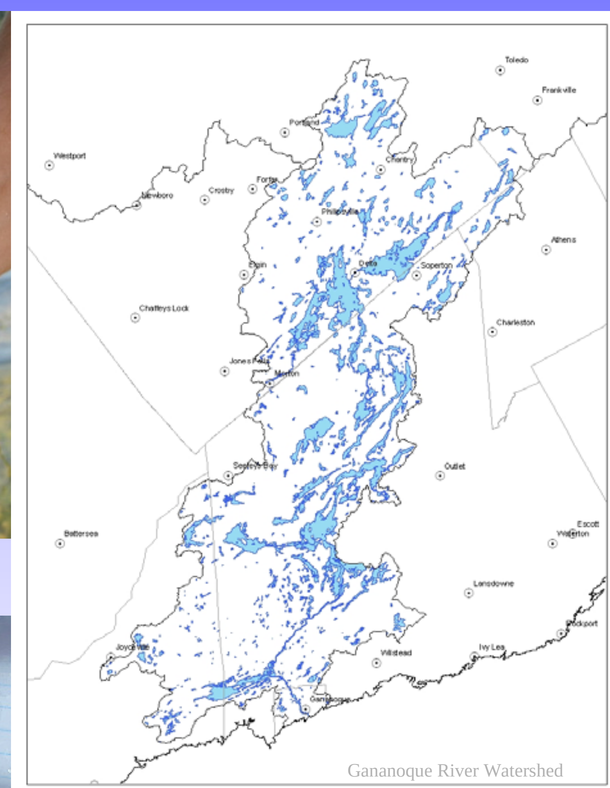
# THE GANANOQUE RIVER WATERSHED COMMUNITY STEWARDSHIP PROJECT: PHASE 1

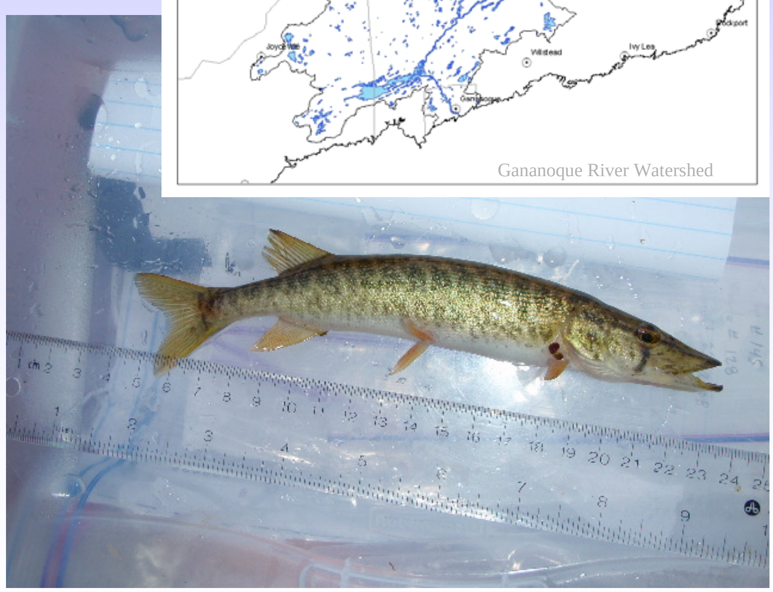
## A PARTNERSHIP PROJECT LED BY THE ALGONQUIN TO ADIRONDACKS CONSERVATION ASSOCIATION

## 2008-2009




Gananoque River Watershed

Lower Beverley Lake



Produced by A2A: The Algonquin to Adirondacks Conservation Association

# The Gananoque River Watershed Community Stewardship Project: Phase 1

## Executive Summary

Phase 1 concentrated on Lower Beverley Lake which is located in Township of Rideau Lakes Township. The lake was chosen because it is close to the headwaters of the watershed, little is known about species at risk in the lake, there are pressures on the lake such as a commercial pan fish fishery, agriculture and cottage development that may affect the aquatic environment, and Ontario Ministry of Natural Resources (MNR) biologists were interested in supplementing previously collected data.

Lower Beverley Lake is in the Gananoque River watershed, located in eastern Ontario, and is within the bottleneck of the Algonquin to Adirondack habitat pathway. Arguably, this pathway is home to Canada's highest biodiversity. It is essential for species connections north and south; however, species at risk are understudied in this river system. Stewardship, grounded by sound biology, within the bottleneck is vital for long term conservation of these species and their habitat. This initiative has the potential to provide a scientifically grounded stewardship plan for maintaining ecological integrity in the bottleneck.

The intent of the work was to identify species at risk and their habitat in Lower Beverley Lake, and to develop stewardship strategies based on their distribution, abundance, critical habitat and pressures on habitat. The species at risk expected to be found in Lower Beverley Lake include: American Eel (*Anguilla rostrata)*, Bigmouth Buffalo *(Ictiobus cyprinellus)*, Bridle Shiner *(Notropis bifrenatus)*, Grass Pickerel *(Esox americanus vermiculatus)*, Pugnose Shiner *(Notropis anagenus),* River Redhorse *(Moxostoma carinatum)*, Stinkpot Turtle *(Sternotherus odoratus)*, Northern Map Turtle *(Graptemys geographica)*, Spotted Turtle *(Clemmys guttata)* and Blandings Turtle *(Emydoidea blandingii)*. This list is based on the historic or anticipated ranges of these species.

This project represents Phase 1 of a multi-year plan which will include 17 of the 18 lakes in the watershed. Charleston Lake is not included because a lake plan has already been completed by the Charleston Lake Association.

<u>Species Inventory and Analysis</u>

13, 483 individuals representing 22 species were collected. The dominant species are: Large Mouth Bass *(Micropterus salmoides)*, Blue Gill *(Pimephales notatus)*, Pumpkinseed *(Lepomis gibbosus)* and Bluntnose Minnow *(Pimephales notatus)*. These 4 species make up 83% of the collection.

The four species at risk that were found are: Grass Pickerel *(Esox americanus vermiculatus)* (22*), Pugnose Shiner *(Notropis anagenus)* (1*), Stink Pot turtle *(Sternotherus odoratus)* (1*) and Northern Map turtle (*Graptemys geographica)* (1*).
(* The numbers in parentheses represent the number of individuals netted during the 2008 field season.)

The only species at risk which was collected in sufficiently high numbers for analysis is Grass Pickerel.

In this study Grass Pickerel was significantly positively correlated ($\alpha$=0.1) with Bog Willow *(Salix pedicellaris)*, Broad-leaved Arrowhead *(Sagittiria latifolia)*, Common Cattail *(Typha latifolia)*, Duckweed *(Lemna* spp.), White Water Lily *(Nymphaea odorata)* and Burweed (*Sparganium* spp.). They are also significantly positively correlated ($\alpha$=0.1) with Emerald Shiner *(Notropis atherinoides)* and Brook Silverside *(Labidesthes sicculus)*. Grass Pickerel is also positively correlated with young of the year ($\alpha$=0.1).

Analysis of frequency abundance data suggests that the fish population in Lower Beverley Lake is highly disturbed, undergoing a major change, was not completely sampled, or some combination of these possibilities. More work is required to determine the factors which may be affecting fish populations in this lake. Stewardship efforts to manage such factors are needed for long term sustainability of species at risk.

Phase 1 of this initiative provides good baseline information for the species at risk in Lower Beverley Lake; however, more work is required before stewardship strategies can be finalized. Statistical analysis of the collected data provides sufficient information for initial stewardship strategies for Grass Pickerel, and provides a solid baseline for further field research on species at risk in Lower Beverley Lake.

Habitat and Shoreline Inventory

A total of 344 data sheets were compiled for upland property parcels. These data sheets can be used as the baseline information for future stewardship initiatives.

Comparison of the seining data with the shoreline features mapped indicates that there are sensitive areas that are close to/within areas pressured by development.

These regions which are mainly considered ornamental closely overlap with portions of the shoreline which have a high concentration of cottages. They are areas concern for stewardship of Grass Pickerel because there are a large number of fish nursery habitats, and there is a higher probability that contaminates will wash into the lake without natural vegetative buffers.

Water quality for the Gananoque River Watershed

The results from the water quality testing are inconclusive because the data collected are single points of information. Future phases of this project will be able to use this information for future comparison.

There is a significant positive correlation between cottage concentration and algae. A plausible explanation is that nutrients are a result of runoff (from septic systems, lawn care, or both), providing ideal conditions for algal growth. The cause for the concentration of algal presence with increased shore line development should be further investigated.

There also should be further investigation of the impact of water quality and algal growth on Grass Pickerel and its associates. The result of the algal analysis further supports the argument that areas with high cottage concentrations may benefit from stewardship initiatives.

## Stewardship strategies for the species at risk in Lower Beverley Lake

Nine stewardship strategies to mitigate negative effects on species at risk have been developed. Considerable future work on Lower Beverley Lake is required before the strategies can be finalized; however, they provide a basis to establish protocols for the conservation of species at risk in this lake.

## Funding for Phase 1

Funding for this initiative was granted by the Species at Risk Stewardship Fund 2008/2009 to the Algonquin to Adirondacks Conservation Association (A2A). Funding for Phase 1 of this project was also received from the Thousand Islands Community Development Corporation, partnering organizations and private individuals.

## Partnering Organizations for Phase 1

Organizations which partnered with A2A are: the Ontario Ministry of Natural Resources, the Cataraqui Region Conservation Authority (CRCA), the Lower Beverley Lake Association, the Gananoque River Waterways Association (GRWA), Charleston Lake Association (CLA), the Leeds County Stewardship Council (LCSC), St. Lawrence Islands National Park, the Frontenac Arch Biosphere (FAB), Ontario Nature, Centre for Sustainable Waterways (CSW), the Ontario Fur Managers Federation, the Toronto Zoo, the Department of Fisheries and Oceans (DFO), Elizabethtown-Kitley Township, Leeds County Soil and Crop Association, Ontario Ministry of the Environment, South Lake Association, Thousand Islands Community Development Corporation, and Upper Beverley Lake Association.

