Central
Lake Ontario
Conservation

2012

Aquatic Monitoring Report

What we do on the land is mirrored in the water

Working In Partnership:

Durham Region
Conservation Ontario Natural Champions

Report No.: 2011-03MR

Acknowledgements

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1.0 INTRODUCTION

In order to make sound, science-based management decisions about local **watersheds**, the Central Lake Ontario Conservation Authority (CLOCA) conducts long-term watershed health monitoring. This information helps CLOCA understand current conditions, identify ecological trends, provides a strong basis to measure the effectiveness of stewardship activities and also provides guidance in making informed land-use decisions. Typical components of the watershed are monitored and include: aquatic habitat (e.g., habitat assessments and temperature monitoring); fish and benthic macro invertebrates (benthos); terrestrial habitat (e.g., riparian and tableland vegetation, wildlife); and, water quality and quantity of both surface water and groundwater. This report focuses on the Aquatic Monitoring Program, specifically Spawning Surveys, Stream Temperature, Biological Water Quality and Fisheries Sampling.

To ensure that monitoring is done using standardized protocols, whenever possible, CLOCA participates in national, provincial or municipal networks. Our partners include Environment Canada (EC), Fisheries and Oceans Canada (DFO), Ministry of Environment (MOE), Ministry of Natural Resources (MNR) and other Conservation Authorities.

Located east of Toronto within the Region of Durham (Figure 1), the Authority's jurisdiction encompasses 638 square kilometers and is defined by the area drained by a number of large and small watersheds (Figure 2). Local municipalities located within the jurisdiction, in whole or in part, include the cities of Oshawa and Pickering, the towns of Ajax and Whitby, the Municipality of Clarington, and the townships of Scugog and Uxbridge.

While every effort has been made to accurately present the findings reported in this document, factors such as significant digits and rounding, and processes such as computer digitizing and data interpretation may influence results. For instance, in data tables no relationship between significant digits and level of accuracy is implied, and as a result values may not always sum to the expected total.

Figure 1: Location of CLOCA Jurisdiction (highlighted in green).

A **watershed** is defined as an area drained by a river or creek and its tributaries.

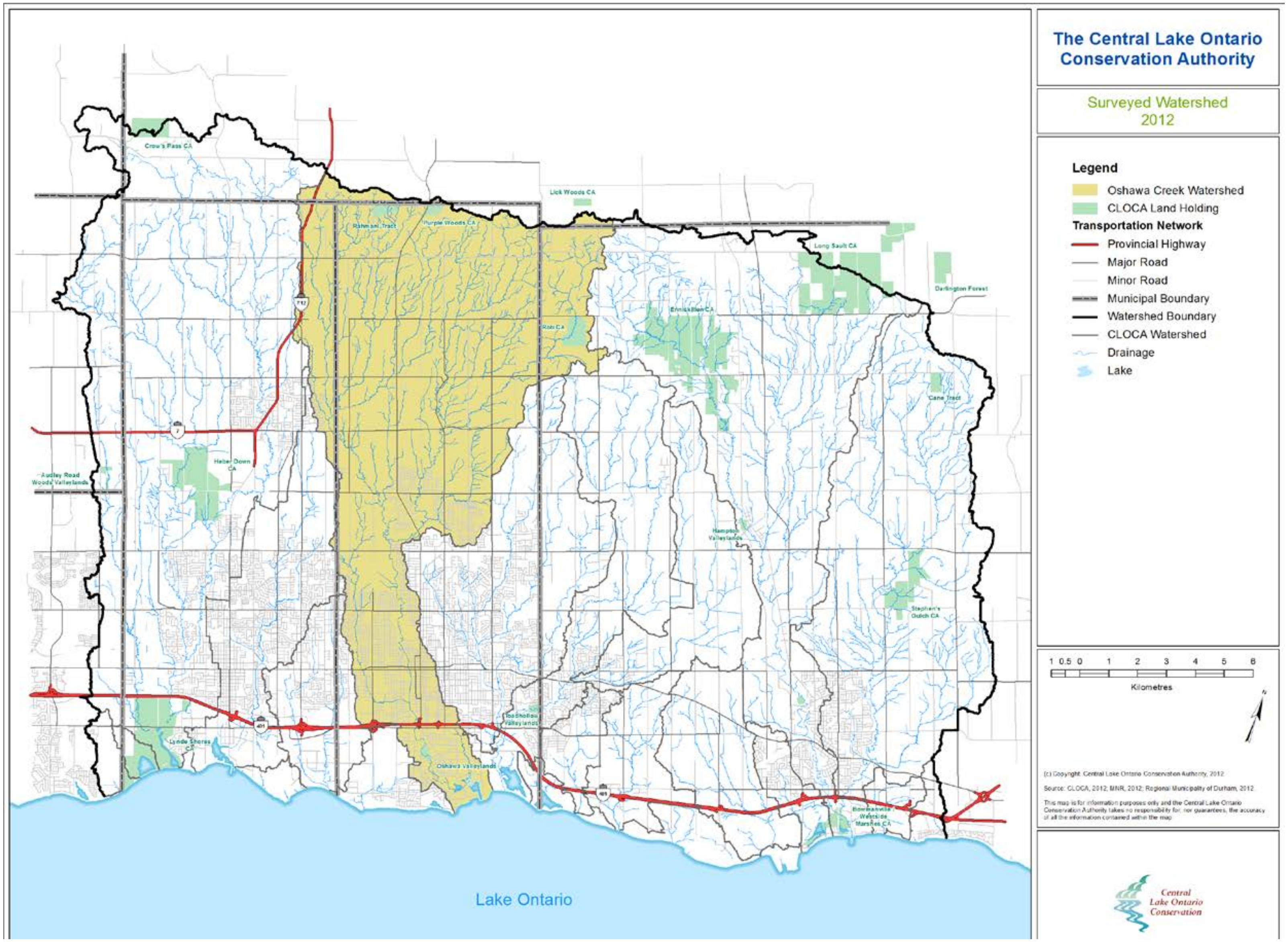


Figure 2: CLOCA Jurisdiction

2.0 Spawning Survey

2.1 Introduction

Sampling methods for capturing fish are sometimes not suitable for obtaining all data needed about a fishery. Many limiting factors may prevent a species of fish from reproducing successfully (producing young). These include poor water quality, migration barriers, temperature, water levels, illegal works etc. Spawning surveys provide useful information for identifying critical spawning habitat. This information is complimentary to standard fish community surveys and is a beneficial component when describing the health of a watershed.

A spawning survey involves observing indicators of spawning, in a specific watershed. These indicators include: the presence of adult fish in a likely spawning area (e.g., Rainbow Trout), the occurrence of active spawning (e.g., fish present on redds) and signs that spawning has taken place (i.e., spawning depressions or **redds)**. "Not all fish species bury their eggs in substrate: some lay eggs on material, others broadcast their eggs into the water column. Salmonids, both true Salmon and Trout (*Salmo* and *Oncorhynchus*) as well as char (i.e. Brook Trout, *Salvelinus fontinalis*) build depressions in the bottom of streams and then lay their eggs into these depressions or redds." (Imhof, 1997).

redd - the gravel nest of salmonid fishes.

Spawning locations are not evenly distributed within a watershed. Therefore, collecting information consistently over 3-5 years will identify where important reproduction areas exist and are consistently used by Salmonid populations (Imhof, 1997).

Spawning surveys within the CLOCA jurisdiction typically are conducted in both the spring and fall. The spawning periods for the fishes most commonly targeted by CLOCA are listed in Table 1. These spawning periods are when we would typically expect to see these fishes migrating during a normal year. Seeing as temperature and rainfall can alter migration routes, seasonal variation can alter these dates.

Table 1: Spawning periods for selected southern Ontario fishes.

Brown Trout	mid-October to late November
Brook Trout	late-October to mid-December
Rainbow Trout	mid-April to late-June
Chinook Salmon	late-September to early-October
White Sucker	May to early-June

[1] - Imhof, J. Salmonid Spawning Survey - Methodology.
[2] - Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. *Fish. Res. Bd. Canada Bull.* 184:184-191

2.2 Results (spring)

Spawning surveys targeting migratory adult Rainbow Trout and White Sucker were conducted on the following watersheds:

- Bennett Creek
- Bowmanville Creek
- Corbett Creek
- Darlington Creek
- Farewell Creek
- Harmony Creek
- Lynde Creek
- Oshawa Creek
- Pringle Creek
- Soper Creek
- Warbler Creek
- Westside Creek

Survey locations and fish observations are shown in Figure 3. Specific locations and significance are outlined below and within Table 10:

2.2.1 *Bennett Creek*

During the 2012 spawning survey, no adult migratory fish were observed in Bennett Creek. Since there was low effort, i.e. too few sampling sites, in Bennett Creek during 2012, it is unknown if this accurately represents the number of fish that utilize this creek for spawning. Local residents have reported seeing adult fish but it is unknown if they were Carp or Trout.

It should be noted that spawning surveys can become more difficult to complete as creek size increases. Since Bennett Creek is large near Lake Ontario, this could have contributed to lack of observed fishes. Large creeks can make spawning surveys more difficult for the following reasons: presence of many deep pools with limited visibility, turbulent and/or turbid waters and wide wetted width.

2.2.2 *Bowmanville Creek*

There were two spawning survey locations within Bowmanville Creek during 2012. Rainbow Trout along with redds were observed at both sites and White Suckers were observed at one. These results are expected as these sites are located where Rainbow Trout annually congregate.

2.2.3 *Corbett Creek*

No adult migratory fish were observed in Corbett Creek during the 2012 spawning survey. Since there was low effort, i.e. too few sampling sites, in Corbett Creek during 2012, it is unknown if this accurately represents the number of fish that utilize this creek. To date, there have been no Rainbow Trout observed through the nine spawning surveys completed by CLOCA in this watershed although effort has been limited.

2.2.4 *Darlington Creek*

During 2012 spawning survey sampling, no adult migratory fish were observed in Darlington Creek. This watershed does have records of both spawning and young-of-year Trout within the past couple seasons. Lack of results could be attributed to timing since the unseasonably warm spring resulted in earlier spawning runs.

2.2.5 *Farewell Creek*

One site was surveyed in Farewell Creek located near Colonel Sam Drive. At this site, Rainbow Trout were observed during the 2012 spawning survey.

2.2.6 *Harmony Creek*

During 2012 spawning survey sampling, Rainbow Trout were observed at one of the two sites within Harmony Creek. Rainbow Trout were observed north of Rossland Road.

2.2.7 *Lynde Creek*

In 2012, two locations in the Lynde Creek Watershed were chosen to conduct spawning surveys. Rainbow Trout and White Sucker were identified at both sites. The sites were located at Heber Downs Conservation Area and at a site north of Rossland Road.

2.2.8 *Oshawa Creek*

During 2012 sampling season, Oshawa Creek was the primary focus. During the spawning season, 32 sites were sampled. Of these sites, Rainbow Trout were observed at twelve and White Sucker were observed at four. Active spawning was observed at one of the sampled sites and a redd was observed at another site. Rainbow Trout were shown to be distributed widely throughout the watershed reaching up into the headwaters in addition to the main branches.

2.2.9 *Pringle Creek*

There were seven spawning survey sampling sites in Pringle Creek during 2012. Of these sites, one recorded Rainbow Trout. Rainbow Trout were found as far north as Taunton Road. The previous season saw migration in Pringle Creek limited to the beaver dam between Rossland Road and Taunton Road. Results from 2012 demonstrate that the barrier is either now passible or has been removed, likely through natural events.

2.2.10 *Soper Creek*

During 2012 sampling, Rainbow Trout adults were documented at four out of five sites within Soper Creek. Rainbow Trout were as far north as Taunton Road. There were no spawning surveys located north of Taunton Road during 2012.

2.2.11 *Warbler Creek*

During 2012 sampling, no adult migratory fish were observed in Warbler Creek. Limited effort, i.e. too few sampling sites, could of contributed to the limited results. It is unknown what species use this creek as it is a small system with limited access to spawning habitat for Salmonids.

2.2.12 *Westside Creek*

During 2012 sampling, Rainbow Trout adults were documented within the Westside Coastal Wetland. It is unknown if the Rainbow Trout attempted to migrate up Westside Creek. Limited effort, i.e. too few sampling sites, in this watershed is a large reason why use by spawning adults is unknown.

2.3 Results (Fall)

Limited resources during the 2012 season prevented fall spawning surveys to be completed.

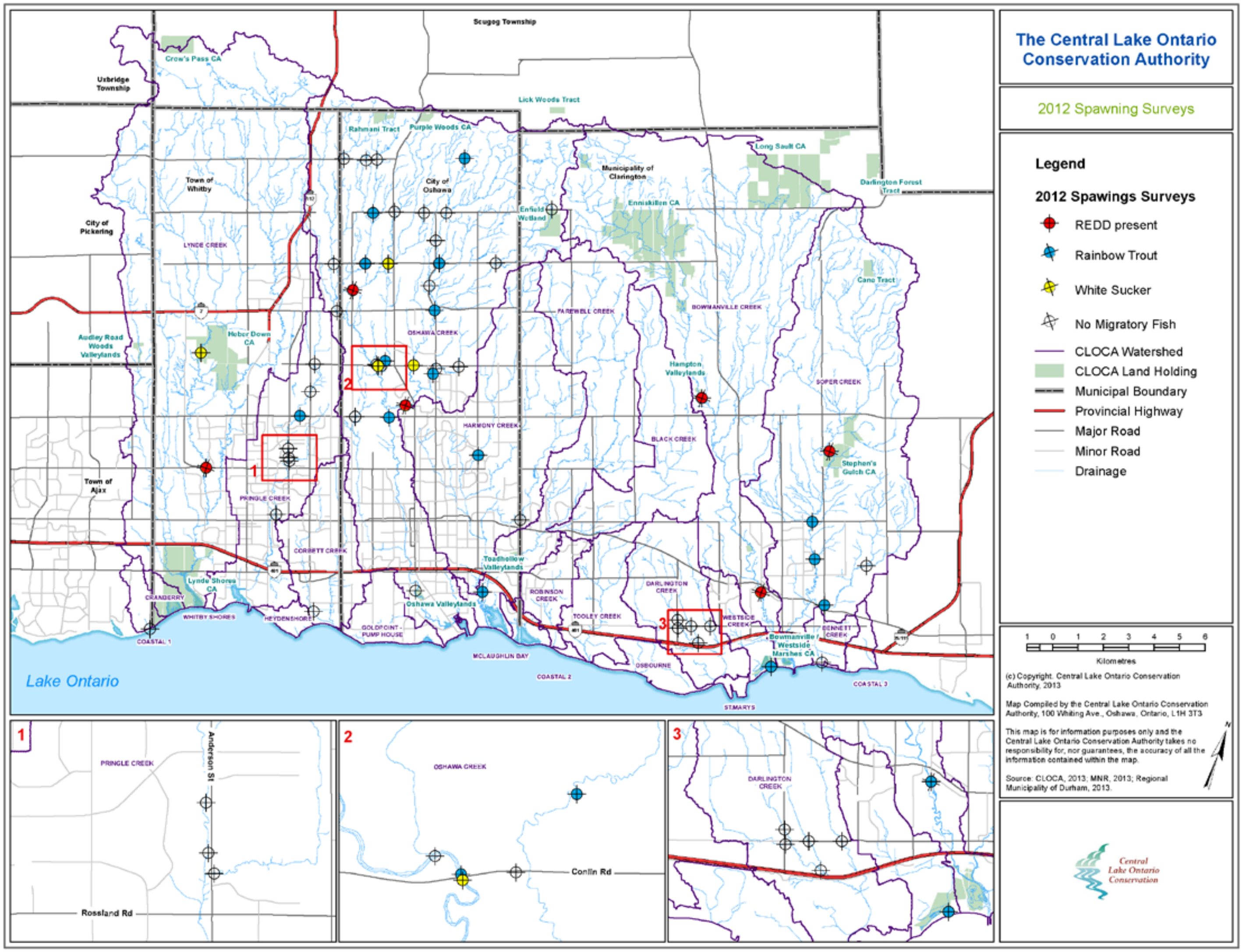


Figure 3: Location of 2012 spring migratory Rainbow Trout and White sucker observations.

3.0 BIOLOGICAL WATER QUALITY

3.1 Introduction

CLOCA monitors surface water quality through both chemical and biological sampling. In general, sampling for chemical and physical parameters measures stressors (e.g., environmental contamination), whereas biological sampling measures ecological effects. Biological surveys involve sampling creatures, such as benthic macro invertebrates ("aquatic bugs"; see photos below) and fish, found living within the aquatic environment. Benthic macro invertebrates or benthos, make good health indicators of aquatic ecosystems for a number of reasons:

- they generally have limited mobility that makes them vulnerable to many creek stresses that may occur;
- they have short life cycles;
- they are easily collected and identified;
- they are relatively inexpensive to sample;
- And they exist almost everywhere (Ontario Benthos Biomonitoring Network, 2005).

Similar to other biological communities, certain species of invertebrates have specific tolerances to various stresses and are referred to as indicator species. Therefore, the presence or absence of these indicator species can be related to the quality of the water.

In the past, CLOCA sampled benthos by following two separate protocols. The primary protocol for assessing water quality was through BioMAP (Griffiths, 1998). The second protocol is part of the OSAP and is a coarse measure of water quality, which uses the Hilsenhoff Index. In order to harmonize long-term monitoring efforts, CLOCA is now a partner in the Ontario Benthos Biomonitoring Network (OBBN) coordinated by the MOE and EC. This provincial network allows practitioners to follow a standardized methodology, share resources and receive technical support.

One method to test whether an aquatic system has been impaired by human activity uses a reference condition approach to compare benthos at “test sites” (where biological condition is in question) to benthos from multiple, minimally impacted “reference sites”. A portion of sampling effort each season should focus on collecting reference sites (OBBN, 2005).

The online database warehoused by MOE has been undergoing upgrades and analysis tools are not yet functional. Currently, site information (i.e., identified species) has been entered into the provincial database and the results, i.e. whether a site is impaired or not, will be available once this upgrade is complete.

Another method to quantify whether an aquatic system has been impaired by human activity is to compare the percentage of three Orders of sensitive benthos; Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies) or otherwise referred to as EPT. These orders are typically only present and abundant in undisturbed areas, often inhabited by sensitive coldwater fishes such as like Trout and Sculpins.

3.2 Results

During May 2012, CLOCA staff sampled 19 OBBN sites throughout 6 different watersheds (Figure 5). One of the sites sampled was a long-term monitoring reference site, 15 sites were test sites, and three were to document conditions on a property where CLOCA was hired to prepare a Natural Heritage Management Plan. Of these 19 test sites, only one, the long-term monitoring reference site, had been previously sampled by CLOCA. This was the eighth season that CLOCA has sampled benthos using the OBBN protocol. Please refer to Table 11 in Section 12.0 Appendix II – Biological Water Quality for full summary.

3.2.1 *2012 OBBN Sampling*

In contrast to past monitoring, while more watersheds were sampled, fewer samples in each watershed were taken. This was done to support a large scale Ministry of Environment (MOE) project titled 'The South-Central Ontario Biocriteria project'. The sites for this project were pre-determined by MOE. Poor quality sites were generally located in the urban areas and the good water quality sites were located in the headwaters of the large watersheds (Bowmanville/Soper, Oshawa, and Lynde). This is a multi-year project contributing to a standardized method for analyzing and determining impairment at each OBBN site.

The one reference site sampled was located in Bowmanville Creek (BOWOB03). This was the seventh year that it has been sampled. Results from 2012 showed an increase in EPT from 2011, but it is still the second lowest year of the seven (See Figure 4). This continued long-term decrease in benthic community is a concern and monitoring should continue. Further testing to see if this is natural variation, human error (i.e. site selection), influences by an unknown short-term anthropogenic effect (i.e. contaminant spill, excessive water taking, etc.) or long-term changes to the creek by development or climate is recommended.

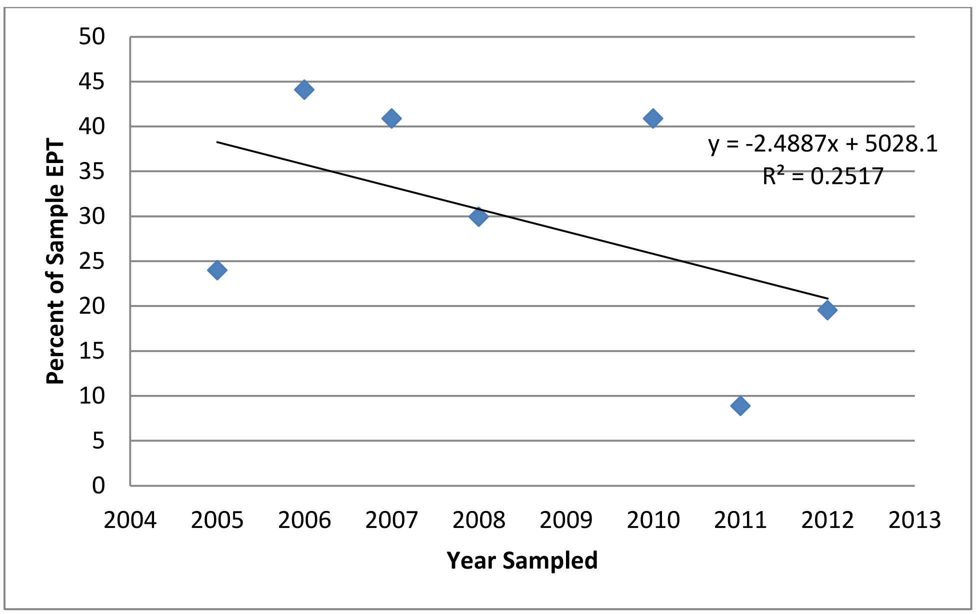


Figure 4: Summary of %EPT averaged per site (Riffle 1, Pool 1, Riffle 2) per year to determine trend data. Site is BOWOB03 located in Long Sault Conservation Area.

A summary of the new sites sampled in 2012 are listed in Table 2 below. Soper, Lynde and Oshawa Creek had the highest average scores for %EPT and Montgomery Creek had the lowest scores. Based on the land cover in these watersheds, these results are expected. It should be noted that although these averages may be expected over the entire watershed, it is hard to predict local conditions when only a few sites per watershed are sampled. Black Creek for example, scored low in the one site sampled but that could be because the goal was to target a degraded area. It is expected that if more sites in Black Creek were sampled, the average %EPT score would increase.

Table 2: Summary of %EPT scores from new sites sampled in 2012 by CLOCA for benthic invertebrates using the OBBN protocol. Scores are calculated by averaging the %EPT for Riffle 1, Riffle 2, and Pool 1 for each site.

Watershed	Number of Sites	Minimum %EPT site average	Maximum %EPT site average	Average score within watershed
Soper	2	5.3	41.7	23.5
Lynde	2	0.7	30.7	15.7
Oshawa	6	2.7	37.2	11.4
Nonquon	3	0.0	20.3	8.6
Goodman	2	0.0	0.7	0.4
Black	1	--	0.3	0.3
Tooley	1	--	0.3	0.3
Montgomery	1	--	0.0	0.0

Although site locations were limited and lack of long-term trends at most sites reduced the ability to consider natural variation, our sampling supports previous studies correlating a loss of important sensitive benthic invertebrates (EPT) with land alteration to urban or agricultural uses (Sponseller et al., 2001; Moore et al., 2005; Utz et al., 2009).

Benthic invertebrates (benthics) are important for understanding water quality but also play a critical role in the food web. Benthic invertebrates are a fundamental food source for many fish. Fish species, such as Rainbow Trout and Brown Trout, require benthics as an energy source. A young salmonids diet can be comprised almost entirely by benthics and are therefore necessary for successful reproduction to occur (Oscoz et al., 2005).

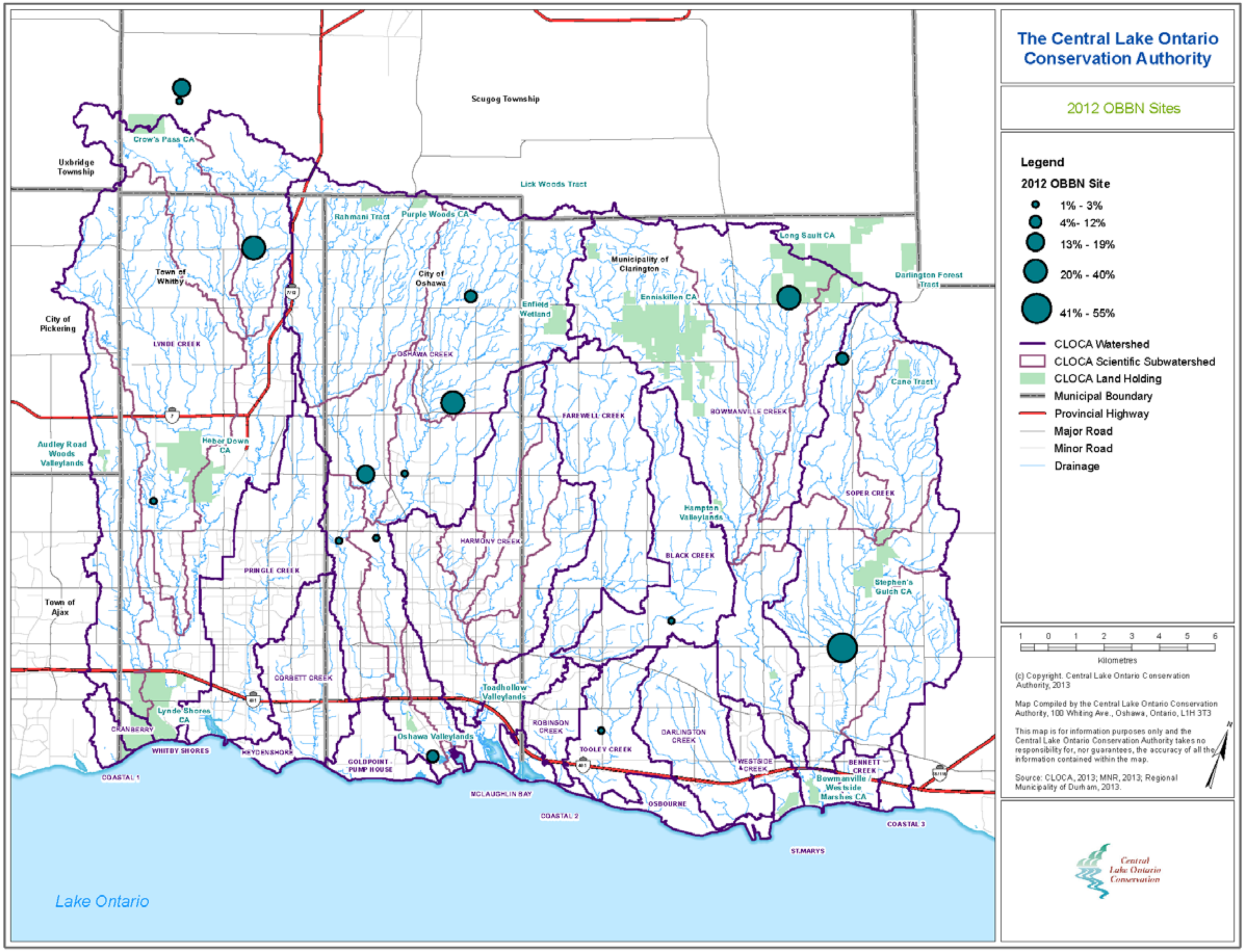


Figure 5: Percent EPT from OBBN site locations sampled during 2012.

4.0 WATER TEMPERATURE

4.1 Introduction

Temperature is considered a controlling factor with respect to habitat suitability for fish. For species such as Slimy Sculpin or Brook Trout, summer stream temperature is considered the single most important factor influencing distributions (Jenkins and Burkhead, 1993; MacCrimmon and Campbell, 1969). Temperature monitoring provides a good indicator of habitat suitability and allows one to assess the impacts of landscape changes on stream health. CLOCA relies on quality stream temperature data for use in plan review, watershed management plans, aquatic resource management plans, fisheries management plans, etc.

Temperature monitoring was conducted between May 2012 and February 2013. This sampling period allows CLOCA to capture stream temperature during the critical summer months when sensitive fish species are vulnerable to warm weather. In addition, by leaving the temperature loggers in the streams through the winter months, CLOCA staff is able to detect the relative contribution of groundwater in the stream. Groundwater temperature is moderated by the sub-surface ground temperature. Depending on the amount of groundwater entering a stream it has the ability to moderate the stream temperature. If enough groundwater enters a stream it will have more of an influence than the air temperature and prevent the stream from freezing.

In total, 74 portable temperature loggers (Figure 6) were installed throughout the CLOCA jurisdiction during 2012 (Figure 7). The primarily focus for temperature monitoring was in the Oshawa Creek watershed. In addition, long-term monitoring sites and areas of interest in various other watersheds were measured. All of the loggers were programmed to collect water temperature every half-hour.

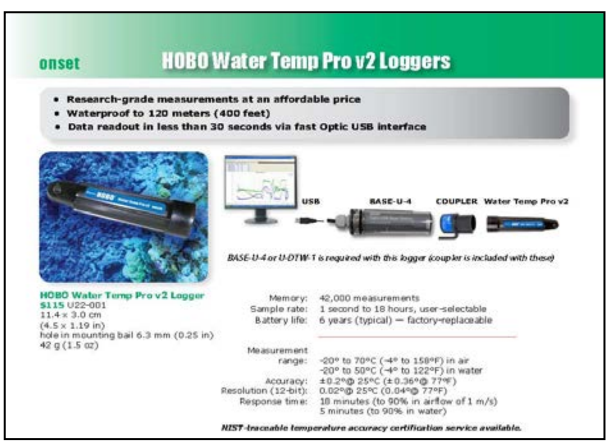


Figure 6: Attributes of one of the temperature logger models used by CLOCA.

Classification of stream temperature was divided into three categories: coldwater, coolwater and warmwater (Coker et al., 2001). The thermal classification for each site was determined by analyzing data summarized through ThermoSTAT V3 (MNR, 2010). This program was designed to help interpret the very large data set acquired by the temperature logger. This new software replaces the previous analysis tool, Stream Temperature Analysis Tool and Exchange (STATE) (Table 12; Jones and Chu, 2007). ThermoSTAT V2 has a finer temporal resolution that provides a more realistic summary of the duration within specific thermal ranges. Conversion of historical data collected using the STATE program was necessary to compare past results with future data. Even though the programs analyze the results slightly differently, it is not expected to significantly impact or change the thermal classification of CLOCA's streams.

It should be noted that stream temperature classification can be confusing. Historically in Ontario only two thermal classification categories were used, coldwater and warmwater. Coldwater fishes such as Trout and Salmon can be found in both coldwater and coolwater temperature zones therefore these zones represent coldwater streams in the traditional classification (Bowlby, 2008).

It is important to note some of the limitations of this data. Although the data provides an excellent idea of what the water temperature is at in an individual section of creek throughout the critical periods, it should be understood that the logger is representing a fixed point. The logger takes the temperature measurement at that location and is not representative of the entire habitat in that section of creek. Temperature is the single most important abiotic factor to a fish because of it being poikilothermic or "cold-blooded". For this reason, there are values derived for most fish that represent what the maximum temperature they can tolerate before their biological functions cease. For example, Rainbow Trout has a maximum tolerable temperature of 26° Celsius (Coker et al., 2001). If a temperature logger exceeds that threshold it is often assumed that no Rainbow Trout can survive in that section of creek. Although this may be true if the water temperature remains above this threshold for an extended period of time, it is not certain especially if the duration of exceedence is short. Fish are experts at seeking out thermal refugia to avoid their lethal maximum temperatures. Deep pools, undercut banks, riparian vegetation, groundwater discharge areas and high flow areas can all provide thermal refuges in which the temperature is lower than the rest of the creek. For this reason, Rainbow Trout have been found in creeks with readings over 26° Celsius (Ebersole et al., 2001; Fowler et al., 2009). The same has been found for other coldwater species, such as Chinook Salmon (Torgersen et al., 1999). Their ability to use behavioural thermoregulation, whereby the fish seeks out thermal refugia, allows them to survive periods where the majority of the creek has a temperature that exceeds its maximum thermal limits.

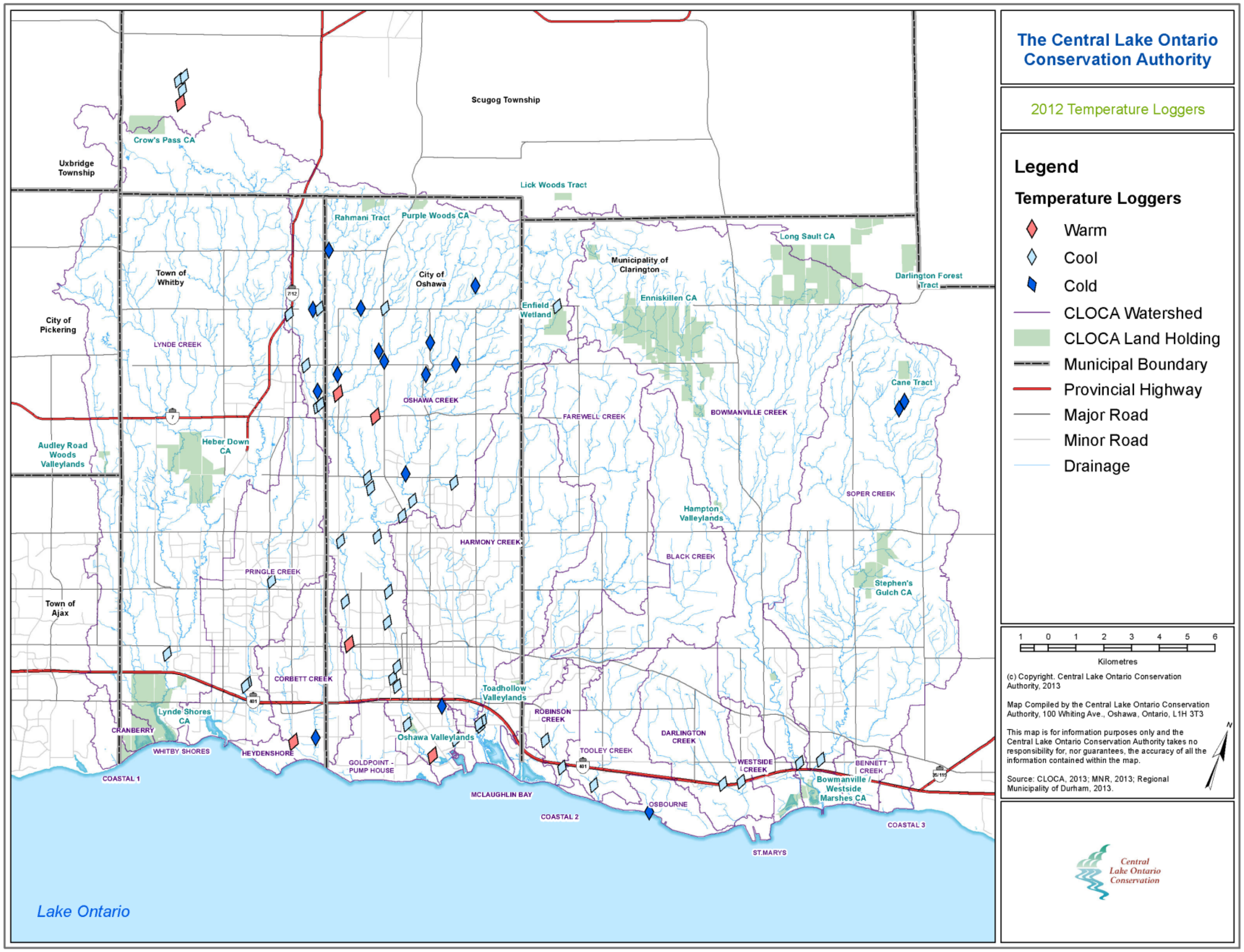


Figure 7: Location and thermal classification of stream temperature loggers during 2012.

