
Secchi disk transparency readings can also give a rough estimate of the depth to which oxygen can support fish and other aquatic life. The *photic zone* is defined as the vertical depth of a lake that has enough light to support plant growth. Algae use the light to produce energy through a process called photosynthesis. Oxygen is released by the algae as a by-product of photosynthesis. The oxygen is in turn used by the fish that live in the deeper waters of the lake. Generally, the depth to which light can penetrate is 1.7 times the Secchi disk reading. For example, if your Secchi disk reading was



10 feet, then light can penetrate to a depth of approximately 17 feet. This tells us that there is enough light to support an algal population throughout that depth of water.

When to Take a Reading

The weather is another factor that will affect your ability to read the Secchi disk. Try to take your readings on days when the lake is calm and the sky is clear. The angle of the sun will affect your ability to see the disk, so take readings between 10 a.m. and 4 p.m. Winds creating high waves will adversely affect your ability to read the disk.



The goal of our program is to have transparency monitored *once every two weeks*. The lake transparency changes rapidly during the summer months and it is important for us to have regular samples. Try to make the sampling a regular part of your activities. If you are able to take a reading every week, great!

Water transparency following intense rainstorms or heavy boating activity is often

lower than other times. This is to be expected. For example, many of our volunteers report worse transparencies on Saturdays, Sundays, and Mondays than on other days of the week. We encourage you to vary the day of the week that you make your Secchi disk transparency measurement. This will help cover the entire range of conditions common on your lake. We especially encourage you to make a measurement after a heavy storm runoff. Use the comment section of the data card or online entry form (see pg. 9-10) to indicate if there was a recent heavy rain or other event that could affect your reading. We analyze your data according to day of the week measured and according to any special conditions you note.

If you are unable to take your scheduled reading, do not worry about it. Take it as soon as you are able. If for some reason you are unable to continue to sample during the sampling season, please do not hesitate to contact SPEA. In this event, it would be extremely helpful to the program if you could provide us with the name of another lake resident interested in volunteering to take the readings. You can also include this information in the volunteer survey, sent out at the end of every sampling season.

Other Information to Collect

After you make each Secchi disk transparency measurement, we would like you to also record the: a) water color, b) recreation potential of the lake, and c) physical appearance of the water.

Water Color

A lake's water color can give insight into whether transparency is affected by algae (green color) or suspended sediments (brownish color) or even what kind of algae (green, blue-green, yellow-brown, etc.). Water color can be determined by lowering your Secchi disk into the water to about one-half the Secchi disk depth. Look at the water color against the white background of the disk. Select one of the following colors that best matches your water color: **clear/blue, blue/green, green, brown or green/brown.**

Recreational Potential

We would also like to get your opinion of your lake's "recreational potential" and "physical appearance" at the time you take your Secchi disk measurement. This helps us relate Secchi disk transparency to the use and appearance of your lake. Remember, this should be your opinion on the condition of your lake. For the "recreational potential", if everything looks great, circle "beautiful" on the data card. If the water looks really scummy and you personally would not want to swim in the lake, circle "no swimming". If swimming is not allowed in your lake, we would still like you to consider "recreational potential" as if swimming was allowed. Similarly, circle the condition that you feel best represents the lake's physical appearance, or enter it into the online entry form.

Lake Level

The Indiana Department of Natural Resources (DNR) Division of Water has asked if our volunteers might be able to record the elevation on the lake level gauge present near the outlet of most public lakes in Indiana. The USGS no longer supports automatic recorders, and DNR does not have the staff to go out and make regular readings. This is where you can help to increase the value of the Volunteer Lake Monitoring Program. A metal staff gauge (see image below) is located near the boat ramp or lake outlet. The gauge is marked in feet, tenths of feet, and hundredths of feet. You will



likely need to wipe off any algae or scum at the waterline before making a reading. Record the lake level in the Lake Level section on the online form (see page 10-11) or in the comments section of the data card, as well as on your data sheet. DNR would like measurements whenever you are able, particularly during periods of high water levels. Please let us know if you have any

questions or if you cannot locate your lake's gauge. If your lake does not have a gauge, you may contact your local DNR office to install one.

