2009 Shell Lake Macroinvertebrate Survey

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Introduction

Personnel from the St. Croix Tribal Environmental and Natural Resources Departments conducted an aquatic macroinvertebrate survey on June 9, 2009. This survey was done as part of the Shell Lake Diversion Project's environmental assessment. The survey was completed to establish baseline data for aquatic macroinvertebrates that live within Shell Lake and document changes within the invertebrate community that may be caused by the diversion over time. It should be noted that this survey was completed after the diversion had already been operational. The diversion became operational November 13, 2003. The last time that the diversion was used was July 18, 2005.

Parameters of the survey were established by the Wisconsin Department of Natural Resources (WI-DNR). Originally both littoral and pelagic macroinvertebrate communities were to be sampled, but the pelagic survey portion was dropped per the WI-DNR. This survey focuses on the macroinvertebrates found in the littoral zone (2-4 feet) of Shell Lake. St. Croix Tribal personnel were responsible for the determination of the survey points, collection and preservation of specimens, and transfer of the specimens to UW-Stevens Point Aquatic Biomonitoring Laboratory for identification. UW-Stevens Point Aquatic Biomonitoring Laboratory was responsible for identification of specimens and analysis of macroinvertebrate communities.

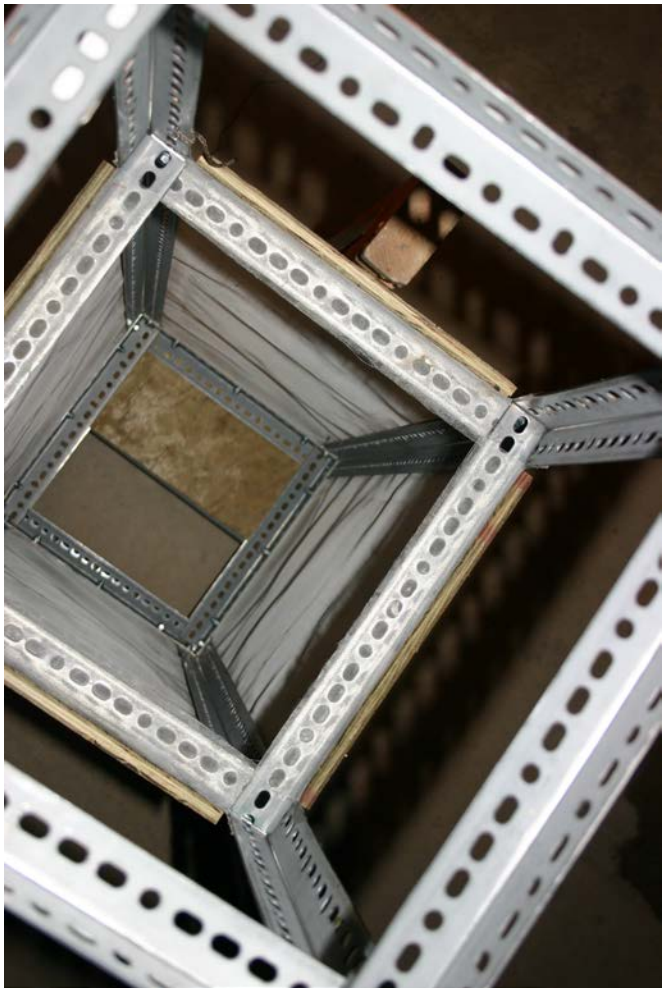
Methods

Six points were to be sampled within Shell Lake, three in the north basin, and three in the south. After discussion it was determined that two sample points would be located in the north basin and four in the south basin. Only two points were placed in the north basin due to its homogeneous substrate types (mostly sand) and its sparse macrophyte community. The south basin offered a more diverse substrate and contained a much more diverse and dense macrophyte community.

The target water depth was within 2-4 feet. This depth was maintained except for one point, which was taken in 1.5 feet of water. This was done to include a plant community that was determined to be representative of Shell Lake.