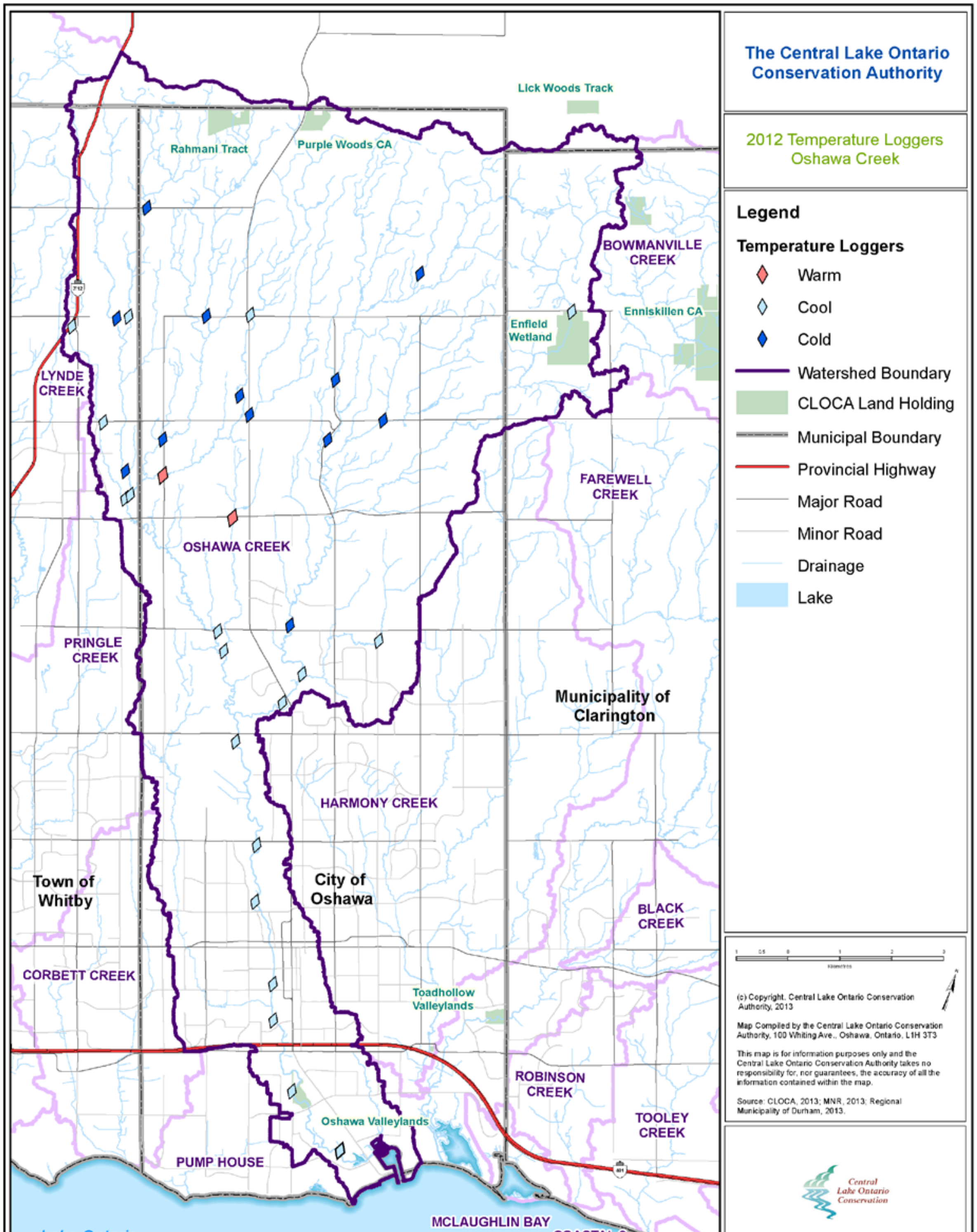


Figure 8: Location and thermal classification of stream temperature loggers within the Bowmanville/Soper Watershed during 2012.

4.2 Results

Please refer to Table 12 in Appendix III – Stream Temperature and Figure 7 and Figure 8 regarding temperature logger data discussion below.

4.2.1 *Bowmanville Creek*

During the 2012 season, one temperature logger was installed within Bowmanville Creek. This logger is one of the long-term monitoring sites and it is the fourth year temperature has been recorded here since 2006. It is located south of Baseline Road and was found to be coolwater as recorded in 2012. This is the third time out of four seasons that it has been classified as coolwater but all years the temperature has been close to the warmwater mark. Even though the temperature is nearing the warmwater mark at this location, electrofishing sites just upstream show an abundance of coldwater species are still able to use this area (e.g. Rainbow Trout, Mottled Sculpin).

4.2.2 *Corbett Creek*

During the 2012 season, two temperature loggers were installed in Corbett Creek. Both of these temperature loggers are installed at long-term monitoring sites south of Wentworth Drive, one on the east branch and one on the west branch. Results from the east branch (TLCE01) showed coldwater, for the first time in six years and the west branch was warmwater for the fourth time in six years (Figure 9).

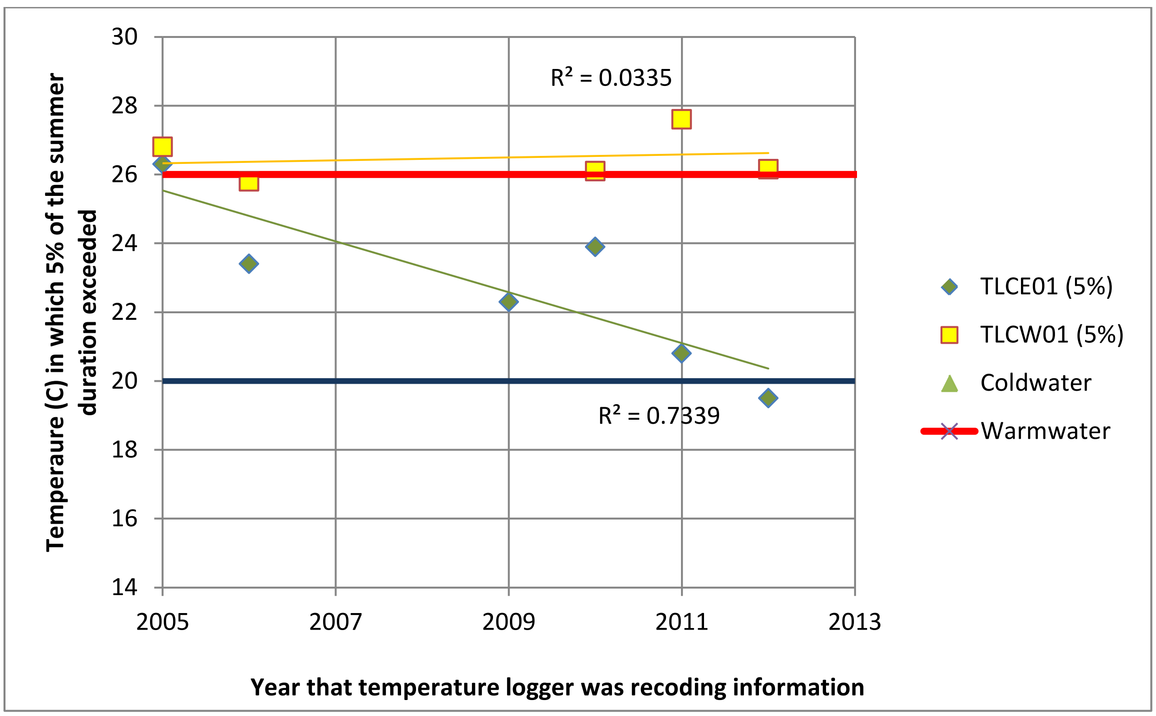


Figure 9: Summary of temperature loggers CE01 and CW01. Temperature value is the temperature at which only 5% of the data set exists above this.

It is interesting to note that the 5% temperature exceedence value for TLCE01 has decreased considerably in the last 7 years where as TLCW01 has remained consistent. The two temperature loggers upstream of TLCE01 from the 2010 season indicated coldwater or coolwater. It was suspected that the one that measured coldwater was largely due to the high proportion of the creek within a pipe. Continued monitoring at these sites to track these trends is recommended.

4.2.3 *Darlington Creek*

During the 2012 season, two temperature loggers were installed in Darlington Creek. Each of these temperature loggers are installed at long-term monitoring sites north of the 401 and south of Baseline Road. One site, TLDN01, is on the west branch and the other site, TLDN02, is on the east branch. Results indicated that both are coolwater which is consisted with all years results.

4.2.4 *Farewell and Harmony Creeks*

During the 2012 season, a total of three temperature loggers were installed around the area of the Harmony and Farewell confluence. Two loggers were located upstream (US) of the confluence, one on each Harmony (TLHA01) and Farewell creeks (TLFA02), and the other below the confluence (downstream - DS (TLFA01)). Since 2008, results from each of the temperature loggers have been coolwater. When the results are looked at in more detail, although they are all coolwater some trends have been found. Figure 10 shows how the three loggers have changed since 2008. During the first year (2008), all three loggers had very similar results. Since 2009, TLFA02 (upstream location) has been consistently cooler than the other two locations. On average, TLFA02 has been 0.725°C cooler than TLFA01 and 0.925°C than TLHA01. It would appear that the Harmony Branch is having a warming effect on the Farewell branch as the two creeks mix. This is due to Harmony having much higher impervious cover (Table 3) and less forest cover.

Table 3: Percent Impervious cover within the Black/Harmony/Farewell Watershed broken down by subwatershed. Original table is from the Black/Harmony/Farewell Existing Conditions Report (2008).

Subwatershed	Percent Impervious Cover
Harmony – Ritson	43.8
Harmony – Wilson	42.8
Harmony – Grandview	15.8
Harmony – Taunton	13.2
Harmony – Mitchell	16.2
Farewell	9.2
Black	5.3

Within the Black/Harmony/Farewell watershed, only 29.2% of the forest cover is located in Harmony subwatershed with the remainder (70.8%) in the Black and Farewell subwatersheds (See Black/Harmony/Farewell Existing Conditions Report (2011) for more information).

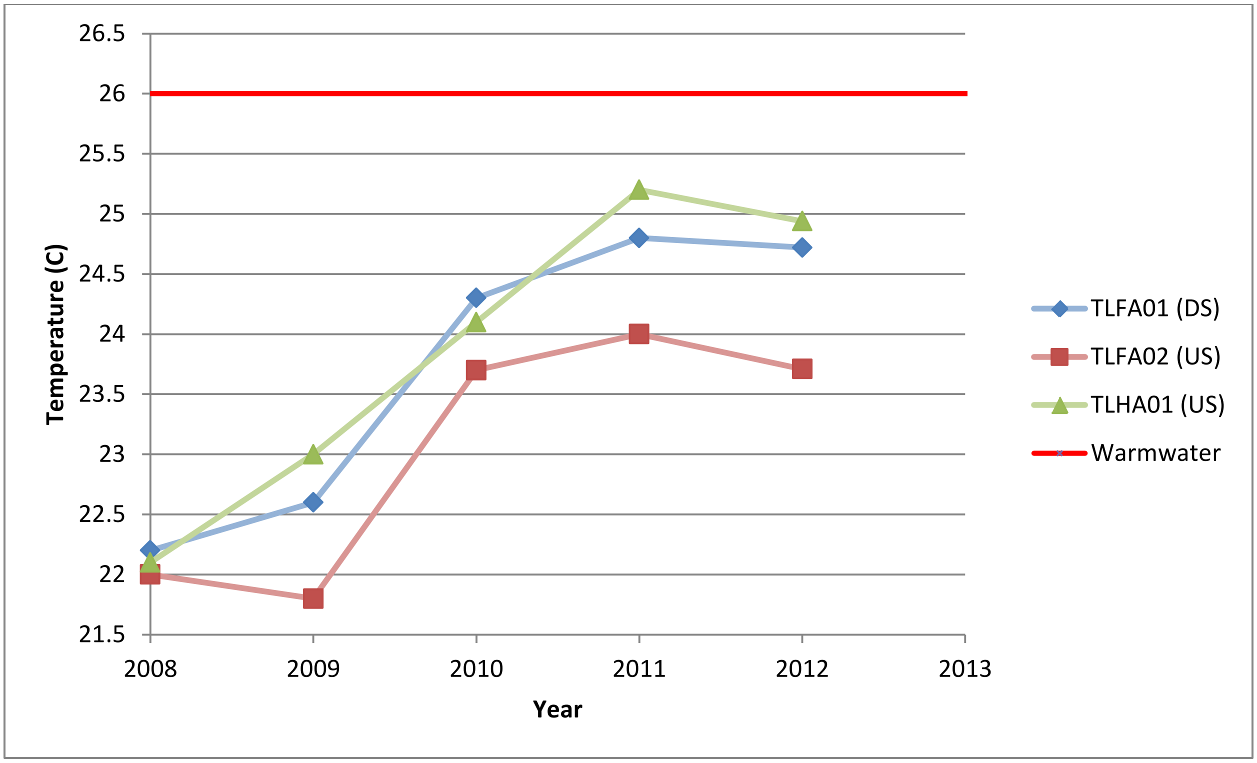


Figure 10: A summary of the temperature loggers data from near Colonel Sam Drive in CLOCA. One logger (TLFA02) is located downstream of the confluence of Farewell and Harmony Creek while the other are upstream on their respective branches. Temperature represents the temperature at which only 5% of the data set is above.

4.2.5 *Gold Point Creek*

During the 2012 season, one temperature logger was installed in Gold Point Creek. It was located near the mouth to Lake Ontario. Due to the extremely low water levels, the data from this logger did not accurately capture the water temperature during the summer of 2012. It is recommended that this location be sampled again in the future to continue getting more data for this highly variable section of creek/wetland.

4.2.6 *Lynde Creek*

One annual monitoring temperature logger was installed within Lynde Creek during 2012. This was the fourth year that temperature had been measured at this location. This site was again found to be coolwater, consistent with all previous years and with a considerably lower maximum temperature in 2012 (2012 max – 27.5°C, 2011 max – 30.1°C).

4.2.7 *Nonquon Creek (Roger's Property)*

Water temperature was measured using temperature loggers at four locations within the Rogers Tract. A temperature logger was placed directly downstream of each of the barriers, as well as at the northern portion of the property and one near the mid-point.

Proximity to a pond or lake is having an obvious effect on water temperature within the Rogers Tract. The logger downstream of Emerald Lake (TLNON01) was classified as warmwater as it exceeded 26 °C for more than 5% of the summer period. TLNON02 was located approximately 600 meters downstream of Emerald Lake and TLNON01. Temperatures are still higher than expected for the area, but considerable thermal recovery is made to this point. Max temperature dropped 3°C, but likely as important was the reduction in hourly temperature fluctuation. TLNON01 had high temperature fluctuation (up to 4.27°C/hour) which is difficult for sensitive fish to adapt to. By the time the water reached TLNON02 the hourly temperature fluctuation decreased to a max. of 1.45°C/hour.

TLNON03 was located downstream of the Main House Ponds and once again showed elevated temperatures for the area. Max. temperature exceeded 26°C but not for more than 5% of the summer season and was therefore classified coolwater. Since Brook Trout have a preferred temperature of 16°C (Coker, et al., 2001) and a maximum lethal temperature of 24.9°C (Jones and Schmidt, 2012), it is unlikely they will be able to inhabit this area if current temperatures are maintained.

TLNON04 is located near where the only Brook Trout within Rogers Tract were captured. This correlated well to the temperature logger data as this site had the lowest max temperature (23.8°C), lowest temperature fluctuations (0.97°C/hour), and was the only site that had 0% of the summer duration within the warmwater thermal regime. This demonstrates that groundwater inputs from the area as well as good natural cover within the riparian corridors are allowing for thermal recovery within the property. The temperature at TLNON04 still are not ideal, as evident by the dominance of Blacknose Dace in the area, but is a big improvement from the temperature at the loggers just downstream of the ponds on the property.

4.2.8 *Oshawa Creek*

During the 2012 season, 49 temperature loggers were installed within Oshawa Creek. The Oshawa Creek has varied conditions ranging from heavily urbanized to less disturbed areas with strong coldwater regimes in the Oak Ridges Moraine headwaters.

One annual long-term monitoring temperature logger was installed within Oshawa Creek during 2012. This was the fourth year that temperature had been measured at this location. The data indicated that this section of creek is coolwater for the fourth year, but has been close to the warmwater mark for the past three seasons. Further monitoring will help to determine if the thermal regime stays as coolwater or if the high density urban land use upstream of the site increases the temperature over the long-term.

The remainder of the sites sampled were a combination of sites previously sampled in 2007 and new locations. In the northern sections of the watershed the thermal regime is predominately coldwater with a few coolwater sites scattered throughout where land use changes have impacted them. Throughout the middle of the watershed the thermal regime is predominately coolwater with some cold and warmwater sections. The areas where the warmwater sections are located have high levels of land use change and are generally located near where the creek changes from permanently flowing to intermittent. This reduced flow can affect the temperature and may not represent the thermal regime when the creek is being used for critical habitat specific functions (e.g. spawning or nursery). The southern part of the watershed, in and around the downtown area of the City of Oshawa, is dominated by coolwater sites as well as two warmwater sites and one coolwater.

These thermal regimes are confirmed with biological evidence as healthy Brook Trout, as well as other Salmonids, populations are found in the northern areas while the southern areas still supporting populations of Mottled Sculpin, Brown and Rainbow Trout as well as seasonal migrants. Continued monitoring to identify if the warming trend in the southern portion of the watershed continues due to upstream land use changes is recommended. With continued development in that area, increased pressured could make it difficult to maintain a thermal regime suitable for the fish that currently occupy the creek.

Of the 38 loggers so far retrieved in Oshawa Creek, 13 were found to be coldwater, 21 were found to be coolwater and 4 were warmwater. There was only one coldwater site located below Taunton Road, largely due to the fact the creek is almost entirely piped upstream of it (Montgomery Creek).

Loggers were placed upstream and downstream of most of the large barriers having a considerable sized pond upstream. Ponds and barriers can impact downstream temperatures so the placement of loggers above and below a barrier can determine if any significant increases of temperature occur. Results from 2012 sampling indicate that many of the larger, as well as some of the smaller, barriers are having a negative effect of thermal regime. Some of the larger barriers are simple stop log, top-draw designs which do not attempt to mitigate thermal issues. There locations in particular are found to be affecting thermal regime.

4.2.9 ***Osbourne Creek***

In Osbourne Creek, one temperature logger was installed in 2012. The logger was placed just upstream from Lake Ontario. This was the fourth year that this logger had been put in this location and once again was found to be coldwater. Due to the type of outlet, no lake water could be influencing this location, making groundwater in combination with limited development and good riparian cover the drivers of this consistently low temperature. Further sampling to determine long-term effects of development within a small watershed is recommended.

4.2.10 ***Pringle Creek***

During the 2012 season, four temperature loggers were installed in Pringle Creek. TLPR05 (located north of Rossland) was monitored for the fifth year and was once again found to be coolwater. It has stayed relatively consistent over this time.

The other three loggers are located near Garden Street and Consumers Drive. These loggers were installed prior to the stormwater pond being installed on Ash Creek. This site over time should show the effects of the stromwater pond, if any, on thermal regime relative to the main branch and downstream of the confluence. Figure 11 below shows trends over time at each of these locations. All three registered near the warmwater mark (26°C) but only one was actually above it. Previously, all loggers had been found to be coolwater. Although it is too early to make concrete conclusions from this data, it is interesting to note that the temperature of TLPR12 (with the stormwater pond upstream) was warmer than the other two loggers for the first time in three years. Speculation could be made there has been a thermal impact due to this pond. Continued monitoring to see if this trend is the new normal or was a coincidence is recommended.

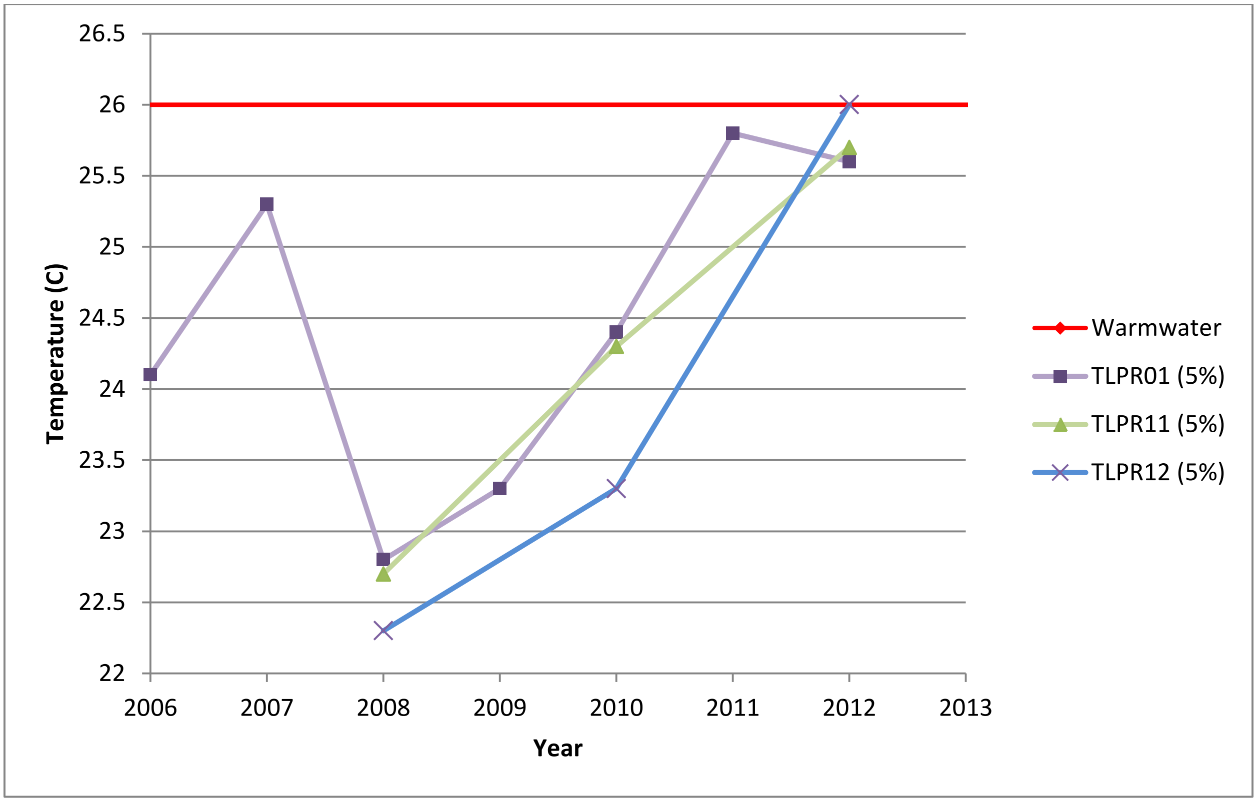


Figure 11: Summary of three temperature loggers located upstream and downstream of a confluence on Pringle Creek near Garden Street and Consumers Drive. The one logger (TLPR12) is now located downstream of a large stormwater pond. Temperature represents the %5 value for that year. This number is the temperature at which only 5% of the dataset exceeds.

4.2.11 *Robinson Creek*

During the 2012 season, two temperature loggers were installed in Robinson Creek. TLROB01 was selected as a site for the fifth time. This site was found to be coolwater for the first time in those five years. Continued monitoring to see if groundwater foundation drains are having an effect on stream temperature is recommended. Considerable land use change has occurred upstream of this location.

The other temperature logger, TLROB02, was located in the northern part of Darlington Provincial Park. Data indicated that this section of creek is coolwater, which is consistent with the four previous sampling events.

4.2.12 *Soper Creek*

During the 2012 season, three temperature loggers were installed in Soper Creek.

All of these loggers are located at annual long-term monitoring sites. The southernmost logger, located near Baseline Road, was monitored for the fourth year since 2006. Data from this logger indicated the thermal regime in this area is again coolwater, making it four years in a row. This area is still safely coolwater but there has been a slight, yet consistent, increase in temperature since 2010 results. Continued monitoring is recommended.

In 2005, two loggers (TLSOP09 and TLSOP10) were purchased by Irv Harrell for his stewardship property (Hawkridge Farm) located within Soper Creek watershed (Gibb Road/Concession Road 7). A section of Soper Creek flows through Hawkridge Farm and data from 2005 to 2012 indicates that it is coldwater. No cool or warmwater days have been recorded during this time. Results from 2013 data shows a decrease in both maximum temperature and 5% temperature (the temperature at which only 5% of the dataset exceeds) from the high levels in 2011. Although yearly maximum values have increased, trends on 5% values have shown to be relatively stable at these locations.

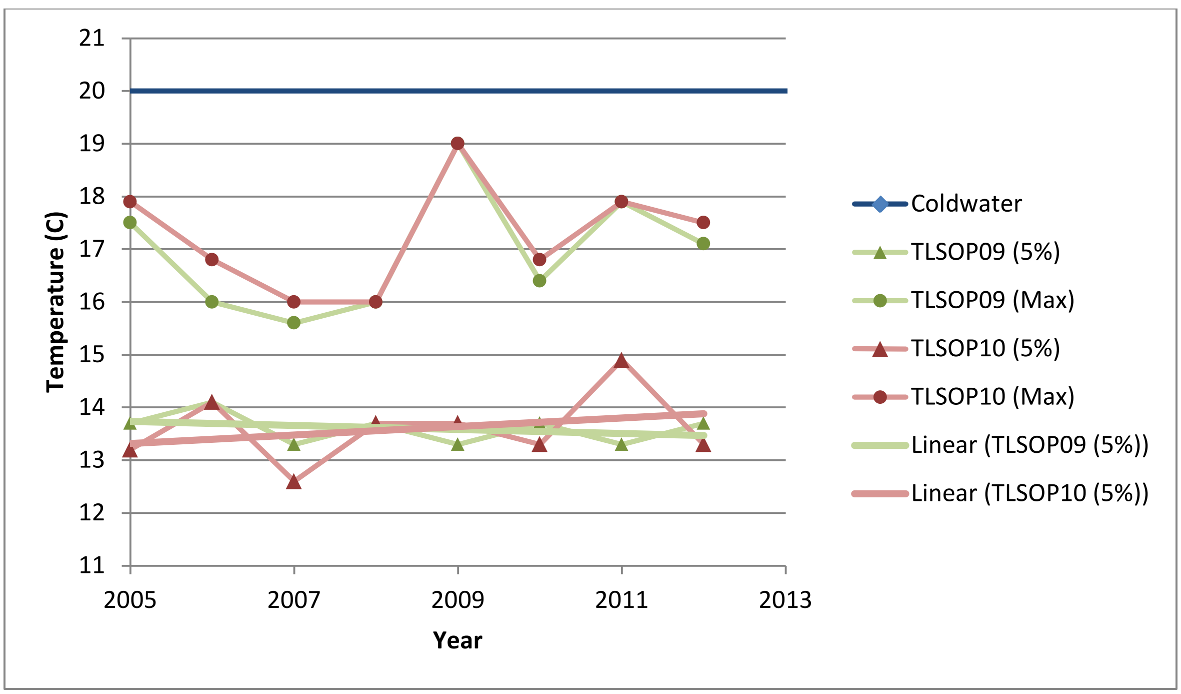


Figure 12: Summary of the temperature logger trend data on Soper Creek, near Gibb Road and Concession Road 7. Temperature (C) is displayed in too formats. Maximum summer temperature (circles) and 5% value (triangles). The 5% value is the temperature at which only 5% of the data set is above. Line of best fit has been applied to the 5% values in their corresponding colours.

4.2.13 *Tooley Creek*

During the 2012 season, one temperature logger was installed in Tooley Creek. This is the sixth year that temperature has been monitored at this site. As seen in Figure 13, the temperature at this location decreased from 2011 back to below the warmwater mark. This is the fourth time in six years that this site has been classified as coolwater.

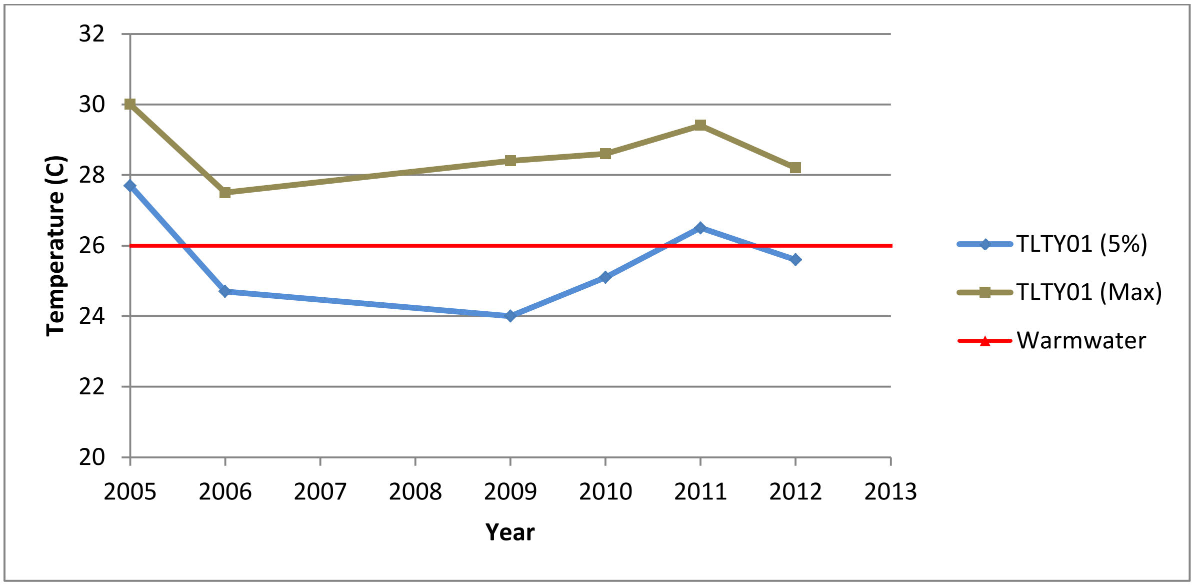


Figure 13: Summary of the temperature data at the long-term temperature monitoring site in Tooley Creek, south of Highway 401. The 5% value represent the temperature at which only 5% of the data exceeds, and max represents the maximum temperature recorded each summer.

5.0 FISHERIES SAMPLING (STREAMS)

5.1 Introduction

Fish are one of our most valued natural resources from ecological, economic, social and cultural perspectives. Healthy fish and environments result from protecting and/or restoring aquatic ecosystems (Draft Terms of Reference, 2005). In order to help determine aquatic ecosystem health and monitor it over time CLOCA conducts fisheries assessments in various watersheds each season. Ongoing annual aquatic monitoring is recommended in the Central Lake Ontario Fisheries Management Plan (CLOFMP; CLOCA/MNR 2007). Information collected during these programs supports the goals and objectives of the CLOFMP and allows for an adaptive management approach.

Historically, watersheds within the Central Lake Ontario Conservation Authority supported healthy coldwater fish communities and a strong Brook Trout and Atlantic Salmon fishery. With increasing urbanization and changing land-use patterns, many of the coldwater streams have become cool or warmwater systems. The Atlantic Salmon fishery has since collapsed and has been supplemented by stocking of Pacific Salmon and Trout species. In CLOCA's jurisdiction, the distribution of Brook Trout has typically been reduced to the undeveloped headwater reaches in the natural settings of the Oak Ridges Moraine (CLOCA/MNR, 2007).

While there have been many changes to the fish communities and fish habitat within CLOCA's jurisdiction, the watersheds are still home to a diverse array of fishes including cold-, cool- and warm-water species. The Bowmanville/Soper watershed has the highest diversity of Salmonids in CLOCA jurisdiction. Angling opportunities include Rainbow Trout and White Sucker during the spring and Chinook and Coho Salmon and Brown Trout during the fall; all during the regular season (refer to Section 8.3 for more information). Brook, Brown and Rainbow Trout resident populations also exist in most of the watershed. Anglers also take advantage of fishing popular warm-water species such as, Bass, Sunfish, Pike, and Carp in the coastal areas (CLOCA/MNR, 2007).

Generally, CLOCA conducts fisheries sampling in streams using a common sampling method called **electrofishing** (see photo on right). On occasion, when electrofishing is not a suitable technique, other sampling methods, such as seine nets, fyke nets, dip nets and minnow traps, are utilized. Backpack electrofishing, is conducted, for the most part, according to the Ontario Stream Assessment Protocol (OSAP) published by the MNR (Stanfield, 2005).

Electrofishing is a sampling method that temporarily immobilizes fish in water using electricity. Once immobilized, they can be captured with nets and fisheries staff can collect biological information (e.g., species, length, weight) before releasing them.

5.2 OSAP Monitoring Results

During 2012, 62 OSAP sites were sampled by CLOCA as part of the annual aquatic monitoring program and another five were sampled through the OSAP Training Course in the Oshawa Creek watershed (Figure 14). Fish species that were captured are listed in Table 13, Table 14, Table 15, Table 16, Table 17, Table 18, Table 19, Table 20, and Table 21. The main focus for sampling during 2012 was in the Oshawa Creek watershed. Other sites were selected to monitor long-term trends in other watersheds or provide fisheries data needed for plan review.

The Central Lake Ontario Fisheries Management Plan (MNR/CLOCA 2007) outlines watershed and subwatershed-based goals and objectives for the fisheries resource and habitat within Oshawa Creek, and identifies target species and fish communities for management. CLOCA's annual aquatic monitoring helps to assess these goals and objectives and is consistent with the management recommendations made within the Plan. Further, it allows for an adaptive management approach.

The results of the 2012 CLOCA Aquatic Monitoring are consistent with the goals and objectives of the FMP. The main branches of Oshawa Creek are still composed largely of migratory salmonids and should remain managed as such. In the headwaters, including upstream of impassable barriers to fish migration, streams remain dominated by resident coldwater fish communities including Brook Trout, Brown Trout and Sculpin species (Figure 15). These headwaters should continue to be managed for these sustainable coldwater fish communities.

Balancing development and environmental integrity can be a difficult process but is necessary to meet the economic goals of the municipalities while still maintaining an ecologically sustainable landscape. Since many of the species that inhabit Oshawa watershed are sensitive to land use it will be important to mitigate the negative impacts that urban and agricultural lands can have on the surrounding area as best possible. With best management practices in place and implementation of environmental standards though development approvals, Oshawa Creek has potential to maintain a healthy population of Trout (below/middle), Salmon and Sculpin (below/right) for years to come.

5.2.1 *Harmony Creek watershed*

During the 2012 season, two sites within Harmony Creek were sampled. These sites were sampled to determine if fish used this portion of the creek. Results showed that both of these sites, H304 and H307, have fish using them in summer baseflow conditions. The sites were dominated by species with a coolwater thermal preference (Blacknose Dace and Creek Chub).

5.2.2 *Nonquon Creek watershed*

During the 2012 season, sampling was carried out on the Roger's property. These streams represent the headwaters of the Nonquon Creek Three OSAP sites were sampled to determine fish community composition. The two sites located on the upstream portions of the property, but also located directly downstream of barriers with considerable ponds, were found to be composed of Blacknose Dace and Creek Chub. Although these species do prefer a coolwater thermal regime, they are considered more tolerant species. The third site, located downstream of the confluence, was found to consist primarily of Blacknose Dace (73) but also had Brook Trout (4) and a Creek Chub. It is positive to find that even with obvious thermal impacts being caused by the on-line ponds; the sensitive Brook Trout are still surviving in this area.

5.2.3 *Oshawa Creek watershed*

During the 2012 season, 32 sites were sampled in Oshawa Creek (including Goodman and Montgomery Creek). Interesting trends were found when looking at the results. Blacknose Dace, Fathead Minnow, White Sucker, and Johnny Darter all showed decreasing trends in total numbers and average number of fish per site when comparing to 2000 sampling data. In an urbanizing watershed it is interesting that the more tolerant species showed the largest declines in population size. Longnose Dace, Rainbow Trout and Mottled Sculpin all had increased average fish per site when compared to 2000 sampling data. This is a positive sign, especially in regards to Mottled Sculpin as they are a good indicator of watercourse health. The increase in Rainbow Trout numbers is also positive, but that could be influenced by the 2012 young-of-year being the products of a strong 2007, 2008 Rainbow Trout year class. Further sampling to determine the cause and long-term direction of these trends is required.