Sampling Checklist

Before going out on the lake to make your Secchi disk reading, make sure that you have everything you need and the weather conditions are okay for sampling! Please confirm everything on this checklist.

Weather:

- Sunny/partly sunny/partly cloudy
- Winds calm to breezy (NO WHITECAPS!!)

Date and time of day:

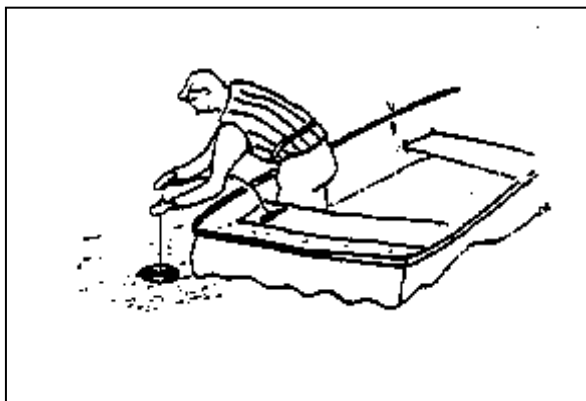
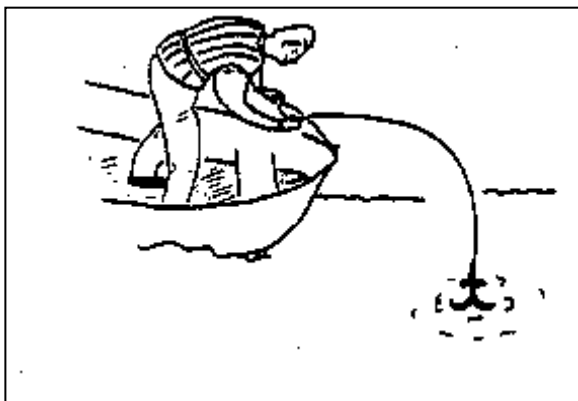
- Between 10 a.m. and 4 p.m.

Do you have:

- Secchi disk?
- Boat anchor?
- Sampling instructions?
- Data forms?
- Something with which to write

HOW TO TAKE A SECCHI DISK READING

When taking the Secchi disk readings, be sure to follow the instructions. The data you collect will be valuable *only* if you take the readings carefully and according to set procedures. Remember, do not feel guilty about missing a scheduled reading. Do it when you have the time. **NEVER** make up data. We would rather have no data than invalid data. Most of all enjoy your time in the boat and on the lake.



1. Use the map of your lake and its marked sampling site and proceed to the site. Always take your Secchi disk measurements from this same general location.
2. Anchor the boat at the sampling site. Remove your sunglasses.
3. Lean over the **shady** side of the boat and slowly lower the Secchi disk into the water until it can no longer be seen. Note the depth that the Secchi disk disappears from site.
4. Lower the disk a few more feet into the water. Slowly raise the disk. When the disk reappears, note this depth. Record the mean depth between where the disk disappeared and reappeared as the Secchi disk transparency depth.

Measuring Tape Markings

5. *Tape Measure:* Carefully read the depth to the nearest **tenth of a foot**. Be sure to record the measurement on the datasheet (see below for an example)



Read the tape at the water line. In this example, the arrow denotes a water line of 1.5 feet, not 1 foot 5 inches. In this example, you would record a reading of 1.5 feet.

Note: the marks on the measuring tape are in tenths (1/10) of a foot, not inches.

6. To determine the water color, lower the Secchi disk into the water to about ½ the Secchi disk depth and observe the water color against the white background. Record your observation based on the color options given.
7. Consider the water quality condition of the lake and circle one answer for “Recreation Potential” and one answer for “Physical Appearance.”
8. When finished, check to see that the data card is completely filled out. Mail it as soon as you can.

