

Appendix B

Protocol for Aquatic Plant Survey Collecting, Mapping, Preserving and Data Entry

Below we outline the protocol for statewide baseline sampling of aquatic macrophytes, with the primary goals of 1) comparing year-to-year data within a lake, and 2) comparing data among lakes. We describe a formal quantitative survey conducted at pre-determined sampling locations distributed evenly over the lake surface (point-intercept approach). We believe that this method, when combined with a boat survey to gather additional information on areas not sampled directly, will best characterize a lake's plant community. The chief benefit of adopting a statewide protocol is that variation in the sample set can be primarily attributed to actual differences in plant communities, instead of the confounding variables introduced by using different sampling techniques.

These guidelines are intended to work on most lakes. However, modifications may be required if a lake is uniquely shaped so that a uniform distribution of points isn't representative (long, skinny lake shape), or if obtaining rake samples is difficult due to substrate (rocky/cobble bottom).

Please note these are “baseline” recommendations. Additional monitoring activities may be warranted if the goal is to assess a specific management activity. For example, to gauge the success of chemical spot-treating stands of an exotic species in a relatively large lake, we recommend additional mapping of the beds within a season before and after treatment.

The baseline sampling described below should be conducted between early July and mid August. Although changes (such as biomass) in the plant community through this long sampling window might complicate data interpretation, in this survey we are mostly interested in species diversity and frequency, variables that should be fairly constant through the growing season. However, as described below, field workers are asked to assess rake fullness for all species and these ratings will likely vary with sample date. For many species, including Eurasian water-milfoil, plant biomass and density will probably increase as the season progresses. Narrow-leaved pondweeds begin to disappear by mid-August. Data for these species must be interpreted carefully with the sampling date in mind.

Curly-leaf pondweed (CLP) creates a special problem because it is often gone before the recommended sampling window between early July and mid-August. If you have any suspicion that CLP is present but not found when sampled, be sure to talk to APM staff to work out the best sampling scheme.

DNR personnel and groups using state money (e.g. planning, protection or aquatic invasive species grants) must follow this protocol.

I. Field Equipment

1. Required field equipment: boat, handheld GPS unit with WAAS (Wide Area Augmentation System) capability (with site locations already loaded, Garmin 76 is a commonly used model within DNR), a lake map, waterproof field data sheets, pole-mounted rake, weighted rake on a rope, depth finder, storage bags for vouchered specimens, personal flotation device.

2. Recommended equipment (helpful, but not necessary): trolling motor, underwater video camera, plant ID references, hand lens, cooler for storing samples, digital camera to document shoreline features (e.g., deadfall, dock, house) for sample points near shore that will provide a visual complement to a dot on a map, waterproof paper tags and/or Sharpie for labeling bags with vouchers and unknown plant species.

II. Point Intercept Sampling Method

1. Description

We require the following point-intercept sampling protocol. In this method, a large number of sampling sites are distributed in a grid across the lake. There are several benefits to a grid sampling design. An evenly spaced distribution of points results in a good overview of the entire lake. It is easy to replicate, and it is easy to preserve and present the spatial information. Please contact Jen Hauxwell (Jennifer.Hauxwell@dnr.state.wi.us) with lake name, county, water body identification code (WBIC), and any other depth and plant information available so that she can establish sampling points for the lake.

The size of the littoral zone and shape of the lake determines the number of points and the grid resolution. You will receive an electronic file of sampling points to upload into a GPS unit (below). Once on the lake, you will go to each site and collect plants and data as described below.

2. Uploading sampling points to the GPS unit

The following step-by-step instructions were adapted from the WIDNR Garmin GPS Tool User Manual v. 8.2.5, available to DNR employees on the intranet.

file:///C:/central/Cet_apps/CPROD/WiDNR_Garmin/standalone_garmin/DEV_Doc/WiDNR_Garmin_Standalone_GPS_Tool_User_Guide.pdf

This is a two step process. First you need to *_load_* the sample points you receive from Jen Hauxwell in a text file into the WIDNR Garmin GPS Tool, a computer file. Second you need to *_upload_* the points from your computer onto the GPS unit itself. For more information or troubleshooting help consult the User Manual.