Each point covered one square foot. This dimension was maintained by using a homemade vertical sampling device (see Figure 1).

Figure 1. Vertical Sampling Device



The vertical sampling device is 4.5 feet high x 1 foot wide. The frame is made of angle iron with small pieces of ½ in treated plywood used to help attachment of the screen to the frame. The bottom four inches of the frame are sharpened to allow the frame to sit on the bottom of the lake. A one foot by 1.5 foot piece of treated plywood is used as a kicker plate that is able to be slid into the device to "close" it. This feature allows the user to remove the sampling device from the water column without losing invertebrates and macrophytes, while straining out the lake water. The screen is #30 nylon mesh screen. This mesh size allowed us to collect specimens that were as small as 2 mm, but allowed other small zooplankton and debris to filter out.

We established sampling points based on the substrate type, shoreline habitat, macrophytes present, and depth. Our goal was to sample a different substrate type for each point.

Once a sample point was established, we used a Trimble® Pro XH receiver with a Trimble® Recon data logger to record latitude and longitudes for each point. Terrasync® software was used to transfer the GPS data to the computer and generate ESRI® shapefiles. Shapefiles were generated in a Wisconsin TransMercator projected coordinate system and plotted.

After the sample point coordinates were recorded, photographs of the water column and the shoreline were taken. Water depth and substrate type were recorded at this time as well. Distance from shore was calculated using ArcMap® software.

We began sampling by observing and recording aquatic macrophytes within a 5 foot radius of the sampling point before the water became clouded from substrate suspension. We recorded all macrophytes present as well as the dominant macrophyte within the sampling point.

Once macrophytes were recorded we placed the vertical sampler in the water column and stabilized it by pushing the sharpened edges of the frame into the sediment. Sample point 2 was more difficult since the substrate was cobble and larger rock (3-5 inch diameter). Figure 2 displays the position of the vertical sampler in the water column and its relation to the surface of the water.

Figure 2. Vertical sampler in water

After placing the sampler in the water, aquatic macrophytes were pulled from the water column and placed in large wash basin. The macrophytes were rinsed and inspected for the presence of aquatic macroinvertebrates. The rinse water from the macrophytes was strained and inspected for aquatic macroinvertebrates.

The top two centimeters of the substrate was removed using three different tools. For fine substrates we used a hand pumping bilge. The bilge created a siphon and deposited sediment from the bottom of the sampling point into a large basin for sorting. For more coarse substrates we used a shovel to bring them topside and deposited them into the same large basin on the boat. For rock, cobble, and woody decries we used a grabbing tool mounted to a long pole.

At this point we had a basin containing the macrophtytes and a basin containing the substrate from the bottom of our sampling point. To filter out the water column of our sampling point we closed the kick plate at the bottom of our vertical sampler and pulled the sampler out. The water was strained from the sampler and any macrophytes remaing in the sampler were rinsed and macroinvertebrates found were tallied as being found in the macrophyte medium. The inside of the screen and frame were rinsed into a separate basin and inspected for the presence of macroinvertebrates.

The substrate samples were the most time consuming to sort through. We used fine mesh screens with squirt bottles to wash away the sediment. This process had to be repeated many times because of the large volume of medium and because of the ability of the macroinvertebrates to "hide". Small subsamples of the substrate were placed in plastic tubs and sorted through for specimens separately.

Specimens were removed from the mediums by either a pair of forceps or by using a small medicine dropper. The latter implement was preferred because it did not damage the specimens, and it was much easier to "grab" them.