—OR—

9. Log onto the Indiana Clean Lakes Program web site and enter your data **on line!** (See page 9-10.) If you are monitoring more than one lake, proceed to the next location and repeat steps 1-8.

After taking your Secchi disk reading, be sure to:

- ❑ Store your Secchi disk and equipment in a dry place.
- ❑ Go over the data form and make sure it is complete.
- ❑ Log onto the Indiana Clean Lakes Program web site at:
<http://www.indiana.edu/~clp/>
and enter your data into our electronic data entry form (see page 9).

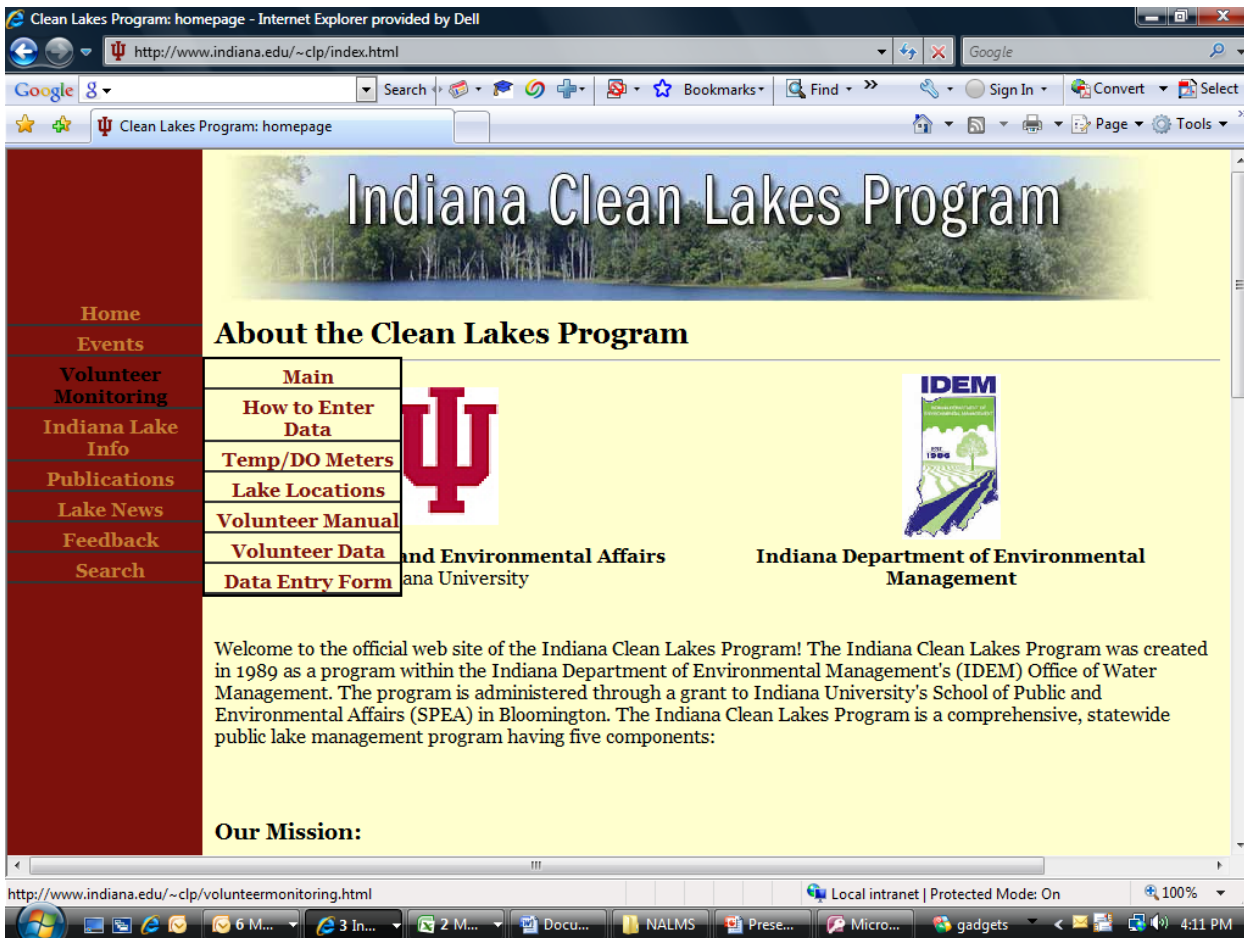
-OR-

- ❑ Carefully copy the data onto the SPEA postcard. Make sure all the blanks are filled. Mail the postcard to SPEA in Bloomington (remember: the postage is prepaid for you!)