Please note that GPS units vary in how many way points they can store. In the event that the number of sampling points exceeds your unit's storage capacity, simply split the text

file containing the point information into multiple files. Upload successive files of points as needed.

(For more information on Garmin GPS units, please see <http://www.garmin.com/> and navigate to consumer/outdoor/GPS mapping. Choose a unit and then click on “specifications” and, under navigation features, find the number of waypoints/icons.)

To upload points into your GPS unit from a text file (.txt) using the WIDNR Garmin GPS Tool you will need:

- **PC/laptop with WIDNR Garmin GPS Tool software.** If you do not have the software on your computer contact your administrator for installation.
- **Waypoint .txt file** in the same format as one created by the WIDNR Garmin GPS Tool. Text files received from DNR Research will be in the correct format.
- **PC Interface cable.** Comes standard with the GPS unit, or can be ordered at <http://www.garmin.com/outdoor/products.html#mapping>.
- **GPS unit with external data port.**

Step 1: SET “SIMULATING GPS” MODE

You must operate the Garmin GPS receiver in Simulating GPS mode while uploading/downloading data, so that the receiver is not trying to acquire satellite data during these activities. Check your GPS manual to determine how to do this. Instructions for the GPSMap 76 are given below.

1. Press and hold the [ON/OFF] button for two seconds to turn the GPS receiver on.
2. Several informational screens will display. Press the [PAGE] button until the first Acquiring Satellites screen appears.
3. Press the [MENU] button and select Start Simulator to see the Simulating GPS page.

Step 2: SET SERIAL DATA FORMAT

You must set the serial data format to GARMIN prior to transferring data. Failure to set the serial data format to GARMIN will cause a communication error between the WIDNR Garmin Tool and the GPS unit. Instructions for a GPSMap 76 are given below.

1. Press the [MENU] button twice, use the rocker key to select Setup, and then press [ENTER].
2. Use the rocker key to scroll left or right until the Interface tab is highlighted. Use the rocker key to scroll down to highlight the drop-down box and press [ENTER].

3. A menu will appear; select GARMIN and [ENTER]. Press [QUIT] twice to return to the main screen.

Step 3: PLUG IN THE PC INTERFACE CABLE

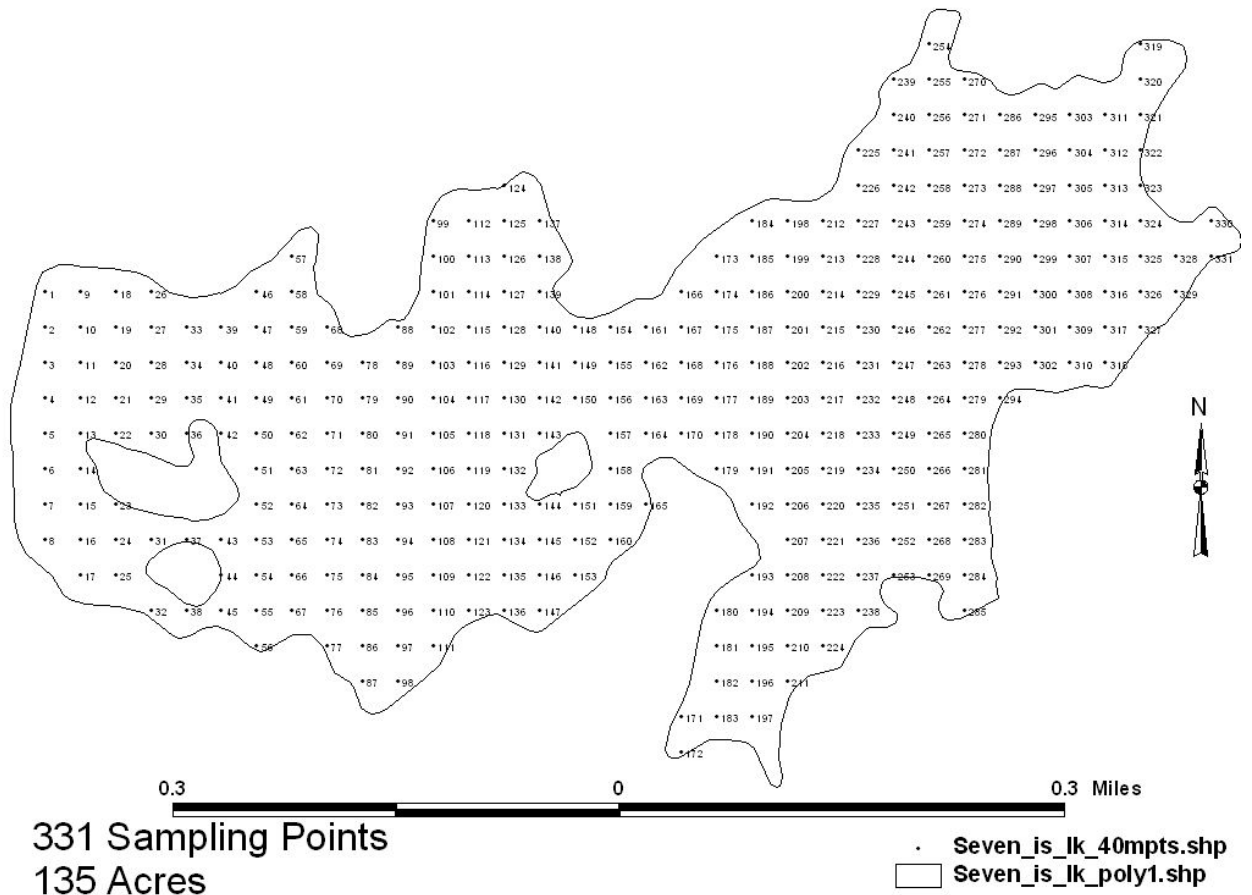
1. Plug the 9-pin serial connector into COM port #1 on your PC. If port #1 is in use, plug into the next available port, and note the port number. The WIDNR Garmin GPS Tool does not support connection through a USB port.
2. Plug the round end of the cable into the external data/auxiliary power port on the back of the GPS receiver. Check your GPS manual if you do not know where the data port is located. The GPS receiver should be on and in “simulating GPS” mode.