The most significant decreases occurred in the main branch of Oshawa Creek. Blacknose Dace, Fathead Minnow, and Johnny Darter had the largest decreases. For example, during 2000 sampling Blacknose Dace averaged 34.2/site. In 2012, Blacknose Dace averaged 3.8/site. Johnny Darters went from 26.7/site in 2000 to 4.9/site in 2012. A couple species with increasing trends when looking at the entire watershed had decreasing trends in the main branch. Longnose Dace dropped by 4.8 fish/site from 2000 to 2012 and Rainbow Trout dropped by 5.7 fish/site from 2000 to 2012 within the Main branch of Oshawa Creek. As a result total fish caught dropped from an average of 184/site in 2000 to 113/site in 2012 with a similar decrease in species richness.

An index of biotic integrity (IBI) was applied to the data to determine what changes in the fish community meant when trying to determine watershed health. From a watershed scale, the average IBI has increased from 30.8 in 2000, to 41.6 in 2007, and 42.2 in 2012. When looking at subwatersheds, all branches except the D branch had increases in IBI score when compared to 2000 data. 2007 data was more difficult to compare to because of the limited number of sites when looking at a subwatershed scale. See Table 4 below for full IBI breakdown.

Table 4: Summary of the Index of Biotic Integrity Scores (IBI) for the Oshawa Watershed as well as the subwatersheds including sampling years 2000, 2007, and 2012. Data is presented as IBI Score with the number of sites used to calculate the IBI Score in brackets. The CLOCA IBI was used in this analysis.

Area IBI was applied	Year Sampled		
	2000	2007	2012
Entire Oshawa watershed	30.8 (56)	41.6 (21)	42.2 (38)
A Branch	26.2 (15)	15.0 (1)	38.3 (12)
B Branch	3.1 (12)	1.0 (3)	8.2 (6)
C Branch	50.0 (4)	79.0 (3)	52.5 (2)
D Branch	45.2 (6)	20.8 (5)	26.3 (4)
E Branch	57.8 (13)	82.3 (6)	71.4 (12)
F Branch	12.2 (6)	6.7 (3)	15.0 (2)

IBI score have increased largely due to the decrease in tolerant species found within the watershed. It is unknown at this time why numbers of tolerant species (e.g. Blacknose Dace and Creek Chub) have decreased. As the IBI indicates, this makes the fish community more balanced but it is not known how this will change overtime. More sampling is required to continue building trend data.

The Brook Trout populations that were sampled in 2012 showed mixed results (Locations in Figure 16). On a positive note, all sites sampled where Brook Trout had been found previously were once again found in 2012. There are a total of six sites where Brook Trout were caught in 2012. Two of these sites (SOE1, SOE3) showed Brook Trout decreases of 70 and 75% respectively. One site, SOE2, showed no obvious trend. The last three sites (OD05, OE11, OE15) showed positive results with OE15 having Brook Trout not previously found at this location in 2007.

It is unknown what the cause is in the decrease at the two sites but it is noteworthy that they are located close together. There is no known disturbance at this time. Rainbow Trout were found in higher numbers at one of these sites which might be contributing to increased competition and therefore decreased Brook Trout populations. Continued monitoring of the sites with positive trends in Brook Trout numbers are necessary to see if these continue long-term.

The Brown Trout population does not appear to have any significant trends at this time. Their population continues to be strong throughout most of the upper watershed.

Migratory Salmonids were found throughout the entire watershed except where movement is impeded by barriers. Rainbow Trout are the most numerous as many of their young-of-year spend much of the summer in the creeks before swimming downstream to Lake Ontario. Most of the Coho and Chinook Salmon have left the creeks for the Lake Ontario by the time sampling begins in July, but pockets of them were still found in various locations in the watershed.

Johnny Daters were found in all branches of the Oshawa Watershed except C and F. During 2012 sampling, a decrease in numbers/site were found in the A branch as well as overall throughout the watershed. Johnny Darters numbers/site actually increased in branches B and D. Continued monitoring of this trend will be necessary to determine if this is seasonal variation or a true long-term trend. Since they are benthic species, a changing substrate can decrease their population size as they have a difficult time adapting. Another group of small, sensitive species are the Sculpins (Mottled and Slimy). The Mottled Sculpin are spread throughout much of the watershed while the Slimy Sculpin are restricted to the headwater areas. Mottled Sculpin numbers appear to be increasing on a watershed scale. In 2000 they averaged 7/site whereas in 2012 they averaged 15/site. The largest increase was found in the A Branch of Oshawa (2000 – 15/site, 2012 – 37/site) which is interesting due to most other species decreasing in abundance here. Again, continued monitoring should help determine if this is a true long-term trend.


Rainbow Trout young-of-year


Brown Trout

Overall the Oshawa Creek watershed is in fair to good health. The best areas are found higher in the watershed where there is less impact from urban and agricultural land uses and where ground water contributions provide excellent water quality and thermal preferences of the fishes that live in that area. The lower sections of Oshawa Creek are still in good condition but the effects of urbanization and the cumulative land use changes upstream are becoming apparent. That being said, some Trout, Salmon, Sculpin and Darter species are still able to survive in these sections which are evidence of fair/good quality habitat (Figure 15).

The Montgomery Creek watershed is considered to be part of the Oshawa Creek Watershed but outlets to Lake Ontario at a different point. Two sites within this portion were monitored during 2012. This watershed is highly urbanized with over 60% impervious cover. The result is a low quality fish community consisting of Blacknose Dace and Creek Chub. A total of six fish were caught, all of which were from MY02. MY03, although having sufficient flow and depth had no fish at the site.

5.2.4 *Soper Creek watershed*

During 2012 sampling, one site in Soper Creek was sampled. SB19, a known location for high quantities of Brown Trout was selected to determine how the low water levels and high temperatures were affecting it during 2012. Total fish numbers were lower and species richness was the lowest of the three sampling dates (4), but total number of Trout did not change significantly. The largest decrease was seen within the Mottled Sculpin group. Continued monitoring is required to determine long-term trends.

5.2.5 *Annual Long-term Monitoring Sites overview*

Ideally, every watershed would be sampled each year to avoid missing any significant events and to develop trend data faster. Due to resources, this is not currently possible. Therefore, seven sites were chosen within CLOCA jurisdiction to be monitored annually long-term. This trend data can be used to determine fish assemblages' shifts and monitor the creeks for establishment of invasive species populations. For this reason, sites in the lower reaches were chosen as they generally exhibit the highest diversity, the most potential anthropogenic impacts and historical records of Round Goby. The annual long-term monitoring sites are located on the larger watersheds. For site locations please refer to Figure 14 and for full fish data please refer to Table 17, Table 18, and Table 19. Summary of the seven long-term monitoring sites are listed below.

5.2.6 *Black Creek – BL01*

This is the fifth year that BL01 has been sampled. The following is a summary of notable observations at this site. Total number of fish caught was the lowest to date (44), but species richness was on par with the average. Lower total number of fish might be representative of the limited habitat due to the low water levels. Rainbow Trout made up the majority of the fish population with Blacknose Dace having the largest reduction in numbers. Chinook Salmon were captured at this site for this first time by CLOCA. This also marks the first time Chinook Salmon have ever been captured in Black Creek by CLOCA. Green Sunfish (please refer to Section 8.1 for more information) population at this site dropped from seven fish caught in 2011 to zero in 2012. That makes Green Sunfish present for two of the five years sampled. This trend will be interesting to monitor over long-term to see if they can establish a consistent population. Mottled Sculpin recorded their lowest catch at this site out of the five years it has been sampled. The IBI score at BL01 was 72, the highest score to date and well over the site average of 59.


BL01 – 2011 Site marking


BA01 – 2012 Site marking

5.2.7 *Bowmanville Creek – BA01*

This is the fourth year that BA01 has been sampled. The following is a summary of the notable observations at this site. The total number of fish caught at this site was the lowest recorded to date. Total species also matched the lowest species richness result set in 2011 for this site. Even with the low total numbers, Round Goby was found for the second year and in higher numbers (26) than in 2011. They were the third most numerous species, out of a total of ten, behind only Longnose Dace (77) and Rainbow Trout (28). Continued monitoring is required to determine if they have established a permanent population in this area. Blacknose Dace and the local Darter species, Rainbow and Johnny, were all at very low numbers. This is consistent with most other sites sampled during 2012, which may be in part caused by water levels. The IBI score at BA01 was 28, the highest to date and well over the site average of 21.

5.2.8 *Bowmanville Creek – BWDJ*

BWDJ has been sampled from 1996-2006 and 2010-2012. Sampling in 2012 was the 14th year that this site has been sampled providing excellent long-term trend data. The following are a summary of notable observations at this site. The total number of fish caught was near the site average but species richness tied the lowest recorded (6) originally set back in 2005. The Rainbow Trout population remained strong during 2011 and Longnose Dace rebounded from low numbers in 2011. Mottled Sculpin showed the strongest increase with 25 caught during 2012, well above the site average of approximately six. With close to 150 Rainbow Trout caught at this site, it is clear this is an important area for the life cycle of the Rainbow Trout. Another Salmonid, Chinook Salmon were also caught indicating the importance of this creek for their life cycle. Since it is thought that approximately 60-80% of Salmons smolt in the spring, the amount caught is likely only a small fraction of the number of salmon that would have occupied these waters during the fall and winter. This was the first time in the 14 years of sampling that Blacknose Dace were not captured at BWDJ. Previous to 2012, they averaged approximately 34 fish/year. The IBI score at BWDJ during 2012 was 64, down from 2011 but still above the site average of 48.


BWDJ – 2012 Site marking


FA04 – 2012 Site marking

5.2.9 *Farewell Creek – FA04*

This was the fifth year that FA04 has been sampled. The following are a summary of notable observations at this site. The total number of individual fish and the total number of species caught remained relatively consistent with previous years sampling. Rainbow Trout populations remained consistently high as they accounted for almost 84% of the fish community. Mottled Sculpin numbers dropped to a new low at this site (11). Given Mottled Sculpins numbers are up in most sites sampled in 2012, more monitoring should be conducted to determine why this indicator species had reduced numbers at this specific location. The IBI score at FA04 in 2012 was 81 which is above the average of 73.

5.2.10 *Lynde Creek – LA01*

This was the fifth year that LA01 has been sampled. The following are a summary of notable observations at this site. Total number of fish caught remained low but species richness was the second highest to date. Two new species at this site in 2012 were Chinook Salmon and Emerald Shiner. Emerald Shiners are well known inhabitants in warmer waters of the coastal wetland downstream, but have not been recorded this far upstream previous to this sampling event. Chinook Salmon, a species highly sensitive to thermal impacts, is not commonly found in Lynde Creek, especially young-of-year. Only on a couple occasions have adult Chinook Salmon been spotted attempting to swim upstream in Lynde Creek to spawn. Further monitoring on this trend will provide important information as to the value of this creek for sport fishery. Darter numbers appeared to be decreasing for both Johnny Darter and Rainbow Darters in 2011. Results from 2012 showed a continued decline for Rainbow Darters but a change in trends for Johnny Darters as they had a slight increase. Rainbow Darters are considered to be the more sensitive of the two species. Continued monitoring of this trend is recommended. The IBI score at LA01 during 2012 was 19, three points above the average score of 16.



5.2.11 *Oshawa Creek – OA05*

This was the fifth year that OA05 has been sampled. The following are a summary of notable observations at this site. Total number of fish caught was very low in 2012 (60), which is less than half of the site average (130). Species richness at the site also dropped to the lowest to date (6). It is possible that the low water levels reduced the amount of suitable habitat and is the result of the low number of fish caught. Interestingly, it is the sensitive species that dropped in numbers. Blacknose Dace were not captured for the first time in the five years sampled at this site and Longnose Dace were almost non-existent (4 caught). The IBI score at OA05 was 55, well above the site average of 29. This can be attributed to the lack of tolerant species. In-tolerant species made up 73% of the total fish community.

5.2.12 *Soper Creek – SB01*

This was the fifth year that SB01 has been sampled. The following are a summary of notable observations at this site. During 2012 sampling, total individual fish caught and species richness was the lowest out of the five years sampled. Round Goby were caught for the third consecutive year at this site. Continued monitoring of the Round Goby to see if it permanently establishes a population is recommended. This was the first year that White Sucker was not captured out of the five years sampled and there were noticeable declines in both Longnose Dace and Rainbow Darter numbers. The IBI score at SB01 during 2012 was 44, 12 points above the site average of 32.

5.2.13 *Coastal Wetland Stream Electrofishing Surveys*

Through the Durham Region Coastal Wetland Monitoring Program fisheries sampling is carried out using a boat electrofisher. For Coastal Wetlands where boat sampling is not an option (e.g. wetted width not wide enough), a backpack electrofisher is used following OSAP protocols. The three sites where this occurs are listed below. Please refer to Table 19 for complete catch information.

5.2.14 *Gold Point Coastal Wetland (GM02)*

Gold Point Coastal Wetland was sampled for the third time during the 2012 season. Results showed a decrease in total fish caught but number of species remained the same. Three species were caught for the first time in this watershed: Banded Killifish, Goldfish, and Rock Bass. Although it is discouraging to see the highly invasive Goldfish present, finding Rock Bass and Banded Killifish which are less tolerant native species is a positive.

5.2.15 *Robinson Creek Coastal Wetland (RN04)*

Robinson Creek Coastal Wetland was sampled for the third time during the 2012 season. Results show a large increase in total fish (203 compared with previous high in 2011 of 105) and the highest species diversity recorded to date (12). Brook Stickleback was caught for the first time at this location by CLOCA. Creek Chub and Fathead Minnow made up the majority of the total fish caught, 95 and 56 respectively.

Two species of Sunfish were caught during 2012 sampling. The native Pumpkinseed was found to be at its' highest numbers to date (14) and the Green Sunfish was caught for the second time in three years at this location. It is native to south-western Ontario but has been expanding its' range to the east. It was first identified within CLOCA during 2008, but is thought to have arrived sooner than that. Since its' arrival, it has generally maintained and/or expanded its' range within the small watersheds and the Black/Harmony/Farewell watershed.

5.2.16 *Tooley Creek Coastal Wetland (TY02)*

Tooley Creek Coastal Wetland was sampled for the third time during the 2012 season. Results showed that total catch and species richness was similar to both previous years (if the school of young-of-year Brown Bullhead is not included during 2011 sampling). Goldfish were caught during 2011 sampling but was not found during 2012. Instead, three Common Carp were caught for the first time in this location by CLOCA. No significant trends can be identified at this point. It is recommended that sampling of this and all other coastal wetlands continue to build a stronger long-term data set.

The fact that fish in these numbers are able to utilize this habitat is impressive given the stresses that are on this coastal wetland. The majority of the wetland is pasture for grazing cattle. The cattle are free to use the creek, which results in: increased sedimentation through disturbance and destabilized banks, no substantial vegetative buffer to limit nutrient loads and limit sunlight penetration, increased turbidity, and an unproductive benthic zone because disturbance prevents healthy vegetative communities. This demonstrates the resilience of this wetland making it a great candidate for stewardship initiatives.

5.3 OSAP Training Course

The 2012 OSAP Training Course was held from June 4-8 at Durham College/UOIT. This was the sixth year that as part of the training program a selection of 5 CLOCA ARMP sites within Oshawa Creek watershed was sampled. Due to the fact that this is a training exercise with participants taking turns in order to gain practical sampling experience, abundance data is not reported (Table 21).


Brown Trout

5.4 Fisheries Sampling (seine netting)

During the 2012 season, an additional sampling method was used to determine fish usage in the non-wadable portions. This area is located between the coastal wetland and where OSAP sampling usually begins. There were three main reasons for completing this sampling. It provides insight into fish community structure during a different season (spring instead of summer/fall). Using a variety of sampling methods ensures that fish that are not susceptible to one method are being recorded using another technique. Each sampling method has strengths and weaknesses. Lastly, to fill a data gap as little information has been gathered in these non-wadable areas where the boat electrofisher has not been able to access.

Seine netting occurred in a variety of locations during spring 2012 (See list below). For exact locations, please refer to Figure 17. During 2012 sampling, only number of species was recorded as well as total number of Round Goby (Figure 18) .In the future, it is recommended that abundance of all species is recorded to have a more complete data set. Please refer to Table 20 for full species lists at each location.

- Bowmanville Creek
- Cranberry Marsh
- Farewell Creek
- Gold Point Coastal Wetland
- Lynde Creek
- Nonquon Creek
- Oshawa Creek
- Robinson Coastal Wetland
- Soper Creek
- Tooley Coastal Wetland
- Westside Marsh/Creek
- Whitby Harbour

Three of the coastal wetlands (Gold Point, Robinson, Tooley) are sampled using the backpack electrofisher during July, but were also included in this sampling because it was thought to be important for understanding seasonal fish community changes as well as comparing different sampling methods. The remainder of the site locations are not sampled outside of this program but will often have both OSAP and DRCWMP sites located upstream and downstream.

5.4.1 *Bowmanville Creek*

Sampling occurred at four different locations on Bowmanville Creek, all between the confluence with Soper Creek and Highway 401 underpass. A total of 11 species were captured at these four locations. Bluntnose Minnow, Round Goby, Spottail Shiner and White Sucker were the only four species present at all four locations. The average number of Round Goby per seine haul was 20. This is a higher number that what has been previously identified at the annual long-term monitoring site upstream. Rainbow Trout and Chinook Salmon young-of-year were captured as they migrated out to Lake Ontario. This is positive to see as it is known the Chinook Salmon spawn in Bowmanville Creek but are rarely picked up because they have migrated to Lake Ontario before summer OSAP sampling occurs. Continued monitoring of Northern Pike, Round Goby, and Chinook Salmon smolt abundance is recommended.

5.4.2 *Cranberry Marsh*

Sampling occurred at three different locations within Cranberry Marsh during 2012. Limited sampling has occurred within this wetland since the water control structure was put in place. It is not accessible by boat and has only been sampled through minnow traps. Prior to 2012 sampling, only Fathead Minnow and Brook Stickleback have been recorded here. Results from 2012 showed Brook Stickleback to be present as well as three new species, Round Goby, Alewife, and Yellow Perch. Round Goby and Alewife are both non-native species but have widespread distribution. Yellow Perch is a common native species with a wide distribution. How they arrived in this marsh is not clear but it will be interesting to see how the Cranberry Marsh biotic community changes with these additions.

5.4.3 *Farewell Creek*

Sampling occurred at four locations within Farewell Creek. All locations were between Lake Ontario and Colonel Sam Drive. No recorded active sampling has been completed by CLOCA along this section of the creek prior to 2012. The results showed a total of nine species being caught in this area. Round Goby were present but in low numbers. Fathead Minnow was the only species that was captured on all four seine hauls. During 2012, boat electrofishing also occurred in this same area during late August. See Table 5 below for species lists from both spring and fall.

Table 5: Determining seasonal changes in fish community composition in a portion of Farewell Creek near Lake Ontario and Oshawa Second Marsh. Seine netting was used during the spring (June, 2012 – 4 hauls) and Boat Electrofishing (DRCWMP methodology) was used during late summer (August, 2012 – 5 transects).

<table>
<tr><th>Spring Seine Netting 2012</th><th>Late Summer Boat Electrofishing 2012</th></tr>
<tr><td colspan="2">Brown Bullhead, Emerald Shiner, Fathead Minnow, Goldfish, Pumpkinseed, Round Goby</td></tr>
<tr><td>Chinook Salmon</td><td>Common Carp</td></tr>
<tr><td>Northern Pike</td><td>White Sucker</td></tr>
<tr><td>Yellow Perch</td><td>Largemouth Bass</td></tr>
<tr><td></td><td>Log Perch</td></tr>
</table>

Interesting results from the spring sampling show that young-of-year Chinook Salmon are using this portion of Farewell Creek. It is unknown if they spawned within the upstream watershed or come up from Lake Ontario. Chinook Salmon have been observed running upstream in the fall, but never has there been confirmed young-of-year captured through CLOCA stream electrofishing prior to 2012. Young-of-year Northern Pike were also captured which is positive because they have not been found in this area since being caught within Oshawa Second Marsh during 2008 DRCWMP sampling.

5.4.4 *Gold Point Coastal Wetland*

Sampling occurred at three locations within Gold Point Coastal Wetland. All locations were between Lake Ontario and Philip Murray Avenue. This area is also sampled using a backpack electrofisher during the summer. Spring data was collected using a different methodology to determine possible seasonal fish community shifts as well as changes in catch based on capture method. See Table 6 below for a comparison of spring and summer catches.

Table 6: A summary of the fish species caught during 2012 seine netting that have not previously been recorded by CLOCA fisheries sampling in this area.

<table>
<tr><th colspan="2">Species caught during 2012 spring seine netting not previously found in Gold Point Coastal Wetland</th></tr>
<tr><td>Alewife</td><td>Bluntnose Minnow</td></tr>
<tr><td>Chinook Salmon</td><td>Emerald Shiner</td></tr>
<tr><td>Green Sunfish</td><td>Log Perch</td></tr>
<tr><td>Northern Pike</td><td>Threespine Stickleback</td></tr>
<tr><td>White Sucker</td><td></td></tr>
</table>

The most interesting catch is likely the abundance of Northern Pike. A total of 17 young-of-year Northern Pike were captured during 2012. These are very high densities which are surprising given the impacts upstream of this area. It demonstrates the unpredictability regarding fish usage in these coastal areas. Continued monitoring to determine if usage is consistent is recommended.

5.4.5 *Lynde Creek*

Sampling occurred at four locations within Lynde Creek and Lynde Shores Marsh. Three locations were just north of Victoria Street and one was located near the mouth to Lake Ontario. A total of 15 species were caught from these four seine hauls. The only species found at each location was the Bluntnose Minnow. The Round Goby was captured in high numbers at all locations except the site nearest to Lake Ontario. The other three sites north of Victoria Street averaged 65 Round Goby per seine haul. These are much higher concentrations than previously reported through OSAP or DRCWMP. It is also interesting that young-of-year Chinook Salmon were captured showing them moving downstream towards Lake Ontario. This sighting, along with catches upstream at the annual long-term monitoring site (OSAP), demonstrates that some Chinook Salmon reproduction occurs in Lynde Creek. Other interesting catches, Spotfin Shiner and Brook Stickleback, were caught just north of Victoria Street and have not previously been documented here by CLOCA.

5.4.6 *Nonquon Creek (Roger's Tract)*

Sampling occurred at two locations within the Roger's Property in the Nonquon Creek Watershed. Both of these sites were located within Emerald Pond. Only one species, Brook Stickleback, were caught in these two seines. This species was in very high abundance but diversity was lacking. It is not uncommon in highly vegetated, slow moving areas for Brook Stickleback to be common. Since this area has no connectivity with the downstream fishes, it is likely not going to change in the near future. Continued monitoring to determine if any other species establish in this area is recommended.

5.4.7 *Oshawa Creek*

Sampling occurred at four locations within Oshawa Creek. All sites were located between Thomas Street and Oshawa Harbour. A total of 10 species were captured. Chinook Salmon, Emerald Shiner, and Round Goby were the only species caught at all four locations. The high numbers of Chinook Salmon caught demonstrate how early this species leave the creek to go into Lake Ontario. While completing backpack electrofishing throughout the rest of the watershed later in the summer (July to early August), only thirteen total Chinook Salmon were caught at 32 sites. An average of approximately 13 Round Goby were caught per transect. These numbers are higher than previously thought.

5.4.8 *Robinson Creek Coastal Wetland*

Sampling occurred at three locations within Robinson Creek. All sites were located in Darlington Provincial Park near Lake Ontario in the Provincially Significant Wetland (PSW). A total of nine species were captured. This site was and has been sampled since 2010 by backpack electrofisher during the summer. A comparison of species caught between the two different methods and seasons are listed in Table 7.

Table 7: Determining seasonal changes in fish community composition in a portion of Robinson Creek Coastal Wetland near Lake Ontario. Seine nets were used during the spring (June, 2012 – 4 hauls) and Backpack Electrofishing (OSAP methodology) was used during July.

<table>
<tr><th>Spring Seine Netting 2012</th><th>Summer Backpack Electrofishing 2012</th></tr>
<tr><td colspan="2">Brown Bullhead, Creek Chub, Fathead Minnow, Johnny Darter, Pumpkinseed, Threespine Stickleback, White Sucker, Yellow Perch</td></tr>
<tr><td>Brook Stickleback
Green Sunfish</td><td>Blacknose Dace</td></tr>
</table>

Results show a similar fish community during both sampling events and techniques. Since access to this wetland is limited based on the barrier beach, continued monitoring during times when access to the Lake is open and closed is recommended to see how the fish community changes.

5.4.9 *Soper Creek*

Sampling occurred at four locations within Soper Creek. All sites were located upstream of the confluence with Bowmanville Creek and downstream of the Highway 401 overpass. A total of ten species were captured in these four seine hauls. Bluntnose Minnow, Round Goby, and Spottail Shiner were the only species caught at all four sites. There was an average of approximately 48 Round Gobies per seine haul. This is a much higher number than previously thought. Northern Pike were caught and observed in large numbers which is consistent with observations and catches made during late summer boat electrofishing.

5.4.10 *Tooley Creek Coastal Wetland*

Sampling occurred at three locations within Tooley Creek Coastal Wetland. All sites were located near Lake Ontario in the PSW. A total of thirteen species were captured. This site was and has been sampled since 2010 by backpack electrofisher in addition, occurring later in the summer. New species caught during spring seine netting include: Green Sunfish, Longnose Dace, Northern Pike, and Rainbow Trout. This marks the first time that Green Sunfish has been recorded in the Tooley Creek Watershed. The Green Sunfish is native to south-western Ontario and has been expanding its range to the east. It is now found in many of CLOCA's small watersheds.

This is also the first time that Northern Pike have been documented in this watershed. It is a positive sign that Northern Pike are using this habitat either for feeding or possibly spawning. Since vegetation is limited due to cattle being in the creek, it is thought that there is probably little opportunity for successful reproduction. Restoration in this area could improve this habitat and make it more suitable for spawning and nursery habitat.

Rainbow Trout young-of-year were also captured at this site. It is encouraging that successful reproduction occurred in this watershed even with the low water levels in the spring. The climatic conditions experienced in the 2011/2012 winter and 2012 spring likely has a bearing on how quickly water temperatures increased and the earlier than normal start to spawning. Continued monitoring to see if this watershed continues to produce Rainbow Trout and to determine if they regularly leave the watershed this early in the season within Tooley Creek is recommended.

5.4.11 *Westside Creek*

Sampling occurred at two locations within Westisde Creek during 2012 sampling. Both locations were above the Coastal Wetland near the hydro corridor. A total of nine species were captured. Northern Pike and Largemouth Bass are two notable catches in this area. It is positive to see large numbers of these species, young-of-year and adult, using this habitat. The only new species found in this area that was not previously found in the marsh or creek is Round Goby. Continued monitoring of their population numbers is recommended.

5.4.12 *Whitby Harbour Wetland Complex*

Sampling occurred at four locations within Whitby Harbour Wetland Complex during 2012 sampling. All sites are located near the Brock Street underpass. A total of fourteen species were captured. Round Goby have been captured near this location previously, but not in the same concentrations. This location averaged approximately 9 Round Goby/seine haul. New species found at this location are Goldfish (two of four seine hauls), Spotfin Shiner, and Threespine Stickleback. Continued monitoring of the non-native species is recommended.

Northern Pike

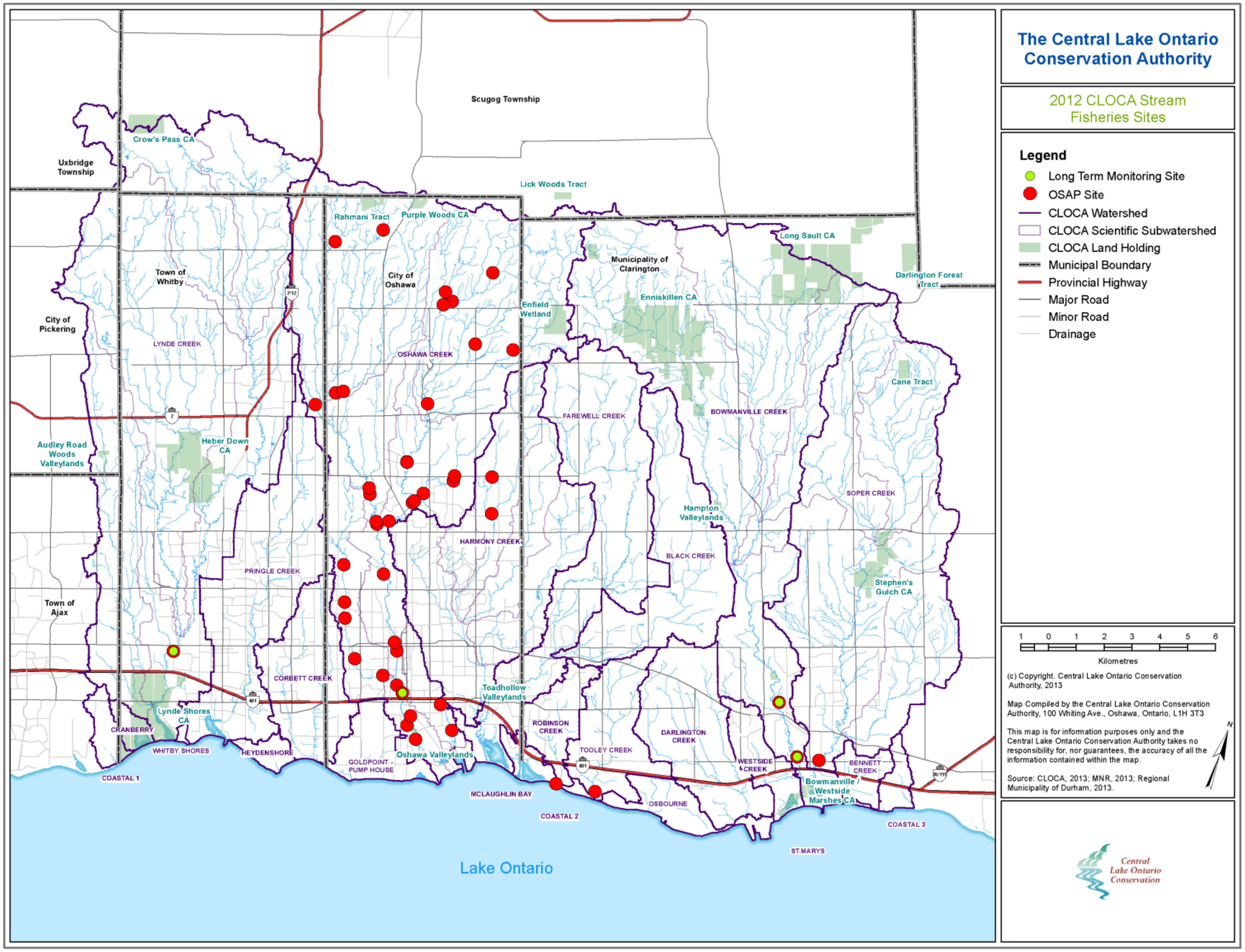


Figure 14: 2012 Stream fisheries site locations.

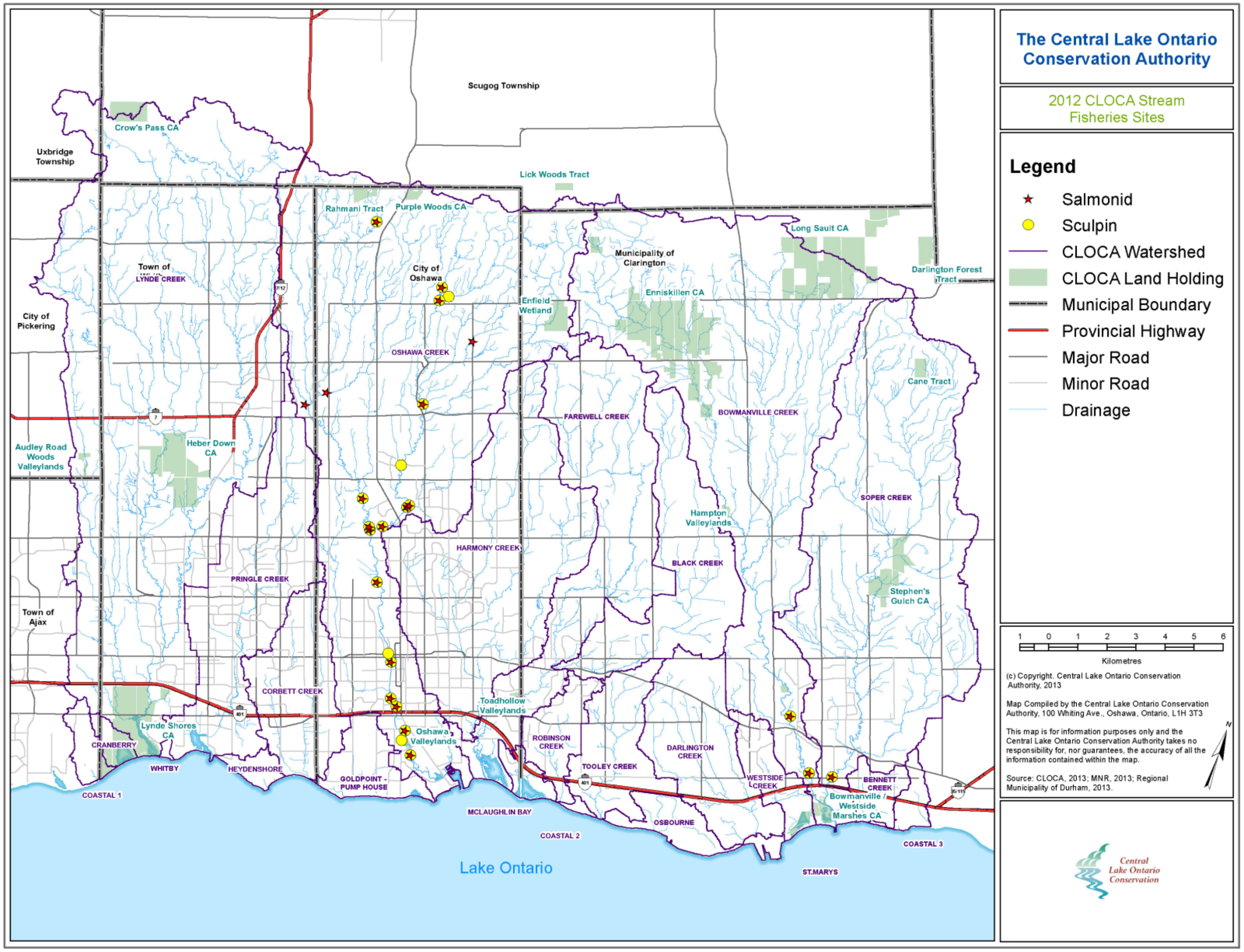


Figure 15: Locations where Salmonid and Sculpin species were caught during 2012 fisheries sampling.