The views expressed in this document are the views of the partnering organizations for this Gananoque River watershed initiative and do not necessarily reflect those of the Crown.

## Table of Contents



## Table of Figures and Tables

# 1. **Species Inventory and Analysis**

## Introduction

Species at risk are understudied in Eastern Ontario. Species inventories to determine their presence are needed before activities related to their conservation can be initiated. Information needed for the implementation of scientifically sound approaches to their stewardship should include identification of key habitats and immediate pressures on those habitats, and interactions between aquatic species. This initiative aims to provide such information for Lower Beverley Lake. The species analysis provided in this section, together with the following shoreline analysis, and water quality information has been used to develop the initial stewardship strategies.

## Methods

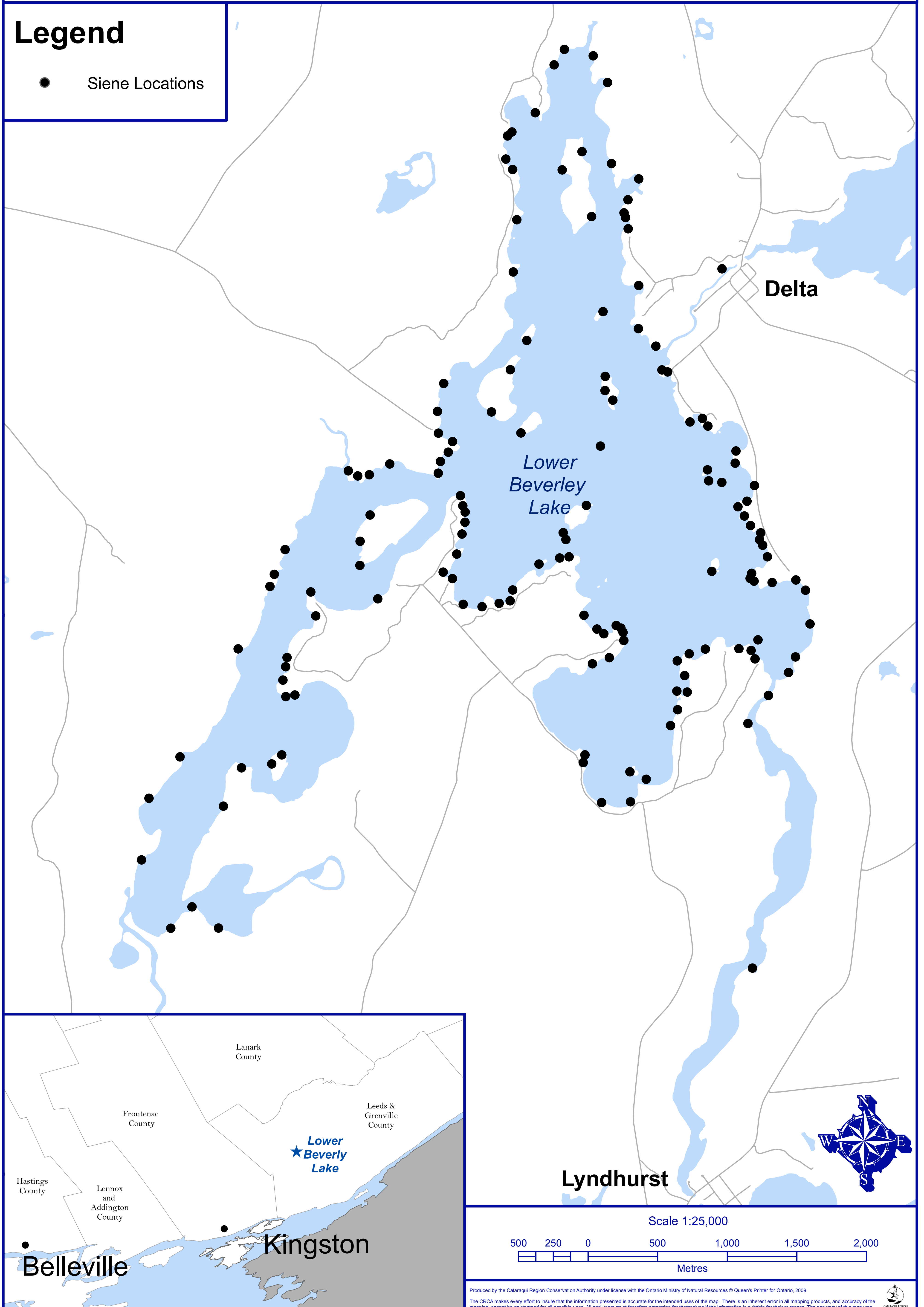
MNR near shore community index netting protocols were used to collect samples on Lower Beverley Lake. Seine netting took place in the littoral zones which the field crew determined as possible nursery locations. From July 29 until August 21 the field crew was occasionally assisted by volunteers. The seines were taken between July 7, 2008 and August 29 2008, during the day from 9:30 - 16:00. The trapped fish were counted, measured and then released. Data on individuals which represented young of the year were recorded. Habitat richness data was also collected for each of the seines. This data included presence of aquatic plant species, substrate and percent of substrate type. The seines were taken over much of Lower Beverley Lake's shoreline (Figure 1). Turtle species which were caught as by-catch in the nets were noted. In the initial proposal to the MNR it was stated that field crews would collect dead mollusc shells. None was collected because they were not encountered.

Diversity of fish species was measured for each seine using richness, abundance, and Shannon-Wiener and Berger-Parker diversity indices. The former measure of alpha diversity is calculated as $H^{/} = -\sum p_i \ln p_i$ where $p_{i,}$ is the proportional abundance of the *ith* species = $(n_i / N)$. The latter is a dominance measure and was calculated as $d = N_{max} /N$, where N = total number of individuals and $N_{max}$ = the number of individuals in the most abundant species. Abundance and richness data were also determined for young of the year in each seine.

Although attempts were made by field crews to record percent plant cover, the data recording was incomplete for many of the sites. For this reason the analysis was conducted on the richness of the plants found at the seine sites. The crews also attempted to record substrate type and percentage of substrate. These data were not included in the analysis because they confound with plant richness and plant type; also the data recording for substrate type was incomplete for many of the sites.

To examine the effect of cottage concentration on the aquatic communities a scoring system was developed using the map in figure 1. The map was prepared by the seining crew as part of their field notes. For each seine marked on the map the number of nearby cottages was scored. If there were 0-2 cottages located on shore within the square created by longitude and latitude, then the seine was assigned a value of 1. If there were 3-5 cottages in the square the score was 2, and if there were more than 6 cottages the assigned

# Lower Beverley Lake
# Figure 1 - Seine Locations

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The CRCA makes every effort to insure that the information presented is accurate for the intended uses of the map. There is an inherent error in all mapping products, and accuracy of the mapping cannot be gauranteed for all possible uses. All end-users must therefore determine for themselves if the information is suitable for their purposes. The accuracy of this map was intended to fit a scale for 11" x 17" paper and should therefore not be altered without the express written consent of the cartographer.

CATARAQUI REGION CONSERVATION AUTHORITY

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Created: January 30, 2009

score was 3. Data for cottage concentration was not included for seines 19, 24, 51, 75 and 89 because they appear on the map twice in different locations. Seines 33, 34, 41, 76, 90 are missing from the map.

The method used for taking the seine (boat, hand, swimming), the time of day and week within the field season, weather conditions, presence/absence of plant species, presence/absence of substrate type, percentage of cover by different substrates, and water temperature were also included in the analysis of the data. The analysis of diversity indices (of fish species) with the dependent variables richness of plant species and development was controlled for week, seine type, cottage concentration and weather. The data for Berger-Parker were normalized using a square root (x + .05) transformation.

The species at risk in greatest abundance was Grass Pickerel and it is the only one found in sufficient quantities to allow analysis. The data for this species was regressed with richness of plant species and abundance of young of year, adult fish and was controlled for week and weather. Grass Pickerel data was regressed with all fish species found using backwards stepwise regression to determine which fish species are associated with it. Variables were removed at $\alpha \geq 0.10$. Grass Pickerel data were also regressed with the richness of plant species (rps), rps (squared) and rps (cubed). Pearson Correlation Coefficients were calculated for all plant species with Grass Pickerel.

**Results**

During the seven weeks of field data collection 150 seines were completed; however data for only 149 is available because field notes for seine 23 were lost. In total 13, 483 individuals representing 22 species were collected. The dominant species which were collected are Large Mouth Bass *(Micropterus salmoides)*, Blue Gill (*Lepomis macrochirus)*, Pumpkinseed *(Lepomis gibbosus)* and Bluntnose Minnow *(Pimephales notatus)*. These 4 species make up 83% of the collection (Table 1).

The two at risk fish species which were collected are Grass Pickerel *(Esox americanus vermiculatus)* and Pugnose Shiner *(Notropis anagenus)*. Grass Pickerel made up 0.16% of the species inventory with a total of 22 individuals. Grass Pickerel were found in 13 out of 149 seine sites. Pugnose Shiner was represented by 1 individual (0.001% of the inventory). Additional species at risk which were found are Stink Pot and Northern Map turtles. There one individual of each were caught as by-catch in the seine nets. Grass Pickerel is the only species at risk which was collected at sufficient numbers for statistical analysis. The others can only be noted for their presence in Lower Beverley Lake.

Ten young of the year fish species were caught. Combined they represent 36.7% of the field collection (Table 1). Large Mouth Bass made up 67.0% of the young of the year and were found in 100% of the seines. At 11.2%, Blue Gills were the second most common species young of the year species, and were collected from 62.4 % of the seines. The third most common young of the year species is the Bluntnose Minnow which made up 6.5% of the collection, and were found in 40.9% of the seines. Pumpkin Seeds made up 5.0% of the collection and were found in 48.3 % of the seines. The rest of the species were each represented in less than 30% of the seines. None of the young of the year which were collected are species at risk.