Step 4: LOAD WAYPOINT DATA FROM A TEXT FILE TO THE WIDNR GARMIN GPS TOOL

1. Open the WIDNR Garmin GPS Tool file on computer. Select the WIDNR Garmin GPS Tool > File > Load > Waypoints From > GPS Text File option.
2. Enter/Select the path and name of the text file to load into the Open window. The GPS data will be loaded into the WIDNR Garmin GPS Tool. If you have trouble at this point, see the next section on troubleshooting. Otherwise, go on to section 4, Waypoints.
3. Troubleshooting. If you encounter problems during loading, a pop-up window will notify the user. Click OK.
 - a. If problems are encountered, check that the COM port is set correctly: GPS > Assign Port > select correct port #.
 - b. Also check that the baud rate matches that of the GPS unit: GPS > Assign Port > Baud Rate > select correct rate. A GPSMap 76 will transfer at 9600.
 - c. Check that the Serial Data Format is set to GARMIN (outlined in Step 2).
4. Waypoints. You can now view/edit waypoints by clicking the [Advanced] button on the WIDNR Garmin GPS Tool window.

Step 5: UPLOAD WAYPOINT DATA TO THE GPS RECEIVER

1. Select the WIDNR Garmin GPS Tool > Waypoint > Upload option.
2. When complete, the number of uploaded points appears at the bottom of the Garmin GPS Tool window. A pop-up window also indicates the number of waypoints successfully uploaded. Click OK. The uploaded waypoints should now be visible on the GPS receiver's Waypoints display.
3. Below is an example of lake with waypoints.



III. Collecting and Recording Plant Data

1. The rake sampler. The rake is constructed of two rake heads (double rake head) welded together, measuring 13.8 inches (35 centimeters) long with 14 teeth on each side. The handle is 8 ft (2.4 meters) in length, and should include a telescoping extension that results in a total handle length (from tip of rake head to fully extended end) of 15 feet (4.6 meters). You will also need a second, weighted, double rake head on a rope (rake-on-a-rope) to sample deeper sites. See section on “rake construction” for more detail.