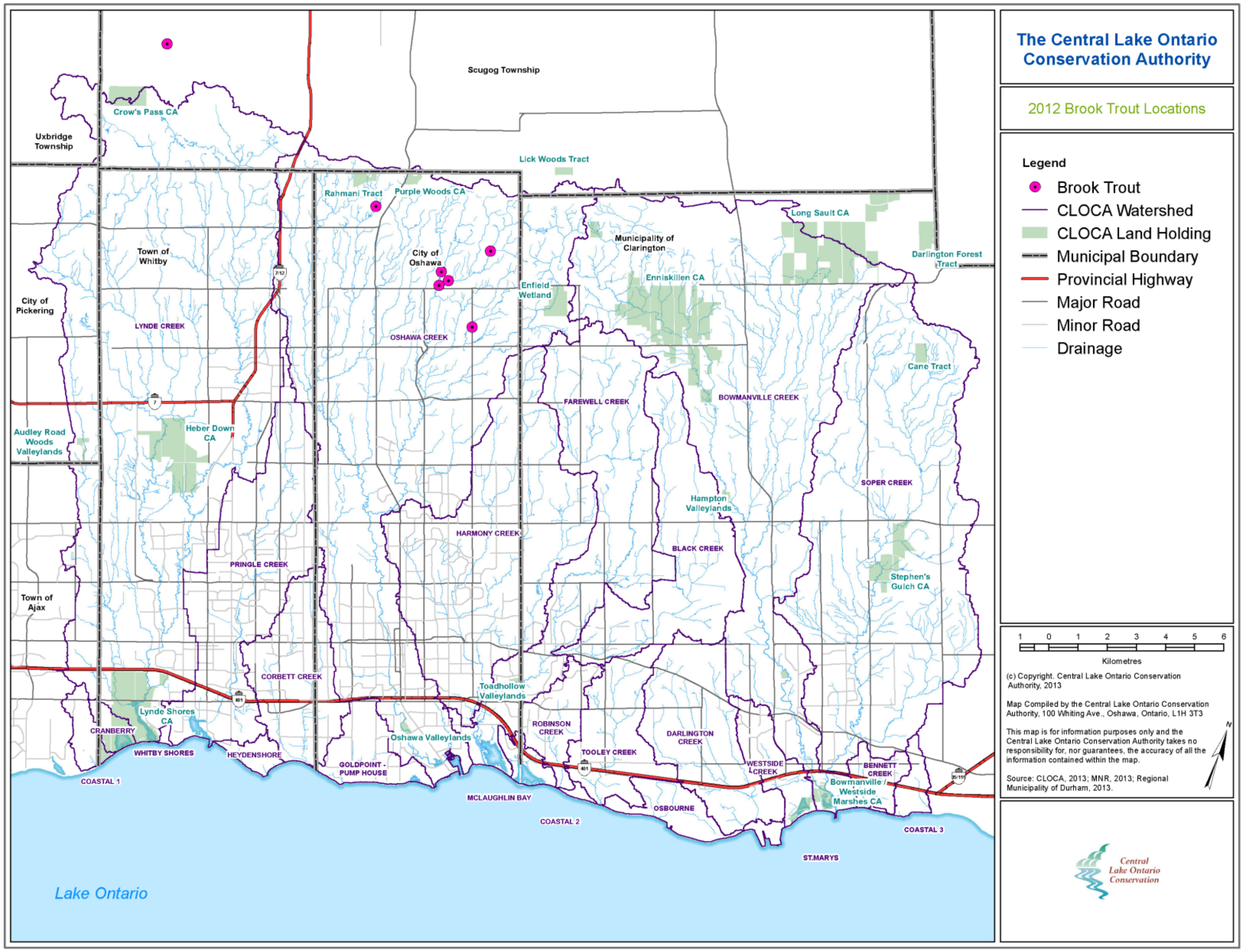


Figure 16: Brook Trout locations found through 2012 fisheries sampling.

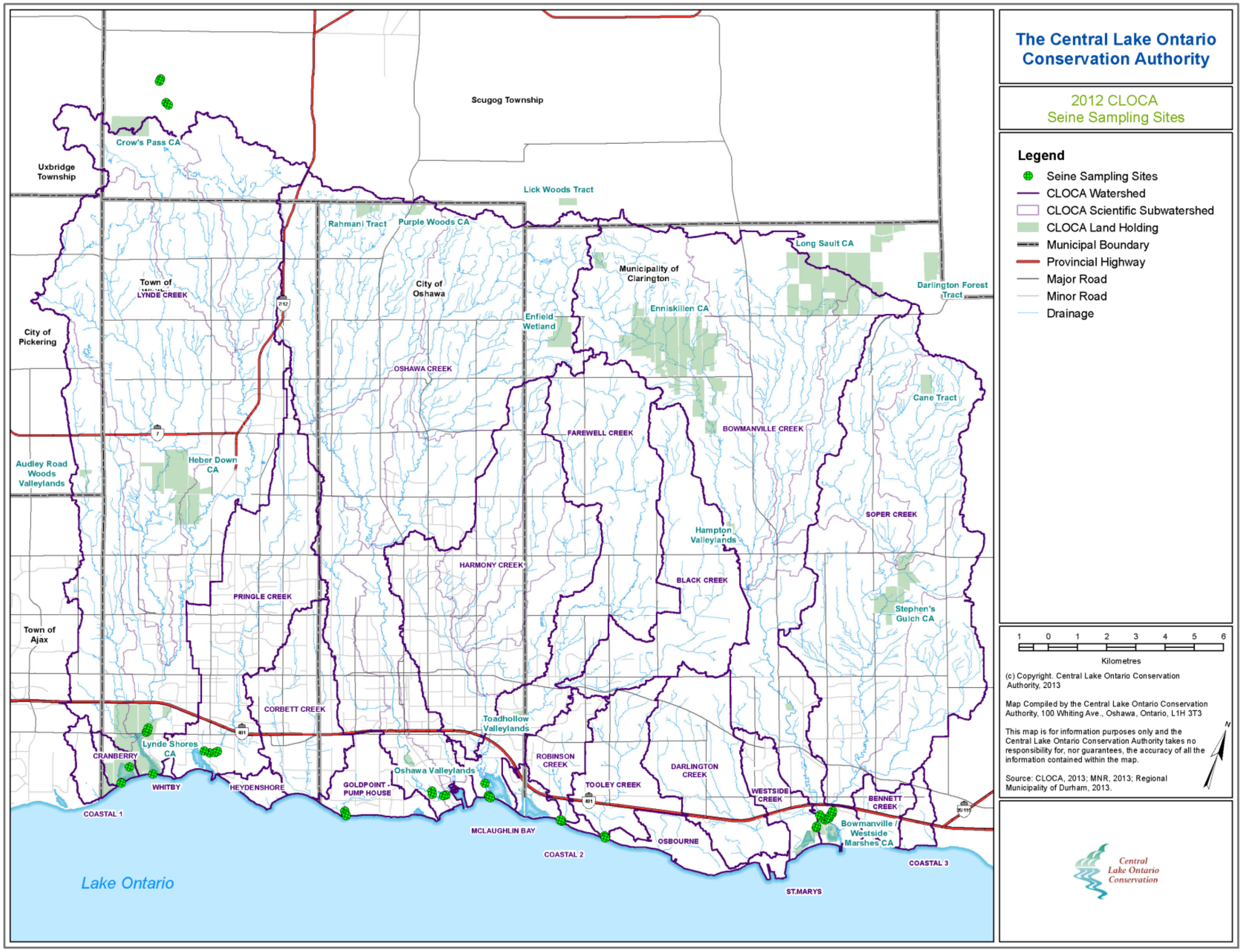


Figure 17: 2012 Seine netting site locations.

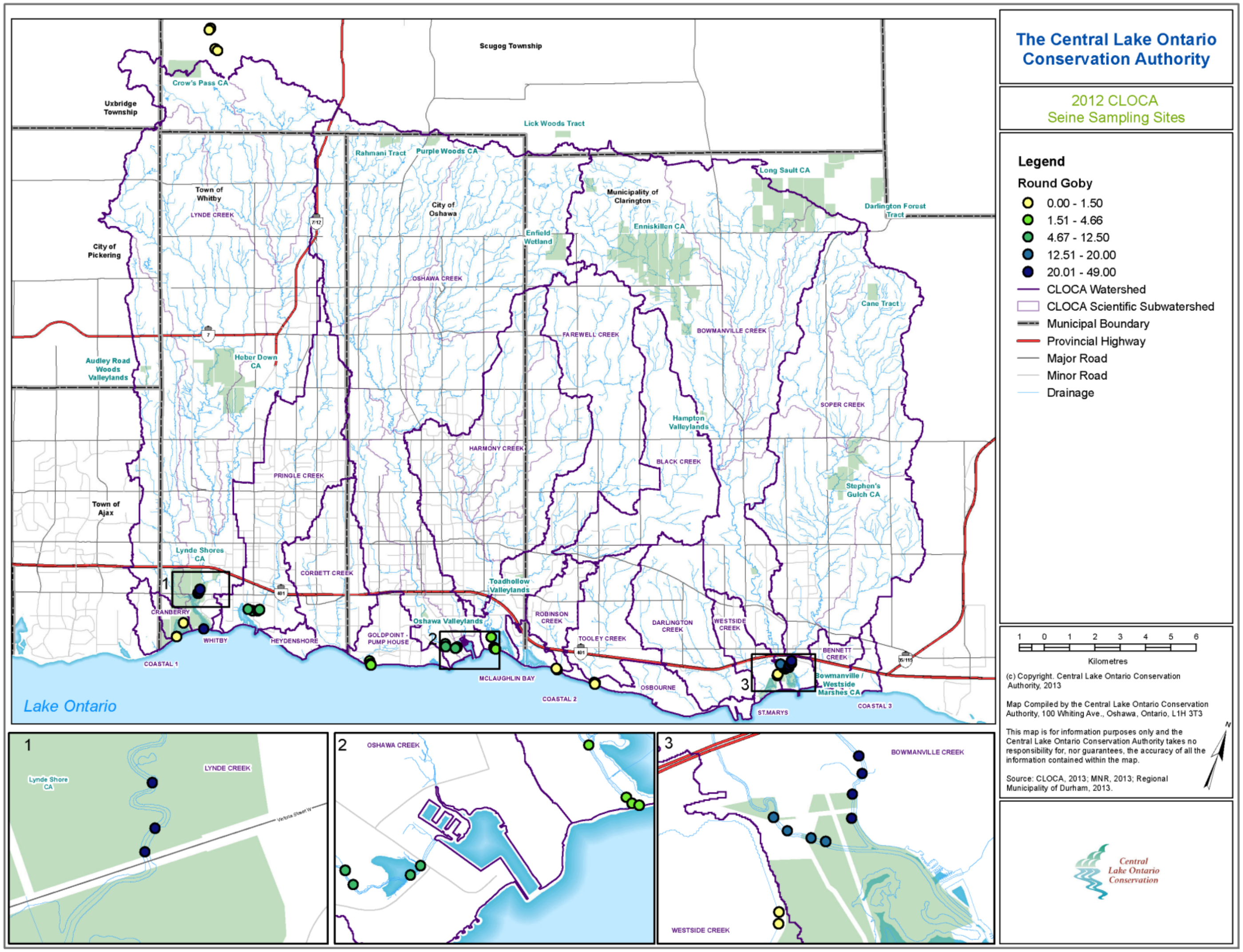


Figure 18: 2012 Round Goby densities at Seine Netting locations during 2012 sampling.

6.0 FISHERIES SAMPLING (COASTAL WETLANDS)

6.1 Introduction

Great Lakes coastal wetlands are a unique wetland type that have formed at the mouths of streams and rivers where they empty into the lakes, or in open or protected bays along the shoreline.

Lake Ontario's water level has been regulated since 1960 to accommodate increased demand for shipping and hydroelectric power. Natural water level variability has been diminished, reducing the biological diversity of coastal wetlands that depend on water level fluctuations to maintain diverse vegetation communities (Environment Canada and Central Lake Ontario Conservation Authority, 2004a).

The Durham Region Coastal Wetland Monitoring Project (DRCWMP) is designed to be a long-term monitoring program that enables reporting on the condition of coastal wetlands in the Region (Figure 19). The project was initiated in 1999 and monitoring began in 2002. Partners involved include Environment Canada, Central Lake Ontario Conservation Authority, Toronto Region Conservation Authority (TRCA) and Ganaraska Region Conservation Authority (GRCA) (Environment Canada and Central Lake Ontario Conservation Authority, 2004b).

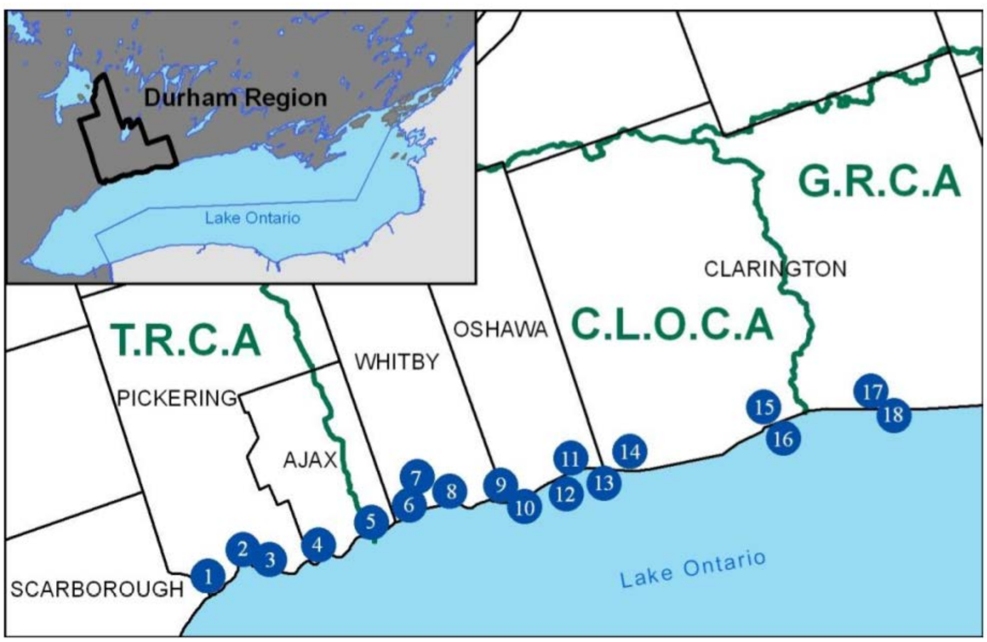


Figure 19: Location of Durham Region coastal wetlands. Wetland information is listed in Table 8.

Table 8: Durham Region coastal wetlands.

Wetland Name	Key map Number	Wetland Type*	Conservation Authority
Rouge River Marsh	1	DR	TRCA
Frenchman's Bay Marsh	2	BB	TRCA
Hydro Marsh	3	BB	TRCA
Duffins Creek Marsh	4	DR	TRCA
Carruthers Creek Marsh	5	DR	TRCA
Cranberry Marsh	6	BB	CLOCA
Lynde Creek Marsh	7	DR	CLOCA
Whitby Harbour Marsh	8	DR	CLOCA
Corbett Creek Marsh	9	DR	CLOCA
Gold Point Marsh	10	DR	CLOCA
Oshawa Creek Marsh	11	DR	CLOCA
Pumphouse Marsh	12	BB	CLOCA
Oshawa Second Marsh	13	BB	CLOCA
McLaughlin Bay Marsh	14	BB	CLOCA
Westside Marsh	15	BB	CLOCA
Bowmanville Marsh	16	DR	CLOCA
Wilmot Creek Marsh	17	DR	GRCA
Port Newcastle Marsh	18	DR	GRCA

* DR = drowned river mouth; BB = barrier beach lagoon

As part of the DRCWMP, fish communities in wetlands are assessed using a sampling method called boat electrofishing (see photo on right; see page 26 for a definition of electrofishing). In order to have consistent sampling effort, fish are sampled within the DRCWMP wetlands using the same electrofishing boat, owned and operated by CLOCA. Boat electrofishing is conducted according to DRCWMP fish sampling protocol (Environment Canada and Central Lake Ontario Conservation Authority, 2003).

The relative condition of the fish community at each wetland and over multiple years is compared using an Index of Biotic Integrity (IBI). IBIs, which are multi-metric indices, were first developed for use with stream fish communities by James Karr in central Illinois and Indiana (Karr, 1981). Metrics, or attributes, appropriate to Lake Ontario coastal wetland fish communities were selected and tested for suitability in the IBI based on a significant ($p<0.05$) or moderate ($p<0.20$) response to disturbances of the wetland. Six metrics were found to correlate either negatively or positively with disturbance and were, thus, retained for use in this IBI (Table 9). Each wetland receives an IBI score between 0 and 100 each year/time that it is sampled (Table 29) (Environment Canada and Central Lake Ontario Conservation Authority, 2004b).

Table 9: Six metrics used in DRCWMP IBI.

1	Number of native species (SNAT),
2	Number of centrarchid species (SCEN),
3	Percent piscivore biomass (PPIS),
4	Number of native individuals* (NNAT),
5	Percent non-indigenous biomass* (PBNI),
6	Biomass (g) of Yellow Perch (BYPE).

*Metric was corrected for site-specific interaction.

6.2 Durham Results

Extremely low water levels during the 2012 season prevented sampling from occurring in Carruthers Creek Marsh and Pumphouse Marsh, as well as significantly reducing (Oshawa Second Marsh and Bowmanville Marsh) and/or altering locations of normally completed transects. Site specific information on how water levels affected the sampling of each wetland is listed below within wetland specific summaries.

Overall wetland health continued to increase slightly in all jurisdictions (Ganaraska CA, Central Lake Ontario CA, Toronto Region CA, and Quinte) as indicated by the IBI averages (See Figure 20 below and Table 29). It is interesting to note the consistent highs and lows were recorded by all jurisdictions. This would suggest a strong climatic or other significant large scale factor plays a role in determining year to year fish communities. More in-depth results for each wetland are included below and full fish information can be found in Table 22, Table 23, Table 24, Table 25, Table 26, and Table 27.

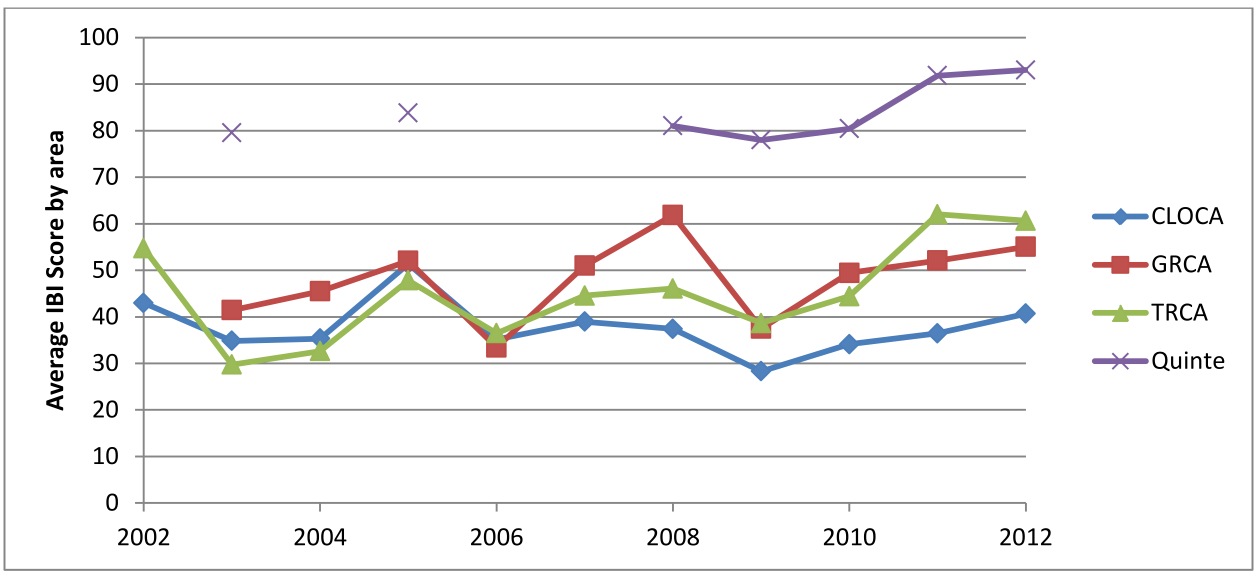


Figure 20: Trends looking at Wetland IBI averages sampled with a boat electrofisher. Wetlands are divided into four jurisdictions, Ganaraska Region CA, Central Lake Ontario CA, Toronto Region CA, and Quinte Region. The number of wetlands sampled within each jurisdiction varies slightly from year to year.

6.2.1 *Lynde Creek Marsh*

This is the tenth season that Lynde Creek Marsh has been sampled through the DRCWMP using CLOCA's boat electrofisher. Despite low water levels, sampling resulted in an IBI score of 63, which is the highest result at Lynde Creek and well above the average of 48. Interesting results include the first time that a Tadpole Madtom had been caught in Lynde Creek by CLOCA. This is a unique catch as these small catfish can be difficult to find. Other interesting catches include high numbers of Common Carp (100) and Gizzard Shad (208) and the first time a Goldfish has been captured in this location. The large numbers of Gizzard Shad as well as a very large increase in Largemouth Bass numbers (12) are largely responsible for high total individual fish caught (421) as well as increasing the IBI score. Round Goby were not caught during 2012 DRCWMP sampling, making it two straight years, but they were captured in high numbers during 2012 spring seine netting. Round Goby are more effectively captured with seine nets but it is also possible that seasonal shifts are occurring and/or more stream like habitats upstream of Victoria Street are preferred.

Sampling completed by the Ministry of Natural Resources during 2012 targeting Freshwater mussels found once again that Eastern Pondmussels are present in Lynde Creek Marsh. This is an interesting find because the Eastern Pondmussel is classified as a species at risk (SAR). For more information on Eastern Pondmussel, please refer to Section 7.0 Fisheries Related Research.

Results from 2010 efforts to determine contaminant levels in sport fish are listed on the MOE site http://www.ene.gov.on.ca/environment/en/mapping/sportfish/index.htm for Lynde Creek. Please refer to Section 8.2 for more information on this partnership and the guide.

6.2.2 *Whitby Harbour Wetland Complex*

Fish Sampling was conducted for the sixth year as part of the DRCWMP within the Whitby Harbour Wetland Complex. Results showed the marsh maintaining high species richness (13). Only three other marshes within Durham had species richness above 13 in 2012. Largemouth Bass (see photo below/right) were found in their highest numbers to date at this marsh (4). It is positive to see young-of-year Bass using this habitat. One new species was captured during 2012 sampling, a Freshwater Drum (see picture below/left). The most common species found in the wetland during 2012 were Brown Bullhead (78) and Common Carp (18). Common Carp made up a significant portion of the total biomass and was the highest of all Durham Wetlands. This along with the disappearance of Pumpkinseed, once again, contributed to the lower IBI score. The 2012 IBI score was 23, down from the previous mark of 32 but still above the marsh average of 19.


Freshwater Drum


Largemouth Bass

Whitby Harbour Wetland Complex has the lowest IBI average (19) of any of the wetlands sampled through DRCWMP even with a stronger score in 2011 and 2012. Although this is discouraging to see consistently low results previous to 2011, it is promising to see high species richness and high catch numbers being maintained. Hopefully with continued use of the area by native species (e.g. Largemouth Bass) this IBI will increase over the long-term.

6.2.3 *Corbett Creek Marsh*

This is the ninth season that Corbett Creek Marsh has been sampled through the DRCWMP using CLOCA's boat electrofisher. Results from 2012 show an IBI score of 10, down from 22 in 2011 and 41 in 2010. This can be attributed to the lack of diversity found in the marsh as well as low overall abundance. During 2012 sampling, total number of species caught dropped to four and total fish caught was 22. Of these 22 fish caught, Brown Bullhead made up the majority of the marsh population (16). Corbett Creek Marsh had both the lowest species richness and the lowest numbers of fish caught out of all of the Durham Marshes in 2012. Goldfish and Common Carp were caught for the second and third year respectively which is concerning that they may be developing a more established population. Continued monitoring of these non-natives is recommended. Pumpkinseed was not caught for the first time in the nine years this marsh has been sampled. Since they make up an important portion of a healthy coastal wetland (and why one IBI metric is devoted to their abundance) it is unfortunate to see this loss. Continued monitoring to see if this population can rebound is recommended.

The marsh was found to have high levels of algae during 2012 sampling. Algae are seen in this location from time to time, but concentrations were especially high during this sampling event, making for a difficult aquatic habitat to survive in.

Banded Killifish

6.2.4 *Pumphouse Marsh*

The Pumphouse Marsh was not sampled during the 2012 season because of extremely low water levels. It was not observed to dry completely like it did in 2007, but water levels were not high enough to get a boat in and hardly enough for a canoe. It will be interesting to see if the fish were able to tolerate the low water and high temperatures when sampling continues in 2013.

6.2.5 *Oshawa Creek Coastal Wetland Complex*

For the fifth time as part of the DRCWMP, fish sampling was conducted within the Oshawa Creek Coastal Wetland Complex. Sampling resulted in an IBI score of 50, which is the second highest to date and above the wetland average of 45. The number of species caught (13) was high once again up from eight in 2011. Total number of fish caught (90) was the highest to date within this wetland. Low water levels prevented sampling in the mouth of Montgomery Creek but these locations will be picked back up again, if possible, in 2013. Interesting results include catching high numbers of Northern Pike (see below/left) for the fifth consecutive year, the absence of Round Goby for the second consecutive year, the first time Bluntnose Minnow and Goldfish were captured at this location through DRCWMP, and high numbers of Common Carp.

Staging Chinook Salmon were observed during shocking in the creek channel as well as in the harbor. Some results from the Guide to Eating Sport Fish sampling that took place during 2011 are available on the MOE website - http://www.ene.gov.on.ca/environment/en/mapping/sportfish/index.htm. Please refer to Section 8.2 for more information on this partnership and the guide.

6.2.6 *Oshawa Second Marsh*

Oshawa Second Marsh had sampling attempted during the 2012 season. Only two transects were possible due to low water levels. Both of these transects had limited fish communities, lacking diversity in particular. Three species were captured at this site: Brown Bullhead (12), Common Carp (3), and Goldfish (39). It is discouraging to see the dominant species in the marsh remain a non-native. The fish community within Oshawa Second Marsh is in decline. Active management within the marsh may need to be considered if the quality of habitat is to be turned around. It is unknown at this point if the fish community will be able to rebound from its current state as well as the low water levels seen during the 2012 and so far into the 2013 season. Goldfish appear to have a stable population within the marsh. It is unknown where this population originated from. It is possible that these are direct human pet releases into the marsh or, indirect human releases into stormwater ponds higher in the watershed. If management is to be considered, eliminating the possibility of a new source population should be addressed.

Since water levels were low within the marsh, the remainder of the sampling occurred in Farewell Creek near the inlet/outlet to Oshawa Second Marsh. This sampling was completed to determine how the creek population compared to the marsh. Species richness remained high within the creek (10) as well as abundance. Key species found were: Largemouth Bass, Logperch, Pumpkinseed, and Emerald Shiner. Northern Pike were also observed but not captured. Goldfish, Common Carp, and Brown Bullhead were also found but in lower proportions. It is unknown if these fish would be occupying the wetland if water levels permitted.

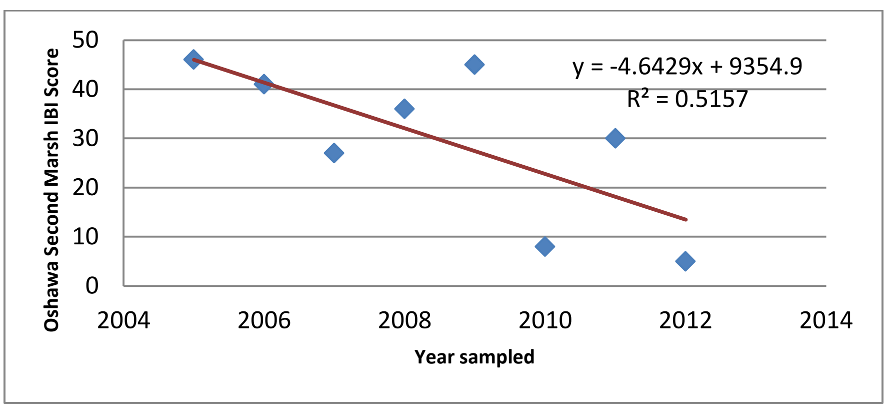


Figure 21: Long-term IBI trend data at Oshawa Second Marsh through Durham Region Coastal Wetland Monitoring Project.

6.2.7 *McLaughlin Bay Marsh*

This was the ninth year that McLaughlin Bay Marsh was sampled through the DRCWMP. It's IBI score was 62 in 2012, improving again from 2011 by 15 points and well above the marsh average of 38. The most notable change in sampling during the 2012 season was the total number of fish caught (468). This is well above the marsh average of 121, and represents the highest catch in all DRCWMP sampling during 2012 and third highest all time. This can largely be attributed to catches of Black Crappie (165), Pumpkinseed (85), Gizzard Shad (81), White Perch (70), and Blugill (33). These five species accounted for just over 92% of the total catch. All of these species (except Gizzard Shad) recorded their highest catches to date. Further sampling to determine if these populations are sustainable is recommended. Black Crappie (see photo below/left) and White Perch (see photo above) continue to reside in large numbers within this wetland. They are not found in these concentrations in any of the other DRCWMP sampling. Other notable catches include Largemouth Bass (see photo below/right) being caught for the fourth consecutive year and Rock Bass being caught for the first time.

Results from the Guide to Eating Sport Fish sampling that took place during 2011 are available on the MOE website - http://www.ene.gov.on.ca/environment/en/mapping/sportfish/index.htm. Please refer to Section 8.2 for more information on this partnership and the guide.

6.2.8 *Westside Marsh*

This is the eighth season that Westside Marsh has been sampled through the DRCWMP for fish. Sampling resulted in an IBI score of 35, up slightly from last year and around the marsh average of 36. Water levels in the marsh were very high due to the closed barrier beach. Total fish caught was surprisingly low (42), the second lowest of the eight seasons. Interesting results include: Black Crappie was not caught at this marsh for only the second time in the eight years sampled; Largemouth Bass (see photo below/right) caught again in high numbers, Northern Pike caught in high numbers (see photo below/left) including an injured individual shown in picture below. It should be noted that the consistent catching of Largemouth Bass could be attributed or affected by the stocking event during the 2005 season (Dillon Consulting, 2009).

The area upstream of the beaver dam was also sampled on a separate occasion. This area has not previously been sampled by boat electrofisher. Results were kept separate from the regular DRCWMP. Concentrations of Largemouth Bass, Northern Pike, Common Carp, and Pumpkinseed were very high in this area. Other minnow species were found to be common here also.

6.2.9 *Bowmanville Marsh*

Bowmanville Marsh had sampling attempted during the 2012 season. Due to low water levels, only two transects within the actual marsh could be sampled. The primary species captured was Brown Bullhead with the other notable catch being an adult Northern Pike.

The remainder of transects sampled were completed within Bowmanville Creek between the outlet to Lake Ontario and the CN Railway tracks. This sampling was done in partnership with MOE for the Guide to Eating Sport Fish. The results of this sampling have not yet been released. Please refer to Section 8.2 for more information on this partnership and the guide.

Since this area is not usually included in DRCWMP sampling, results will not be officially recorded and the IBI will not be applied. Results from the sampling demonstrate that both Northern Pike and Chinook Salmon are using this habitat at this time of year.

6.2.10 *Wilmot Creek Marsh*

This is the ninth season that Wilmot Creek Marsh has been sampled through the DRCWMP using CLOCA's boat electrofisher. Sampling resulted in an IBI score of 40 which is slightly below the average of 46. 2012 sampling recorded thirteen different species and total catch of 74. This total catch was twice what was recorded in 2011 but still near the marsh average. Interesting results include: catching Bowfin for the second year in a row; high numbers of migratory Chinook Salmon (see photo below/right); Northern Pike caught for the sixth year in a row; Round Goby were caught in the highest numbers to date (21) making it the most common species during 2012 sampling at this location; and the first time a

Goldfish was captured at Wilmot. Although Brown Trout were not recorded on the official transects, numerous Brown Trout (see photo above/left) were caught and observed for other research being conducted by the Ganaraska Region Conservation Authority.

6.2.11 *Port Newcastle Marsh*

This is the ninth season that Port Newcastle Marsh has been sampled through the DRCWMP using CLOCA's boat electrofisher. Results from 2012 were positive showing high total catch (179) and high species diversity (17). Port Newcastle Marsh tied Duffins creek for the highest diversity during 2012 sampling through DRCWMP. This diversity contriburted to the IBI score being 70, the top score for the marsh to date and well above the marsh average of 49. There were many interesting results from this sampling, none more so than capturing three American Eels. This is of particular interest because it is considered endangered under COSEWIC (http://www.dfo-mpo.gc.ca/species-especes/species-especes/eel-anguille-eng.htm). Stocking of American Eel occurred during 2006 so it is not known if these are naturally reproduced or stocked. Further sampling to determine if American Eel consistenly use this habitat and to see how populations within the area change is recommneded. Other interesting results include: the first records of Black Crappie, Bluegill, Brook Silverside, and Northern Pike at this location; Round Goby being caught in the largest numbers to date; and no Common Carp being caught for three consecutive years.

6.2.12 *Frenchman's Bay Marsh*

In Frenchman's Bay Marsh total fish caught increased from 2011 and species richness decreased to its lowest level since 2005. Since 2005 was also a hot dry year, there could be a relationship between the two results. Further sampling would be required to determine confidence in that relationship. Even with slightly lower species richness, IBI score increased slightly from 2011 to 59 in 2012. This is slightly above the marsh average of 50. Interesting results include Round Goby being caught again making it seven years in a row that they have been found at this site; Largemouth Bass have been caught all nine times this marsh has been sampled recording high numbers again in 2012; and Pumpkinseed remain an important part of the fish community with 40 caught during 2012 making it the most abundant fish this year within this wetland.

6.2.13 *Rouge River Marsh*

This is the ninth year that Rouge River Marsh was sampled through the DRCWMP. Although total catch and species richness dropped slightly from 2011 sampling, the IBI results from 2012 increased to a marsh high and Durham Region all time high 76. The marsh had a good balance of Centrarchid species (Bluegill and Pumpkinseed), Yellow Perch, minnow species (e.g. Common, Emerald, and Golden Shiner) and well as predator species (Largemouth Bass, Northern Pike, and Bowfin). This well -balanced system, in combination with high numbers of native species and low numbers of non-natives, resulted in the high IBI score. Continued monitoring to determine if this community can maintain itself given all of the local pressures is recommended.

6.2.14 *Carruthers Creek Marsh*

The Carruthers Creek Marsh was not sampled during the 2012 season because of extremely low water levels. Sampling will be attempted again during the 2013 season.

6.2.15 *Duffins Creek Marsh*

This is the eleventh year that Duffins Creek Marsh has been sampled through the DRCWMP. During 2012 sampling Duffins recorded high total catch (241) and species richness (17). Species richness is tied for the second highest all time in Durham Wetlands. The IBI score in 2012 was 60, which is above the marsh average of 39. Interesting results include: the first time Goldfish have been captured in Duffins through DRCWMP; potentially the first time Common Carp/Goldfish hybrid has been found within Duffins Creek through DRCWMP (awaiting confirmation); and high numbers of Largemouth Bass for the second consecutive year. The photo above/right shows an aerial photograph taken of Duffins Creek Marsh during 2012. This photo shows how low the water levels were within the marsh this season.

6.2.16 *Hydro Marsh*

This is the ninth year that Hydro Marsh has been sampled through the DRCWMP. During 2012 it recorded an IBI score of 47 which is well below the mark of 71 in 2011 but still above the marsh average of 45. Due to low water levels not all transects normally sampled were accessible. The most dominant species were Pumpkinseed (86) and Largemouth Bass (14). Yellow Perch were not captured during 2012 sampling which is the first time since initial sampling in 2003. This would have contributed to the lower IBI score slightly as 1/6th of the score is based on numbers of Yellow Perch. The high score could be partially reflective of 2012 sampling being restriction to the area of the marsh that has restoration completed. Although it is encouraging to see a healthy fish community in this area, it might not be reflective of the entire marshes health.



