Water Chemistry and Biology

The regional lakes survey in 2015 followed the standard LTER protocol for standard water chemistry and biology. Samples were taken as close to solar noon as possible. Seven lakes had replicates performed, which were chosen at random between the four lake classes.

Gas Sampling

Equipment list:

- 1 liter jug
- Two 30 cc syringes
- One 20 cc syringe
- Mylar bag rinsed with nitrogen
- Glass vials
- Syringe needles
- Pump
- Stopper with tubing and stopcocks

Before going to field:

Gas vials were first rinsed with nitrogen to purge all other air. 30 cc of air was then removed using a syringe to create a vacuum within the vial. Mylar bags were refilled with nitrogen when needed.

In field:

A one-liter jug was filled up with lake water at a half-meter depth using a standard pump.

The jug was left to overfill for approximately 30 seconds to flush it out. After it had overflowed, the tubing was carefully removed to make sure there was no headspace left within the jug. The stopper with tubing was placed on top and all stopcocks were closed. Make sure there is NO headspace! 30 cc of nitrogen was extracted from the mylar bag using a 30 cc syringe. This 30 cc syringe was screwed onto one of the pieces of tubing. A second empty 30 cc syringe was screwed onto the other piece of tubing. The 30 cc of nitrogen was injected into the bottle while water was also extracted. Once the full amount of was injected all stopcocks were closed and the syringes were removed. The bottle was then shaken for 100 seconds. After this amount of time, the 30 cc syringe containing water was screwed back on and a 20 cc was also placed onto the tubing. 15 cc of the headspace was extracted while water was also being injected. All stopcocks were then closed and the 20 cc syringe was removed. 3 cc of air was rinsed from the syringe while the last 12 were injected into the appropriate vial. For gas blanks vial 12 cc of the pure nitrogen was injected into the vial. Two replicates were performed within field.

Protocol Format
Process
Protocol Type

field

Gear needed:

- Calipers
- Waders
- Meter Stick
- 50m tape measure
- Clipboards
- Data Sheets
- Pencils
- GPS
- Spare batteries
- 2 transect markers
- Camera

Sampling Process: Begin by navigating to the start of each transect using the GPS; the transects run to the right of the point marked in the GPS. Upon arrival at the start, place a transect marker at one half meter depth. Then measure the distance from the marker to the high water mark on shore using the tape measure. To measure out the transect, have one person standing at the marker and another walking at the half meter depth contour with the tape measure. Once you reach 50 meters drop the other transect marker. The person walking the transect should be looking for any potential coarse woody habitat (CWH) on the way. If they determine that there is none, the person at the start of the transect can take the boat and meet the other person at the end of the transect. On the way, a picture should be taken of the transect by motoring out far enough so that the picture captures the starting and ending buoys and the land us behind it. If you have a crew of three people, the picture can be taken by the third person when the transect is marked out. So they should motor out and wait for the two markers to be placed, then take the picture and come back to help. If it is determined that there is any coarse woody habitat in the transect, the person who measured out the transect should walk back to the start. From there, the crew should walk the transect at half meter depth and look for any CWH in the transect. Upon finding a piece of CWH, you should use the meter stick to locate exactly where the half meter mark is on the log; the diameter measurement should be done at this location. Every log must be at least one and a half meters long and at least 5cm in diameter in order to be counted. Each log must also be located above the substrate so that it is able to provide habitat, if it is submerged under the substrate it is not counted. If the log is between five and ten centimeters in diameter, it should just be marked down in the tally section of the data sheet. For all logs greater than 10cm, you need to write down the specific diameter, length class, branchiness class, decay class, orientation to shore, whether it is attached to a previous log, species (if you can identify it), and source

(anthropogenic, beavers, or natural).