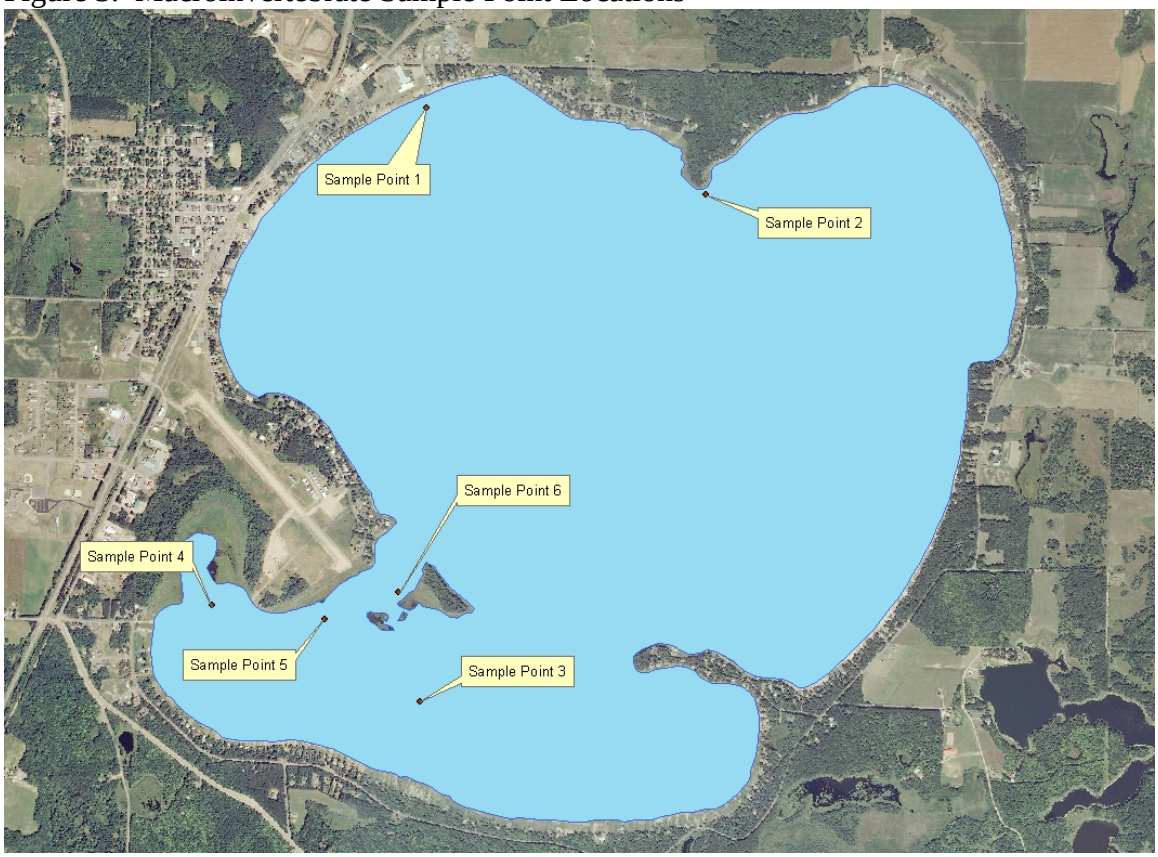
As specimens were removed from each of the mediums they were placed in 95% ethanol alcohol solution. This killed the specimens quickly which prevented them from damaging eachother. Once all of the specimens from each medium were collected, they were transferred to a 20 ml glass vial that contained 80% ethanol alcohol. This concentration would keep the specimens from decomposing but allow them to remain pliable enough to be identified in a laboratory setting. Each glass vial was labeled with the sampling point and transferred to an ice filled cooler. A chain-of-custody form was filled out for the samples as a batch.

Once all samples had been collected, they were placed in a refrigerator at the St. Croix Tribal Environmental Services Department. Specimens were transferred to an ice filled cooler and transported to the Aquatic Biomonitoring Laboratory at the UW-Stevens Point by St. Croix Tribal Natural Resources personnel on June 10, 2009.

Field Results

Weather conditions for sample collection were ideal. Winds were calm for the entire collection time making it quite easy to view the bottom of the lake, hold boats in position, and work outside of the boats in waders. Temperatures ranged from the 60s in the morning to the 70s by early evening. Water temperature ranged from 62 to 64º F. Skies ranged from partly sunny to mostly cloudy.