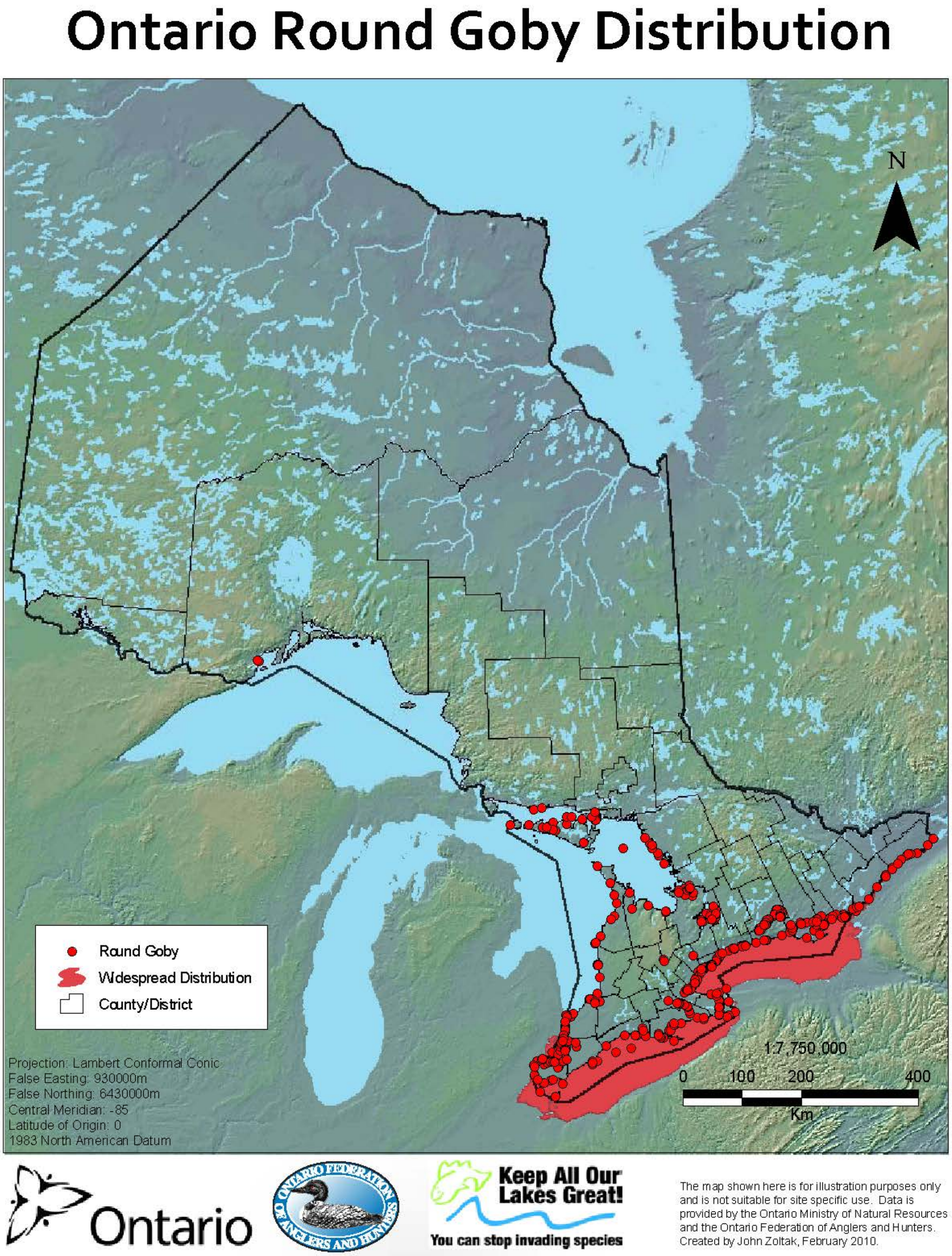


Figure 22: Round Goby distribution in Ontario as of February 2010 (OFAH 2010).

6.3 Bay of Quinte RAP

6.3.1 *Introduction*

Fish sampling through the DRCWMP in the Bay of Quinte and surrounding area first took place in 2003 with the sampling of two wetlands followed by an additional five in 2005. Data from these wetlands helped to strengthen the Durham project and other EC initiatives.

In 2008 CLOCA partnered with the Bay of Quinte Remedial Action Plan (BQRAP) to sample approximately 15 wetlands over a 3-year period. This partnership has continued on an annual basis with the data collected contributing to the evaluation of the success of the Action Plan. See below for details regarding the BQRAP.

> ***Great Lakes Water Quality Agreement (GLWQA):***
> *An international treaty made between Canada and the United States in 1978. The purposes of this agreement were:*
>
> *1) To provide measurable goals to restore, protect and maintain the environment quality of the Great Lakes Ecosystem.*
>
> *2) To identify Areas of Concern where the environmental quality does not meet international standards.*
>
> ***Area of Concern (AOC):*** *An area where the environmental quality does not meet international standards set out by the GLWQA. Each AOC is required by the GLWQA to have a Remedial Action Plan. Currently there are 17 AOC's in Ontario.*
>
> ***Remedial Action Plan (RAP):*** *Under the GLWQA, each AOC is required to have a Remedial Action Plan to enforce an "ecosystem approach" to improving water quality so that international standards can eventually be met.*

Bay of Quinte RAP – The Big Cleanup, (www.bqrap.ca)

6.3.2 *Results*

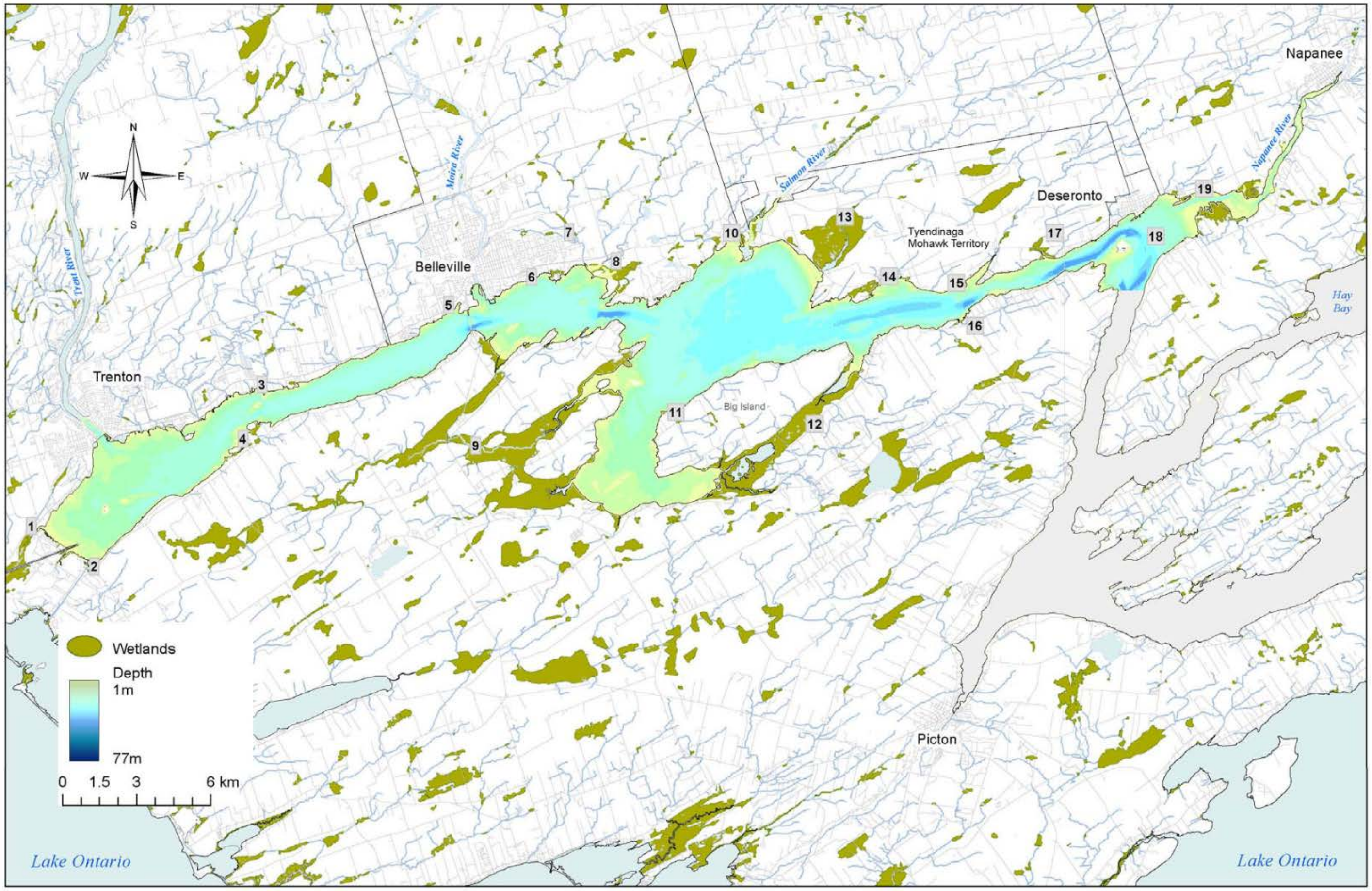
This past summer, fisheries sampling as part of the BQRAP began on August 14th and finished August 29th with five Quinte wetlands being sampled (for marsh locations refer to Figure 23):

1. Dead Creek Marsh
2. Robinson Cove Marsh
3. Sawguin Creek Central Marsh
4. Big Island West Marsh
5. Airport Creek Marsh

Of the five marshes, Dead Creek Marsh had the lowest IBI score of 75 and Airport Creek, Big Island West, and Sawguin Central Marshes all receiving the highest score of 100 (Table 28). It is encouraging to see three marshes score perfect. Quinte continues to produce a high diversity of predator species as well as smaller forage fish. Interesting results include catching Bowfin (see photo middle/right), Walleye (see photo top/left), American Eel (see photo top right) which is considered an endangered species (COSEWIC), Northern Pike (see photo bottom/right), Yellow Perch (see photo middle/left), and Largemouth Bass (see photo bottom left).





Coastal wetlands in the upper bay of the Bay of Quinte:

1. Dead Creek Marsh
2. Carrying Place Marsh
3. Bayside Wetland
4. Pine Point Marsh
5. Belleville Treatment Plant Marsh
6. Belleville Marsh
7. Bell Creek Marsh
8. Blessington Creek Marsh
9. Sawguin Creek Marsh
10. Lower Salmon River
11. Robinson's Cove Marsh
12. Big Island Marsh
13. Big Marsh
14. Bluff Point Marsh
15. Lower Sucker Creek
16. Northport Swamp
17. Airport Creek Marsh
18. Forester's Island
19. Lower Napanee River

Figure 23: Map of the upper Bay of Quinte showing wetlands and depth contours (Bay of Quinte Remedial Action Plan, 2007)

7.0 Fisheries Related Research

Freshwater mussels are part of the Phylum Mollusca (molluscs), which also includes snails, slugs, clams, scallops, oysters, squids and octopuses. In Ontario all of the mussels are part of the Family Unionidae. Of the 55 species that occur in Canada, Ontario has 41, 28 of which are showing signs of decline. In North America 21 species are already extinct (Metcalfe-Smith and MacKenzie and Carmichael and McGoldrick, 2005).

Many methods are used to sample mussels and include: visual searches, tactile searches, sediment collection and sieving, or special methods such as brail bars, dredges, or muskrat middens (Strayer and Smith, 2003).

Mussels are preyed upon by various animals such as River Otters, Mink, Raccoons, Muskrats, birds and fish. Many of these predators especially Muskrats, leave piles of mussel shells called "middens" along the shore and around structures such as tree roots and bridge abutments. During periods of low water, shorelines can be walked to determine if mussels are present in the area (Metcalfe-Smith and MacKenzie and Carmichael and McGoldrick, 2005).

No one agency or organization has unlimited resources available to devote to environmental monitoring and research. To help address this fact, whenever possible, CLOCA participates in and partners with national, provincial or municipal networks and agencies. Through just such a partnership, during the summer of 2011, an important discovery was made within the Lynde Shores Conservation Area; specifically the Lynde Creek Marsh. A survey targeting freshwater mussels was conducted by the MNR at various sample locations within the marsh as part of a larger study area along Lake Ontario coastal wetlands. This resulted in the first known record of the Eastern Pondmussel within Lynde Creek Marsh and the CLOCA jurisdiction. This discovery was important due to the fact that the Eastern Pondmussel is a Species at Risk (SAR).

Some of the threats facing the Eastern Pondmussel include upstream watershed land uses, Lake Ontario water level regulation, global warming, and likely the largest threat being the Zebra and Quagga Mussel. The Zebra and Quagga Mussel are invasive species that attaches itself to other mussels in large numbers, causing them to suffocate or die from starvation, (MNR, 2010).

8.0 Partnerships

8.1 Non-native Aquatic Species

Non-Native species (also known as Introduced, Invasive, Alien, Exotic, Naturalized) are plants, animals and microorganisms introduced into areas beyond their native range due to human actions. The introduction might be:

- Deliberate or accidental
- Beneficial or harmful
- From other continents, neighboring countries or from other ecosystems in Canada

Invasive species are those most commonly heard about as they are the non-native species whose introduction and spread threatens the environment, the economy or society, including human health.

Non-native species are recognized as a serious problem that threatens global biodiversity and human health worldwide. They are one of the leading causes of native species becoming rare, threatened or endangered. The economy also suffers with the spread of non-native species. Millions of dollars are spent on trying to control invasive species when they alter aquatic and terrestrial environments destroy crops, etc.

In the Great Lakes Basin alone, nearly 200 species from around the world have been introduced, including such well known species as the Sea Lamprey and Round Goby (OMNR, 2009).

Currently within CLOCA jurisdiction there are six aquatic non-native species of concern:

- Round Goby
- Sea Lamprey
- Common Carp
- Goldfish
- Green Sunfish
- White Perch

Management of aquatic invasive species is a difficult task because of their wide range and aggressive life history strategies. For this reason partnerships are critical to monitor and manage changes in their populations. Through our aquatic monitoring programs we actively monitor population sizes and changes and report it each year's Aquatic Monitoring Report. When possible, management of species within our Conservation Lands occurs by either dealing with the biota directly or using education as a tool. Partners with CLOCA, such as

Ontario Federation of Anglers and Hunters, the Department of Fisheries and Oceans and the Ministry of Natural Resources, work together to manage and deal with these species as effectively as possible.

Information for each species is contained within CLOCA's 2010 Aquatic Monitoring Report. For more information please refer to InvadingSpecies.com through Ontario Federation of Anglers and Hunters (OFAH) or the Aquatic Invasive Species program through MNR.

8.2 Guide to Eating Ontario Sport Fish (2011-2012 Edition)

Through the Durham Region Coastal Wetland Monitoring Project (DRCWMP), CLOCA staff partnered with Ministry of the Environment staff to collect fish samples from various Durham Region Coastal Wetlands. The results from 2010 and 2011 will be incorporated in a future update of the Guide to Eating Ontario Sport Fish. It is anticipated that other locations included in the DRCWMP will be sampled in the near future as well.

8.2.1 *About the guide*

Staff from the Ontario Ministry of Natural Resources and Ministry of the Environment collect the fish which are then analyzed for a variety of substances, including mercury, PCBs, mirex, DDT and dioxins. The results are used to develop the advisory tables which give size-specific consumption advice for each species tested from each location. The guide is published every other year. A new interactive version of the guide is available at Guide to Eating Ontario Sport Fish (2011-2012 Edition).

8.2.2 *Contaminants in Ontario sport fish*

Ontario is not unique in having consumption restrictions on sport fish. Most jurisdictions in North America also have them. An extensive review of consumption restrictions on sport fish in North America is available on the Internet at www.epa.gov/waterscience/fish/.

Contaminants found in sport fish originate not only from local sources, but some are transported thousands of kilometers in the atmosphere before being deposited with rainfall. Mercury, PCBs and toxaphene are a few of the contaminants that are known to be transported long distances and can cause low-level contamination even in isolated lakes and rivers.

8.3 Fishing Regulations and Enforcement

8.3.1 *Overview*

Where permitted, fishing regulations within Conservation Areas as well as throughout the CLOCA jurisdiction are regulated through the Ontario Ministry of Natural Resources (MNR). For up-to-date information on specific Regulations and Acts pertaining to fishing in Ontario, please contact the Ministry of Natural Resources.

8.3.2 *Report a Violation*

All Ontarians can play a part in protecting our natural resources from waste, abuse and depletion. If you are witness to a resource violation within Ontario, please call the Ministry of Natural Resources TIPS line at:

1-877-TIPS-MNR (847-7667)

In order to investigate an occurrence, it will assist an officer to know the following information:

- Nature of violation
- Vehicle information
- Location of violation (address, county, township, municipality, lot, concession)
- Particulars of violation, other relevant information

The TIPS-MNR reporting line is not an emergency response telephone number. If you are calling to report public safety matters please call 911 or the police. Please Note: This is not an information line. For general inquiries please call 1-800 667-1940.

Information for section 10.2 is from http://www.mnr.gov.on.ca/en/Business/Enforcement/2ColumnSubPage/STEL02_163377.html accessed on April 1, 2011.

9.0 RECOMMENDATIONS

Section	Results	Recommendations
2.0 Spawning Survey	During 2012, spawning surveys targeting migratory adult Rainbow Trout and White Sucker were conducted on various CLOCA watersheds: 1. Bennett Creek 2. Bowmanville Creek 3. Corbett Creek 4. Darlington Creek 5. Farewell Creek 6. Harmony Creek 7. Lynde Creek 8. Oshawa Creek 9. Pringle Creek 10. Soper Creek 11. Warbler Creek 12. Westside Creek Fishes were observed within Bowmanville, Farewell, Harmony, Lynde, Oshawa, Pringle, Soper Creeks and Westside Marsh.	Overall stream monitoring efforts during the 2013 season will be focused in the Black/Harmony/Farewell Watershed. Spawning Surveys should also continue on the Small Watersheds to determine accurate uses by different species. It is recommended that spawning surveys continue as this information is complimentary to standard fish community surveys. Completing spawning surveys during the fall is recommended in order to compare the following summer's catch of young-of-year Chinook Salmon.

Section	Results	Recommendations
3.0 Biological Water Quality	During May 2012, CLOCA staff sampled 19 OBBN sites throughout 6 watersheds (Figure 5). One of the sites sampled was a reference site and the remaining 18 sites were test sites, generally at new locations. This was the eighth season that CLOCA has sampled benthos using the OBBN protocol.	Overall stream monitoring efforts during the 2013 season will be focused in the Black/Harmony/Farewell watershed. In order to compliment this, it is recommended that the OBBN test site locations be selected with regard to OSAP site locations.
4.0 Stream Temperature	In total, 74 portable temperature loggers (Figure 6) were installed throughout the CLOCA jurisdiction in 2012 largely in the Oshawa Watershed (Figure 7).	Overall stream monitoring efforts during the 2013 season will be focused in the Black/Harmony/Farewell Watershed. In order to complement this, it is recommended that the majority of stream temperature loggers that are not dedicated to long-term sites be installed at or near OSAP site locations.
	Data indicates that coolwater and coldwater habitat dominates the areas surveyed with few warmwater sites recorded during 2012. The Oshawa Creeks have maintained thermal stability in most areas within the headwaters but are at coolwater and close to warmwater in some areas near urban development.	Continue to monitor and report on the thermal regimes within these sites over the long-term following the CLOCA Aquatic Monitoring Schedule.
	Fisheries staff coordinated logger sites with engineering staff as their respective programs complement each other i.e., thermal impacts of stormwater ponds on fish and fish habitat.	It is recommended that fisheries staff continue to coordinate logger sites with engineering staff.
	No new temperature loggers were acquired in 2012.	It is recommended that additional temperature loggers be acquired as needed to replenish aging stock.
	As recommended in the 2008 Aquatic Resource Monitoring Report temperature loggers continued to collect minimum temperature data in order to validate groundwater modeling.	It is recommended that temperature loggers continue to collect minimum temperature data in order to validate groundwater modeling.

Section	Results	Recommendations
5.0 Fisheries - Streams	During 2012, 62 OSAP sites were sampled by CLOCA as part of the annual aquatic monitoring program and another five were sampled through the OSAP Training Course in the Oshawa Creek watershed. Fish species that were captured are listed in Table 13, Table 14, Table 15, Table 16, Table 17, Table 18, and Table 19.	Overall stream monitoring efforts during the 2013 season will be focused in the Black/Harmony/Farewell watershed. It is recommended that a selection of historical CLOCA fisheries sites and new sites be sampled consistent with the goals and objectives of the FMP.
	The results of the 2012 CLOCA Aquatic Monitoring are consistent with the goals and objectives of the FMP. The main branches of Oshawa Creeks are still dominated by migratory Salmonids and should remain managed as such. Upstream of impassable barriers to fish migration, streams remain dominated by resident coldwater fish communities including Brook Trout, Brown Trout and Sculpin species. These headwaters should continue to be managed for these sustainable and diverse fish communities.	It is recommended that the Aquatic Monitoring Program continue to acknowledge and support the goals and recommendations of the CLOCA FMP.

Section	Results	Recommendations
5.0 Fisheries – Streams con't	As with all CLOCA watersheds, aquatic invasive species are present within the Oshawa Creek Watershed. Round Goby (Figure 18) are present in the lower sections of Oshawa Creek as well as Lynde, Westside, Bowmanville, Soper, Pringle, Farewell, Gold Point Creeks, and Cranberry Marsh	It is recommended that fisheries monitoring be conducted annually in the lower section of the major watersheds to help detect change over the long-term e.g., invasion of Round Goby. Continued monitoring of other invasive species and range expansions is recommended for all of the watersheds.
	Electrofishing and seine netting were the main methods used for conducting fisheries assessments during 2012.	It is recommended that we continue to explore other methods of sampling, such as rapid dip netting and minnow traps, as a supplemental technique. Each method provides good species distribution data with minimal effort and is a useful technique to help fill in data gaps. It is recommended that the seine netting work started in 2012 continued as it provided useful information between OSAP and DRCWMP sites and provided good information on Round Goby populations and Chinook Salmon smolts.
	During the 2012 season, Gold Point, Robinson and Tooley Coastal Wetlands were sampled for the third time using the OSAP protocol.	It is recommended that these three sites continue to be monitored. Further data will help determine the importance of these systems to fish and how impacted they are.

<table>
<tr><th>Section</th><th>Results</th><th>Recommendations</th></tr>
<tr><td rowspan="3">6.0 Fisheries - Wetlands</td><td>In Durham, fisheries sampling was conducted within 13 coastal wetlands through the Durham Region Coastal Wetland Monitoring Project (DRCWMP) in 2012. See tables for more information (Table 22, Table 23, Table 24, Table 25, Table 26, Table 27, and Table 28)</td><td>Sampling through the DRCWMP in 2013 will include all wetlands in the project.</td></tr>
<tr><td>This past summer, fisheries sampling as part of the BQRAP began on August 14th and finished August 29th with five Quinte wetlands being sampled:

1. Dead Creek Marsh
2. Robinson Cove Marsh
3. Sawguin Creek Central Marsh
4. Big Island West Marsh
5. Airport Creek Marsh</td><td>Sampling in the Bay of Quinte area in 2013 through the DRCWMP will re-sample five different BQRAP wetlands.</td></tr>
<tr><td>As recommended in the 2008 Aquatic Resource Monitoring Report Round Goby locations (i.e., Frenchman's Bay Marsh and Port Newcastle Marsh) were monitored to track changing population trends.

Round Goby have been found in all wetlands except for the following: Oshawa Second Marsh, McLaughlin Bay, Westside Marsh, Corbett Creek Marsh, and Pumphouse Marsh.</td><td>It is recommended that currently known Round Goby locations continue to be monitored to track any changing population trends.</td></tr>
</table>

Section	Results	Recommendations
6.0 Fisheries – Wetlands con't	As recommended in the 2008 Aquatic Resource Monitoring Report the barrier beach at McLaughlin Bay Marsh was monitored for breakages to help better understand fish utilization of the marsh.	It is recommended that the barrier beach at McLaughlin Bay Marsh continue to be monitored for breakages to help better understand fish utilization of the marsh.
	As recommended in the 2008 Aquatic Resource Monitoring Report the currently known Goldfish locations (i.e., Rouge River Marsh, Corbett Creek Marsh, Pumphouse Marsh and Oshawa Second Marsh) were monitored to track any changing population trends. Populations in Oshawa Second Marsh appear to be rising continuously. Lynde Creek Marsh, Oshawa Creek Coastal Wetland and Duffins Creek all recorded Goldfish for the first time during 2012 sampling.	It is recommended that currently known Goldfish locations (i.e. Oshawa Second Marsh) continue to be monitored to track any changing population trends. Public education regarding the harmful effects of releasing non-native species into waterways should continue through the DRCWMP, proper signage and public outreach events in which CLOCA is involved.
	Results from MOE contaminant sampling showed elevated levels of PCB in Common Carp within Lynde Creek Marsh.	It is recommended that more sampling and analysis occur at Lynde Creek Marsh. Common Carp should again be analyzed to determine if they are continually high in contaminates and fish with a smaller range should also be analyzed to try and determine if the PCBs are being picked up from Lynde Creek Marsh or a neighbouring wetland and/or Lake Ontario.
	Sampling conducted by the Ministry of Natural Resources found a population of Eastern Pondmussel (SAR) within Lynde Creek Marsh.	It is recommended that CLOCA encourage continued sampling of Eastern Pondmussel in Lynde Creek Marsh and the other wetlands within DRCWMP. CLOCA should also consider Eastern Pondmussel when reviewing planning applications and managing the Conservation Area as directed by MNR.

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11.0 Appendix I – Spawning Surveys

Table 10: Summary of 2012 Spring Spawning Survey observations.

Site	Number of Times Surveyed	Type of Survey	Observed			
			Rainbow Trout	White Sucker	Redd	Spawning
SSBT01	1	Roadside				
SSBOW01	1	Creek walk	x	x	x	
SSBOW02	1	Roadside	x		x	
SSCOR06	1	Roadside				
SSDAR01	1	Roadside				
SSDAR02	1	Roadside				
SSDAR03	1	Roadside				
SSDAR04	1	Roadside				
SSDAR05	1	Roadside				
SSFAR06	1	Roadside	x			
SSHAR01	1	Roadside				
SSHAR06	1	Creek walk	x			
SSLYN06	1	Creek walk	x	x		
SSLYN36	1	Creek walk	X	x		
SSOSH01	1	Creek walk				
SSOSH02	1	Creek walk	X	x		x
SSOSH03	1	Roadside				
SSOSH04	1	Roadside	x			
SSOSH06	1	Creek walk	x			
SSOSH07	1	Creek walk	X	x		
SSOSH09	1	Creek walk	X			
SSOSH10	1	Roadside				
SSOSH11	1	Roadside				
SSOSH12	1	Creek walk				
SSOSH13	1	Bridge stop				
SSOSH14	1	Creek walk	x			
SSOSH15	2	Roadside				
SSOSH16	1	Roadside				
SSOSH17	1	Creek walk	X	X	x	
SSOSH18	2	Roadside	x			
SSOSH19	2	Roadside				
SSOSH20	2	Roadside				
SSOSH21	2	Roadside				
SSOSH22	2	Roadside				
SSOSH23	2	Roadside	x			
SSOSH24	2	Roadside				
SSOSH25	1	Roadside	x			
SSOSH26	2	Roadside				

SSOSH27	2	Roadside	x			
SSOSH28	2	Roadside				
Site	**Number of Times Surveyed**	**Type of Survey**	**Observed**			
			Rainbow Trout	**White Sucker**	**Redd**	**Spawning**
SSOSH29	2	Roadside				
SSOSH30	2	Roadside	x			
SSOSH31	2	Roadside				
SSOSH32	2	Roadside				
SSOSH33	2	Roadside				
SSOSH34	2	Roadside		x		
SSPRI04	2	Creek walk	x			
SSPRI08	1	Creek walk				
SSPRI09	1	Creek walk				
SSPRI10	1	Roadside				
SSPRI11	1	Roadside				
SSPRI15	1	Creek walk				
SSPRI16	1	Creek walk				
SSSOP02	1	Creek walk	x			
SSSOP04	1	Roadside				
SSSOP16	1	Roadside	x			
SSSOP17	1	Creek walk	x			
SSSOP18	1	Creek walk	x			
SSWAR01	1	Creek walk				
SSWES02	1	Roadside	x			

Roadside survey is observations made at the intersection of the road and Creek Walk has a start point and an end point over a larger area

12.0 Appendix II – Biological Water Quality

Table 11: Percent EPT and Family Richness for OBBN sites sampled in 2012 including their historical results if applicable.

	Side Code	Date	Methodology	%EPT	Family Richness
1	BOWOB03	05/27/05	Combined	24.0	9
		05/30/06	Riffle 1	27.2	7
			Riffle 2	62.8	10
			Pool 1	42.3	10
		08/05/07	Riffle 1	59.6	11
			Riffle 2	48.7	7
			Pool 1	14.3	8
		05/30/08	Riffle 1	40.4	10
			Riffle 2	46.5	7
			Pool 1	2.9	8
		05/19/10	Riffle 1	61.8	9
			Riffle 2	49.5	9
			Pool 1	11.3	12
		05/11/11	Riffle 1	14.7	8
			Riffle 2	5.9	8
			Pool 1	6.0	9
		05/17/12	Pool 1	5.9	11
			Riffle 1	35.1	10
			Riffle 2	17.6	11
2	OAOB01	05/22/12	Pool 1	0.0	3
			Riffle 1	17.4	6
			Riffle 2	3.8	7
3	OAOB02	05/29/12	Pool 1	0.0	6
			Riffle 1	6.0	10
			Riffle 2	2.0	9
4	OAOB04	05/15/12	Pool 1	1.0	9
			Riffle 1	32.7	10
			Riffle 2	5.8	8
5	OAOB05	05/15/12	Pool 1	0.0	5
			Riffle 1	5.0	5
			Riffle 2	3.0	9

	Side Code	Date	Methodology	%EPT	Family Richness
6	GNOB02	05/29/12	Pool 1	0.0	7
			Riffle 1	0.9	11
			Riffle 2	1.1	9
7	MYOB01	05/16/12	Pool 1	0.0	3
			Riffle 1	0.0	1
			Riffle 2	0.0	2
8	ROGERS1	05/30/12	Transect 1	2.6	5
			Transect 2	0.0	2
9	ROGERS2	05/30/12	Transect 1	5.9	6
			Transect 2	34.6	5
10	ROGERS3	05/30/12	Transect 1	0.0	1
11	2HC6419	05/24/12	Pool 1	0.0	5
			Riffle 1	46.7	7
			Riffle 2	45.5	8
12	2HC7131	05/22/12	Pool 1	2.2	13
			Riffle 1	0.0	5
			Riffle2	0.0	3
13	2HD5820	05/17/12	Pool 1	0.0	6
			Riffle 1	0.0	6
			Riffle 2	1.0	8
14	2HD6124	05/24/12	Pool 1	0.0	6
			Riffle 1	82.0	8
			Riffle 2	29.7	8
15	2HD6408	05/24/12	Pool 1	0.0	6
			Riffle 1	1.0	6
			Riffle 2	0.0	7
16	2HD6575	05/17/12	Pool 1	6.8	8
			Riffle 1	5.2	8
			Riffle 2	4.9	9

	Side Code	Date	Methodology	%EPT	Family Richness
17	2HD7097	05/22/12	Pool 1	0.0	7
			Riffle 1	0.0	9
			Riffle 2	0.0	3
18	2HD7105	05/24/11	Pool 1	6.9	9
			Riffle 1	0.0	7
			Riffle 2	8.9	11
19	2HD7173	05/23/12	Pool 1	34.6	8
			Riffle 1	22.3	9
			Riffle 2	68.3	9

13.0 Appendix III – Stream Temperature

Table 12: Summary of temperature logger data collected from CLOCA jurisdiction during 2012 with comparison to 2005-2011 data when available.