2. Using the rake. Collect one rake sample per site: In waters less than 12 feet, handle the rake using the pole. In deeper water, toss the rake-on-a-rope. In either case, try to drag the rake along the bottom for 2.5 feet (0.75 meters). The amount of plants brought up on the rake may vary tremendously. Record each species present and estimate the rake fullness rating (more fully described). Keep two examples of each species found in the lake (see 7. *Collect voucher samples* below). The rake may dislodge plants that will float to the surface, especially short rosette species not easily caught in the rake tines. Record each species present and estimate the rake fullness rating just as you would plants brought up on the rake

3. Point-intercept sampling issues and procedures.

a. Under-sampling near shore. One problem with the grid system is that it may under-sample very shallow sites where the vegetation is often quite different, even from sites just a bit deeper. To compensate for this problem, it is essential that you visit bays and shoreline areas missed by the grid and use the rake to collect and identify. Record any species seen, especially emergent vegetation (rooted in water), and describe near-shore habitats on the Boat Survey sheet. These data will not be tallied in the ENTRY or STATS pages but should be recorded on an electronic version of the Boat Survey Sheet to accompany the other data.

b. Navigational error. When navigating to sites using a handheld GPS unit, remember that there will be inherent error in locating points, sometimes as great as 60 feet. In addition to that error, there remains the question of “How close to the point is close enough?” You will almost never be able to sample a point at 0 feet from the point. Total error from the GPS error and navigational error *combined* should not exceed half of the sampling resolution. To avoid this when navigating using the map screen, navigate at no more than an 80-foot zoom level and completely cover the point with the arrow. At this level, the locational arrow on the screen is ~8 m long. This means that to sample with acceptable accuracy, the arrow must completely cover the point you are trying to hit, with the arrow centered over the point. At coarser zoom – 120-foot and up, even if you are completely covering the point you still may be quite far from the point, just because the arrow is so large in comparison to the size of the points. You may need to navigate at a greater zoom resolution, but, as you approach the target point, switch to the 80-ft zoom resolution to assure you hit your point accurately.

c. Hard-to-reach points. It may be hard to get to some sampling sites, especially in certain bays, where the water is very shallow and the substrate is mucky. When possible and practical, try to get to the point by poling with an oar, but do not spend undue time poling to these shallow sites. Due to safety concerns, field workers should not get out and drag the boat through mucky sediment to reach a site. If the sampling site is shallow but the substrate is firm, you should walk to the site from shore. If you cannot access a site, leave the depth blank and record NA (no access) or “land” (if the site is on land) in the comments column. (Remember to transfer these comments to the ENTRY sheet).

4. Filling out the Field Data sheet. Print the FIELD DATA sheet from the Excel workbook APMstats123.xls for use in the field. We recommend printing the data sheet onto waterproof paper such as Xerox Never Tear Paper.

a. Top portion. Fill out the top portion of the Field sheet with lake name, WBIC, county, and date. Also, record all the observers and how many hours they worked on this lake.

b. Site Number. Each site location is defined by the lat/long data imported onto your GPS unit and each site should have one row of data.

c. Depth. Measure and record the depth at each site sampled, regardless of whether vegetation is present. It is often easiest to mark the pole to establish depth for the shallower sites. However, a variety of options exist for taking depth measurements, including SONAR guns, depth finders that attach to the boat, or depth increments marked on the rope attached to the weighted rake sampler. If using a depth finder, please note that the accuracy decreases greatly in densely vegetated areas—depth will often be given to the top of the vegetation instead of to the lake bottom.

d. Dominant sediment type: Record sediment type (based on how the rake feels when in contact with the bottom) at each site where plants are sampled as: mucky (M), sandy (S), or rocky (R).

e. Pole vs. rope. Record whether the field team held the rake by the pole (P) or rope (R).

f. Species information. Note that the field data entry sheet does not include any species names, except for EWM (Eurasian water-milfoil) and CLP (curly-leaf pondweed). The sampling team must enter the species name the first time that species is encountered. Names will have to be entered again on successive field sheets (as they are encountered). The use of standard abbreviations can greatly shorten this process.