Sample Data Card

Your Name: _____
Lake Name: _____ ID# _____
County: _____
Sample Date: _____ Sample Time: _____
SECCHI DISK TRANSPARENCY: (Record to nearest 1/10 foot)
Depth: _____ Did it hit bottom? (circle one) NO YES
WATER COLOR: (select one)
Clear/Blue Blue/Green Green Brown Green/Brown
RECREATION POTENTIAL: PHYSICAL APPEARANCE
16. Beautiful 1. Crystal Clear
17. Minor Aesthetic Problems 2. Some Algae
18. Swimming Impaired 3. Definite Algae
19. No Swimming 4. High Algae
20. No Recreation 5. Severe Algae
(Circle the condition that most applies in each category.)
OTHER COMMENTS:

Entering data into the “Data Entry Form” on the CLP Website



1. Access the Clean Lakes Program website at: www.indiana.edu/~clp
2. Navigate to the “Volunteer Monitoring” tab, this opens up a drop-down window.
3. Move the cursor down to “Data Entry Form” and left-click on your mouse to open up the form (see next page).
4. Enter data in the blank spaces
5. Use the drop-down menus to select Lake Name, County and Water Color.
6. Use the calendar provided to select the Sample Date that you measured the data.
7. Enter Sample Time in format shown and indicate AM or PM.

8. If you recorded the Lake Level, enter that next. If not, leave it blank.
9. Use drop-down menus to select Recreation Potential and Physical Appearance.
10. Enter any comments you may have. For example: a) recent rain, b) lots of boats, ...
11. When you have entered everything, click on **Click to Submit Your Data** to send your data to our computer in Bloomington.
12. If successful, you will receive a message at the bottom of the form that says, “**Your data have been submitted....**”

Indiana Volunteer Lake Monitoring Program Data Entry Form

First Name: **Please Include your First Name!**

Last Name: **Please Include your Last Name!**

Email: **Please Include your Email!**

Volunteer ID Number (xxx-xx-xx):

Lake Name:

County Name:

Water Color:

Sample Date:

Sample Time (hh:mm): AM PM **Please enter the sample time**

Lake Level (xx to the nearest tenth of a foot):

Secchi Disk Transparency: **Please enter the Transparency**

Did the Secchi Disk hit bottom?: Yes No

Recreation Potential:

Physical Appearance:

Comment:

Click to Submit your Data

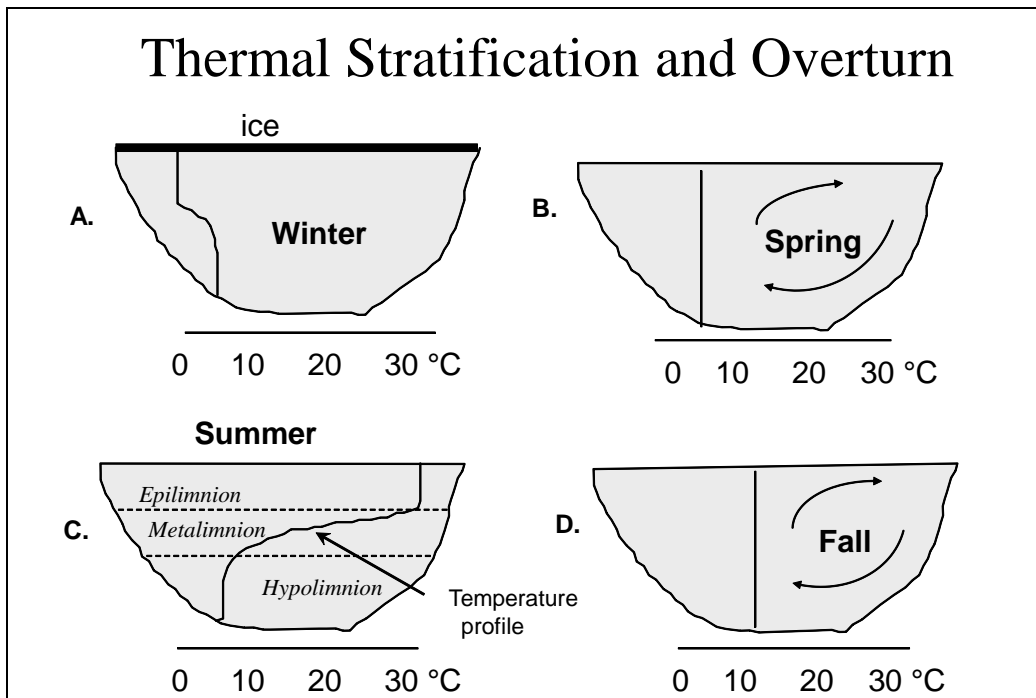
NOTE: If you leave a space blank or enter data in the incorrect format, you will get one of these red error messages telling you how to correct the error. If this happens, simply correct the error and re-submit.

TEMPERATURE & DISSOLVED OXYGEN MONITORING

The Temperature and Dissolved Oxygen meters that were previously used for volunteer monitoring have been replaced with new meters. Therefore, meters will once again be available for volunteer use from a number of Soil and Water Conservation Districts (page 14). Included below is some information highlighting the importance of temperature and dissolved oxygen monitoring.

How Lakes Change With the Seasons

As the spring sun rises higher in the sky and air temperatures become warmer, the surface water of lakes warms as well. This warm water is less dense than the cold, heavy water on the lake bottom. The wind does not have enough energy to overcome these density differences and completely mix the lake; so only the surface water (*epilimnion*) is mixed during the summer in deeper lakes (5-7 meters deep). Thus, the bottom waters in the *hypolimnion* are isolated from the air at the surface. The narrow zone of water separating the epilimnion and hypolimnion is called the *metalimnion*. This temperature and density layering in lakes is called *thermal stratification*.



Dissolved oxygen in the hypolimnion is consumed by bacteria decomposing organic matter (dead algae, leaves, etc.) on the sediments. This lost oxygen is not replaced during stratification because the hypolimnion is not in contact with the atmosphere (the major source of oxygen to lake water) and photosynthesis (which produces oxygen as a by-product) cannot take place in the dark waters. As a

result, oxygen concentrations are often lower in the hypolimnion of stratified lakes - the lower the hypolimnetic oxygen concentration, the more productive (*eutrophic*) the lake is. Low oxygen in the hypolimnion can prevent the use of the area by fish and aquatic macroinvertebrates. Fish need at least 3-5 ppm (mg/L) of dissolved oxygen to survive. If no oxygen is present in the hypolimnion, phosphorus can separate from compounds in the sediments and re-dissolve in the water. Ammonia can also accumulate in the hypolimnion as a result of bacterial decomposition of organic material in the sediments.

In the fall, cooler air temperatures gradually cool the lake's surface water until it is nearly the same temperature as the bottom water. Because all the water now has similar density, a light wind can cause the lake to mix completely down to the bottom. This is called *fall overturn*. Nutrients released into the hypolimnion from the sediments during summer stratification can now mix with the surface water and this may cause a fall algae bloom in some lakes.