Figure 3. Macroinvertebrate Sample Point Locations



Sample point 1

Sample point 1 is located in the north basin of Shell Lake roughly 190 feet from shore. Water depth at sample point 1 was 3 feet. Sand was the only substrate, therefore it was also the dominant substrate. Macrophytes within the sample point included dwarf water milfoil (*Myriophyllum tenellum*), needle spike rush (*Eleocharis acicularis*), and filamentous algae. The dominant plant was needle spike rush. This is also the dominant substrate and plant community in Shell Lake.

Figure 4. Sample point 1

The shoreline was a sandy beach dotted with small rocks and shrubs that began growing due to low water levels. We selected this point because of the close proximity to the diversion pipe.

Figure 5. Sample point 1 shoreline

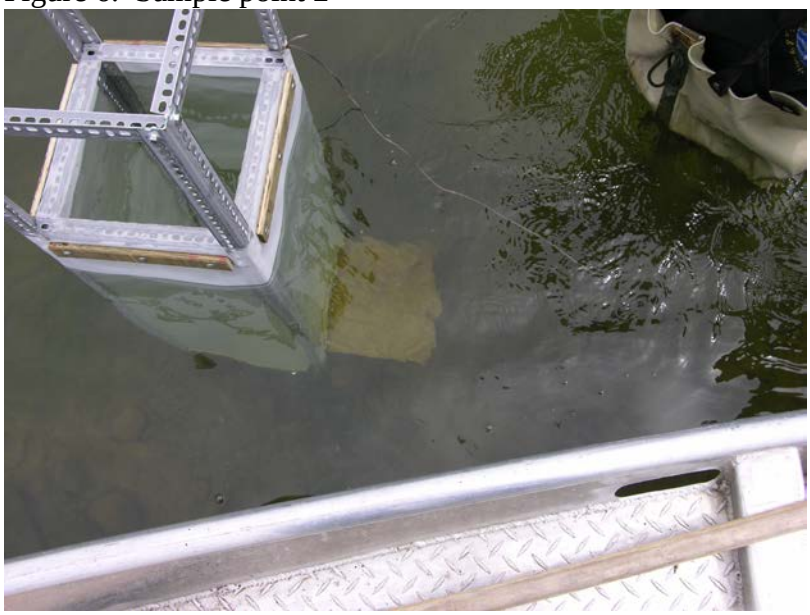
Approximate counts for macroinvertebrates are: Substrate = 137, macrophytes= 0, Water Column= 2, **total= 139**.

It is suspected that macroinvertebrates that were on the macrophytes probably fell to the substrate once they were disturbed. This is believed to be the case for all sample points.

Sample Point 2

Sample point 2 is also located in the north basin 107 feet from shore. Water depth was three feet. Substrates at this point included gravel, sand, and rock (3-5”), with the dominant substrate being gravel. Filamentous algae and dwarf water milfoil (*Myriophyllum tenellum*) were the two aquatic species that were present, but were very sparse. Filamentous algae was the dominant aquatic plant at this location.

Figure 6. Sample point 2



The shoreline near sample point two was relatively flat with a rocky beach, brush, and large dead trees.

Figure 7. Sample point 2 shoreline

Approximate counts for macroinvertebrates are: substrate= 22, macrophyte=0, and water column= 2, **total= 24**. Very few macroinvertebrates were found on the larger rocks, most were found within the sand substrate. This sampling point also had very sparse macrophytes.

Sample Point 3

Sample point three is located in the southern basin, off of an island of cattail (*Typha spp*.) submerged at a depth of 2.5 feet. Sample point three is roughly 1,250 feet from the main shore. Sand was the dominant substrate at this location, but there was some detritus and rock (<3") mixed in. There were multiple root masses within the substrate that we included as part of the substrate sample. The dominant macrophyte was cattail (*Typha spp*.), but dwarf water milfoil (*Myriophyllum tenellum*), fern pondweed (*Potamogeton robbinsi*), and filamentous algae were also present.