Table 1. Fish species collected from 149 seines on Lower Beverley Lake from July 8 - August 29 2008.

| **Fish Species** | **Total number of individuals found in seines** | **Total Number of Young of Year** | **Number of seines in which the species was found.** |
|---|---|---|---|
| Banded Killifish (*Fundulus diaphanous)* | 682 | 67 | 74 |
| Black Crappie *(Pomoxis nigromaculatus)* | 74 | | 11 |
| Bluegill *(Lepomis macrochirus)* | 3119 | 556 | 134 |
| Bluntnose Minnow *(Pimephales notatus)* | 1911 | 323 | 95 |
| Bowfin *(Amia calva)* | 1 | | 1 |
| Brook Silverside *(Labidesthes sicculus)* | 86 | 3 | 8 |
| Brook Stickleback *(Culaea inconstans)* | 4 | | 4 |
| Brown Bullhead *(Ameiurus nebulosus)* | 139 | 132 | 11 |
| Central Mudminnow *(Umbra limi)* | 1 | | 1 |
| Emerald Shiner *(Notropis atherinoides)* | 69 | | 14 |
| Grass Pickerel *(Esox americanus vermiculatus)* | 22 | | 13 |
| Johnny Darter *(Etheostoma nigrum)* | 29 | | 17 |
| Largemouth Bass *(Micropterus salmoides)* | 3411 | 3316 | 149 |
| Northern Pike *(Esox lucius)* | 11 | | 8 |
| Pumpkinseed *(Lepomis gibbosus)* | 2667 | 251 | 144 |
| Pugnose Shiner *(Notropis anagenus)* | 1 | | 1 |
| Rock Bass *(Ambloplites rupestris)* | 948 | 141 | 104 |
| Smallmouth Bass *(Micropterus dolomieui)* | 179 | 156 | 47 |
| Spottail Shiner *(Notropis hudsonius)* | 4 | | 3 |
| Yellow Bullhead *(Ameiurus natalis)* | 1 | | 1 |
| Yellow Perch *(Perca flavescens)* | 140 | 2 | 42 |
| White Sucker *(Catostomus commersonii)* | 3 | | 1 |
| Total number | 13, 483 | 4947 | |

Seventeen plant species were identified in Lower Beverley Lake by the seining crew. The plant inventory including any potential invasive species is provided in Table 2. Wild Celery *(Vallisneria americana),* the most common species found, was identified in 124 out of 149 sites. Algae were the second most common group, and were found in 98 seine sites. The field crews did not identify algae to genera or species. Plant species information which was used for this analysis is from presence - absence data. Percent vegetation cover data were not reliably collected and could not be used.

The Shannon-Weiner index for fish diversity did not significantly vary by cottage concentration when controlled for week, seine type and weather. The analysis of Berger-Parker index for fish diversity with the dependent variables richness of plant species and cottage concentration was controlled for week, seine type, and weather. No significance was found for richness of plant species or development. An ANOVA was performed on development's role in presence of algae. The results were significant ($p = 0.02$) and are discussed in the water quality section.

Table 2. Plant species identified at 149 seines on Lower Beverley Lake from July 8 - August 29 2008.

| **Plant Species** | **Number of seines in which the species was found.** |
|---|---|
| Algae | 98 |
| Bog Willow *(Salix pedicellaris)* | 4 |
| Broad-leaved Arrowhead *(Sagittiria latifolia)* | 10 |
| Hardstem Bulrush *(Scripus acutus)* | 11 |
| Common Cattail *(Typha latifolia)* | 5 |
| Canadian Pond weed *(Elodea canadensis)* | 19 |
| Coontail *(Ceratophyllum demersum)* | 19 |
| Duckweed *(Lemna* spp.) | 65 |
| Milfoil (*Myriophyllum alterniflorum)* | 64 |
| Pickerel weed *(Pontederia cordata)* | 8 |
| Pondweed (*Potamogeton* spp.) | 40 |
| Slender Naiad (*Najas flexilis)* | 50 |
| Stonewort (*Chara* spp*.)* | 34 |
| Sago Pondweed *(Potamegeton pectinatus)** | 6 |
| White Water Lily *(Nymphaea odorata)* | 61 |
| Wild Celery *(Vallisneria americana)* | 124 |
| Yellow Pond Lily *(Nuphar lutea)* | 22 |
| Burweed (*Sparganium* spp.) | 2 |

* Note: Sago was recorded separately from other *Potamogeton* species.

Grass Pickerel (gp) were regressed with richness of plant species (rps) and abundance of young of year (ay) and the 2nd yr and older fish (adult) and controlled for week (wk) and weather (we). The formula of the regression is Gp=0.083(rps) + 0.011 (ay) ($r^2$=0.35 $p<0.05$). Older fish, week and weather were not significant in the regression. The regression for Grass Pickerel with richness of plant species is $Gp=-0.24+0.33(rps)-.10(rps)^2+.01(rps)^3$ ($r^2$=0.24 p=<0.0001). Plant species richness is significant in the regression.

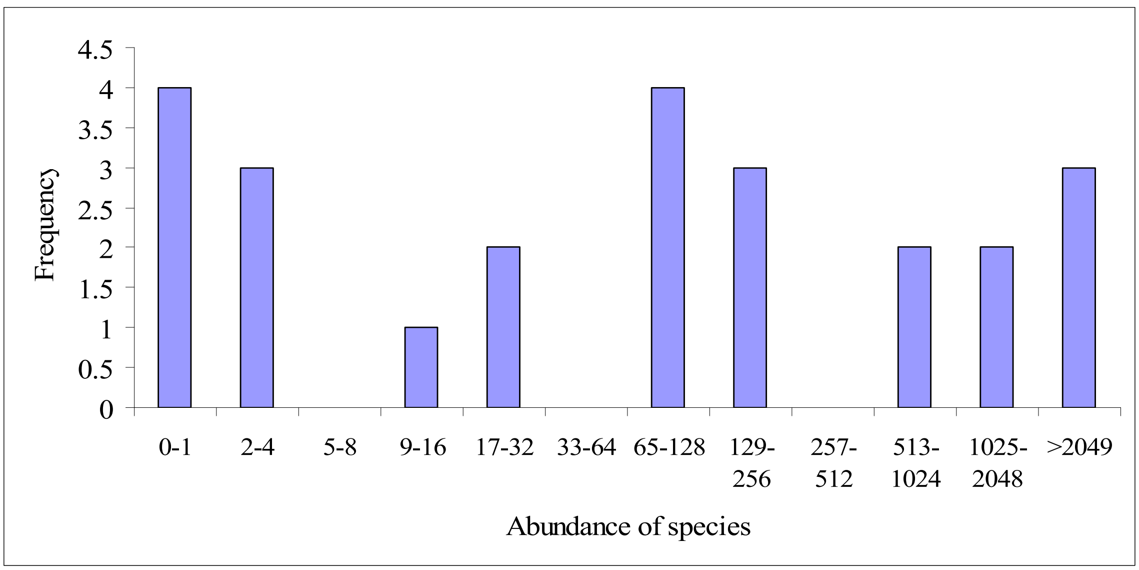
In the backwards stepwise regression for grass pickerel and other fish species, (species removed at $\alpha \geq 0.10$), Brown Bullhead *(Ameiurus nebulosus)* (BBull), Bluntnose Minnow *(Pimephales notatus)* (bnm), Brook Silverside *(Labidesthes sicculus)* (bss), and Emerald Shiner *(Notropis atherinoides* (es). The regression model is gp=0.10+0.46(bbull)-0.003(BNM)+0.039(bss)+0.053(ES) p=<.0001 (r2=0.54). Brown Bullhead may be an outlier because 106 out of 120 were found in 1 seine which also contained with Grass Pickerel. There is a negative association with Bluntnose Minnows; however, this result may be an artifact caused because of the limited number of Grass Pickerel found. Further sampling is necessary to determine this relationship.

Grass pickerel were found to be positively correlated with Bog Willow *(Salix pedicellaris)*, Broad-leaved Arrowhead *(Sagittiria latifolia)*, Common Cattail *(Typha latifolia)*, Duckweed *(Lemna* spp.), White Water Lily *(Nymphaea odorata)* and Burweed (*Sparganium* spp.) with Pearson correlation coefficients and probabilities of 0.31 (p<0.0001), 0.39 (p<0.0001), 0.27 (p=0.008), 0.22 (p=0.008), 0.16 (p=0.05) and 0.47

(p<0.0001) respectively. These results are of interest but must be treated with caution because of the low number of sites in which some of the plants were found. Burweed was recorded at only 2 sites, Willow at 4 sites and Cattails at 5 sites. More detailed plant data is needed to gain a more complete understanding of the interactions between fish and plant communities.

The distribution abundance patterns of the fish species which were caught are not represented by a log-normal distribution. Fifteen of 22 species can be considered as rare in the species inventory, and represent less than 1.5% of the individuals which were identified. Visual inspection of the frequency abundance graph (Figure 2) indicates that the assemblage is highly disturbed, undergoing a change in the structure or was not completely sampled. It is also possible that some combination of these possibilities is occurring.

Figure 2. Frequency distribution of fish species in relation to their abundance for data collected from near shore netting in Lower Beverley Lake.



## Discussion

Although it initially was suggested that 10 species at risk may reside in Lower Beverley Lake, only 4 were recorded. It is of particular note that Pugnose Shiner was found because it is one of the rarest minnow species in north eastern North America. This record will be of value for defining the region in which it resides; however, at this point there is insufficient data to develop stewardship strategies for this species. It is not surprising that species such as the American Eel and River Redhorse were not recorded because the netting methods used in this work are not appropriate for them. The methods used primarily focus on small fish species, and young of the year. Turtles were caught as by-catch and as a result in 149 seines only 2 individuals were recorded during near shore netting of small fish. Further collection, including the use of additional techniques, is required to gather more data on species at risk in Lower Beverley Lake.