Length Class:

- 1.5-3 meters- A
- 3-6 meters- B
- >6 meters- C

Branchiness Class:

- 0- no branches
- 1- few branches
- 2- moderate number of branches
- 3- full crown

Decay Class:

- 1- recently downed
- 2- algal growth but bark still sound
- 3- bark sloughing off but wood still sound
- 4- wood soft
- 5- wood very soft and no longer structurally sound

Orientation:

- 0-30 degrees- Parallel
- 30-60 degrees- oblique
- 60-90 degrees perpendicular

Once all logs have been accounted for and the data recorded, the distance from the high water mark to the transect marker at the end of the transect should be measured. Substrate checks should be done at at least 3 points along the transects as well. You should characterize what types of substrate are present along the transect along with a maximum of two that can be characterized as dominant. You should also mark down the number of docks and the number of boats on shore. Any docks that cross the transect that are extra wide or have T sections at the transect depth are counted as 2. Also count any docks on shore that looked like they are going to be put in the water at some point. The final step is to determine the land use of the shoreline. This is done by recording the percents of each type that is present from the high water mark to about 20 feet back. Shoreline land uses: Forested- Dense trees and understory vegetation Shrubs- Smaller woody plants Wetlands- Bog, swamp, or marshland; low areas with water present. Herbaceous- Large grasses or un-manicured meadows. Manicured Lawn- Human maintained grass areas like lawns or gardens. Beach- Larger expanses of sand Engineered Shoreline- Anthropogenic influenced shoreline; including rock barriers or rip rap. Forest no understory- Trees with no understory, anthropogenic influenced area under trees.

LTER Keywords
coarse woody debris
lakes
limnology
Protocol Format
Process
Protocol Type
field

Sampling Schedule

Summer fieldwork was divided into two rounds of sampling. All 28 focus lakes were first sampled for water chemistry and coarse woody habitat (CWH). These sampling procedures were performed on the same day for each lake. This sampling ran from 1 June - 25 June. The second half of the summer was devoted to sampling macrophyte communities using point intercept (PI) surveys. PI surveys were conducted on the study lakes from 10 July - 11 August.

Lake Order

For chemistry and CWH sampling, lake order was determined using a stratified random sampling technique. Focus lakes were divided into four categories (low conductivity, low development; low conductivity, high development; high conductivity, low development; high conductivity, high development). A lake was randomly selected from each category in turn until all 28 lakes had been placed in order. Lake order for PI surveys was randomly selected.

Crew Logistics

In 2015 four full-time and two part-time technicians worked on the Regional Lake Survey. During each day of sampling, workers divided into crews of 2-3 people so that two lakes could be sampled each day. Crews of three were most efficient, especially for the PI surveys. Crews were randomly shuffled each day to reduce bias.

Training

Several days were devoted to training before each round of sampling. During the last week of May, training exercises were conducted on Sparkling lake. These exercises allowed the crew to practice chemistry and CWH sampling as well as basic trailering and boating techniques. This training was led by supervisors Noah Lottig and Tim Kratz and a crew member with previous experience with LTER's water chemistry sampling protocols.

To prepare for macrophyte sampling, all crew members attended an aquatic plant identification workshop led by Susan Knight. Additionally, during the first week of PI surveys, crews went to field with one of two plant experts, Susan Knight and Carol Warden. This field training was critically important in strengthening the crew's ability to identify macrophytes.

Cleaning Procedure

Throughout the summer members of the Regional Lakes Survey followed the WDNR's most current guidelines for watercraft and gear decontamination. Boats, oars, PI rakes, and anchors were cleaned using a pressure steam washer. Waders, ropes, floats, calipers and meter tapes were cleaned with bleach solution. Graduated cylinders and Wisconsin nets were washed with tap water while chemistry tubing was cleaned using deionized water. Cleaning procedures were modified slightly for Stormy Lake, which contains spiny water fleas. A boat and Wisconsin net were borrowed from DNR scientist Carol Warden and extra care was taken in cleaning all gear after sampling.

Protocol Format
Process
Protocol Type
field