Site Code	Year	Logger Serial No.	Period of Record	Percent of period within thermal regime			Max. (°C)	Min. (°C)	Percent of Period Above Upper Lethal				Percent of time exceeding (for summer period)		temp increase rate		Classification
				Cold	Cool	Warm		Entire Data Set	Chinook Salmon (> 24.1 °C)	Brown/Brook Trout (> 24.9 °C)	Rainbow Trout (> 25.2 °C)	Atlantic Salmon (> 26.1 °C)	5%	25%	Max - C/hour	Ave.	
TLBOW04	2006	842238	July 1, 2006 to August 31, 2006	33.0	58.6	8.4	29.3	0.8	13.1	9.0	7.8	4.7	26.0	22.5			Warmwater
	2010	2312941	July 1, 2010 to August 31, 2010	31.3	60.0	8.6	29.6	0.0	12.8	9.0	7.8	3.9	25.8	22.6			Coolwater
	2011	2373165	July 1, 2011 to August 31, 2011	36.8	55.6	7.6	29.7	0.0	12.0	8.1	7.0	3.6	25.7	22.4			Coolwater
	2012	1135916	July 1, 2012 to August 31, 2012	32.0	59.0	9.0	28.9	0.0	18.0	9.4	9.0	0.8	25.9	22.6	1.65	0.715	Coolwater
TLCE01	2005	842239	June 24, 2005 to August 31, 2005	6.0	80.8	13.2	34.5	0.0	20.1	13.8	11.9	5.7	26.3	23.7			**Warmwater**
	2006	905535	July 1, 2006 to August 31, 2006	18.1	81.9	0.0	24.6	1.1	0.6	0.0	0.0	0.0	23.4	22.0			Coolwater
	2009	2312947	July 4, 2009 to August 31, 2009	53.2	46.8	0.0	23.7	0.0	0.0	0.0	0.0	0.0	22.3	20.3			Coolwater
	2010	2312949	July 1, 2010 to August 31, 2010	17.5	81.6	1.0	26.3	--	3.7	1.2	0.8	0.1	23.9	22.2			Coolwater
	2011	1135917	July 1, 2011 to August 31, 2011	67.8	32.2	0.0	22.1	1.5	0.0	0.0	0.0	0.0	20.8	19.4			Coolwater
	2012	2013240	July 1, 2012 to August 31, 2012	88.0	12.0	0.0	22.1	0.6	0.0	0.0	0.0	0.0	19.5	18.1	2.07	0.170	**Coldwater**
TLCW01	2005	787473	June 23, 2005 to August 31, 2005	15.4	70.9	13.8	29.7	0.2	20.8	14.5	12.7	8.6	26.8	23.6			**Warmwater**
	2006	877053	July 1, 2006 to August 31, 2006	14.7	76.4	8.9	28.9	0.4	16.4	9.4	7.7	3.6	25.8	23.4			Coolwater
	2009	2312946	July 4, 2009 to August 31. 2009	41.4	58.6	0.0	24.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0			Coolwater
	2010	2312943	July 1, 2010 to August 31, 2010	14.9	75.3	9.8	29.4	0.0	16.2	10.3	8.6	4.9	26.1	23.3			**Warmwater**
	2011	2373156	July 1, 2011 to August 31, 2011	20.1	66.6	13.3	31.8	0.0	17.8	13.6	12.3	9.0	27.6	23.1			**Warmwater**[10]
	2012	2373170	July 1, 2012 to August 31, 2012	17.0	73.0	10.0	28.9	0.0	19.3	10.2	9.8	0.0	26.2	22.8	2.09	0.650	**Warmwater**
TLDN01	2005	842237	July 1, 2005 to August 31, 2005	50.7	49.2	0.1	27.4	0.0	0.2	0.1	0.1	0.1	22.0	20.2			Coolwater[3]
	2006	842237	July 1, 2006 to August 31, 2006	57.3	37.5	5.2	30.1	0.0	6.8	5.4	5.0	3.7	25.2	20.3			Coolwater[3]
	2009	2312951	July 3, 2009 to August 31, 2009	57.9	42.1	0.0	22.7	0.2	0.0	0.0	0.0	0.0	21.6	19.9			Coolwater
	2011	1134276	July 1, 2011 to August 31, 2011	20.8	74.1	5.1	28.4	0.0	10.1	5.6	4.4	1.7	25.1	22.5			Coolwater[5]
	2012	2312945	July 1, 2012 to August 31, 2012	25.0	75.0	0.0	26.6	0.7	2.2	0.0	0.0	0.0	23.0	21.3	0.98	0.383	Coolwater
TLDN02	2005	842236	July 1, 2005 to Aug 31, 2005	22.0	68.8	9.2	28.0	0.0	14.2	9.8	8.0	3.2	25.7	22.8			Coolwater
	2006	842236	July 1, 2006 to Aug 31, 2006	38.3	56.2	5.5	28.5	0.3	9.3	5.8	4.7	3.0	25.1	21.9			Coolwater
	2009	2312946	July 2, 2009 to August 31, 2009	57.9	42.1	0.0	22.7	0.2	0.0	0.0	0.0	0.0	21.6	19.9			Coolwater
	2010	2000191	July 1, 2010 to August 31, 2010	25.0	75.0	0.0	24.9	0.0	0.6	0.0	0.0	0.0	23.2	21.4			Coolwater
	2011	2373164	July 1, 2011 to August 31, 2011	26.5	69.1	4.4	27.4	0.5	9.0	4.8	3.6	1.5	24.9	22.3			Coolwater
	2012	2000191	July 1, 2012 to August 31, 2012	23.0	77.0	0.0	24.9	0.8	4.3	0.0	0.0	0.0	23.4	21.6	1.46	0.331	Coolwater
TLFA01	2008	1134281	June 1, 2008 to August 31, 2008	53.6	46.3	0.0	25.2	0.0	0.6	0.1	0.0	0.0	22.2	20.0			Coolwater
	2009	1135910	July 1, 2009 to August 31, 2009	56.7	43.1	0.1	25.3	0.0	0.7	0.1	0.0	0.0	22.6	20.1			Coolwater
	2010	2312942	July 1, 2010 to August 31, 2010	18.5	79.6	1.9	27.1	0.2	6.0	2.2	1.5	0.4	24.3	22.3			Coolwater
	2011	2373167	July 1, 2011 to August 31, 2011	20.3	75.4	4.3	27.7	0.0	8.2	4.5	3.9	1.6	24.8	22.4			Coolwater
	2012	2373358	July 1, 2012 to August 31, 2012	16.0	81.0	4.0	27.0	0.0	13.6	3.7	3.7	0.0	24.7	22.5	1.17	0.452	Coolwater
TLFA02	2008	1134288	June 1, 2008 to August 31, 2008	58.0	42.0	0.0	25.1	0.0	0.3	0.0	0.0	0.0	22.0	19.8			Coolwater
	2009	1135912	July 1, 2009 to August 31, 2009	66.1	33.9	0.0	24.3	0.0	0.2	0.0	0.0	0.0	21.8	19.6			Coolwater
	2010	2001402	July 1, 2010 to August 31, 2010	24.6	74.6	0.8	26.2	1.3	2.8	0.9	0.6	0.1	23.7	21.6			Coolwater
	2011	2373163	July 1, 2011 to August 31, 2011	28.6	69.3	2.2	27.0	0.0	4.4	2.4	1.8	0.7	24.0	21.6			Coolwater
	2012	2000174	July 1, 2012 to August 31, 2012	20.0	80.0	0.0	25.7	0.0	6.6	0.9	0.8	0.0	23.7	21.8	0.98	0.347	Coolwater

Site Code	Year	Logger Serial No.	Period of Record	Percent of period within thermal regime			Max. (°C)	Min. (°C)	Percent of Period Above Upper Lethal				Percent of time exceeding (for summer period)		temp increase rate		Classification
				Cold	Cool	Warm		Entire Data Set	Chinook Salmon (> 24.1°C)	Brown/Brook Trout (> 24.9°C)	Rainbow Trout (> 25.2°C)	Atlantic Salmon (> 26.1°C)	5%	25%	Max - C/hour	Ave.	
TLGN01	2007	842237	July 1, 2007 to August 31, 2007	40.0	60.0	0.0	25.4	0.0	1.4	0.1	0.1	0.0	22.6	20.7	2.82	0.357	Coolwater
TLGN01	2012	2312948	July 1, 2012 to August 31, 2012	7.0	90.0	3.0	27.5	0.0	14.1	3.1	2.8	0.0	24.5	22.8	1.60	0.374	Coolwater
TLGN02	2007	905538	July 1, 2007 to August 31, 2007	82.0	18.0	0.0	24.3	0.0	0.1	0.0	0.0	0.0	20.6	18.5	4.55	0.500	Coolwater
TLGN02	2012	2000176	July 1, 2012 to August 31, 2012	66.0	34.0	0	25.2	0.0	0.2	0.0	0.0	0.0	21.4	19.4	3.72	0.402	Coolwater
TLGN03	2007	877053	July 1, 2007 to August 31, 2007	63.0	37.0	0.0	24.3	0.0	0.1	0.0	0.0	0.0	21.2	19.5	3.9	0.217	Coolwater
TLGN03	2012	1134291	July 1, 2012 to August 31, 2012	41.0	59.0	0.0	23.2	0.0	0.0	0.0	0.0	0.0	21.3	20.1	0.93	0.138	Coolwater
TLGNO4	2007	905536	July 1, 2007 to August 31, 2007	31.0	68.0	1.0	25.7	0.6	5.3	1.2	1.1	0.0	23.6	21.4	1.85	0.423	Coolwater
TLGNO4	2012	2373156	July 1, 2012 to August 31, 2012	0.0	68.0	32.0	30.0	0.0	--	33.5	32.0	3.5	27.3	25.6	1.57	0.203	Warmwater
TLHA01	2008	1134275	June 1, 2008 to August 31, 2008	46.0	53.8	0.2	25.7	0.0	0.6	0.3	0.0	0.0	22.1	20.3			Coolwater
TLHA01	2009	1135918	June 25, 2009 to August 31, 2009	46.5	53.3	0.2	25.4	0.0	0.9	0.2	0.1	0.0	23.0	20.5			Coolwater
TLHA01	2010	2001401	July 1, 2010 to August 31, 2010	9.2	89.5	1.2	26.5	0.6	4.6	1.3	0.9	0.2	24.1	22.9			Coolwater
TLHA01	2011	2312949	July 1, 2011 to August 31, 2011	13.1	81.1	5.7	27.8	0.0	10.6	6.1	5.0	2.6	25.2	22.6			Coolwater
TLHA01	2012	2373352	July 1, 2012 to August 31, 2012	10.0	86.0	5.0	27.2	0.0	16.7	5.2	4.6	0.0	24.9	22.9	1.33	0.440	Coolwater
TLLY50	2009	1135920	July 1, 2009 to August 31, 2009	44.4	54.7	1.0	26.6	0.3	2.1	1.1	0.6	0.0	23.2	20.9			Coolwater
TLLY50	2010	2000185	July 1, 2010 to August 31, 2010	No Data – Logger Missing													
TLLY50	2011	2000174	July 1, 2011 to August 31, 2011	11.7	81.4	6.9	30.1	0.0	13.1	7.4	5.9	3.2	25.4	23.0			Coolwater
TLLY50	2012	2312949	July 1, 2012 to August 31, 2012	7.0	90.0	3.0	27.5	0.0	14.1	3.1	2.8	0.0	24.5	22.8	1.60	0.374	Coolwater
TLMY01	2007	818793	July 1, 2007 to August 31, 2007	39.0	53.0	8.0	29.7	0.0	15.2	8.2	7.7	1.3	25.9	22.2	3.65	0.98	Coolwater
TLMY01	2012	1134274	July 1, 2012 to August 31, 2012	26.0	69.0	5.0	28.4	0.0	11.3	5.3	4.8	0.2	25.0	21.9	2.76	0.836	Coolwater
TLMY02	2007	877051	July 1, 2007 to August 31, 2007	98.0	2.0	0.0	23.7	2.6	0.0	0.0	0.0	0.0	17.5	15.9	7.58	0.278	**Coldwater**
TLMY02	2012	2373350	July 1, 2012 to August 31, 2012	93.0	7.0	0.0	26.5	1.3	0.2	0.1	0.1	0.0	19.3	17.6	6.74	0.403	**Coldwater**
TLNON01	2012	1135913	July 1, 2012 to August 31, 2012	13.0	77.0	10.0	29.0	0.2	23.0	10.6	10.0	1.6	26.2	23.4	4.27	0.430	Warmwater
TLNON02	2012	1134295	July 1, 2012 to August 31, 2012	27.0	72.0	1.0	26.0	0.0	7.6	1.6	1.4	0.0	24.0	21.8	1.45	0.331	Coolwater
TLNON03	2012	1134288	July 1, 2012 to August 31, 2012	2.0	93.0	5.0	26.3	0.3	31.9	5.6	4.8	0.0	25.0	23.8	1.24	0.277	Coolwater
TLNON04	2012	1134278	July 1, 2012 to August 31, 2012	37.0	63.0	0.0	23.8	0.2	0.2	0.0	0.0	0.0	22.1	20.6	0.97	0.301	Coolwater
TLOA01	2007	842236	July 1, 2007 to August 31, 2007	66.0	34.0	0.0	24.1	0.0	0.3	0.0	0.0	0.0	21.6	19.5	1.05	0.372	Coolwater
TLOA01	2012	1135849	July 1, 2012 to August 31, 2012	54.0	46.0	0.0	24.0	0.0	1.0	0.0	0.0	0.0	22.5	20.3	1.07	0.392	Coolwater
TLOA02	2007	905539	July 1, 2007 to August 31, 2007	84.0	16.0	0.0	23.2	0.7	0.0	0.0	0.0	0.0	20.6	18.3	1.35	0.455	Coolwater
TLOA02	2012	2000184	July 1, 2012 to August 31, 2012	90.0	10.0	0.0	20.5	0.4	0.0	0.0	0.0	0.0	19.4	18.2	0.50	0.190	**Coldwater**
TLOA03	2007	905537	July 1, 2007 to August 31, 2007	55.0	46.0	0.0	25.6	0.0	2.6	0.4	0.4	0.0	22.8	20.3	2.69	0.515	Coolwater
TLOA03	2012	20014701	July 1, 2012 to August 31, 2012	39.0	60.0	1.0	25.6	0.0	4.3	0.8	0.6	0.0	23.3	20.9	1.24	0.476	Coolwater
TLOA04	2007	787475	July 1, 2007 to August 31, 2007	29.0	66.9	4.1	28.1	0.0	8.1	4.3	3.5	1.5	24.8	22.1			Coolwater
TLOA04	2010	1135920	July 1, 2010 to August 31, 2010	15.3	76.1	8.5	29.2	0.2	15.0	9.1	7.5	3.4	25.7	23.2			Coolwater
TLOA04	2011	1134279	July 1, 2011 to August 31, 2011	17.6	75.6	6.8	28.1	0.0	12.8	7.2	6.0	3.5	25.5	22.9			Coolwater
TLOA04	2012	1135918	July 1, 2012 to August 31, 2012	13.0	79.0	8.0	27.7	0.0	21.5	8.9	8.3	0.0	25.7	23.2	1.30	0.529	Coolwater
TLOA05	2007	877052	July 1, 2007 to August 31, 2007	38.0	59.0	3.0	27.0	0.0	9.3	2.9	2.6	0.0	24.3	21.6	2.78	0.582	Coolwater
TLOA05	2012	2373165	July 1, 2012 to August 31, 2012	17.0	83.0	0.0	24.9	0.1	3.8	0.0	0.0	0.0	23.3	21.6	0.69	0.280	Coolwater
TLOA06	2007	842229	July 1, 2007 to August 31, 2007	52.0	48.0	0.0	26.4	0.0	1.4	0.1	0.1	0.0	22.4	20.3	1.74	0.435	Coolwater
TLOA06	2012	2373172	July 1, 2012 to August 31, 2012	40.0	60.0	0.0	25.5	0.4	5.6	0.3	0.3	0.0	23.7	21.3	1.58	0.383	Coolwater
TLOA07	2007	842238	July 1, 2007 to August 31, 2007	54.0	46.0	0.0	22.9	0.0	0.0	0.0	0.0	0.0	21.3	19.8	1.36	0.147	Coolwater
TLOA07	2012	2373167	July 1, 2012 to August 31, 2012	39.0	61.0	0.0	22.1	0.1	0.0	0.0	0.0	0.0	21.5	20.3	0.72	0.097	Coolwater

Site Code	Year	Logger Serial No.	Period of Record	Percent of period within thermal regime			Max. (°C)	Min. (°C)	Percent of Period Above Upper Lethal				Percent of time exceeding (for summer period)		temp increase rate		Classification
				Cold	Cool	Warm		Entire Data Set	Chinook Salmon (> 24.1°C)	Brown/Brook Trout (> 24.9°C)	Rainbow Trout (> 25.2°C)	Atlantic Salmon (> 26.1°C)	5%	25%	Max - C/hour	Ave.	
TLOA08	2007	842239	July 1, 2007 to August 31, 2007	60.0	40.0	0.0	24.7	0.0	0.0	0.0	0.0	0.0	20.6	19.5	1.29	0.196	Coolwater
	2012	2373163	July 1, 2012 to August 31, 2012	Logger not yet retrieved													
TLOA09	2007	905540	July 1, 2007 to August 31, 2007	89.0	11.0	0.0	23.9	0.0	0.3	0.0	0.0	0.0	20.5	17.1	5.92	0.126	Coolwater
	2012	1134292	July 1, 2012 to August 31, 2012	82.0	18.0	0.0	22.7	0.5	0.0	0.0	0.0	0.0	20.4	18.5	2.40	0.087	Coolwater
TLOA10	2007	787473	July 1, 2007 to August 31, 2007	78.0	22.0	0.0	23.4	1.1	0.0	0.0	0.0	0.0	20.1	18.9	1.12	0.232	Coolwater
	2012	1134294	July 1, 2012 to August 31, 2012	66.0	34.0	0.0	21.6	1.3	0.0	0.0	0.0	0.0	20.2	19.4	0.59	0.149	Coolwater
TLOA11	2007	877050	July 1, 2007 to August 31, 2007	46.0	53.0	2.0	26.6	0.0	6.2	1.8	1.6	0.0	23.8	21.1	1.59	0.572	Coolwater
	2012	2373182	July 1, 2012 to August 31, 2012	31.0	66.0	3.0	26.7	0.0	10.3	3.4	3.1	0.0	24.5	21.8	1.67	0.582	Coolwater
TLOA12	2007	1019280	July 1, 2007 to August 31, 2007	43.0	55.0	2.0	27.0	0.0	7.8	2.3	2.3	0.0	24.2	21.3	2.26	0.608	Coolwater
	2012	1135917	July 1, 2012 to August 31, 2012	25.0	70.0	5.0	27.2	0.0	12.7	5.2	4.9	0.0	25.0	22.1	1.51	0.561	Coolwater
TLOA13	2007	1019281	July 1, 2007 to August 31, 2007	37.0	61.0	2.0	26.7	0.0	7.6	2.2	1.9	0.0	24.0	21.6	1.99	0.517	Coolwater
	2012	2312947	July 1, 2012 to August 31, 2012	20.0	75.0	5.0	27.3	0.0	15.7	5.9	5.4	0.0	25.1	22.6	1.45	0.523	Coolwater
TLOA14	2007	1019261	July 1, 2007 to August 31, 2007	33.0	63.0	4.0	28.0	0.0	11.1	4.0	3.7	0.1	24.6	22.0	1.50	0.589	Coolwater
	2012	2373351	July 1, 2012 to August 31, 2012	16.0	77.0	7.0	27.5	0.0	18.5	7.6	7.1	0.0	25.4	22.9	1.43	0.574	Coolwater
TLOA15	2007	818797	July 1, 2007 to August 31, 2007	95.0	5.0	0.0	22.9	1.0	0.0	0.0	0.0	0.0	18.9	16.3	4.07	0.582	**Coldwater**
	2012	2312942	July 1, 2012 to August 31, 2012	97.0	3.0	0.0	23.3	0.0	0.0	0.0	0.0	0.0	18.6	16.8	4.50	0.374	**Coldwater**
TLOA16	2007	1134277	July 1, 2007 to August 31, 2007	100.0	0.0	0.0	13.1	6.1	0.0	0.0	0.0	0.0	11.2	10.2	3.58	0.204	**Coldwater**
	2012	1019277	July 1, 2012 to August 31, 2012	Logger not yet retrieved													
TLOA17	2007	1134285	July 1, 2007 to August 31, 2007	100.0	0.0	0.0	19.4	0.8	0.0	0.0	0.0	0.0	17.4	15.4	1.60	0.423	**Coldwater**
	2012	2373171	July 1, 2012 to August 31, 2012	Logger not yet retrieved													
TLOA18	2007	1019277	July 1, 2007 to August 31, 2007	91.0	9.0	0.0	22.3	0.0	0.0	0.0	0.0	0.0	19.7	16.9	1.67	0.608	**Coldwater**
	2012	1135912	July 1, 2012 to August 31, 2012	Logger not yet retrieved													
TLOA19	2007	905535	July 1, 2007 to August 31, 2007	98.0	2.0	0.0	19.9	0.0	0.0	0.0	0.0	0.0	18.3	16.8	1.28	0.258	**Coldwater**
	2012	9774460	July 1, 2012 to August 31, 2012	95.0	5.0	0.0	20.4	0.0	0.0	0.0	0.0	0.0	19.0	17.6	0.69	0.234	**Coldwater**
TLOA20	2007	1020772	July 1, 2007 to August 31, 2007	82.0	18.0	0.0	23.7	0.5	0.0	0.0	0.0	0.0	20.8	18.6	2.19	0.417	Coolwater
	2012	1134281	July 1, 2012 to August 31, 2012	80.0	20.0	0.0	22.7	0.0	0.0	0.0	0.0	0.0	20.6	18.6	1.19	0.342	**Coldwater**
TLOA21	2007	1134276	July 1, 2007 to August 31, 2007	100.0	0.0	0.0	17.5	0.6	0.0	0.0	0.0	0.0	15.8	14.5	1.89	0.227	**Coldwater**
	2012	2013208	July 1, 2012 to August 31, 2012	96.0	4.0	0.0	20.8	0.0	0.0	0.0	0.0	0.0	18.9	17.2	1.17	0.329	**Coldwater**
TLOA22	2007	1134286	July 1, 2007 to August 31, 2007	99.0	1.0	0.0	21.9	0.5	0.0	0.0	0.0	0.0	18.2	15.0	1.21	0.184	**Coldwater**
	2012	1134276	July 1, 2012 to August 31, 2012	80.0	20.0	0.0	21.3	0.0	0.0	0.0	0.0	0.0	20.1	18.8	0.62	0.185	Coolwater
TLOA23	2007	1134291	July 1, 2007 to August 31, 2007	95.0	5.0	0.0	23.7	1.6	0.0	0.0	0.0	0.0	18.4	15.0	3.55	0.235	**Coldwater**
	2012	2013209	July 1, 2012 to August 31, 2012	Logger not yet retrieved													
TLOA24	2007	1134273	July 1, 2007 to August 31, 2007	62.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0	0.0	--	--	--	--	**Coldwater**
	2012	1135847	July 1, 2012 to August 31, 2012	98.0	2.0	0.0	19.8	0.0	0.0	0.0	0.0	0.0	18.4	17.1	0.69	0.233	**Coldwater**
TLOA25	2007	1134284	July 1, 2007 to August 31, 2007	97.0	3.0	0.0	20.2	0.1	0.0	0.0	0.0	0.0	18.5	17.4	0.83	0.153	**Coldwater**
	2012	2001410	July 1, 2012 to August 31, 2012	68.0	32.0	0.0	22.8	0.0	0.0	0.0	0.0	0.0	21.2	19.4	1.69	0.323	Coolwater
TLOA26	2007	1134288	July 1, 2007 to August 31, 2007	31.0	67.0	2.0	29.0	0.0	9.7	2.4	2.2	0.2	24.3	22.1	1.81	0.447	Coolwater
	2012	2373162	July 1, 2012 to August 31, 2012	33.0	57.0	10.0	29.2	0.0	18.7	10.3	10.0	1.9	26.6	22.6	2.02	0.770	Warmwater
TLOA27	2007	1134282	July 1, 2007 to August 31, 2007	96.0	4.0	0.0	20.5	0.0	0.0	0.0	0.0	0.0	18.8	17.5	0.71	0.228	**Coldwater**
	2012	2001402	July 1, 2012 to August 31, 2012	89.0	11.0	0.0	21.0	0.0	0.0	0.0	0.0	0.0	19.5	18.1	0.64	0.236	**Coldwater**
TLOA28	2007	1134289	July 1, 2007 to August 31, 2007	60.0	40.0	0.0	24.6	0	0	0	0	0	22.0	19.9	1.14	0.397	Coolwater
	2012	2013204	July 1, 2012 to August 31, 2012	Logger not yet retrieved													

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				Cold	Cool	Warm		Entire Data Set	Chinook Salmon (> 24.1°C)	Brown/Brook Trout (> 24.9°C)	Rainbow Trout (> 25.2°C)	Atlantic Salmon (> 26.1°C)	5%	25%	Max - C/hour	Ave.	
TLOA29	2007	1134287	July 1, 2007 to August 31, 2007	46.0	52.0	2.0	28.2	0.0	5.6	1.9	1.7	0.0	23.7	21.1	1.30	0.478	Coolwater
	2012	1135848	July 1, 2012 to August 31, 2012	Logger not yet retrieved													
TLOA31	2007	1134295	July 1, 2007 to August 31, 2007	93.0	7.0	0.0	21.5	0.0	0.0	0.0	0.0	0.0	19.3	17.3	1.40	0.424	Coldwater
	2012	1135920	July 1, 2012 to August 31, 2012	92.0	8.0	0.0	21.3	0.0	0.0	0.0	0.0	0.0	19.3	17.6	1.17	0.401	Coldwater
TLOA32	2007	1134278	July 1, 2007 to August 31, 2007	98.0	2.0	0.0	20.4	0.1	0.0	0.0	0.0	0.0	18.2	16.8	1.74	0.267	Coldwater
	2012	2312944	July 1, 2012 to August 31, 2012	Logger not yet retrieved													
TLOA33	2007	1134271	July 1, 2007 to August 31, 2007	96.0	4.0	0.0	20.8	0.0	0.0	0.0	0.0	0.0	18.9	17.4	1.55	0.280	Coldwater
	2012	2373365	July 1, 2012 to August 31, 2012	100.0	0.0	0.0	18.6	0.0	0.0	0.0	0.0	0.0	17.1	15.8	0.65	0.207	Coldwater
TLOA34	2007	1134274	July 1, 2007 to August 31, 2007	78.0	22.0	0.0	24.7	0.2	0.0	0.0	0.0	0.0	20.6	18.9	3.36	0.33	Coolwater
	2012	1135919	July 1, 2012 to August 31, 2012	95.0	5.0	0.0	20.8	0.0	0.0	0.0	0.0	0.0	19.0	17.4	0.71	0.251	Coldwater
TLOA35	2007	787477	July 1, 2007 to August 31, 2007	27.0	68.0	5.0	28.1	0.0	13.4	4.9	4.8	0.2	24.9	22.3	1.28	0.456	Coolwater
	2012	2373161	July 1, 2012 to August 31, 2012	4.0	83.0	13.0	27.9	0.0	29.7	14.0	13.3	0.5	26.1	23.9	2.04	0.478	Warmwater
TLOA36	2012	1134286	July 1, 2012 to August 31, 2012	74.0	26.0	0.0	23.5	0.0	0.0	0.0	0.0	0.0	20.9	19.1	1.69	0.304	Coolwater
TLOA37	2012	2373164	July 1, 2012 to August 31, 2012	Logger not yet retrieved													
TLOA38	2012	2312943	July 1, 2012 to August 31, 2012	52.0	48.0	0.0	24.8	0.0	1.2	0.0	0.0	0.0	22.5	20.4	0.93	0.305	Coolwater
TLOA39	2012	1135922	July 1, 2012 to August 31, 2012	45.0	55.0	0.0	24.2	0.0	1.5	0.0	0.0	0.0	22.9	20.7	2.28	--	Coolwater
TLOA40	2012	2000177	July 1, 2012 to August 31, 2012	22.0	78.0	0.0	25.0	0.0	4.4	0.2	0.1	0.0	23.4	21.5	1.76	0.448	Coolwater
TLOA41	2012	2312950	July 1, 2012 to August 31, 2012	100.0	0.0	0.0	18.1	0.0	0.0	0.0	0.0	0.0	16.4	14.8	1.65	0.320	Coldwater
TLOA42	2012	1134279	July 1, 2012 to August 31, 2012	55.0	44.0	1.0	27.6	0.0	2.5	0.9	0.9	0.0	21.9	19.8	3.33	0.375	Coolwater
TLOA43	2012	1019281	July 1, 2012 to August 31, 2012	53.0	39.0	8.0	38.1	0.0	13.6	8.5	8.4	4.4	27.0	21.4	8.31	1.157	Warmwater
TLOA44	2012	1135911	July 1, 2012 to August 31, 2012	91.0	9.0	0.0	21.2	0.2	0.0	0.0	0.0	0.0	19.5	17.4	1.19	0.340	Coldwater
TLOSB01	2009	2312942	July 1, 2009 to August 31, 2009	96.1	3.9	0.0	20.3	0.0	0.0	0.0	0.0	0.0	18.8	17.6			Coldwater
	2010	1134281	July 8, 2010 to August 31, 2010	90.9	9.1	0.0	20.9	0.0	0.0	0.0	0.0	0.0	19.3**	18.3**			Coldwater
	2011	1134295	July 1, 2011 to August 31, 2011	90.3	9.7	0.0	20.9	0.0	0.0	0.0	0.0	0.0	19.4	18.3			Coldwater
	2012	2013207	July 1, 2012 to August 31, 2012	90.0	10.0	0.0	21.1	0.4	0.0	0.0	0.0	0.0	19.5	18.5	1.31	0.234	Coldwater
TLPR01	2005	842230		No Data – Logger Missing													
	2006	842229	May 24, 2006 to Jan 4, 2007	16.9	82.1	1.0	25.7	0.4	4.7	1.2	0.5	0.0	24.1	22.4			Coolwater
	2007	1134283	July 1, 2007 to August 31, 2007	23.2	70.9	5.9	28.5	0.0	9.8	6.3	5.1	2.3	25.3	22.6			Coolwater
	2008	877053	June 1, 2008 to August 31, 2008	38.0	62.0	0.1	25.1	0.0	0.5	0.1	0.0	0.0	22.8	20.9			Coolwater
	2009	1134294	July 1, 2009 to August 31, 2009	45.4	54.2	0.4	25.9	0.0	2.3	0.5	0.3	0.0	23.3	20.8			Coolwater
	2010	2373162	July 1, 2010 to August 31, 2010	14.0	84.2	1.7	26.4	--	7.5	2.3	1.2	0.2	24.4	22.5			Coolwater
	2011	2373162	July 1, 2011 to August 31, 2011	6.2	84.8	9.0	28.5	--	14.3	9.6	7.9	3.9	25.8	22.9			Coolwater
	2012	2373342	July 1, 2012 to August 31, 2012	8.0	83.0	9.0	27.9	--	22.7	9.3	8.8	0.4	25.6	23.4	1.24	0.429	Coolwater
TLPR05	2007	1134280	July 1, 2007 to August 31, 2007	45.4	52.1	2.6	27.0	0.0	5.2	2.7	2.2	0.8	24.2	21.2			Coolwater
	2008	2013209	June 26, 2008 to August 31, 2008	63.7	36.2	0.1	26.2	0.0	0.7	0.1	0.0	0.0	21.8	19.7			Coolwater
	2010	2000184	July 1, 2010 to August 31, 2010	42.3	57.7	0.0	25.0	0.0	1.2	0.1	0.0	0.0	23.2	21.0			Coolwater
	2011	2001401	July 1, 2011 to August 31, 2011	43.0	54.3	2.6	27.7	0.0	4.6	2.7	2.1	0.7	24.0	21.1			Coolwater
	2012	2373177	July 1, 2012 to August 31, 2012	30.0	66.0	4.0	27.7	0.0	11.9	4.5	4.1	0.1	24.8	21.8	2.52	0.582	Coolwater
TLPR11	2008	905540	July 1, 2008 to August 31, 2008	39.0	61.0	0.0	25.2	0.0	2.0	0.1	0.1	0.0	22.7	20.8	4.19	0.376	Coolwater
	2010	1135918	July 1, 2010 to August 31, 2010	15.0	83.0	2.0	26.1	--	11.6	1.7	1.3	0.0	24.3	22.4	2.89	0.448	Coolwater
	2012	1134283	July 1, 2012 to August 31, 2012	7.0	84.0	9.0	28.0	--	22.9	9.8	9.2	0.4	25.7	23.4	1.29	0.472	Coolwater

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				Cold	Cool	Warm		Entire Data Set	Chinook Salmon (> 24.1°C)	Brown/Brook Trout (> 24.9°C)	Rainbow Trout (> 25.2°C)	Atlantic Salmon (> 26.1°C)	5%	25%	Max - C/hour	Ave.	
TLPR12	2008	842229	July 1, 2008 to August 31, 2008	66.0	33.0	0.0	25.3	0.6	1.8	0.3	0.2	0.0	22.3	19.8	3.97	5.777	Coolwater
	2010	2000177	July 1, 2010 to August 31, 2010	53.0	46.0	1.0	25.9	--	4.5	0.6	0.5	0.0	23.3	20.7	6.67	0.613	Coolwater
	2012	2312951	July 1, 2012 to August 31, 2012	4.0	86.0	10.0	28.0	--	22.4	10.7	10.0	0.3	26.0	23.2	2.13	0.543	Warmwater
TLROB01	2005	818793	July 1, 2005 to August 31, 2005	9.3	71.7	19.0	32.3	0.7	30.0	19.9	17.3	10.8	27.4	24.4			Warmwater
	2006	818794	July 1, 2006 to August 31, 2006	9.1	75.6	15.3	29.0	1.8	25.3	16.1	13.8	7.7	26.6	24.2			Warmwater
	2010	1135848	July 1, 2010 to August 31, 2010	3.4	71.6	25.0	31.1	0.9	39.6	26.5	21.6	11.9	27.3	25.0			Warmwater
	2011	2373172	July 1, 2011 to August 31, 2011	5.4	76.1	18.4	36.8	0.1	28.1	19.3	17.0	11.1	28.6	24.4			Warmwater[9]
	2012	2373159	July 1, 2012 to August 31, 2012	7.0	86.0	7.0	27.9	0.0	24.3	7.9	7.1	0.0	25.4	23.5	1.23	0.333	Coolwater
TLROB02	2006	905538	July 1, 2009 to August 31, 2009	51.3	48.7	0.0	23.5	0.3	0.0	0.0	0.0	0.0	22.3	20.4			Coolwater
	2009	2312950	July 1, 2009 to August 31, 2009	65.2	34.8	0.0	23.8	0.0	0.0	0.0	0.0	0.0	21.8	19.6			Coolwater
	2010	2312945	July 1, 2010 to August 31, 2010	26.6	73.4	0.1	25.2	0.0	0.4	0.1	0.0	0.0	22.9	21.5			Coolwater
	2011	2312944	July 1, 2011 to August 31, 2011	34.5	65.5	0.0	23.8	0.0	0.0	0.0	0.0	0.0	22.3	20.8			Coolwater
	2012	2013228	July 1, 2012 to August 31, 2012	50.0	50.0	0.0	25.1	0.0	1.4	0.0	0.0	0.0	22.0	20.08	4.82	0.206	Coolwater
TLSOP03	2006	818793	May 25, 2006 to December 21, 2006	56.7	43.0	0.3	25.6	0.2	1.2	0.3	0.2	0.0	22.8	20.3			Coolwater
	2010	1135922	July 1, 2010 to August 31, 2010	45.2	54.6	0.2	25.3	0.0	1.2	0.2	0.1	0.0	22.8	20.7			Coolwater
	2011	2373161	July 1, 2011 to August 31, 2011	49.3	50.1	0.7	26.3	0.0	1.7	0.7	0.6	0.3	23.1	20.7			Coolwater
	2012	2373166	July 1, 2012 to August 31, 2012	46.0	52.0	1.0	25.7	0.0	3.5	0.4	0.4	0.0	23.2	20.91	1.29	0.432	Coolwater
TLSOP09	2005	739513	July 1, 2005 to August 31, 2005	100.0	0.0	0.0	17.5	--	0.0	0.0	0.0	0.0	13.7	12.6			Coldwater
	2006	739513	June 1, 2006 to November 13, 2006	100.0	0.0	0.0	16.0	--	0.0	0.0	0.0	0.0	14.1	12.9			Coldwater
	2007	739513	July 1, 2007 to August 31, 2007	100.0	0.0	0.0	15.6	--	0.0	0.0	0.0	0.0	13.3	12.2			Coldwater
	2008	739513	July 1, 2008 to August 31, 2008	100.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	13.7	12.6			Coldwater
	2009	739513	July 3, 2009 to August 31, 2009	100.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	13.3	12.2			Coldwater
	2010	739513	July 1, 2010 to August 31, 2010	100.0	0.0	0.0	16.4	--	0.0	0.0	0.0	0.0	13.7	12.6			Coldwater
	2011	739513	July 1, 2011 to August 31, 2011	100.0	0.0	0.0	17.9	0.0	0.0	0.0	0.0	0.0	13.3	12.6			Coldwater
	2012	739513	July 1, 2012 to August 31, 2012	100.0	0.0	0.0	17.1	0.0	0.0	0.0	0.0	0.0	13.7	12.6	1.53	0.301	Coldwater
TLSOP10	2005	739517	July 1, 2005 to August 31, 2005	100.0	0.0	0.0	17.9	--	0.0	0.0	0.0	0.0	13.2	11.8			Coldwater
	2006	739517	June 10, 2006 to November 22, 2006	100.0	0.0	0.0	16.8	--	0.0	0.0	0.0	0.0	14.1	12.6			Coldwater
	2007	739517	July 1, 2007 to August 31, 2007	100.0	0.0	0.0	16.0	--	0.0	0.0	0.0	0.0	12.6	11.4			Coldwater
	2008	739517	July 1, 2008 to August 31, 2008	100.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	13.7	12.6			Coldwater
	2009	739517	July 2, 2009 to August 31, 2009	100.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	13.7	12.6			Coldwater
	2010	739517	July 1, 2010 to August 31, 2010	100.0	0.0	0.0	16.8	--	0.0	0.0	0.0	0.0	13.3	12.2			Coldwater
	2011	739517	July 1, 2011 to August 31, 2011	100.0	0.0	0.0	17.9	0.0	0.0	0.0	0.0	0.0	14.9	13.3			Coldwater
	2012	739517	July 1, 2012 to August 31, 2012	100.0	0.0	0.0	17.5	1.2	0.0	0.0	0.0	0.0	13.3	12.2	2.30	0.291	Coldwater
TLTY01	2005	842238	June 29, 2005 to August 31, 2005	19.3	62.4	18.3	30.0	0.0	23.9	19.0	17.3	12.2	27.7	24.0			Warmwater
	2006	905536	July 1, 2006 to August 31, 2006	37.7	58.4	4.0	27.5	0.0	7.8	4.2	3.7	1.6	24.7	21.8			Coolwater
	2009	2312943	July 1, 2009 to August 31, 2009	58.9	38.3	2.8	28.4	0.0	4.6	3.0	2.6	1.3	24.0	20.5			Coolwater
	2010	1134295	July 1, 2010 to August 31, 2010	27.3	66.1	6.7	28.6	0.0	10.7	6.9	5.6	2.8	25.1**	22.3**			Coolwater
	2011	2373157	July 1, 2011 to August 31, 2011	31.6	58.8	9.6	29.4	0.0	14.3	9.9	8.9	5.9	26.5	22.6			Warmwater[13]
	2012	2000187	July 1, 2012 to August 31, 2012	21.0	71.0	8.0	28.2	0.0	18.3	8.3	7.8	0.3	25.6	22.7	1.87	0.623	Coolwater

Maximum temperature generally occurs during July or August but is reported from entire data set

Minimum temperature is reported from entire data set which generally also includes cold-weather conditions i.e., sampling period in December

** Exceedence based on August temperatures only

	Site Code	Year	Logger Serial No.	Period of Record	Percent of period within thermal regime			Max. (°C)	Min. (°C)	Percent of Period Above Upper Lethal				Percent of time exceeding (for summer period)		temp increase rate		Classification
					Cold	Cool	Warm		Entire Data Set	Chinook Salmon (> 24.1 °C)	Brown/Brook Trout (> 24.9 °C)	Rainbow Trout (> 25.2 °C)	Atlantic Salmon (> 26.1 °C)	5%	25%	Max - C/hour	Ave.	