A sufficient number of Grass Pickerel was collected for statistical analysis. The analysis has provided valuable information about its associations with fish and plant species that occur in Lower Beverley Lake. The results of this field season indicate that Grass Pickerel is positively correlated with Bog Willow, Broad-leaved, Common Cattail, Duckweed, White Water Lily and Burweed. They are also found with Emerald Shiner and Brook Silverside which are likely prey items. They have an affinity with areas that are rich in young of the year, which also may be areas that provide prey.

This work just touches upon the interactions between Grass Pickerel and the plant and fish species in Lower Beverley Lake. The plant richness information which was provided by the field crews was assessed as presence-absence data. The data does not include biological interactions between the plant species and Grass Pickerel. Such information is important for long term stewardship of this species at risk because it would provide basic understanding of its ecological requirements. Likewise, the data analysis suggests that Brook Silverside, and Emerald Shiner are important, likely as prey items. Little else was revealed about how Grass Pickerel fit into the fish communities in this lake. For conservation of the species, more information is needed to understand the role of Grass Pickerel in the lake. Knowledge of the aquatic species which are important to this species at risk, and their interactions are important for long term conservation of them. Factors which may impact on the populations of species which Grass Pickerel depend upon were not investigated.

Initial stewardship strategies can be developed from the results found; however, more sampling of the fish species in Lower Beverley Lake is required before stewardship strategies for Species at Risk in the lake are finalized. It is necessary to determine if the fish assemblages are disturbed or under represented. To do so field collection of data needs to be supplemented, not with more seines but with additional collection techniques. Such techniques should include those to sample adult fish so that a more complete representation of the fish assemblages can be collected. Disruptive influences which were not examined include natural factors such the disappearance of American Eels as a dominant species within the community, and the relatively recent introduction of invasive species such as Zebra Mussels *(Dreissena polymorpha)*, as well as anthropogenic disturbances such as nutrient seepage into the lake, and sport and commercial fisheries. In order to evaluate and offer appropriate stewardship strategies for the species at risk it is important to consider the potential influence of natural and anthropogenic factors.

The implications of the distribution abundance patterns may also explain in part some of the surprising results, which include measures of fish species diversity that were even throughout the lake. This means that there is no significant change in fish species diversity in the different pressures caused by cottage concentration. It was expected that different sections of the lake would contain differing degrees of fish species diversity. The values given for the Shannon-Weiner and Berger-Parker indices can be a basis for comparison in the future years. Fish species diversity did not vary according to the richness of plant species or the concentration of cottages on the lake shore. These results are of interest but must be treated with caution because of the low number of sites in which some of the fish were found. Another unexpected finding is that the presence of Grass Pickerel was not associated with any particular region of Lower Beverley Lake. For stewardship planning of this species more work is required to confirm this result. It was expected that there would be an increased presence of species in the shallow south western arm of the lake.

Results from a more detailed study focused primarily on the species at risk would allow better stewardship protocols for these species in this lake and watershed. The fieldwork from 2008 will allow for the development of initial stewardship strategies. A considerable benefit from this work is that it clearly indicates work which is needed to further develop stewardship strategies for species at risk in Lower Beverley Lake. The results of the species analysis together with the shoreline data allow for the development of initial stewardship strategies for Grass Pickerel. More work will be required to further develop these strategies; however, the work completed in 2008 provides a solid basis to approach the next stage of work on Lower Beverley Lake.

# 2. **Habitat and Shoreline Inventory**

## Introduction

Habitat and shoreline inventories provide complementary data to the species analysis. With such information, limiting or critical habitats in Lower Beverley Lake can be determined. As a result, scientifically sound approaches to stewardship can be prepared. Interested shoreline owners can be provided with information to direct them in the stewardship of species at risk in their lake and allow for consideration of options.

## Methods

Project staff completed a total of three passes around the shoreline of Lower Beverley Lake to collect three data sets: 1. Shoreline data records for each visible upland parcel, 2. mapping of shoreline development and features and 3. in-water vegetation characteristics. The first pass concentrated efforts on collecting data on properties that were visible from the water. The observational data was compiled into a data record sheet. An effort was made to record a GPS position with each data sheet completed in order to link the data with a physical location. The data sheets were a comprehensive review of typical shoreline/upland development features that could be noted for future stewardship initiatives. A GIS layer was created to link the data sheets to the positional information recorded.

The second pass required the crew to travel as close to shore as feasibly possible, while recording data points (GPS Position) when a change in the shoreline character occurred. A table of points was created that indicated the character of the shoreline between each point. The GPS points were then assessed and evaluated in ArcView to create line segments that depicted the shoreline character.

The final pass was to look at vegetation and substrate characteristics within the littoral zone of the lake (water depth 6 feet). Attempts were made to create polygon features that could be used in a GIS application.

## Results

A total of 344 data sheets were compiled for upland property parcels. These data sheets can be used as the baseline information for future stewardship initiatives. The background information and the level of detail can provide landowners with a quick reference sheet on the features that were observed on their property. The data record sheets will be made available to stewardship organizations to provide a baseline of information so that efforts can be directed to the aspects that will provide the most gain with respect to lake health.

A Cansel GeoXt GPS unit was requested in the funding proposal for this initiative. Due to the significant limitations of a recreational grade GPS unit mapping of in-water vegetation with any level of accuracy or confidence was not feasible. Although some vegetation mapping was done using information gathered by seining crews it lacks the detail which would have otherwise been available. That information is needed for a more detailed habitat analysis.  Even so it was possible to create maps with the data gathered by the shoreline crew.

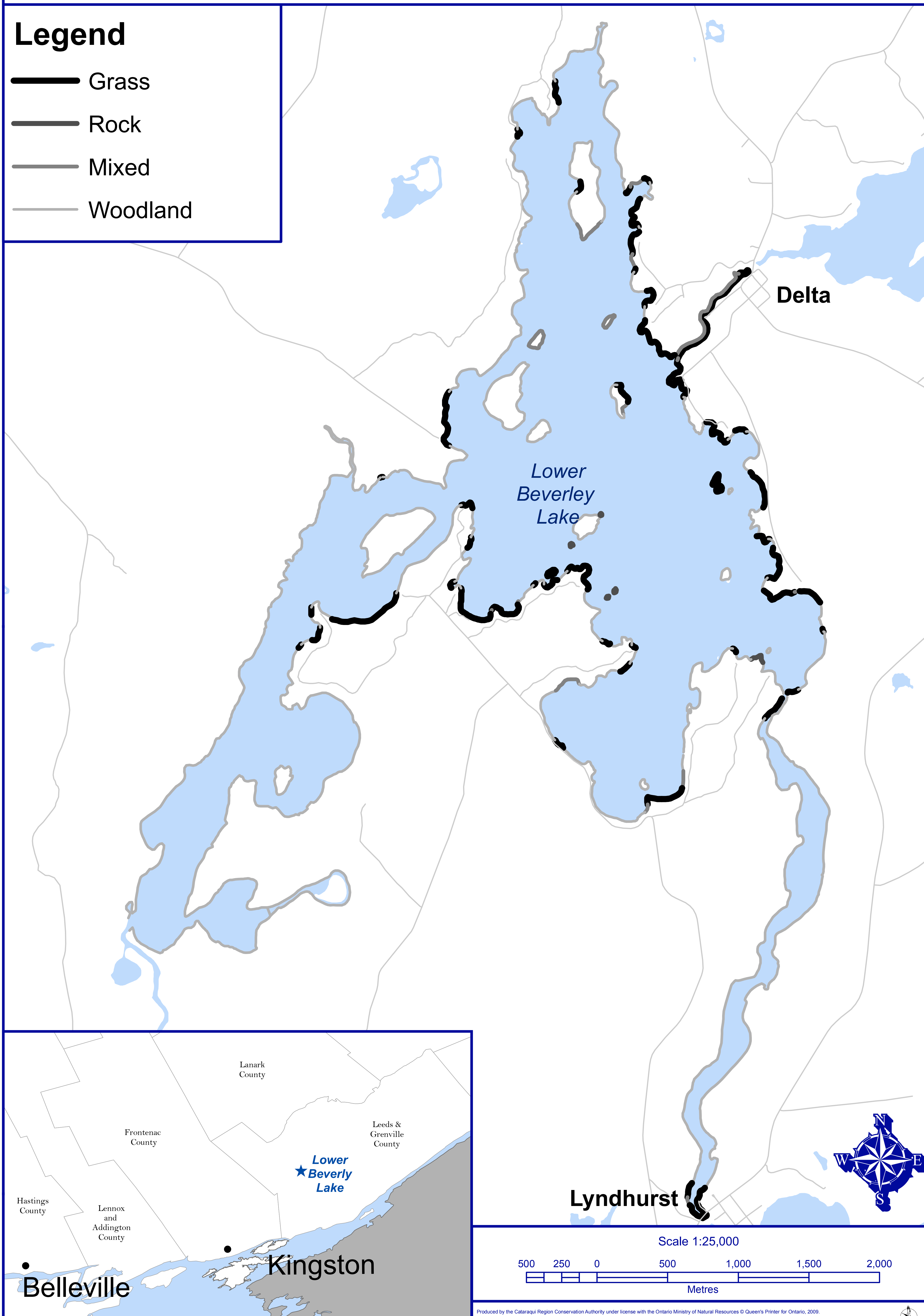
This was the first opportunity for the Gananoque River watershed group to undertake a mapping project of this scale and scope.  There are many ways in which subsequent projects can benefit from the experiences gained during  Phase 1.  Data compilation and analysis were hindered by data entry issues (paper records and manual data input) while accuracy was greatly compromised through the use of the recreational grade GPS. Despite the crew's effort to obtain accurate in-water vegetation data, the analysis and mapping of this information was not possible due to positional inaccuracies. The GPS unit also limited the ability of the crew to assess their progress, as the unit required regular downloading of data and linkages to hand scribed information.  It is anticipated that in future efforts, a more versatile GPS unit will be available in order to provide pre-determined data fields, background imaging that will ensure data is verified in the field, and linkage to photos without data manipulation/input beyond the unit's functionality (i.e., would not require manual input/linkage of data since it would be recorded in the unit).