Figure 8. Sample point 3

Macroinvertebrate counts for each medium are: substrate= 39, macrophytes=0, and water column= 27, **total=66**.

Sample Point 4

Sample point 4 is located in the south basin, at a water depth of 1.5 feet. Sample point 4 was located at the end of a peninsula of hardstem bulrush (*Scirpus acutus*) that extended out into the lake 350 feet. The water depth of 1.5 feet did not fall within the 2-4 foot range that we had established as a goal for water depths, but the macrophyte community that was present at this point was common throughout the south basin. In fact, it was probably most dominant behind the community that was sampled at point 1. Sand was the dominant substrate with some silt present. Hardstem bulrush (*Scirpus acutus*) was the dominant macrophyte which was accompanied by brown fruited rush (*Juncus pelocarpus*), and dwarf water milfoil (*Myriophyllum tenellum*).

Figure 9. Sample point 4

Macroinvertebrate counts for each medium are: substrate= 100+, macrophyte= 3, water column= 32, **total= 135+**. While sorting the samples it was noticed that there was a disproportionate number of both small red worms that resembled midges and small, black, crab-like invertebrates that resembled zooplankton in the ephipia stage. Both of these specimens may be too small to be included with the tally for macroinvertebrates, but they should still be noted.

Sample Point 5

Sample point 5 is located in the south basin 281 feet from the shoreline. Water depth at this point was 3.5 feet. The dominant substrate was silty muck with clay and detritus mixed in. The substrate was very flocculent at this point which made it hard to observe the macrophytes. Macrophytes that were present include clasping leaf pondweed (*Potamogeton richardsonii*), dwarf water milfoil (*Myriophyllum tenellum*), with large leaf pondweed (*Potamogeton amplifolius*) being the dominant plant species.

Figure 10. Sample Point 5

The shoreline was sandy with grasses and sedges compromising the vegetation. No impervious surface was noted. This is depicted in figure 10.

Macroinvertebrate counts for each medium were: substrate= 160+, macrophyte=0, water column=105+, **total= 165+.** It was very difficult to filter out the macroinvertebrates from the macrophytes and the detritus. We also may have included invertebrates that may be too small to classify as macroinvertebrates, but we erred on the side of safety while sampling.

We also lost battery power in our GPS satellite receiver and had to return to the point to record coordinates and the location.

Sample Point 6

Sample point 6 was located in the south basin, 120 feet offshore of an island. Water depth was 3 feet. The substrate was silty sand with some clay mixed in. In addition to sampling soil substrate we also sampled woody debris that was an old beaver chew. Fern pondweed (*Potamogeton robbinsii*) was the dominant macrophyte, while flatstem pondweed (*Potamogeton zostriformis*) was present as well. Fern pondweed formed a very dense carpet along the bottom of the lake.

Figure 11. Sample point 6

The shoreline was a sandy beach with cattails (*Typha spp*.) as the primary vegetation on an undeveloped island.

Because of the large number of macrophytes within the sample and the late hour in which it was collected, we decided to separate all three mediums and store them overnight in a refrigerator. We then sorted the following morning in the St. Croix Tribal Natural Resources garage and all specimens were alive and in good condition. Macroinvertebrate counts were as follows: substrate= 1+, macrophyte= 100+, water column= 100+, **total= 300+**.

Sample point 6 had the largest number and densest macrophyte population of all points sampled.

We tried to keep accurate counts of the number of all macroinvertebrates that were collected in each medium. However, due to the tedious nature of sorting the samples, some macroinvertebrates were missed, but we feel confident that a representative sample was collected. Also, we may have collected specimens in some samples that may be too small to be counted as macroinvertebrates. Because of the above two reasons, the counts that are given for number of specimens for each sample may differ from results obtained in the laboratory analysis.