°Maximum temperature occurred during June

- represents the number of days the logger recorded and out-of-water day (over ten degree Celsius change in temperature within one day) – likely mis-representing thermal regime as air temperature is being recorded

14.0 Appendix IV – Fisheries Sampling (Stream)

Table 13: Number of fish species and individuals caught at OSAP sites during 2012 sampling compared to historical sampling results (when available).

	BA01				H304		H307	MY02			MY03		NON01	NON02	NON03	OA01		OA02		OA03		OA04		OA06		OA07	
	1998	2006	2011	2012	2002	2012	2012	2000	2007	2012	2000	2012	2012	2012	2012	2000	2012	2000	2012	2000	2012	2000	2012	2000	2012	2000	2012
American Brook Lamprey																			1								
Blacknose Dace	26	24	16	8		7	2	1	2	4	8		30	3	73	105	17	2	8	53	5	13	4	38	3	4	
Bluntnose Minnow	29	17														2		1		8		2					
Brook Stickleback						10																					
Brook Trout															4	13											
Brown Bullhead																		6			2						
Brown Trout		1														1					4						
Chinook Salmon		3															5		3	3				4			1
Coho Salmon				1																							
Common Shiner	1	5	3	2												7						3				1	
Creek Chub	1	5				22	1		3	2			22	4	1	16	2				1	2		2			
Fathead Minnow						7					4					13	1	143	1							1	
Fallfish																	1										
Finescale Dace		1																									
Golden Shiner		1																									
Johnny Darter	20	4	1	2												37	4	64	6	34	3	52	1	5		46	13
Log Perch	1	1														11											
Longnose Dace	61	173	93	77												196	146	3		98	73	77	160	79	13	4	32
Mottled Sculpin	5	3	1	1												7	5	1	10	1	13	8	114	6	28	8	61
Northern Redbelly Dace						1																					
Pumpkinseed		1									1					1	6	5	1		1					1	2
Rainbow Darter	20	83	23	8																							
Rainbow Trout (YOY)		13	4	27													1						1		2		2
Rainbow Trout	3	5	9	1													7		7	5	6	6	8	3	5		6
Rock Bass																9	4	18		2							
Round Goby			19	26																							
Smallmouth Bass																		4				5	1	1		4	
Unknown YOY minnows*			1																								
White Sucker	3	3	11	1		1	6									10	13	18	5	10	6	13	8	1		21	1
Yellow Perch	1																										
Grand Total	171	343	181	154	0	48	9	1	5	6	13	0	52	7	78	428	209	265	78	214	116	181	217	139	58	90	118
Species Total	13	16	10	10	0	6	3	1	2	2	3	0	2	2	3	14	12	11	10	9	10	10	7	9	5	9	7
Effort (s/m^3)	2.0	2.8	4.2	2.97	19.1	N/A	4.05	4.16	6.72	3.06	5.08	4.79	8.57	6.27	8.29	2.89	2.34	3.16	2.49	2.50	2.33	2.36	2.51	2.86	3.69	2.24	3.03

Table 14: Number of fish species and individuals caught at OSAP sites during 2012 sampling compared to historical sampling results (where available) con't.

	OA08		OA09		OA11		OA12		OA16		OB02		OB03		OB04			OB06		OB08		OB13	OC01			OC05	
	2000	2012	2000	2012	2000	2012	2000	2012	2011	2012	2000	2012	2000	2012	2000	2007	2012	2000	2012	2000	2012	2012	2000	2007	2012	2007	2012
American Brook Lamprey																									2		
Banded Killifish								3																			
Blacknose Dace	37	3			5		65		14	6	166	37	94	56	210	45	29	2	76	15		5				5	12
Bluntnose Minnow											18																
Brook Stickleback											1			4		8	2	2	3	1		1					
Brook Trout																									1		
Brown Trout	2		3						1														18	10	14		
Chinook Salmon	2		2		1	1		3																			1
Common Shiner			1								1									7							
Creek Chub	7	1	3		2		6	1	21	16	23	36	45	119	166	66	62	54	115	111	4	7					7
Fathead Minnow								1	28	6		1								76							
Goldfish																				3							
Johnny Darter	8	5	17	1	22	3		7		2	33	39		4		2	9	26	35	1		1					
Largemouth Bass																						1					
Longnose Dace	75	8	13	84	31	15	58	7																			
Mottled Sculpin	17	99	7	47	14	21	45	44															11	5	10		
Pumpkinseed			1	1			1			1												6					
Rainbow Trout (YOY)				24		8		36		2																	4
Rainbow Trout	9	17	13	18	30		98	20	4														1	16	23	4	
Rock Bass	2		2	1																1							
Smallmouth Bass		1	7		1																						
White Sucker		5	9	5	5		5	5	1		4			7	1	11	1	2	11				1				3
Grand Total	159	139	78	181	111	48	278	127	77	33	246	103	139	190	377	132	103	86	240	215	1	21	31	31	49	9	27
Species Total	9	8	12	7	9	5	7	9	8	6	7	4	2	5	3	5	5	5	5	8	1	6	4	3	5	2	5
Effort (s/m^3)	4.33	2.24	2.64	3.55	2.03	2.64	4.45	5.34	4.58	6.54	7.45	4.36	5.31	7.71	6.35	5.07	5.02	5.37	7.29	7.62	6.08	5.72	4.56	4.84	4.04	3.34	4.14

Table 15: Number of fish species and individuals caught at OSAP sites during 2012 sampling compared to historical sampling results (where available) con't.

	OC06		OD05			OD06		OE01		OE04		OE06		OE07			OE11			OE14		OE15		OE16	OE17	OE18
	2007	2012	2000	2007	2012	2007	2012	2000	2012	2000	2012	2000	2012	2000	2007	2012	2000	2007	2012	2007	2012	2007	2012	2012	2012	2012
American Brook Lamprey																1									1	
Blacknose Dace						53	29	9	3	24	7	68		2						13	3			30	8	8
Brook Trout			5	20	42												2	13	15				6			
Brown Trout														1	1	1									5	
Chinook Salmon											3															1
Coho Salmon																1										
Common Shiner												1														
Creek Chub						40	25	5	2	21	6	132	2							32	12			60		1
Fathead Minnow							4	6		6	1		7											51		
Green Sunfish									1																	
Johnny Darter								15	10	6			4													3
Longnose Dace								51	25	10	28														9	23
Mottled Sculpin								17	21	24	18			47	40	71					1				25	19
Pumpkinseed		1						1					2			1										3
Rainbow Trout (YOY)			2								27		3			17				2	44				16	44
Rainbow Trout								5	33	5	11			9	37	26									5	
Slimy Sculpin			2	2	23																					
White Sucker						1	3		1	5	17	10	3	2						1				1	3	4
Grand Total	0	1	9	22	65	94	61	109	96	101	118	231	21	61	78	118	2	13	15	48	50	0	6	142	71	106
Species Total	0	1	3	2	2	3	4	8	8	8	8	6	6	5	3	6	1	1	1	4	4	0	1	4	7	9
Effort (s/m^3)	9.41	14.34	5.43	4.89	5.88	8.79	9.18	1.10	3.19	1.16	2.95	1.28	N/A	1.48	6.08	8.59	1.51	11.06	9.33	5.68	5.79	8.40	10.62	9.62	3.1	2.69

Table 16: Number of fish species and individuals caught at OSAP sites during 2012 sampling compared to historical sampling results (where available) con't.:

	OF01			OF03			SOB1		SB19			SOD1			SOD2			SOE1			SOE2			SOE2B		SOE4	SOE5	TY01		
	2000	2007	2012	2000	2007	2012	2000	2012	2006	2011	2012	2000	2007	2012	2000	2007	2012	2000	2007	2012	2000	2007	2012	2007	2012	2012	2012	2003	2010	2012
Blacknose Dace	14	28	16	91	157	134			9			68	89	133	42	79	81											12	14	
Bluntnose Minnow		4					2					1			45													15		
Brook Stickleback							13																					33	13	22
Brook Trout																		44	40	13	63	177	79	8	2					
Brown Bullhead							11	8																					2	
Brown Trout									14	8	11	6									9	6	2	18	10					
Chinook Salmon									1	7	1																			
Coho Salmon									2																					
Common Shiner												2		1	4															
Creek Chub	2	5	2	45	112	89	2					44	37	83	86	152	63									1		10	1	4
Fathead Minnow			12		24	25	14					7	2	34	28	3	3													
Goldfish							146	28																						
Johnny Darter									18			5	13	21	1	18	2											29	60	8
Largemouth Bass								1																						
Longnose Dace				3					28																					
Mottled Sculpin									46	16	9							2	2		36	4	45	10	12					
Northern Redbelly Dace				1	22	7						2	1			1												4	1	
Pumpkinseed							22	203	19	4		2		8															10	2
Rainbow Darter									1																					
Rainbow Trout (YOY)																									23					
Rainbow Trout		1	18						30	66	41	1												8	10				6	
Rock Bass	1																													
Slimy Sculpin																			9	28										
Threespine Stickleback																												5	3	2
Unknown YOY minnows*																												1		
White Sucker	2	3	1	1	6	2	7		8			37	7	4		27	5											12	4	7
Grand Total	19	41	49	141	321	257	217	240	176	101	62	175	149	284	206	280	109	46	51	61	108	187	90	44	59	1	0	121	114	45
Species Total	4	5	5	5	5	5	8	4	11	5	4	11	6	7	6	6	5	2	3	2	3	3	3	4	4	1	0	8	10	6
Effort (s/m^3)	13.94	5.79	4.92	7.31	5.48	7.01	N/A	N/A	9.41	4.19	2.19	2.68	7.79	9.49	N/A	5.09	6.39	2.91	6.67	6.54	6.59	7.96	7.95	8.41	5.2	N/A	N/A	12.32	9.84	5.45

Table 17: Number of fish species and individuals caught a long-term annual monitoring OSAP sites during 2012 sampling compared to historical sampling results (where available).

	BL01					FA04					LA01					OA05					SB01				
Fish Species (common name)	2002	2008	2010	2011	2012	2002	2008	2010	2011	2012	2001	2009	2010	2011	2012	2000	2007	2010	2011	2012	1999	2006	2010	2011	2012
American Brook Lamprey									1	1				1											
Blacknose Dace	20	11	10	11	1	19	1	4	1	1			1			10	30	3	7		9			1	
Bluntnose Minnow				1							1	1	6	1	2										
Brook Stickleback													1												
Brown Trout			4														1		2		7	4		4	
Brown Trout (YOY)																	2				1				
Chinook Salmon					2										1	2	4	1		1				1	
Common Shiner													13				20								
Creek Chub	16	10	3	5	4	4						8	12	9	9			1							
Emerald Shiner															2										
Fathead Minnow											1	2	1		3										
Green Sunfish		1		7																					
Johnny Darter	7	2	3		1						19	20	58	7	16	41	14	8	7	11	9	3			1
Largemouth Bass							1																		
Logperch											3												2		1
Longnose Dace	2			1	1	3	3	9	2	2	15		20	3	9	31	162	118	66	4	52	40	24	28	15
Mottled Sculpin	5	10	9	3	1	23	14	12	17	11						1	1	18	15	1	5	2	19	8	15
Pumpkinseed	2					2		1				1	2	1				3	1	1	1				
Rainbow Darter											48	20	33	20	17							16	26	8	5
Rainbow Trout		4	2	4	33	25	42	36	7	16		1		1		1	4	1	7	3	8	3	3	3	3
Rainbow Trout (YOY)	55	24	17	37	1	5	10	62	71	61					1	1	1	1		3	1		2		7
Rock Bass											1				1						1	1			
Rosyface Shiner													2												
Round Goby																							1	2	5
Smallmouth Bass																1			1						
Spotfin Shiner														1											
Stonecat												1													
White Sucker	2										52	18	8	17	9	2	35	2			22	5	1	5	
Yellow Perch																					1		2		
Grand Total	109	62	48	70	44	81	71	124	99	92	140	72	157	61	70	90	274	156	106	26	117	74	80	60	52
Species Total	8	6	6	7	7	6	5	5	5	5	8	9	12	10	11	8	9	9	8	6	10	8	8	9	7
Effort (s/m^2)	5.4	2.7	4.4	6.4	4.07	4.3	4.0	2.9	5.3	4.57	4.6	2.3	3.0	2.7	2.21	2.0	3.8	2.4	2.1	2.35	3.4	3.0	3.2	2.8	2.63

Table 18: Number of fish and individuals caught at BWDJ in 2012 compared to historical results.

Species	Sampling Years - BWDJ													
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2010	2011	2012
American brook lamprey					2							1		
Blacknose dace	5	21	41	35	42	54	63	100	17	24	24	4	11	
Bluntnose minnow					2	1	3							
Brown bullhead									2					
Brown trout (YOY)								7						1
Brown trout	2	2	4	2	5	2	1	1	1		1		2	
Chinook salmon				21	2	11		1			10	4	8	2
Coho salmon			2		2									
Common shiner			2											
Creek chub		8	5		5	3	5		1		2			
Fathead minnow							3	23	2					
Finescale dace	1													
Goldfish					2		1							
Johnny darter	1	1	4	1		2	25	5	1	1				
Lamprey sp.											2			
Longnose dace	13	27	76	54	58	81	210	186	72	205	64	42	16	122
Mottled sculpin		2	12	3	10	4	13	4	1		3	6	3	25
Pumpkinseed		1		7	30	1	9	1	3		1	4		
Rainbow darter				10	1	2	17	10	7	22	12			
Rainbow trout (YOY)		105	98	143	71	163	61	223	9	25	7	119	97	138
Rainbow trout	8	21	44	24	18	18	8	17	1	18	64	22	47	7
White sucker	16	11	19	10	9	9	35	9		14	3	4	2	2
Grand Total	46	199	307	310	259	351	454	587	117	309	193	206	186	297
Species Total	7	9	10	10	14	12	13	11	11	6	11	8	7	6
Effort (s/m^2)	1.6	3.0	3.1	3.0	4.2	2.5	3.5	4.3	2.8	3.1	7.9	3.0	3.3	3.96

* - undetermined identification; possibly American Brook Lamprey or Sea Lamprey
Note: YOY or young-of-the-year refers to fishes that are in their first year of life i.e., < 100 mm.

Table 19: Number of fish and individuals caught at Long-term Coastal Wetland backpack electrofishing sites in 2012 compared to historical results.

	GM02			RN04			TY012		
Fish Species (common name)	2010	2011	2012	2010	2011	2012	2010	2011	2012
Banded Killifish			3						
Bluntnose Minnow				1					
Brook Stickleback						6	28	69	2
Brown Bullhead	2	1	1	2	5	5		429	28
Common Carp									3
Creek Chub		1		5	3	95	10	2	8
Emerald Shiner							3		
Fathead Minnow	30	21	13	13	1	56	2		14
Goldfish			4					3	
Green Sunfish				2		4			
Johnny Darter				11		4	18	3	1
Lake Chub	1								
Largemouth Bass				2					
Northern Redbelly Dace							3	4	
Pumpkinseed	2	3	2	2	4	14	18	4	26
Rock Bass			1						
Round Goby	1								
Threespine Stickleback					4	1	7	17	
White Sucker	2	3		14	85	16	39	24	26
Yellow Perch					3	2	2		3
Unknown		7							
Grand Total	38	36	24	52	105	203	130	556	115
Species Total	6	6	6	9	7	10	10	10	9
Effort (s/m^2)	2.50	2.72	4.16	N/A	6.04	5.34	2.85	3.85	2.43

Table 20: Number of fish and individuals caught at Seine netting sites in 2012.

	Robinson Creek			Westside Marsh		Tooley Creek			Nonquon Creek		Cranberry Marsh			Oshawa Creek				Lynde Marsh				Bowmanville Creek				Soper Creek				Whitby Harbour				Farewell Creek				Goldpoint		
Fish Species Common Name	SNROB01	SNROB02	SNROB03	SNWES01	SNWES02	SNTLY01	SNTLY02	SNTLY03	SNNON01	SNNON02	SNCRA01	SNCRA02	SNCRA03	SNOSH01	SNOSH02	SNOSH03	SNOSH04	SNLYN01	SNLYN02	SNLYN03	SNLYN04	SNBOW01	SNBOW02	SNBOW03	SNBOW04	SNSOP01	SNSOP02	SNSOP03	SNSOP04	SNWHT01	SNWHT02	SNWHT03	SNWHT04	SNFAR01	SNFAR02	SNFAR03	SNFAR04	SNGP01	SNGP02	SNGP03
Alewife												x																			x							x		
Banded killifish																																							x	x
Black crappie				x	x																																			
Blacknose dace			x																																					
Bluntnose minnow				x	x													x	x	x	x	x	x	x	x	x	x	x	x		x	x	x					x	x	x
Brook stickleback						x	x		x	x	x		x						x	x																				
Brown bullhead			x	x	x	x	x							x					x	x							3			x					x				x	
Chinook Salmon														x	x	x	x	x				x		x	x	x	x		x								x	x		
Common carp																														x										
Common shiner				x	x																			x								x								
Creek chub			x			x	x															x	x																	
Emerald shiner								x						x	x	x	x				x	x	x		x	x	x		x		x	x		x				x		x
Fathead minnow	x	x	x			x	x						x						x			x								x		x	x	x	x	x	x		x	x
Golden shiner																			x																					
Goldfish																														x	x			x					x	
Green Sunfish						x	x																																x	
Johnny darter			x													x		x		x					x				x											
Largemouth bass				x	x																																			
Logperch																		x																				x		
Longnose dace								x																																
Northern pike					x			x											x								2								1				17	
Northern redbelly dace							x																																	
Pumpkinseed			x	x	x	x	x												x	x										x	x			x					x	x
Rainbow Trout								x						x	x	x							x	x		x	x	x												
Rock bass																x		x												x									x	
Round goby[†]				3								1		1	11	33	5	117	37	42		29	11	12	28	16	106	5	63		31	3	1			3	x	14		
Spotfin shiner														x			x		x		x											x	x							
Spottail shiner																x						x	x	x	x	x	x	x	x											
Three spine stickleback	x	x	x			x		x																						x								x		
White sucker			x			x	x										x	x	x	x		x	x	x	x		x	x			x	x	x						x	x
Yellow perch			x	x	x							x																						x	x					
Species Total	2	2	9	8	8	8	8	5	1	1	1	3	2	6	4	7	5	7	10	6	3	8	7	7	7	6	9	5	6	7	9	7	5	5	4	2	3	7	10	6

Table 21: Number of species caught at OSAP Training Course sites within Oshawa Creek watershed in 2012 compared to historical results (where applicable).

	Sites																												
	OA09	OA10	OA12						OA13						OA15					OE04					OE07				
Fish Species (common name)	2007	2007	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012	2007	2008	2009	2010	2012	2008	2009	2010	2011	2012
American Brook Lamprey													Not Sampled															✓	
Blacknose Dace	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓					
Bluntnose Minnow																													
Brook Stickleback																													
Brook Trout																									✓				✓
Brook Trout (YOY)																													
Brown Trout	✓		✓				✓	✓	✓	✓	✓					✓		✓	✓		✓				✓		✓		
Brown Trout (YOY)																													
Chinook Salmon (YOY)					✓	✓	✓				✓	✓		✓									✓						
Coho Salmon (YOY)																✓													
Common Shiner						✓			✓															✓					
Creek Chub	✓	✓		✓	✓	✓			✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
Etheostoma sp. (Darter)														✓					✓										
Fantail Darter		✓																											
Fathead Minnow							✓	✓						✓					✓		✓	✓							
Green Sunfish																													
Johnny Darter	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓						✓					
Lamprey spp.										✓					✓	✓					✓				✓	✓	✓		✓
Largemouth Bass																													
Rainbow Trout (YOY)					✓	✓		✓			✓	✓		✓			✓					✓		✓		✓	✓	✓	
Rainbow Trout	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
Longnose Dace	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓			✓	✓	✓	✓	✓					
Minnow family																		✓			✓								
Mottled Sculpin						✓	✓	✓				✓		✓			✓	✓	✓				✓	✓			✓	✓	✓
Northern redbelly Dace																													
Phoxinus sp. (minnow)																				✓									
Pumpkinseed		✓					✓	✓	✓																				
Rainbow Darter																													
Rock Bass	✓	✓	✓				✓				✓																		
Salmonid	✓		✓				✓	✓								✓		✓	✓		✓		✓						
Sea Lamprey																		✓											
Sculpin	✓	✓		✓	✓	✓			✓	✓	✓				✓	✓				✓	✓	✓			✓	✓			
Smallmouth Bass	✓						✓			✓	✓																		
White Sucker	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
Yellow Perch																				✓									
Species Total	11	10	6	7	7	9	12	10	10	9	11	7	--	8	7	10	7	9	9	8	10	7	7	9	5	3	4	4	4

Note: YOY or young-of-the-year refers to fishes that are in their first year of life i.e., < 100 mm.
✓ - site was not sampled with consistent effort therefore only presence information is reported.

15.0 Appendix V – Fisheries Sampling (Coastal Wetland)

Table 22: Number of fish and species caught at CLOCA coastal wetlands from 2002 – 2012.

	Lynde Creek Marsh												Whitby Harbour Wetland Complex						Corbett Creek Marsh									Pumphouse Marsh							
Fish Species Common Name	2002	2003	2004(1)	2004(2)	2005	2006	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012	2003	2005	2006	2007	2008	2009	2010	2011	2012	2003	2006	2007	2008	2009	2010	2011	2012
Alewife		1	1	1		12				7		1		6			1	8												Marsh Completely Dry					Marsh too Shallow to Sample
Banded killifish																			1			2					1								
Black crappie	4			1		4	1				2	1																	3						
Bluegill																				5									6					4	
Bluntnose minnow		3		7		1	1		1	14	4		2	4			5	7																	
Bowfin	1																																		
Brook stickleback																				1															
Brown bullhead	12	18	11	118	19	9	56	2	5	1	29	33			2		1	78	6	55	32	4	2	7	2	82	16	5	5		1		25	14	
Central mudminnow																												32							
Common carp	2			4	5	1	1			1	1	100	5	9	5	5	2	18	3	6	2				6	1	4					2		3	
Common shiner					1		5	2																											
Emerald shiner			2	31		11	2		15	6		3	2	157		17	2	2																	
Fathead minnow	46	24	1	2		4	4	20		550	289	23	1	3			33	1	21	3	15	9			2			484	10		25	73	38	33	
Freshwater drum																		1																	
Gizzard shad		10	6		30	4	1	38	1	8	126	208	19	4			4	7																	
Golden shiner		6	1	2		1	2	2	1	4		2								17															
Goldfish												1									1					2	1	37	60			4	22	74	
Johnny darter				2									1																						
Largemouth bass				1				1	1	1		12					2	4							1										
Logperch			3	6					1	2			1																						
Northern pike					3	1		1			1									1	1				2										
Pumpkinseed	92	38	6	26	45	11	7	1		3	15	25		3			4		8	23	3	13	3	3	17	3			36			1	45	31	
Rock bass											1	1					5	7																	
Round goby†										4							1	1																	
Smallmouth bass	2					1			1																										
Spottail shiner	23	18	1		1	6		1		3		1		1																					
Tadpole madtom												1																							
Walleye		1		1										1																					
White perch								1																											
White sucker				5		1	5					1	3		2	2	1	4							3	3									
Yellow perch	1		1		9	3	13	4	2	13	4	8		4			4	3		1		2	1		1										
Grand Total	**183**	**119**	**33**	**207**	**113**	**70**	**98**	**73**	**28**	**617**	**472**	**421**	**34**	**189**	**9**	**24**	**65**	**141**	**39**	**112**	**54**	**30**	**6**	**10**	**34**	**91**	**22**	**558**	**120**	**–**	**26**	**70**	**130**	**159**	**–**
Species Total	**9**	**9**	**10**	**14**	**8**	**15**	**12**	**11**	**9**	**14**	**10**	**16**	**8**	**10**	**3**	**3**	**13**	**13**	**5**	**9**	**6**	**5**	**3**	**2**	**6**	**5**	**4**	**4**	**6**	**–**	**2**	**4**	**4**	**6**	**–**
IBI Score	**–**	**41**	**34**		**60**	**48**	**50**	**42**	**38**	**48**	**60**		**9**	**29**	**6**	**13**	**32**		**27**	**66**	**31**	**40**	**23**	**21**	**41**	**22**		**27**	**34**	**–**	**24**	**16**	**41**	**36**	**–**
No. of Transects	**9**	**11**	**10**	**10**	**8**	**10**	**8**	**9**	**10**	**9**	**10**	**10**	**8**	**8**	**9**	**10**	**11**	**11**	**8**	**6**	**8**	**9**	**9**	**9**	**6**	**9**	**9**	**4**	**4**	**–**	**4**	**3**	**4**	**6**	**–**
No. fish/transect	20.3	10.8	3.3	20.7	14.1	7.0	12.3	8.1	2.8	68.6	47.2	42.1	4.3	23.6	1.0	2.4	5.9	12.8	4.9	18.7	6.8	3.3	0.7	1.1	5.7	10.1	2.4	139.5	30.0	–	6.5	23.3	32.5	26.5	–
Ave. No. of fish/transect & species	21.4 fish/ transect & 11.4 spp/year												8.3 fish/ transect & 8.3 spp/year						6.0 fish/ transect & 5.0 spp/year									43.1 fish/ transect & 4.3 spp/year							

Table 23: Number of fish and species caught at CLOCA coastal wetlands from 2002 – 2012 con'd.

	Oshawa Second Marsh									McLaughlin Bay Marsh									Westside Marsh							
Fish Species Common Name	2002	2005	2006	2007	2008	2009	2010	2011	2012	2003	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012
Alewife											1															
Banded killifish		28	1	2	3		1																			
Black crappie				1						13	2	12	7		1	3	4	165	1		1	10	2	2	4	
Bluegill					13	37										1	2	33		1						
Bluntnose minnow						2					3									2						1
Brook stickleback		4																								
Brown bullhead	3	22	49	67	12	62	76	12	12	17	16	4	8		8	8	8	18	23	5	99	5	12	11	39	14
Common carp						3	17	8	3	1	2	3	4		2	2	1	3	3	1			3	14	6	7
Emerald shiner																	2	1				1	7			
Fathead minnow	154	167	12	1	4	13	6	154							1				17	7						
Freshwater drum											3															
Gizzard shad							1	12			212	36	19	8	21	3	26	81	37	5	11	33	1	11	27	5
Golden shiner					1										1				1							1
Goldfish	10	69	30	67	18	32	156	186	39																1	
Johnny darter																										
Largemouth bass													1		1	4	2	4		1	1		2	5	4	4
Logperch																										
Northern pike					1												1					5	1	1		3
Pumpkinseed		50	97	24	23	94		14		6	24	4	6	1	6	3	13	85	7	18	24	8	3	5	5	3
Rainbow Trout																										
Rock bass																		1								
Spottail shiner											1				1				1							
Walleye																										
White perch											4		1	2	18	10	7	70								
White sucker		1			1						1				1						1	1			4	
Yellow perch	20		4	1	1	2	1	1		5	11	5	5	6	2	2	3	7	2	4	7	8	1	1	6	4
Grand Total	187	341	193	163	77	239	258	387	54	42	280	64	51	17	63	36	69	468	92	44	144	71	32	50	96	42
Species Total	4	7	6	7	10	8	7	7	3	5	12	6	8	4	12	9	11	11	9	9	7	8	9	8	9	9
IBI Score	–	46	41	27	36	45	8	30		36	57	30	35	24	21	28	47		30	35	52	42	25	37	31	
Transects	7	8	6	7	6	9	10	10	2	7	8	9	7	8	9	9	9	11	7	8	8	8	8	9	11	8
No. fish/transect	26.7	42.6	32.2	23.3	12.8	26.6	25.8	38.7	27.0	6.0	35.0	7.1	7.3	2.1	7.0	4.0	7.7	42.5	13.1	5.5	18.0	8.9	4.0	5.6	8.7	5.3
Ave. No. of fish/transect & species	28.4 fish/ transect & 6.6 spp/year									13.1 fish/ transect & 8.8 spp/year									8.8 fish/ transect & 8.5 spp/year							

Table 24: Number of fish and species caught at CLOCA coastal wetlands from 2002 – 2012 con'd.

	Bowmanville Marsh												Oshawa Harbour				
Fish Species Common Name	2002	2003	2004[(1)]	2004[(2)]	2005	2006	2007	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Alewife	6	1	2				1				1		2				
Black crappie										2							
Bluegill											2	16			2		
Bluntnose minnow		4	1		9		2		1	1							35
Brown bullhead	2	13	1	6	24	1	16		29	48	49	18	3		6	32	7
Chinook salmon												1	1			1	
Common carp				1		3					1	9	3	4		3	10
Common shiner								2									
Emerald shiner			12	12				1	1				22		14		
Fathead minnow				1	3		15	1	2	1		1			1		
Gizzard shad	1				8	1	13	1		9		1	4	2	1		2
Golden shiner	2	16	1	3	33		12	30	3			1					
Goldfish											3						1
Johnny darter		1															
Largemouth bass											1			1	6		3
Logperch										1				5	1		1
Northern pike						1						3	9	2	1	3	5
Pumpkinseed	11	28	23	13	42		88	18	25	40	7	16	12	10	16	12	15
Rainbow Trout																2	
Rock bass												1	2		1		2
Round goby[†]														5	4		
Smallmouth bass				1									1	1			1
Spottail shiner		7	10	9	2	1	31	1	9	2		1	2				
Sunfish (Lepomis)									14								
Walleye			1														
White sucker			1						1	1			3	13	3	1	5
Yellow perch		5			1	1	1	15	7	1	2	5	5	1	2	2	3
Grand Total	**22**	**75**	**52**	**46**	**122**	**8**	**179**	**69**	**78**	**106**	**66**	**73**	**69**	**44**	**58**	**56**	**90**
Species Total	**5**	**8**	**9**	**8**	**8**	**6**	**9**	**8**	**10**	**10**	**8**	**12**	**13**	**10**	**13**	**8**	**13**
IBI Score	**--**	**44**	**36**		**49**	**26**	**60**	**63**	**46**	**47**	**29**		**54**	**37**	**45**	**41**	
Transects	**5**	**8**	**9**	**9**	**6**	**9**	**8**	**9**	**8**	**9**	**9**	**5**	**8**	**10**	**10**	**7**	**10**
No. fish/transect	**4.4**	**9.4**	**5.8**	**5.1**	**20.3**	**0.9**	**22.4**	**7.7**	**9.8**	**11.8**	**7.3**	**14.6**	**8.6**	**4.4**	**5.8**	**8.0**	**9.0**
Ave. No. of fish/transect & species	**10.0 fish/ transect & 8.4 spp/year**												**7.2 fish/ transect & 11.4 spp/year**				

Table 25: Number of fish and species caught at GRCA coastal wetlands from 2002 – 2012.

	Wilmot Creek Marsh										Port Newcastle Marsh								
Fish Species Common Name	2003	2004[(1)]	2004[(2)]	2006	2007	2008	2009	2010	2011	2012	2003	2005	2006	2007	2008	2009	2010	2011	2012
Alewife														16		1	1	1	
American Eel																			3
Banded killifish															1				
Black crappie						1													1
Blacknose dace								1											
Bluegill																			32
Bluntnose minnow	2	26	10	1	1			7				8	1	3	14		3	3	
Bowfin					1				1	1								1	3
Brook Silverside																			1
Brown bullhead	12	3	10	26	1	2	8	1	6	9		2	16	102	1	71	22	1	3
Brown trout							1		1										
Chinook salmon		3	3			1		9	11	12					2				
Coho Salmon								1											
Goldfish										1									
Common carp	5	3	10	37	3						1	9	2	1	2	4			
Common shiner					2							3	14	2	1	3	8	7	43
Creek Chub										1									
Emerald shiner		31	20	1				13						3		1	15	1	2
Fathead minnow			1	5				2				3	1		1		2		
Gizzard shad								3	1			4	3	3	4	5	2	23	
Golden shiner	2			6	2	20		1				97	1					4	1
Johnny darter	19	1	3	8		13	3	1			4	1	3						
Largemouth bass	1		1					1				1			1	2	1	3	6
Logperch								1						1					1
Northern pike	4	2			1	5	3	3	5	1									1
Pumpkinseed	31	4		11	25	16	12	6	6	15	24	85	12	46	12	6	26	22	60
Rainbow Trout								3											
Rock bass	1				1			1		5		5		2			2	2	1
Round goby[†]							1	10	1	21			✓		4	1			15
Smallmouth bass														2		1			
Spottail shiner	1	2			1	1		22					3	3		2	1		1
Walleye						1									1		1		
White sucker	2	7	50	11	6	3	5	74	1	5	1	1	1	3	8	2	19	6	
Yellow perch	3	3	2	9	1	13		2	3	3	3	6	8	4	62	16	9	14	5
Grand Total	**85**	**85**	**110**	**115**	**45**	**76**	**32**	**162**	**36**	**74**	**33**	**225**	**65**	**191**	**114**	**115**	**112**	**88**	**179**
Species Total	**12**	**11**	**10**	**10**	**12**	**11**	**7**	**20**	**10**	**13**	**5**	**13**	**12**	**14**	**14**	**14**	**14**	**13**	**17**
IBI Score	**56**	**45**		**36**	**47**	**73**	**29**	**53**	**37**	**40**	**26**	**52**	**31**	**56**	**50**	**46**	**46**	**67**	**70**
Transects	**9**	**9**	**8**	**9**	**8**	**7**	**9**	**8**	**8**	**8**	**9**	**9**	**9**	**9**	**8**	**9**	**10**	**8**	**10**

Table 26: Number of fish and species caught at TRCA coastal wetlands from 2002 – 2012.

	Rouge River Marsh									Frenchman's Bay Marsh									Hydro Marsh								
Fish Species Common Name	2003	2005	2006	2007	2008	2009	2010	2011	2012	2003	2005	2006	2007	2008	2009	2010	2011	2012	2003	2005	2006	2007	2008	2009	2010	2011	2012
Alewife							25			11			41			4			4		3				15		
Black crappie						2	5	6											1			1			1		
Bluegill									34	4							1	2								1	1
Bluntnose minnow	2		2							7	6		4	3	1		6			2			4	1		10	
Bowfin			2						3						1												
Brown bullhead	64	21	14	33	1		8	40	5	2		9		2	2	2	4	22	66			33	2		5	5	4
Common carp	3	1	5	1			16		4	5	1	1		5		6	4	4	3	3		6	4		5	1	3
Common shiner	1	1	18	3				2	23							2				2			18		2		
Emerald shiner	5	1			4		5	14	2	35	9	1	20	9	1	2					4				16	2	
Fathead minnow	2		3	2			4	1				6		1					22		18						
Freshwater drum										1																	
Gizzard shad	3	10	7	3	13	2	3	10	2	1	23	6		1	1	18	4		1	3	24		1		6	3	
Golden shiner				2	2	4		4	13				28	33		2		1	5	18	7	1	3		1	36	4
Goldfish			1																								
Johnny darter										1																	
Largemouth bass		2					2	10	9	5	4	4	12	16	13	12	28	22		1	1	7	6	2	1	22	14
Logperch																1											
Northern pike			1				3	4	3						1		3						2			3	
Pumpkinseed	8	58	22	16	14	43	42	47	19	57	36	3	12	14	12	25	10	40	4	15	20	54	4	2	14	65	86
Rock bass								1					2														
Round goby[†]						1						6	12	9	6	4	1	1								1	
Smallmouth bass										2										1							
Spotfin shiner										5																	
Spottail shiner			1					1			1														1		
Sunfish																	1	27									4
White perch								1					2														
White sucker			1							1		1	2								1	1					
Yellow perch	9	6	3		16	5	4	1	5	2	50		6	12	2	12	5	4		4	2	5	17	6	8	9	
Grand Total	**97**	**100**	**80**	**60**	**50**	**57**	**117**	**142**	**122**	**139**	**130**	**37**	**141**	**105**	**40**	**90**	**67**	**123**	**106**	**49**	**80**	**108**	**61**	**11**	**75**	**158**	**116**
Species Total	**9**	**8**	**13**	**7**	**6**	**6**	**11**	**14**	**12**	**15**	**8**	**9**	**11**	**11**	**10**	**12**	**10**	**8**	**8**	**9**	**9**	**8**	**10**	**4**	**12**	**12**	**6**
IBI Score	**32**	**50**	**49**	**25**	**40**	**38**	**57**	**68**		**45**	**56**	**30**	**49**	**54**	**52**	**46**	**58**		**17**	**47**	**48**	**52**	**45**	**47**	**33**	**71**	
No. of transects	**10**	**8**	**9**	**7**	**8**	**10**	**8**	**11**	**8**	**11**	**11**	**11**	**9**	**9**	**11**	**10**	**10**	**12**	**11**	**9**	**10**	**7**	**8**	**7**	**8**	**10**	**5**
No. fish/transect	**9.7**	**12.5**	**8.9**	**8.6**	**6.3**	**5.7**	**14.6**	**12.9**	**15.3**	**12.6**	**11.8**	**3.4**	**15.7**	**11.7**	**3.6**	**9.0**	**6.7**	**10.3**	**9.6**	**5.4**	**8.0**	**15.4**	**7.6**	**1.6**	**9.4**	**15.8**	**23.2**
Ave. No. of fish/transect & species	**10.5 fish/ transect & 9.6 spp/year**									**9.4 fish/ transect & 10.4 spp/year**									**10.7 fish/ transect & 8.7 spp/year**								

Table 27: Number of fish and species caught at TRCA coastal wetlands from 2002 – 2012.