Although the data obtained is rich in content, the accuracy and credibility of some aspects must be considered.  Therefore this discussion is limited to those items where there is a reasonable level of confidence in the data integrity.  The intent of the in-water vegetation mapping was to provide a habitat predictability model that could be used to assess potential habitat sites for conservation efforts and verification.  Due to the inaccuracies noted above, it is not feasible to complete/prepare this analysis and therefore the mapping portion of the project can only provide data for consideration in future stewardship targeting and initiatives.

**Discussion**

A significant portion of the upland areas of Lower Beverley Lake may still considered in a natural state (Figure 3).  Comparison of the seining data with the mapped shoreline features indicates that there are sensitive areas that are close to/within areas pressured by development. The regions which are mainly considered ornamental closely overlap with portions of the shoreline which have a high concentration of cottages.  These are areas of concern for stewardship of Grass Pickerel because there are a large number of fish nursery habitats, and there is a higher probability that contaminates will wash into the lake without natural vegetative buffers. General stewardship opportunities can be undertaken in these areas in order to promote healthy shorelines with appropriate vegetative buffers (Figure 4).

# Lower Beverley Lake
# Figure 3 - Upland Vegetation



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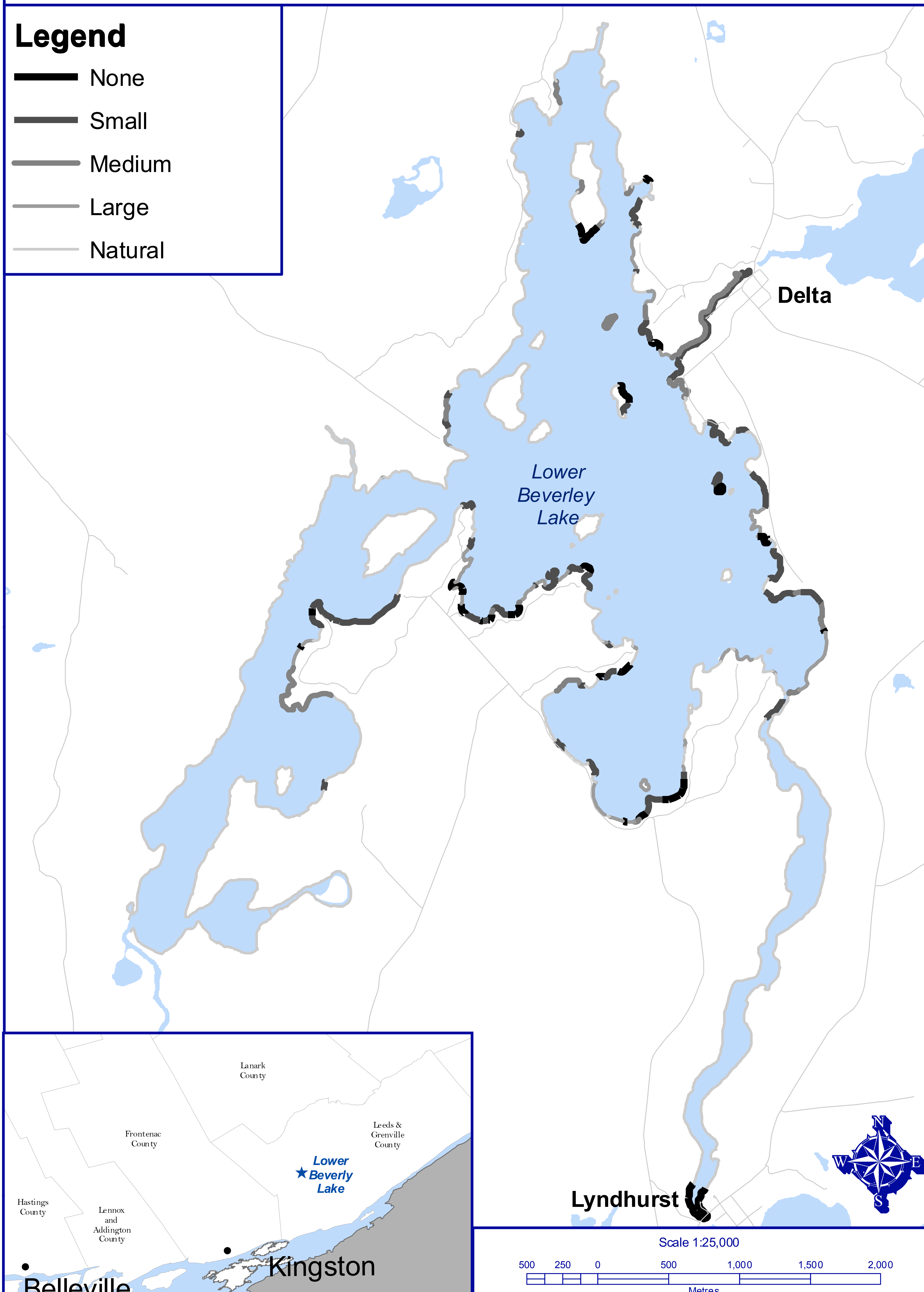
//GIS_Department/Projects/Staff/Lower Beverly Lake 2009/ LB Lak YOY Richness.mxd

Created: January 30, 2009

# Lower Beverley Lake
# Figure 4 - Vegetative Buffer

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Created: January 30, 2009

# 3. Water quality for the Gananoque River Watershed

## Introduction

One important consideration in stewardship planning for species at risk and their habitat is water quality. Changes in water quality are needed to determine factors which influence quality (e.g., residents, farm runoff, or natural processes). This information is important for the analysis of habitat quality for species at risk, and any habitat remediation needed for their stewardship. Water quality reporting in this initiative, as it relates to species at risk, can be inferred by algal presence. Initial stewardship recommendations in this report are based on that information.

## Methods

A YSI-6600 Multiparameter Water Quality Sonde was used to obtain water quality measures for the lakes in the Gananoque River Watershed. The lakes which were sampled with this unit did not have records of invasive species such as Zebra Mussels. Concerns had been raised by watershed residents that invasive species could be introduced if the equipment were not properly sterilized.

Volunteers or project staff collected water quality data at inflows and outflows, as well as at three randomly selected points along the shore. The random areas were also selected using random man methods. Whenever possible at the sample site two readings were taken. The first was as close as possible to the entrance of the inflow or outflow from the lake, and the second was approximately 10 metres into the lake. For each location depth reading, GPS coordinates and YSI 6600 readings were taken together with notes about the upland region.

To supplement the data collected with the Sonde, water samples were collected by volunteers or project staff to send to the Lake Partners program for phosphorous testing. The lakes which were tested included those for which water quality data was not collected using the Sonde. Two water samples were taken from each of the tested lakes at the deepest part.

## Results

The results from this initiative are inconclusive, because the data collected are single points of information (Tables 3 and 4). To have meaning, there needs to be comparison, within and among years. Phosphorous testing on Wiltse Lake should be repeated. The reading suggests that there is either a major phosphorous problem on the lake, or that the samples were contaminated.

Algae was recorded at 65.8% of the seine sites. It was determined that increased cottage concentration was associated with increased presence of Algae ($F = 4.07$ $df = 2$ $p = 0.02$) suggesting run off from cottages is causing algal blooms. The mean square error for the lowest concentration of cottages is 0.47, the intermediate concentration is 0.60 and the highest concentration is 0.74. An ANOVA was also performed on upland vegetation (Figure 3), but no significant differences were found with presence of algae.

Table 3. Water quality data collected from Aug 13 - Aug 25 from 7 lakes in the Gananoque River Watershed.
This data was collected using a YSI-6600 Multiparametrer Water Quality Sonde. Location: 1 = nearshore, 2= 10 metres out, Site types: 1 = random, 2= in take, 3= out take, Habitat: 1= residence, 2 = woods, 3 =marsh, 4 = farm, TDS = total dissolved solids, DO% = dissolved oxygenm DO mg = dissolved oxygen in mg/L, DOch = dissolvedoxygen sensor change, m = depth in metres, orp= oxidation reduction, NTU+ = turbidity, Chl = Chlorophyll, FL = Florescence, "." = missing datum.