Generally, temperature and dissolved oxygen are measured from just below the water surface down to just off the bottom in one-meter increments. The instrument's cable is marked in one-meter increments to facilitate this. Temperature and oxygen profiles of lakes can yield very useful information. For example, the temperature profile indicates: a) if the lake is thermally stratified or unstratified (mixing), b) if stratified, the depth of the epilimnion or hypolimnion, c) the position of the metalimnion (fish often hang out at the top of the metalimnion). The dissolved oxygen profile indicates: a) how much of the lake has sufficient oxygen for fish, b) if the hypolimnion has no oxygen, and c) the potential for nutrient release from bottom sediments (this may occur when the hypolimnion is anoxic).

INSTRUCTIONS FOR TAKING TEMPERATURE AND DISSOLVED OXYGEN MEASUREMENTS

Temperature and oxygen profiles should generally be made from the deepest water depths in your lake. You will have to anchor your boat, otherwise drift will cause inaccurate depth measurements.

1. Turn on meter and calibrate according to instructions. **The meter must be turned on for 20 minutes prior to calibration to allow the electronics to stabilize.
2. Calibrate the meter according to the enclosed directions. **Make sure that the internal sponge in the calibration chamber is moist with distilled water. You will need to know the approximate altitude in order to complete calibration. As long as you are using distilled water the conductivity should be zero.
3. Once calibrated, remove probe from calibration/storage chamber.
4. Lower probe into water to desired depth.
5. (Always start measurements with the probe at just below the water's surface. Then make measurements at one-meter intervals, for example, 1m, 2m, 3m, 4m, etc. The cord is marked with tape at these intervals. Be careful to not let probe hit the bottom sediments.)
6. Check to see that the meter is in "dissolved oxygen % air saturation" mode (% saturation should be the default as you turn on the meter). If it is not in % saturation, press MODE until the units are in %.
7. Allow temperature to stabilize (about 30 seconds).
8. Record temperature on data sheet (see example data sheet on page 16).
9. Raise and lower the probe gently (about 2 inches per second) until % air saturation stabilizes. Record this percentage.
10. Press MODE button once so dissolved oxygen is displayed in "mg/L". Again raise and lower the probe until stable. Record this value.
11. Lower probe to next depth.
12. Press the MODE button to return to "% air saturation" mode. Repeat steps 5 – 9 as necessary.
13. When finished, rinse probe with distilled water from the squirt bottle. Place probe in storage chamber and be sure the sponge inside is moistened. Turn off meter.

REMEMBER: Never hold the meter over the water. Keep it securely inside the boat. Put **only** the probe over and into the water.

Send completed data sheet to: **Bill Jones, SPEA 340, Indiana University, Bloomington, IN 47405**

Where to Sign Out a Dissolved Oxygen and Temperature Meter

Fulton County SWCD
1252 E. 100 S, Suite D
Rochester, IN 46975-8036
574-223-3220 ext. 3
Contact: Chris Gardner

Kosciusko County SWCD
217 E. Bell Dr.
Warsaw, IN 46582
574-267-7445 ext. 3
Contact: Darci Zolman

LaGrange County SWCD
910 S. Detroit St.
LaGrange, IN 46761-2235
260-463-3166
Contact: Donna Hunter

Marshall County SWCD
2903 Gary Dr.
Plymouth, IN 46563-1825
574-936-2024 ex. 3
Contact: Wanda Norris

Merry Lea Environmental Learning
Center
2388 S 500 W
Albion, IN 46701
260-799-5869
Contact: Lisa Zinn
<http://www.goshen.edu/merrylea/>

School of Public and Environmental
Affairs (SPEA)
Indiana University
1315 E. 10th St.
Bloomington, IN 47405-1701
812-855-4556
Contact: Bill Jones

Steuben County SWCD
Peachtree Plaza 200
1220 N. 200 W
Angola, IN 46703-8901
260-665-3211 ext. 3
Contact: Kayleen Hart



VOLUNTEER LAKE MONITORING PROGRAM

- Temperature/D.O. Data Sheet -

Lake: _____ Date: _____

Volunteer: _____ Time: _____

DEPTH (m)	TEMP. (°C)	D.O. (%)	D.O. (ppm)
Surface			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
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