For all species, record the rake fullness rating (1- few, 2- moderate, 3-abundant, see illustration following this text) on the field data entry sheet at each sampling point where it is found. Record rake fullness for filamentous algae as well. Record the rake fullness rating for plants dislodged by, but not collected on the rake (please see “Under-sampling near shore”, above). While at a site, look for any other plants (not already recorded) at that site within 6 ft (2m) of the boat. Record these species as a “visual” (V) on the data sheet. These species will be included in total number of species seen but will not be included in summary statistics. Account for plant parts that dangle or trail from the rake tines as if they were fully wrapped around the rake head.

5. Filling out the Boat Survey Data sheet. Often there will be localized occurrences of certain species (e.g., floating-leaf or emergent species) that are obvious to the viewer but could possibly be missed by the point-intercept grid. As discussed above in “Under-sampling near shore”, you should examine shoreline areas that are out of the grid. While you need not make a separate trip around the entire lake, do visit areas that may be under-sampled and record the information (including the closest sampling point) on the Boat Survey (see APMstats123.xls) and on a lake map. Be sure to create an electronic version of the Boat Survey from the field notes.

6. If no plants are found. If no plants are found at a sampling site while approaching a deep section in the lake, record the depth but do not record any species information. Sample one more (deeper) site beyond that point to ensure that you have correctly identified the maximum plant depth. This should be done for each set of points surrounding the deep portion of the lake. Along any N-S or E-W transect, sampling should continue for at least 2 points beyond the last site with plants. Some sites may not have any plants, even if the site is shallower than the maximum plant depth. For these sites, fill out the data sheet as usual (with no species identified). These sites will be included as sites as deep as, or shallower than, the maximum plant depth.

7. Collect voucher samples. Collect 2 samples of each species found on each lake. These samples must be pressed and dried according to the protocol in Appendix F. Send one prepared specimen to the local DNR office (who will pass them on to a University herbarium). Keep one specimen for the lake group as a reference for future plant identification. If the field team is unable to identify a plant, please try to get fresh plants to the local DNR lake management specialist as it is much easier to identify fresh plants than pressed plants. Be sure to let them know you are sending plants so that they can be processed promptly.

IV. Entering data on the spreadsheets and summary data

The APMstats123.xls Excel workbook has 5 spreadsheets:

a. READ ME, with a summary of all the spreadsheets included in the worksheet. The date records the most recent version.

b. Field Data, discussed above.

c. ENTRY, a data entry sheet for transferring field data to the computer spread sheet. You must transfer all of the information collected in the field to the ENTRY sheet. You should be able to copy the coordinates for the sampling points from the text file you uploaded onto the GPS unit and paste these into the entry sheet. There is a column for comments on the ENTRY sheet.

d. STATS, an automated statistics page that provides a summary of the plant data. The summary statistics of the plant survey will automatically appear in the STATS sheet of APMstats123.xls after data are entered in ENTRY.

e. Boat Survey, discussed above.

V. Where to Send Data

Send electronic copies of the ENTRY, STATS and Boat Survey to Jen Hauxwell (Jennifer.Hauxwell@dnr.state.wi.us).

Rake Fullness Ratings

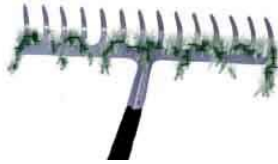
Rake fullness ratings are given from 1-3 for each species. Conditions of the ratings are described below:

Rating

Coverage

Description

1



A few plants on rake head

2



Rake head is about ½ full
Can easily see top of rake head

3



Overflowing
Cannot see top of rake head

Rake Construction

Pictures of a rake are shown below, with potential vendors of the components indicated. (These are not endorsements of specific vendors.)



Pole Sampler

The rake sampler is made from two rake heads welded together, measuring 13.8 inches (35 centimeters) long with 14 teeth on each side. This example purchased from Menards with wooden poles attached and subsequently removed).

The handle is 8 ft (2.4 meters) in length, and should include a telescoping extension that results in a total handle length (from tip of rake head to fully extended end) of 15 feet (4.6 meters). This example was purchased from a pool supply company in Madison, WI (Bachmann Pool & Spas).



Rope Sampler

A similar rake head should be constructed for the rope sampler. At the point where the pole would be attached, tie on a rope or anchor line of at least 40 ft in length. If desired, attach a 5 lb weight to the top of the rake (away from the tines) or thread it on the rake rope. This example has a length of steel tubing welded to the rake head to serve as a handle through which is strung ~45 ft of climbing rope.