| date | lake name | location | site type | habitat | gps | temp | TDS | DO% | DO mg | Doch | m | pH | orp | NTU | Ch | Fl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13-Aug | Long | 1 | 2 | 2 | N4429.910 W07604.200 | 24.45 | 0.0001 | 108.6 | 9.04 | 66.5 | 1.04 | 8.8 | 73 | 7.8 | 1.3 | 0.2 |
| 13-Aug | Long | 2 | 2 | 2 | N4429.906 W07604.211 | 24.43 | 0.0001 | 99.6 | 8.31 | 65.5 | 0.997 | 8.65 | 80 | 7.5 | 3.6 | 0.7 |
| 13-Aug | Long | 1 | 1 | 2 | N4429.36 W076 05.240 | 23.23 | 0.0001 | 101.8 | 8.64 | 64.5 | 0.46 | 8.45 | 116.7 | 6.9 | 7.3 | 1.2 |
| 13-Aug | Long | 2 | 1 | 2 | N4429.37 Wo76.226 | 23.4 | 0.0001 | 103.5 | 8.8 | 65.5 | 1.005 | 8.56 | 111.8 | 6.8 | 3.5 | 1 |
| 13-Aug | Long | 1 | 1 | 2 | N4429.684 W07604.834 | 24.08 | 0.0001 | 107.6 | 9.05 | 65.5 | 0.55 | 8.72 | 113.5 | 7.3 | 1.7 | 0.3 |
| 13-Aug | Long | 2 | 1 | 2 | N4429.676 W07604.823 | 24.27 | 0.0001 | 105.2 | 8.99 | 65.5 | 1.002 | 8.74 | 108.8 | 7.2 | 0.4 | 0.1 |
| 13-Aug | Long | 2 | 1 | 2 | N4429.773 Wo76 4.704 | 24.3 | 0.0001 | 129 | 10.78 | 68.6 | 0.45 | 8.97 | 52.8 | 7.4 | 1.3 | 0.2 |
| 13-Aug | Long | 2 | 1 | 2 | N4429.773 W0.7604.704 | 24.3 | 0.0001 | 103.6 | 8.67 | 65.5 | 0.998 | 8.75 | 75 | 7.3 | -9.9 | -1.6 |
| 14-Aug | Red Horse | 1 | 2 | . | 0413276 494105 | 23.31 | 0.26 | 89.5 | 7.6 | 63.5 | 0.597 | 8.37 | 101.9 | 7.5 | -3.7 | -0.7 |
| 14-Aug | Red Horse | 2 | 1 | . | 413367 4933726 | 23.31 | 0.002 | 95.7 | 8.18 | 64.5 | 0.706 | 8.47 | 104.7 | 7.8 | 1.3 | -1.3 |
| 14-Aug | Red Horse | 2 | 2 | 2 | 414184 4933158 | 24.09 | 0.0002 | 93.6 | 7.85 | 63.5 | 0.74 | 8.5 | 105.1 | 7.3 | -8.4 | -1.4 |
| 14-Aug | Red Horse | 2 | 2 | 2 | 0414427 4933898 | 23.75 | 0.0002 | 99.4 | 8.32 | 64.5 | 0.803 | 8.55 | 86.7 | 7.3 | -4.9 | -1.5 |
| 14-Aug | Red Horse | 1 | 2 | 2 | 414572 493370 | 23.95 | 0.0002 | 97.3 | 8.08 | 63.5 | 0.713 | 8.47 | 86.1 | 7.4 | -7.7 | -0.2 |
| 14-Aug | Red Horse | 2 | 2 | 2 | 414511 49338869 | 23.87 | 0.0002 | 95.6 | 7.9 | 63.5 | 0.675 | 8.47 | 89.4 | 7.5 | -4.5 | -1.1 |
| 14-Aug | Red Horse | 1 | 2 | 2 | 414846 4932574 | 23.84 | 0.0002 | 119.3 | 9.62 | 66.5 | 0.78 | 8.72 | 73.4 | 7.1 | -4.6 | -0.8 |
| 14-Aug | Red Horse | 2 | 2 | 2 | . | 24.03 | 0.0002 | 99.3 | 8.23 | 64.5 | 0.782 | 8.54 | 85.1 | 7.3 | -7.7 | -1.2 |
| 14-Aug | Red Horse | 2 | 2 | 3 | 0414217 4930944 | 24.06 | 0.0002 | 110.3 | 9.2 | 66.5 | 0.754 | 8.77 | 73.1 | 7.5 | -1.2 | -1.6 |
| 14-Aug | Red Horse | 1 | 3 | 2 | 413326 4979135 | 24.3 | 0.0002 | 101.6 | 8.65 | 64.5 | 0.775 | 8.6 | 72.6 | 7.3 | -6.5 | -0.7 |
| 14-Aug | Red Horse | 1 | 1 | 2 | 413633 4937415 | 23.5 | 0.002 | 101.7 | 8.53 | 64.5 | 1.23 | 8.49 | 70.5 | 7.3 | -1.6 | -1 |
| 14-Aug | Red Horse | 1 | 1 | 2 | 412295 4929837 | 23.44 | 0.0002 | 106.2 | 8.8 | 64.5 | 1.241 | 8.4 | 103.8 | 7.4 | -3.2 | -0.8 |
| 14-Aug | Red Horse | 1 | 2 | 2 | 0411887 4929338 | 23.46 | 0.0002 | 112.1 | 9.26 | 65.5 | 0.767 | 8.42 | 95.5 | 7.4 | -6.5 | -1.4 |
| 14-Aug | Red Horse | 1 | 2 | 3 | 411772 4929274 | 23.8 | 0.0002 | 105.9 | 8.79 | 65.5 | 0.961 | 8.37 | 91.4 | 7.6 | -1.6 | -0.5 |
| 14-Aug | Red Horse | 1 | 2 | 2 | 411795 49295586 | 23.64 | 0.0002 | 97.8 | 8.11 | 63.5 | 0.92 | 8.31 | 91.3 | 33.6 | -6.5 | -0.2 |
| 14-Aug | Singleton | 1 | 3 | . | 412145 4930491 | 23.6 | 0.0002 | 111.3 | 9.15 | 66.5 | 0.53 | 8.45 | 84.7 | 7.5 | -5.2 | -0.9 |
| 26-Aug | Singleton | 1 | . | 3 | 18T 0412169 4930421 | 23.14 | 0.0002 | 86.9 | 7.45 | 65.5 | 0.862 | 8.41 | 85.5 | 7 | -6.4 | -1.1 |
| 26-Aug | Singleton | 2 | . | 3 | 18T 0412031 4926901 | 23.56 | 0.0002 | 87.3 | 7.41 | 64.5 | 0.807 | 8.5 | 101.9 | 6.8 | -8.6 | -0.5 |
| 26-Aug | Singleton | 1 | . | . | 18T 0411533 4931329 | 22.65 | 0.0002 | 74.9 | 6.48 | 63.5 | 0.812 | 8.21 | 135.2 | 7.4 | -7.5 | -1.2 |
| 26-Aug | Singleton | 2 | . | . | . | 22.82 | 0.0002 | 79.5 | 6.76 | 63.5 | 0.789 | 8.23 | 120.9 | 7.2 | -0.4 | -0.5 |
| 26-Aug | Singleton | 1 | 1 | 2 | 18T 0411148 4930570 | 23.21 | 0.0002 | 86.7 | 7.4 | 65.5 | 0.838 | 8.38 | 123.9 | 7.5 | -1.5 | -0.2 |
| 26-Aug | Singleton | 2 | 1 | 2 | 18T 0411988 4930475 | 23.55 | 0.0002 | 119.6 | 10.2 | 69.6 | 0.797 | 8.66 | 70 | 6.6 | -3 | -1.8 |
| 27-Aug | Eloida | . | 1 | 2 | . | . | 0.0002 | 108.2 | 9.45 | 66.5 | . | 8.95 | 45.4 | 7.5 | -7.6 | -1 |
| 18-Aug | Lower Beverley | 1 | 2 | 3 | 4434 108N 076 10.584W | 23.08 | 0.0002 | 102.2 | 8.72 | 67.6 | 0.811 | 8.81 | 90.1 | 10.6 | -0.1 | 0 |
| | | | | | | | | | | | | | | | | |

| date | lake name | location | site type | habitat | gps | temp | TDS | DO% | DO mg | Doch | m | pH | orp | NTU | Ch | Fl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18-Aug | Lower Beverley | 1 | 2 | 3 | 4435.720N 076 09.520W | 24.41 | 0.0002 | 112.6 | 9.43 | 69.6 | 9.06 | 9.14 | 108.5 | 11.2 | 4.2 | 0.7 |
| 18-Aug | Lower Beverley | 1 | . | . | 44 35.735N 076 08.915W | 23.06 | 0.0002 | 81.9 | 6.98 | 64.5 | 0.833 | 8.77 | 105.4 | 7.3 | -0.6 | -0.6 |
| 18-Aug | Lower Beverley | 1 | 1 | 2 | 44 36.276N 076 08.616W | 23.71 | 0.0002 | 114.2 | 9.76 | 70.6 | 0.864 | 9.14 | 106.9 | 7.2 | -3.8 | -0.6 |
| 18-Aug | Lower Beverley | 1 | 2 | 3 | 44 37.389N 076 08.287W | 24.5 | 0.0002 | 88.3 | 7.39 | 66.5 | 8.42 | 8.9 | 50.7 | 24.8 | -6.4 | -1 |
| 18-Aug | Lower Beverley | 1 | 2 | 3 | 44 37.3994N 076 08.224W | 23.95 | 0.0002 | 91.5 | 7.69 | 65.5 | 7.43 | 8.79 | 78.4 | 17 | 9.7 | 1.8 |
| 18-Aug | Lower Beverley | 1 | 1 | 2 | 44 37.153N 076 08.162W | 24.17 | 0.0002 | 87.8 | 7.37 | 66.5 | 0.94 | 8.9 | 94.8 | 7.2 | -5.3 | -0.9 |
| 18-Aug | Lower Beverley | 1 | 2 | 1 | 44 36.535N 076 07.775W | 23.32 | 0.0002 | 80.8 | 6.89 | 64.5 | 0.761 | 8.66 | 101.3 | 10.7 | -3.6 | -0.6 |
| 18-Aug | Lower Beverley | 2 | 2 | 1 | 44 36.227N 076 07.804W | 23.96 | 0.0002 | 85.6 | 7.22 | 65.5 | 0.97 | 8.87 | 97.6 | 7.4 | -1.9 | -0.3 |
| 18-Aug | Lower Beverley | 1 | 1 | 1 | 44 34.734N 076 07.715W | 23.39 | 0.0002 | 74.9 | 6.36 | 63.5 | 0.97 | 8.67 | 101.6 | 7.2 | -4.2 | -0.8 |
| 18-Aug | Lower Beverley | 1 | 1 | 3 | 44 35.311N 076 08.123W | 23.43 | 0.0002 | 76.5 | 6.45 | 63.5 | 1.008 | 8.66 | 94.8 | 7.2 | 1.5 | 0.2 |
| 18-Aug | Lower Beverley | 1 | 3 | 1 | 44 35.009N 076 07.139W | 24.53 | 0.0002 | 88.8 | 7.62 | 67.6 | 1.009 | 8.91 | 112.4 | 7 | -10.6 | -1.7 |
| 18-Aug | Lower Beverley | 2 | 3 | 1 | 44 35.030N 076 07.147W | 24.28 | 0.0002 | 86 | 7.28 | 66.5 | 0.967 | 8.88 | 114 | 10.3 | -6.2 | 0.1 |
| 22-Aug | Lyndhurst | 1 | 2 | 2 | 18T 0411047 4933204 | 23.03 | 0.0002 | 82.6 | 7.06 | 65.5 | 0.866 | 8.4 | 80.1 | 7.3 | -7.1 | -1.2 |
| 22-Aug | Lyndhurst | 1 | 1 | 2 | 18T 0411311 4933063 | 23.14 | 0.0002 | 86 | 7.35 | 66.5 | 0.891 | 8.52 | 89.6 | 7.8 | -0.4 | 0 |
| 22-Aug | Lyndhurst | 1 | 2 | . | 18T 0411603 4933270 | 23.66 | 0.0002 | 98.4 | 8.35 | 69.6 | 0.842 | 8.81 | 100.1 | 7.3 | -4 | -0.7 |
| 22-Aug | Lyndhurst | 1 | 1 | . | 18T 044325 4933657 | 24.77 | 0.0002 | 91.7 | 7.64 | 69.6 | 0.878 | 8.7 | 101.5 | 7.8 | -4.1 | -0.7 |
| 22-Aug | Lyndhurst | 1 | 1 | 1 | 18T 0411073 4933582 | 24.65 | 0.0002 | 84.4 | 7.17 | 66.5 | 0.824 | 8.66 | 90.6 | 7.9 | 7.4 | 1.2 |
| 25-Aug | Gananoque | 1 | 1 | 2 | 18T 0407170 9921783 | 23.54 | 0.0002 | 106.4 | 8.89 | 67.6 | 0.778 | 9.14 | 41.4 | 7.1 | -8.6 | -1.4 |
| 25-Aug | Gananoque | 1 | . | . | 18T 0407482 4921141 | 23.36 | 0.0002 | 93.1 | 7.89 | 65.5 | 0.737 | 8.67 | 25.8 | 7.3 | -4.8 | -0.3 |
| 25-Aug | Gananoque | 1 | . | . | 0407744 4920991 | 23.01 | 0.0002 | 92.6 | 7.94 | 65.5 | 0.829 | 8.56 | 51.1 | 7 | -3.6 | -0.8 |
| 25-Aug | Gananoque | 1 | 2 | 3 | 8T 0409147 UTM 4920612 | 23.07 | 0.0002 | 85.1 | 7.26 | 64.5 | 0.794 | 8.57 | 68.3 | 7.4 | -2.4 | -0.4 |
| 25-Aug | Gananoque | 2 | 2 | 3 | 18T 0409153 UTM 4920641 | 23.11 | 0.0002 | 85.8 | 7.29 | 64.5 | 0.808 | 8.54 | 69.9 | 7.2 | -2.7 | -0.9 |
| 25-Aug | Gananoque | 1 | 1 | 2 | 18T0408985 UTM 4921736 | 23.43 | 0.0002 | 99.2 | 8.45 | 66.7 | 0.94 | 8.76 | 71.8 | 7.1 | 2.4 | 0.4 |
| 25-Aug | Gananoque | 1 | . | . | 18T049373 UTM 4922596 | 24.14 | 0.0002 | 106.2 | 8.9 | 67.6 | 0.807 | 8.81 | 69.6 | 6.8 | -3.1 | -0.5 |
| 25-Aug | Gananoque | 1 | 1 | 2 | 18T0408430 UTM 4923338 | 23.26 | 0.0002 | 82.5 | 6.95 | 63.5 | 0.81 | 8.6 | 66.2 | 7.7 | -4.1 | -0.4 |
| 25-Aug | Gananoque | 1 | 1 | . | 18T 0411983 UTM 4926882 | 23.54 | 0.0002 | 89.8 | 7.44 | 64.5 | 0.81 | 8.53 | 121.1 | 7.2 | -1.7 | -0.3 |
| 25-Aug | Gananoque | 2 | 1 | . | 18 0412031 UTM 4926901 | 23.56 | 0.0002 | 87.3 | 7.41 | 64.5 | 0.807 | 8.5 | 101.9 | 6.8 | -8.6 | -0.5 |

Table 4. Phosphorous data collected for 15 lakes in the Gananoque River Watershed. Samples were analysed by the Lake Partners Association. P1 refers to sample 1, P2 to sample 2. The Phosphorous concentration is measured in ug/L.

| Date | Lake | P1 | P2 |
|---|---|---|---|
| 10-Sep-08 | Bass | 6.3 | 7.0 |
| 27-Aug-08 | Centre | 15.1 | 13.5 |
| 27-Aug-08 | Eloida | 11.2 | 14.1 |
| 25-Aug-08 | Gananoque | 21.8 | 21.2 |
| 27-Aug-08 | Graham | 16.5 | 16.5 |
| 10-Sep-08 | Green | 11.2 | 8.8 |
| 22-Aug-08 | Grippen | 8.5 | 6.4 |
| 27-Aug-08 | Killenbeck | 20.4 | 21.4 |
| 18-Aug-08 | Lower Beverley | 17.7 | 17.6 |
| 22-Aug-08 | Lyndhurst | 22.1 | 21.1 |
| 26-Aug-08 | Singleton | 22.9 | 18.0 |
| 25-Aug-08 | South | 21.3 | 24.2 |
| 27-Aug-08 | Temperance | 21.0 | 22.1 |
| 21-Aug-08 | Upper Beverley | 15.8 | 17.2 |
| 29-Aug-08 | Wiltse | 131.4 | 149.5 |

**Discussion**

Water quality data collected during Phase 1 can be used for comparative purposes with data collected in subsequent years. All tested lakes in the Gananoque River watershed, except for Bass, Green and Grippen have higher levels than those reported in Charleston Lake in 2007. It is intended that future phases of this initiative will examine the factors influencing phosphorous levels in the lakes, and develop stewardship protocols specific to each lake.

As part of the analysis of the data for Species Inventory and Analysis, an ANOVA was performed on the role of development on the presence of algae. Development in this case refers to the concentration of cottages along the shore (i.e., the higher the concentration of cottages, the increased likelihood of algal presence). Algae was recorded at 65.8% of the seine sites. It was determined that increased cottage concentration was associated with increased presence of Algae ($p = 0.02$) suggesting run off from cottages is causing algal blooms. An ANOVA was also performed on upland vegetation (Figure 3), but no significant differences were found with presence of algae. This is likely because of the close proximity between some of the areas designated as ornamental and wooded (or because run off from the cottages spreads in the water affecting a larger area). It is noteworthy that most of the areas with high cottage concentration tend to be the regions which have a great deal of ornamental upland vegetation.

One explanation for this result is that nutrients are a result of runoff (from septic systems, lawn care, or both). The cause for the concentration of algal presence with increased shore line development should be further investigated because areas of high cottage concentration are close to regions of the lake which may be sensitive habitat for Grass Pickerel. There also should be further investigation on the impact of water quality and algal growth and this species and its associates. The result of the algal analysis further supports the argument that this is an area which may benefit from stewardship initiatives.

## 4. Stewardship Strategies for Species at Risk in Lower Beverley Lake

When combined, the species inventory analysis and the shoreline analysis can be used to identify threats to species at risk in the lake. Stewardship strategies to mitigate negative effects on species at risk have been developed from the results presented above. Considerable future work on Lower Beverley Lake is required before they can be finalized. These initial strategies provide a basis for establishing protocols for the conservation of species at risk in this lake.

The stewardship strategy recommendations are divided into 2 sections. The first includes initial strategies specifically targeted at Grass Pickerel. This is the only species at risk found in Lower Beverley Lake in sufficient numbers for statistical analysis during the 2008 field collection. The second are more general strategies which are geared towards allowing the general public to have a greater understanding of the species which live in this lake. They will help to address the general lack of knowledge, or misinformation, about the aquatic species which were revealed during interactions with the public over the course of the summer.

**Stewardship strategies for species at risk**

1. Based on historical data and species range information it can be expected that at least 10 aquatic species at risk may be found in Lower Beverley Lake. Only 4 species at risk were identified in the 2008 season. It is likely that more species at risk would be found by altering the collection methods so that specific species are targeted. This may include changing the time of day of collection, altering the trapping techniques, and evaluating different depths of water. Further efforts to identify more species at risk are required to establish stewardship strategies for this lake.

2. The results of the analysis of distribution and abundance of species collected during 2008 indicate that the data lacks robustness. This suggests that more data needs to be collected from this lake before sound recommendations are made about the status of its populations of aquatic species. Some of the oddities in the analyses may be a result of aquatic species under stress caused by factors such as fishing (sport and/or commercial), water quality, invasive species and decline of top predators such as American Eels. Before any stewardship plan is finalized for species at risk in this lake, stress factors must be determined in order to establish the mediation actions that are required.

3. Grass Pickerel was found to be positively correlated with the following plant species: Bog Willow, Broad-leaved Arrowhead, Common Cattail, Duckweed, White Water Lily and Burweed. They are also found with the fish species Emerald Shiner and Brook Silverside. From these results for Lower Beverley Lake, initial stewardship plans for Grass Pickerel should include maintaining the populations of its associated species. Although more detailed information is required for a more thorough analysis, initial approaches to foster Grass Pickerel should include plant and fish species with which they are associated.

The regions in Lower Beverley Lake where these species are found should be targeted for stewardship. Their habitat requirements need to be identified and efforts need to be made to reduce impact on them as part of the stewardship for Grass Pickerel. The relationship between the close proximity of development and these species needs to be determined. An initial stewardship strategy is to exercise caution with regards to further development in these areas with mid - high concentration of cottages until this relationship is better understood.

4. Grass Pickerel was found to be positively correlated with young of the year. The nursery habitats which are represented by the presence of young of the year need to be targeted for stewardship activities. Grass Pickerel are likely feeding on the young of the year. Further investigation is required to determine the key nursery sites and potential threats to them. Sites with greatest abundance of young of the year are in close proximity to developed areas in Lower Beverley Lake. The relationship between the close proximity of development and nursery habitat needs to be determined. An initial stewardship strategy is to exercise caution with regard to further development in these areas until this relationship is better understood.

5. There is a positive correlation between algae and cottage concentration. This result indicates that there may be cause for concern about water quality in these areas. One explanation for this result is that nutrients are a result of runoff (from septic systems, lawn care, or both). The cause for the concentration of algal presence with increased shore line development should be further investigated. Because areas of high cottage concentration are close to regions of the lake which may be sensitive habitat for Grass Pickerel, there also should be further investigation on the impact of water quality and algal growth and this species and its associates.

## Stewardship strategies for species at risk which involve the public

1. Residents of Lower Beverley Lake reported to the seining crew field crew that Bowfin *(Amia calva)* is an exotic invasive and must be destroyed when encountered. This is a native species to the lake and killing them other than for consumption is illegal. Education about this species is required, particularly if the lake ecosystem is under stress. Although not specifically geared towards aquatic species at risk, such education would indirectly help them by maintaining species assemblages of which they are part.

2. One way to improve public knowledge about the species in the lake would be to provide public tours to different aquatic habitats within Lower Beverley Lake, and have explanations about the species that live there and some of the limiting factors which face them. Without providing exact locations of the species at risk habitat, emphasis could be made on those habitats and their ecology. Such a public education effort could be part of future funding applications to continue the work started in 2008 on Lower Beverley Lake.

3. Find volunteer residents of the Lower Beverley Lake who would be willing to act as good will ambassadors for the species at risk in the lake. Once educated about the project results they could meet with other lake residents in informal settings to discuss the species and their stewardship. Such a public education effort could be part of future funding applications to continue the work started in 2008 on Lower Beverley Lake.

4. There are general stewardship practices which owners of shoreline property can implement. These activities include:

- inspecting  septic systems, and repairing them if necessary
- reducing the use of pesticides and commercial fertilizers
- increasing native vegetative cover near shorelines
- eliminating the use of detergents containing phosphates
- avoiding the use of boat motors in fish nursery areas where there are sensitive aquatic plants
- reducing wave action at shorelines caused by motorboats

Although not specifically geared towards aquatic species at risk, such practices would indirectly help them by maintaining their habitat and the general health of the ecosystem.

**List of volunteers:**

A number of people volunteered to help in various areas of the study, below is the list of volunteers who participated in fieldwork activities during 2008:
Leah Adams, Stuart Bawn, Harold Benham, Clyde Bressler, Phil Chadwick, Dave Champagne, Emily Conger, Richard Deering, Frank Ellis, Sandy Ellis, Andra Gerry, Denise Johnson, Fred Olivo, Sharon Olivo, Bud Rowe, George Singleton, Quentin Vanderbrugh

# Stewardship Addendum to The Gananoque River Watershed Community Stewardship Project: Phase 1

## A partnership project led by The Algonquin to Adirondacks Conservation Association

## 2008-2009

Prepared By Tom Beaubiah
Cataraqui Region Conservation Authority
February 12, 2009

# Stewardship Addendum

The Gananoque River Watershed Community Stewardship Project (Phase 1) was developed to increase the understanding of Species At Risk (SAR) through a comprehensive near shore inventory within Lower Beverley Lake. A total of 4 SAR species were confirmed through the near shore sampling that was conducted.

An inventory of the shoreline characteristics of the lake was also documented. Through analysis of the netting data there did not appear to be any specific location(s) within the lake that statistically stood out. Therefore all seine sites are considered equal. However, the netting did result in the recording of presence and absence of SAR species.

It is important to look at future stewardship strategies that can be utilized in order to preserve the health of the lake in general, so that negative human induced change does not occur. There are numerous publications available both electronically and in print that can be used to develop proper stewardship programs for lake environments. The proposed creation of shoreline binders for each landowner in the upcoming 2009-2010 season is an excellent means of bringing attention to the initiatives of the lake association. These binders can be filled with literature and advice that can guide landowners in their management of their properties.

The first question that should be asked of all residents is "What brought you to Lower Beverley Lake?" It is doubtful that there will be a single respondent who will state that the mown lawns, hardened shorelines, or heavy development was the feature. We are drawn to water instinctively, because it provides relaxation, comfort, and enjoyment. We seek these natural retreats in order to escape the hustle and bustle of urban life, yet once we establish ourselves within these natural environments (e.g. the lake) we often bring the features we are trying to leave behind with us. Sometimes our attitudes are in conflict, in that we enjoy nature, yet we require it to be neat and controlled. We complain about the pressures of urban life to maintain pristine lawns and keep up with the Joneses yet we clear and mow our rural environments. The time that we might spend enjoying the lake and its natural community becomes taken up cutting the grass and maintaining a "clean" appearance. We create manicured properties yet we complain about the landowner on the opposite side of the lake who has cleared the trees (often forgetting what our properties must look like from another vantage point).

The key to an effective stewardship strategy is a return to basics. Learn to leave the urban ideas within the urban bounds of our cities and towns and appreciate the natural aspects that are a short drive from their boundaries. Strive to live within the environment rather than trying to alter it to a perceived notion of what it should be. Recognize that as current landowners, it is our responsibility to set the standard on how things should be, we can show leadership, knowing others will follow in our footsteps.

The following is provided as general guidance for the Lower Beverley Lake Association as its members determine the next steps in preserving the lake environment that they all appreciate and enjoy.

The shoreline of Lower Beverley Lake is approximately 20% developed. The areas that have been developed have a high intensity of use with many properties within close proximity to each other (particularly in the older development areas).

It is important to assess the shoreline development that has taken place and to work towards restoring the altered shorelines within Lower Beverley Lake. The restoration of shorelines to a more natural state will require a long term vision and will not occur rapidly. It is recognized that many landowners have invested significant resources (financial and time) in their waterfronts in the form of retaining walls, decks, and other urbanized features. It is not expected that landowners will begin to demolish these structures; however, it is important to work with the landowners so that any future maintenance will have consideration for the natural environment, rather than repair a structure that is having a negative effect on the lake environment.

New development should consider the amount of shoreline that is required to accommodate the needs of the landowner. Pathways to the shore should be minimized and centralized with healthy shoreline buffers in place to either side.

It is important to work with local real estate professionals so that prospective land owners are aware of the limitations that may be present on the properties. Many new waterfront landowners lack the information and knowledge to make informed decisions about their land purchases. It should be stressed that the property should accommodate their needs with minor modifications. For example a purchaser who wants to swim at the shoreline, but is not fond of aquatic vegetation should not purchase a waterfront with shallow water depths and dense aquatic vegetation. The natural condition of a waterfront is easy to maintain; attempts to alter these conditions are costly and very seldom remain in that state. It is also important to note that approvals for such alterations are not generally supported by regulating bodies. Perspective landowners should realize that water fronts are valued based on the characteristics they possess which can be divided into recreational attributes or nature appreciation.

As the Lower Beverley Lake Association works towards a management plan for the lake it is important to focus attention to those development areas that may be deemed to be significant with respect to the aquatic communities within the lake. These areas would include those regions that are highly productive, provide unique habitats, or support the species at risk within the lake. The data of the 2008-2009 report is a snapshot in time; however it may form the basis for informed decisions to be made in the future with further data input.

Upon confirmation of these areas, guidelines or additional considerations should be made to ensure that development and other activities are done in a manner that has no negative impacts to them. Should the areas be limited in their quantity or sensitive in their location, efforts should be made to incorporate provisions within Official Plans and zoning by-laws that would recognize these lands/areas, and where appropriate designations put in place.

The shoreline analysis of Lower Beverley Lake indicates that within the developed regions of the lake natural vegetative buffers are lacking. On many properties mown lawns are maintained near the water's edge.

The benefits of buffers are well documented. Over 90% of the organisms that exist in a lake environment are born, raised, or live in the near shore area including the adjacent upland area. Healthy shoreline buffers are comprised of a mix of ground covers, shrubs, and trees.

It is understood that many landowners within the older development zones lack the available shoreline to increase buffers significantly; however, even minimal improvements to the near shore area can have impacts to the health of the lake. Landowners should also consider that planting vegetation such as shrubs and trees need not block views of the lake. Proper planting location and selective trimming can frame views, thus providing the benefits of a buffer as well as privacy and shade.

The most significant area of improvement would be to lessen the reliance on engineered shorelines (rip-rap, retaining walls, etc.) that are used to reduce erosion forces. Although engineered structures have their place, in certain locations they are used in areas where erosion forces are not high.

The health and beauty of lake (both economically and environmentally) are often directly correlated to the water quality of the lake. It is be essential for the Lower Beverley Lake Association to establish whether the lake is degrading or improving with respect to water quality. This assessment should clearly outline the direction and goals for the lake, since there are a number of potential considerations to be made.

General improvements to water quality can be made by addressing the human induced changes that impair water quality. These would include, but are not limited to, degraded shoreline buffers, improper septic maintenance, improper shoreline developments, sediment and erosion sources, application of fertilizers and pesticides, the use of harmful cleaning products.

The Lower Beverley Lake Association, in cooperation with its partners, should be commended for commencing on what often appears to be a daunting and long term commitment. Through the efforts of its executive and its members, change over time can occur. The Association should take the information at hand (both recent and historic) and look at the parameters that have been studied. Through this, review targets should be established for those parameters. Through the preparation of the 2008-2009 report, partnerships have been strengthened and new ones formed. These partners will be key in assisting the Association in the development and achievement of stewardship goals for the lake environment. Eventually goals can be put in place for the entire Gananoque River System.

The following are general goals that can form the basis of future discussions.

1. Improve water quality
2. Preserve and restore natural communities/environments
3. Educate existing and future landowners
4. Increase participation in the Association and its partners
5. Continue to improve understanding and knowledge of the lake through researching and monitoring.
6. Work to mitigate impacts of existing developments
7. Ensure that new developments are environmentally sound
8. Maintain and establish partnerships

It is therefore the recommendation of this stewardship addendum that a meeting be held between the Association and its partners to provide input with respect to direction for the future.

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