	Duffins Creek Marsh												Carruthers Creek Marsh								
Fish Species Common Name	2002	2003	2004(1)	2004(2)	2005	2006	2007	2008	2009	2010	2011	2012	2002	2003	2006	2007	2008	2009	2010	2011	2012
Alewife			5					13			1							14		1	
Black crappie			1										5		3	1				2	
Bluegill														2							
Bluntnose minnow	31	6	10			5	1	3	6	2	4	11	37	6	3						
Brown bullhead	38	1	1	4			1	3	2		9	1	12	8	1	31		1		13	
Chinook salmon								2		1	1	2									
Common carp		3		1		2				1	1		7	7	1	12					
Common Carp/Goldfish hybrid*												63									
Common shiner	41	14	1		4	1				1		2	32								
Creek Chub											1										
Emerald shiner		1	2	6			4	6		8	4	4		1							
Fathead minnow		13		17		29		6		172	25			37	12	48		1		3	
Freshwater drum																					
Gizzard shad	59	12	4	1	13	20	24			6	7	47	87	6	1	158	Not Sampled		Not Sampled	7	Not Sampled
Golden shiner			3							1		1									
Goldfish												13									
Johnny darter	5	1					1				1		6					6			
Largemouth bass	4										6	17	4			1		1		5	
Logperch		5		1							1										
Minnow Species (Cyprinid)												2									
Northern pike			1				1	3			3							1		1	
Pumpkinseed	45	8	6	1		5	3	7	1	9	18	30	66	31	12	16		2		11	
Rainbow Trout											1										
Rock bass	91	1								1	2	2									
Round goby†											1										
Smallmouth Bass												1									
Spotfin Shiner												2									
Spottail shiner	36	2	23	1			17		2		1	1									
Sunfish species												32									
White sucker		1	10	15		2		2		7	5	7								1	
Yellow perch	2	5	1	1	6	2	7	1		14	4	3	5		1	6					
Grand Total	**352**	**73**	**68**	**48**	**26**	**66**	**59**	**46**	**11**	**222**	**96**	**241**	**270**	**98**	**34**	**273**	**--**	**26**	**--**	**44**	**--**
Species Total	**10**	**14**	**13**	**9**	**3**	**8**	**9**	**10**	**4**	**12**	**20**	**17**	**10**	**8**	**8**	**8**	**--**	**7**	**--**	**9**	**--**
IBI Score	**--**	**26**	**32**		**38**	**23**	**49**	**46**	**21**	**42**	**56**		**--**	**30**	**33**	**47**	**--**	**36**	**--**	**57**	**--**
No. of transects	**--**	**9**	**--**		**5**	**9**	**8**	**8**	**8**	**8**	**10**	**8**	**--**	**9**	**9**	**9**	**--**	**7**	**--**	**8**	**--**
No. fish/transect	**--**	**8.1**	**--**		**5.2**	**7.3**	**7.4**	**5.8**	**1.4**	**27.8**	**9.6**	**30.1**	**--**	**10.9**	**3.8**	**30.3**	**--**	**3.7**	**--**	**5.5**	**--**
Ave. No. of fish/transect & species	**11.4 fish/ transect & 10.7 spp/year**												**10.8 fish/ transect & 8.3 spp/year**								

Table 28: Number of fish and species caught at Quinte coastal wetlands during 2012 sampling compared to historical sampling results (where available).

	Airport Creek Marsh		Big Island West		Sawguin Central Marsh			Robinson Cove			Dead Creek Marsh	
Fish Species Common Name	**2010**	**2012**	**2008**	**2012**	**2005**	**2008**	**2012**	**2005**	**2009**	**2012**	**2010**	**2012**
American Eel		2										
Banded Killifish		11		3				4		5		2
Blackchin Shiner			1	3							3	4
Blacknose Shiner			7	2	1		3					1
Black Crappie			4		2		1	3				
Bluegill	1	29	64	45	63	29	111	19	24	56	23	36
Bluntnose Minnow		1		2							9	2
Bowfin		3		1	1		1	2	1	5	1	
Bridle Shiner				4								
Brook silverside				1	2							
Brown bullhead	2	16	1	6	1	2	12	3		1		1
Central mudminnow	9	12	3	3	1		2					
Common carp									1		1	
Golden shiner	6		3	10	6	21	33	2				3
Largemouth bass	2	12	5	11	1		16	9	7	12	8	7
Logperch		3	2	5						3	8	
Northern pike		4	2	3	1		2					
Pumpkinseed	23	7	24	37	6	7	41	50	11	2	35	42
Rock bass		7										1
Round goby†									1			
Spottail shiner										3		
Walleye				1								
Yellow perch		89	80	111	18	17	179			123	98	116
Darter Spp.				1								
Sunfish Spp.		2		12						3		
Grand Total	**60**	**198**	**196**	**250**	**103**	**76**	**401**	**117**	**71**	**213**	**186**	**215**
Species Total	**7**	**14**	**12**	**19**	**12**	**5**	**11**	**9**	**7**	**10**	**9**	**11**
IBI Score	**53**	**100**	**96**	**100**	**70**	**55**	**100**	**85**	**67**	**90**	**85**	**75**
Number of Transects	**8**	**9**	**7**	**11**	**8**	**7**	**11**	**8**	**8**	**11**	**9**	**10**
No. fish/transect	**7.5**	**22.0**	**28.0**	**22.7**	**12.9**	**10.9**	**36.5**	**14.6**	**8.9**	**19.4**	**20.7**	**21.5**
Ave. No. of fish/transect & species	**14.8 fish/ transect & 10.5 spp/year**		**25.4 fish/ transect & 15.5 spp/year**		**20.1 fish/ transect & 9.3 spp/year**			**14.3 fish/ transect & 9.6 spp/year**			**21.1 fish/ transect & 10.0 spp/year**	

Table 29: IBI results of DRCWMP Fish Sampling from 2003 – 2012.

	2012 Fish Metrics						IBI Score									
Wetlands Name	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
Parrott'sBay	--	--	--	--	--	--	--	-	-	-	-	-	-	-	-	85.4
Hay Bay South Marsh	--	--	--	--	--	--	--	--	-	-	90.9	-	-	78.5	-	-
Hay Bay North Marsh	--	--	--	--	--	--	--	-	-	-	76.9	-	-	84.5	-	-
Big Island East Marsh	--	--	--	--	--	--	--	-	-	-	86.2	-	-	99.9	-	-
Big Island West Marsh	10.00	10.00	10.00	10.00	9.96	10.00	100.0	-	-	-	96.3	-	-	-	-	-
Robinson's Cove Marsh	8.91	10.00	10.00	5.23	9.91	10.00	90.1	-	-	67.3	-	-	-	84.6	-	-
Sawguin Creek Central Marsh	10.00	10.00	10.00	10.00	10.00	10.00	100.0	-	-	-	55.4	-	-	70.4	-	-
Huyck's Bay Marsh	--	--	--	--	--	--	--	-	-	-	-	-	-	-	-	74.0
Port Newcastle Marsh	6.69	10.00	10.00	4.32	7.12	3.89	70.0	67.1	45.8	45.8	50.4	55.6	31.0	52.0	-	26.4
Wilmot Creek Marsh	2.99	2.76	10.00	1.28	6.63	0.36	40.0	37.1	53.1	29.2	73.3	46.8	35.9	-	45.4	56.5
Bowmanville Marsh	--	--	--	--	--	--	--	29.0	46.8	45.6	62.5	59.7	26.5	49.0	36.3	43.7
Westside Marsh	4.48	3.68	10.00	0.98	0.00	1.78	34.9	30.8	37.2	24.3	42.2	51.5	35.1	30.1	-	-
McLaughlin Marsh	10.00	10.00	4.60	10.00	0.00	2.90	62.5	47.2	27.6	20.7	23.8	35.3	30.5	57.1	-	36.0
Oshawa Second Marsh	--	--	--	--	--	--	--	30.3	8.3	44.8	36.1	26.5	40.9	45.6	-	-
Oshawa Creek Costal Wetland	6.93	8.10	10.00	2.24	0.00	2.70	50.0	40.9	44.9	37.2	54.2	-	-	-	-	-
Pumphouse Marsh	--	--	--	--	--	--	--	35.9	40.1	16.4	23.6	-	34.4	-	-	26.6
Corbett Creek Marsh	1.33	0.00	0.00	0.30	4.58	0.00	10.4	21.9	40.5	20.7	23.4	40.2	31.1	65.9	-	27.1
Whitby Harbour Wetland	4.13	2.68	0.08	2.80	0.00	4.11	23.0	32.3	12.5	6.3	29.0	9.4	-	-	-	-
Lynde Creek Marsh	8.60	8.10	4.90	10.00	0.00	6.46	63.4	59.6	48.1	38.0	41.9	50.0	47.6	59.8	34.3	40.7
Carruthers Creek Marsh	--	--	--	--	--	--	--	56.9	-	35.6	-	47.3	32.9	-	-	29.5
Duffins Creek Marsh	10.00	8.28	9.36	4.29	2.83	1.31	60.1	56.1	41.5	21.3	45.6	49.0	23.2	37.6	32.4	26.0
Hydro Marsh	5.74	10.00	2.55	10.00	0.00	0.00	47.2	71.5	32.6	46.7	44.9	52.4	47.5	47.3	-	17.2
Frenchman's Bay Marsh	6.97	10.00	10.00	2.05	3.05	3.36	59.1	57.7	46.4	52.1	53.8	48.7	30.0	56.4	-	44.9
Rouge River Marsh	8.66	10.00	10.00	3.95	8.90	4.23	76.2	67.8	57.2	37.5	40.1	25.0	48.7	49.9	-	31.5
Carnachan Bay	--	--	--	--	--	--	--	99.3	-	75.0	-	-	-	-	-	-
Carrying Place	--	--	--	--	--	--	--	86.0	-	80.4	-	-	-	-	-	-
Blessington Creek Marsh	--	--	--	--	--	--	--	-	-	85.5	-	-	-	-	-	-
Sawguin Ditched	--	--	--	--	--	--	--	-	-	82.8	-	-	-	-	-	-
Airport Creek Marsh	10.00	10.00	10.00	10.00	9.95	10.00	100.0	-	53.0	-	-	-	-	-	-	-
Dead Creek Marsh	10.00	10.00	0.41	5.83	10.00	8.57	74.7	-	85.3	-	-	-	-	-	-	-
Lower Sucker Creek	--	--	--	--	--	--	--	-	77.5	-	-	-	-	-	-	-
Lower Napanee River Marsh	--	--	--	--	--	--	--	81.4	94.0	-	-	-	-	-	-	-
Sawguin Creek North Marsh	--	--	--	--	--	--	--	100.0	92.2	-	-	-	-	-	-	-

Table 30: Average IBI score for all wetlands sampled within in each jurisdictional area (Ganaraska Region CA, Central Lake Ontario CA, Toronto Region CA, Quinte) per year. Years may vary in the number of wetlands sampled due to water levels or other uncontrollable conditions.

	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	Total
Ganaraska Region CA Wetlands	55.0	52.0	49.5	37.5	61.5	51.5	33.5	--	--	41.0	47.9
Central Lake Ontario CA Wetlands	40.7	38.4	34.2	28.3	37.4	39.0	35.0	51.3	35.0	35.0	37.8
Toronto Region CA Wetlands	60.6	62.0	44.5	38.8	46.3	44.4	36.6	47.8	--	30.0	45.2
Quinte Wetlands	93.0	91.9	80.4	78.2	81.1	--	--	83.6	--	79.7	83.9

16.0 APPENDIX VI – CLIMATE TRENDS (ENVIRONMENT CANADA, 2012)

Government of Canada Gouvernement du Canada

Canada

Environment Canada

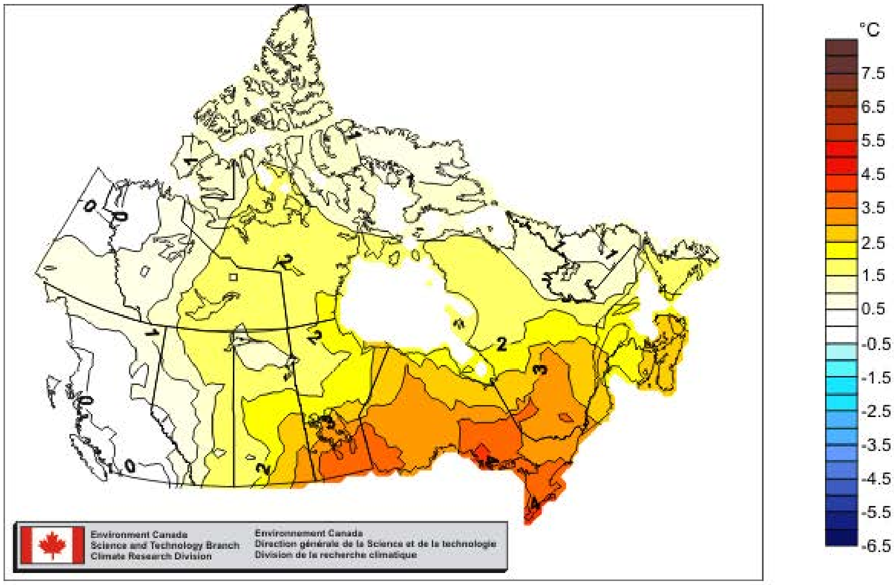
Climate Trends and Variations Bulletin - Spring 2012

This bulletin summarizes recent climate data and presents it in a historical context. It first examines the national temperature, and then highlights interesting regional temperature information. Precipitation is examined in the same manner.

National Temperature

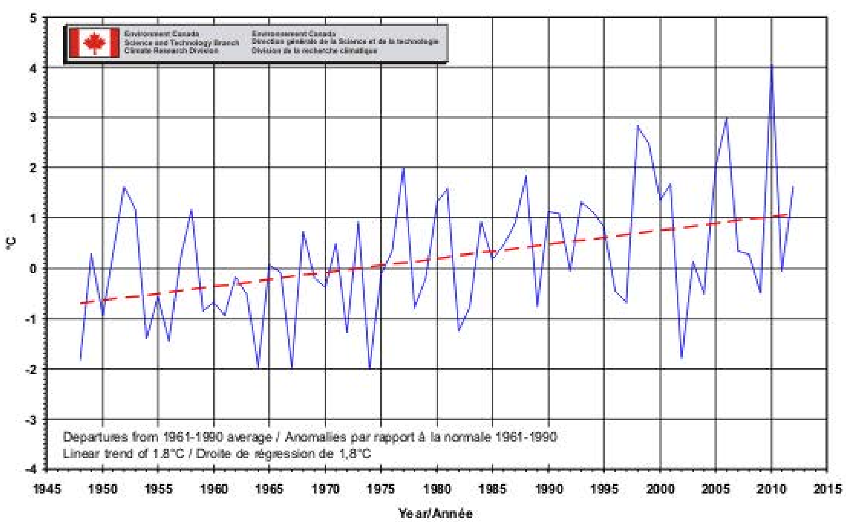
The national average temperature for the spring of 2012 was 1.6°C above normal (1961-1990 average), based on preliminary data, which makes this spring the ninth warmest on record since nationwide records began in 1948. The warmest spring was in 2010, which was 4.1°C above normal. At 2.0°C below normal 1974 was the coolest. As the temperature departures map below shows, virtually all of the country was above normal this spring, with southern Manitoba, most of Ontario, and southern Quebec experiencing temperatures more than 3 degrees above normal. Small areas of the British Columbia coast, northern Yukon and western Northwest Territories had temperatures closest to normal this spring.

Temperature Departures from Normal - Spring (Mar, Apr, May) 2012



The time series graph below shows that spring temperatures have fluctuated greatly. The red dashed linear trend line indicates spring temperatures have warmed over the last 65 years by 1.8°C.

Spring National Temperature Departures and Long-term Trend, 1948 - 2012



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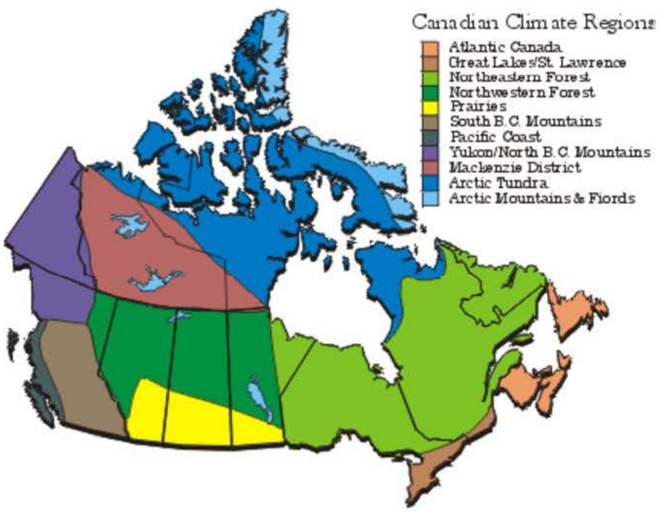
Regional Temperature

Four climate regions experienced rankings among their ten warmest springs this year. They were: Great Lakes/St. Lawrence (2nd warmest, 3.5°C above normal); Atlantic Canada (4th warmest, 2.1°C above normal); Prairies (5th warmest, 2.3°C above normal); and Northeastern Forest (6th warmest, 2.5°C above normal). All the regional and national temperature departures and rankings are presented in the ranked regional temperatures table (MS Excel Version, 41 KB). The trends, extremes and current year rankings table shows that all of the eleven climate regions exhibit positive trends in spring temperatures, with the Mackenzie District and the Northwest Forest showing the greatest trends of 2.6°C over the 65 years of record. Arctic Mountains and Fiords Region has the least positive trend of 0.9°C over the same period.



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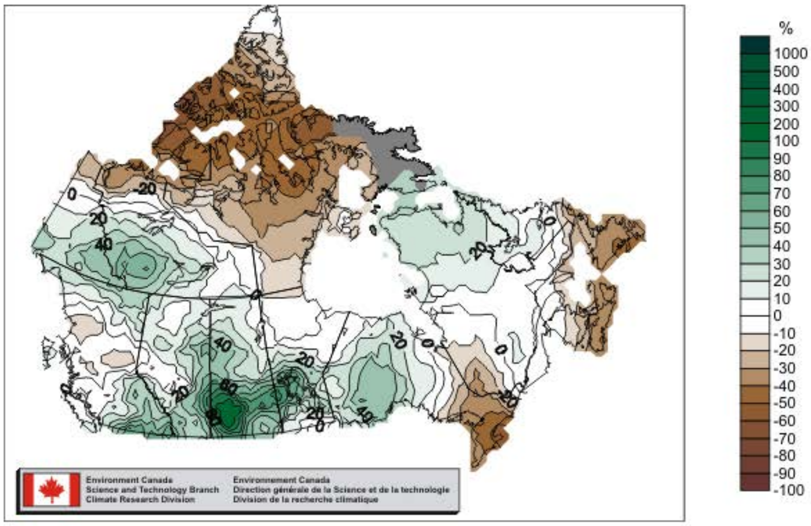
National Precipitation

Canada experienced a slightly wetter than normal spring in 2012, 3% above normal (1961-1990 average). This spring ranked as the 24th wettest out of the 65 years of record. The wettest spring was 1979, 20% above normal, and the driest spring was 1956, 27% above normal. The precipitation percent departure map below shows most of country had wetter than normal conditions, with the Prairie Provinces, southern Yukon and Northwest Territories, and northern Ontario experiencing conditions that were at least 40% wetter than normal. Three areas of drier than normal conditions were Nunavut, southern Ontario, and Atlantic Canada.

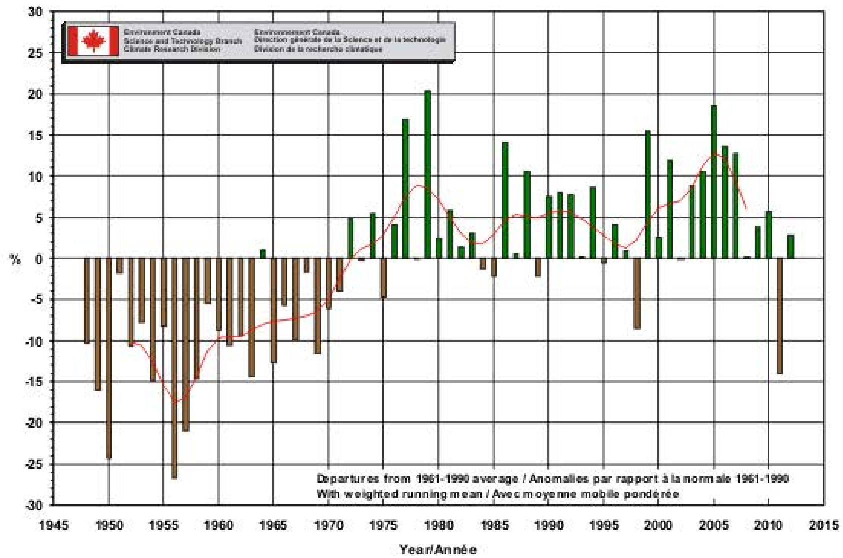
Precipitation Departures from Normal - Spring (Mar, Apr, May) 2012



It should be noted that "normal" precipitation in northern Canada is generally much less than it is in southern Canada, and hence a percent departure in the north represents a smaller change in the actual amount of precipitation than the same percentage in the south. The national precipitation rankings are therefore strongly influenced by the northern departures and do not represent rankings for the volume of water falling on the country.

The precipitation percent departures graph below shows that springs have tended to be wetter than normal since the mid-1970s.

Spring National Precipitation Departures with Weighted Running Mean, 1948 - 2012



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Regional Precipitation

Atlantic Canada climate region had its driest spring on record, 28% below normal, beating out 1959 at 25% below normal. One other region had a top ten driest spring: the Great Lakes/St. Lawrence Region had its 6th driest spring, 26% below normal. Three climate regions had one of their ten wettest springs this year: the Prairies (3rd wettest, 52% above normal); Northwestern Forest (7th wettest, 19% above normal); and North B.C. Mountains/Yukon (7th wettest, 18% above normal). The national and regional values along with their rankings for the spring of 2012 relative to the last 65 years are listed in the ranked regional precipitation table (MS Excel Version, 44 KB). This past spring's precipitation rankings for each region, along with the record wettest and driest years, are summarized in the extremes and current year rankings table.

To read a spreadsheet in Microsoft Excel format, you will need the Microsoft Excel Viewer.

Date Modified: 2012-06-29

Ministry of Natural Resources

Ontario

Natural. Valued. Protected.

State of resources reporting

February 2007

American eel in Ontario

American Eel Information Update (2010) on Page 5

American eel populations in Ontario have been declining since the 1980s. The Ontario Ministry of Natural Resources is working with partners to assist in the recovery of American eel by taking actions to protect their populations from further decline.

The American eel is an important part of the diversity of life in Lake Ontario and a valuable indicator of the health of the ecosystem. As a top predator, eels help to keep other fish species in balance, including invasive species such as the goby.

The formerly abundant American eel has a long history as a food and commercial product for residents of the upper St. Lawrence River and Lake Ontario. Eels were a highly valued fish resource for Aboriginal people, particularly the St. Lawrence Iroquois, who depended upon them as winter and travelling food. Historical accounts from the mid-1600s record a fisherman spearing as many as 1,000 eel in a single night.

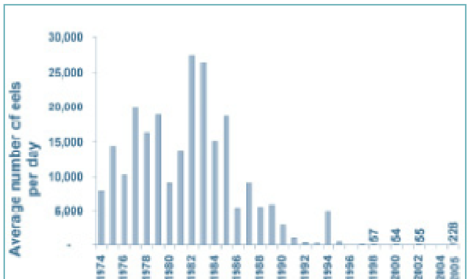

Figure 1. Average number of eels ascending the eel ladder per day, over a 31-day period for each year from 1974 to 2004. The ladder is located at the R.H. Saunders Hydroelectric Dam, in Cornwall, Ontario. Note: no data are available for 1996.

Records of commercial fisheries list catches of eel as early as 1886. During the 1980s and early 1990s, the American eel was one of the top three species in commercial value to Ontario's fishing industry. At its peak, the eel harvest was valued at $600,000 and, in some years, eel accounted for almost half of the value of the entire commercial fish harvest from Lake Ontario.

Over recent decades, the number of young American eels entering the upper St. Lawrence River and Lake Ontario has been declining dramatically (Figure 1). For example, the average number of eels migrating up the St. Lawrence River near Cornwall decreased from 25,000 per day in the 1980s to roughly 230 per day in 2005. American eel appears to be in decline throughout its global range.

At the same time, the commercial catch of eel has declined from approximately 223,000 kilograms (kg) in the early 1980s to 11,000 kg in 2002.

Distribution and life cycle of the American eel

Globally, American eel are found in coastal freshwater and marine waters stretching from Greenland along the east coast of North America to northern South America (Figure 2). Eels extend into Ontario through the St. Lawrence River and Lake Ontario.

American eels have a complex lifecycle (Figure 3). All American eel are part of a single breeding population that spawns in only one place in the world – the Sargasso Sea in the Atlantic Ocean. From there, young eels drift with ocean currents and then migrate inland into streams, rivers and lakes. This journey may take many years to complete with some eels travelling as far as 6,000 kilometres. After reaching these freshwater bodies they feed and mature for approximately 10 to 25 years before migrating back to the Sargasso Sea to spawn.

Virtually all American eels in Ontario are large, highly fecund (egg-laden) females. Prior to the decline of eel in Ontario, eels in Lake Ontario and the upper St. Lawrence River appear to have contributed substantially to reproduction of the global eel population.

Further details regarding the life history and distribution of eels can be found in the American eel fact sheet at http://www.mnr.gov.on.ca/en/Newsroom/LatestNews/MNR_E004285.html

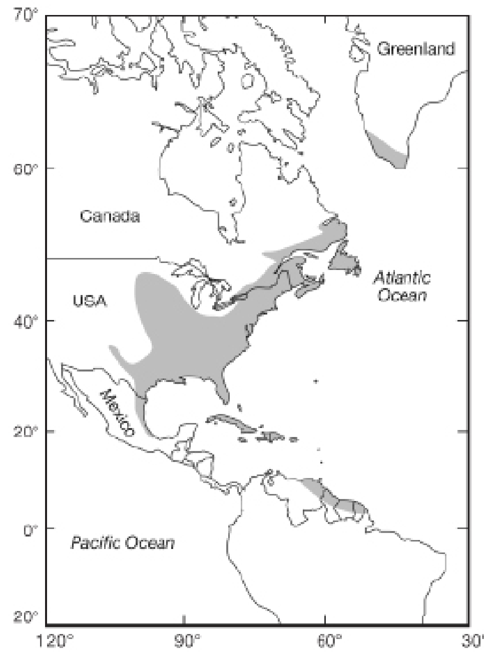

Figure 2. Global distribution of American Eel. (Fisheries and Oceans Canada, American eel, Underwater World.) (Reproduced with the permission of Her Majesty the Queen in Right of Canada, 2006)

Factors affecting eel poplulations

The long life span of American eel, combined with their vast migration route makes them susceptible to a wide range of factors. While no one factor has been identified as the single cause of the American eel decline, the actors below appear to be having a cumulative impact on American eel. These factors generally occur globally and include:

- Turbines at hydro electric facilities: eels can be killed as they migrate downstream through the turbines on their way to spawn in the Sargasso Sea. In the St. Lawrence River system, 40 per cent of mature eels that pass through turbines are killed.
- Physical barriers such as hydro dams can block eels from migrating upstream to their freshwater habitats. A large portion of the eels' freshwater habitat in Canada and the United States has been made inaccessible due to such physical barriers.
- Harvesting: American eel are harvested throughout their global range and during all of their life stages.
- Deteriorating habitat quality: contaminants such as PCBs may affect eel fertility and survival.
- Habitat loss in marine waters due to the over-harvest of seaweed in the Sargasso Sea.
- Changing ocean conditions may influence the ability of eel to drift and migrate to and from the Sargasso Sea.
- An exotic, parasitic worm that affects the health and survival of eels. (While this worm has been introduced into United States waters, it has not been found in Canadian waters).

Eel management

Ensuring the long-term sustainability of the American eel population is highly complex and requires significant coordination across many international jurisdictions. Ontario is working closely with federal, provincial, and United States governments and industry partners to facilitate the recovery of the American eel. Some of the measures include:

Stocking:

- In October 2006, the Ontario Ministry of Natural Resources, in partnership with Ontario Power Generation, the Ontario Federation of Anglers and Hunters and the Ontario Commercial Fisheries' Association released over 144,000 eels into the St. Lawrence River.
- Quebec has also started stocking eels into LakeChamplain.

Cancelling American eel harvests:

- Ontario cancelled the commercial and recreational harvest of American eels in 2004.
- The Quebec government has also reduced the commercial harvest of eels.

Reducing migration barriers:

- The Ontario Ministry of Natural Resources and Ontario Power Generation are working to improve the safety of eels as they pass through hydroelectric turbines in Ontario waters.
- An eel ladder was installed in 1974 at the R.H. Saunders Hydroelectric Dam near Cornwall, Ontario, to help eels climb over the dam as they migrate into Ontario from the Sargasso Sea. By counting the number of eels that pass through these ladders, biologists are able to monitor changes in the size of local eel populations over time.
- Quebec Hydro and New York Power Authority, in association with provincial and United States state authorities, have also established eel adders at their dams in the St. Lawrence River.

Management Plans:

- In September 2004, the Department of Fisheries and Oceans Canada with the Quebec and Ontario governments agreed to develop a co-ordinated management plan for American eel in Canada.
- This draft management plan is now available for comment on the Fisheries and Oceans Canada website. (http://www.aquaticspeciesatrisk.gc.ca)
- While there is no North American management plan for American eel, efforts are under way to ensure the coordination of management actions between Canada and the United States. Ontario is working with Fisheries and Oceans Canada, other provincial governments, the Great Lakes Fishery Commission, and United States federal and state governments to develop inter-jurisdictional management plans for American eel.

Status Designation:

- American eel is being considered for listing as a species at risk on the Species at Risk in Ontario List and under the Canadian Species at Risk Act and the United States Endangered Species Act. The Species at Risk Act Legal Listing Consultation Workbook for the American Eel has been posted for comment on the Canadian Species at Risk Act Public Registry website.

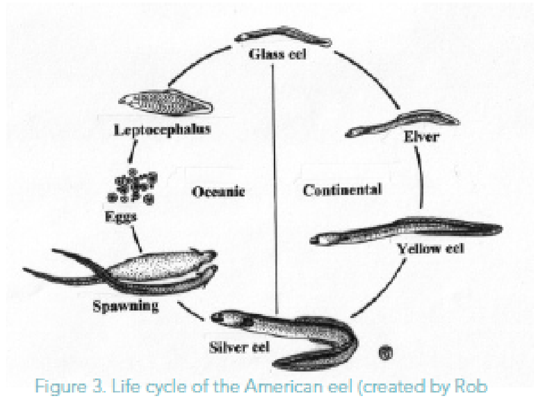

Figure 3. Life cycle of the American eel (created by Rob Slapkauskas).

American eels might be confused with sea lamprey. The eel has a snake-like body and a dorsal fin that extends from half-way down the length of its back to the underside of its body. At maturity, eel range from 75 to 100 centimetres (cm) in length and weigh one to three kilograms. Sea lamprey grow up to roughly 85 cm in length. A major difference between sea lamprey and the American eel is that, unlike eels, sea lamprey has a circular, suction-cup like mouth with numerous teeth used to attach themselves to fish.

Outlook for the resource

The future of the American eel in Ontario waters is uncertain. The low numbers of eel migrating into the upper St. Lawrence River and Lake Ontario in recent years suggest that the eel populations will remain low and will not provide a commercial resource for at least the next decade.

Information Sources

The information provided in this document is based on data collected for the Ontario Ministry of NaturalResources' fish monitoring programs and on information from scientific reports and research scientists.

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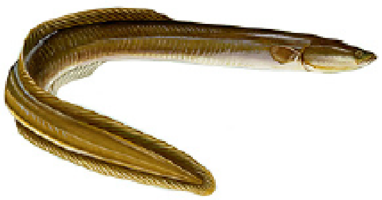

American Eel Update – 2010

Since 2007, the Ontario Ministry of Natural Resources (MNR) has partnered with Ontario Power Generation (OPG), Hydro Québec, Québec Ministère des Ressources naturelles et de la Faune (Natural Resources and Wildlife), and Fisheries and Oceans Canada to work toward the protection and recovery of American eel populations in Ontario. The result of these collaborations has been innovations at hydroelectric generating stations, government policy changes, and new management and research initiatives.

In 2008, American eel was designated as an endangered species and became protected under the Endangered Species Act, 2007 (ESA 2007). Its habitat will be protected as of June 30, 2013, or earlier if a habitat regulation is developed.

The R.H. Saunders Generating Station on the St. Lawrence River near Cornwall, Ontario became exempt from certain prohibitions under the ESA when they entered into an agreement with the Minister to take reasonable steps to minimize adverse effects on the American eel. These exemptions may only be made when the survival or recovery of a species is not jeopardized and when it will not interfere with protection and recovery plans.

As a result of this exemption, the Saunders Generating Station will continue to operate. OPG will be undertaking the following measures to minimize the effects of Saunders Station on American eel:

- Stocking young eel into the St. Lawrence–Lake Ontario watershed
- Trapping and transporting eel around Saunders Station during their downstream migration
- Monitoring eel mortality
- Operating, maintaining, and reporting on the effectiveness of the Saunders eel ladder

In 2009, OPG installed a 300-metre extension to the eel ladder at the Saunders Station as well as a new surface to help eels climb the ladder faster. The purpose of the extension is to increase the ease of upstream migration and reduce the number of eels that are swept back through the dam. A new photoelectric counter installed on the ladder will improve estimates of the number of eels migrating upstream past the Saunders Station. The New York Power Authority, the owner and operator of the R.H. Moses Generating Station (the other half of the dam, situated in U.S. waters), also recently constructed and began operating a ladder to facilitate the upstream passage of American eel during 2006.

The number of American eel that move upstream via eel ladders is an indicator of overall eel abundance (Figure 4). The total number of American eel that passed through the ladder at the Saunders Station in 2008 was twice that recorded in recent years. However, even though this trend is encouraging, it is still less than 3% of that observed in the early 1980s.

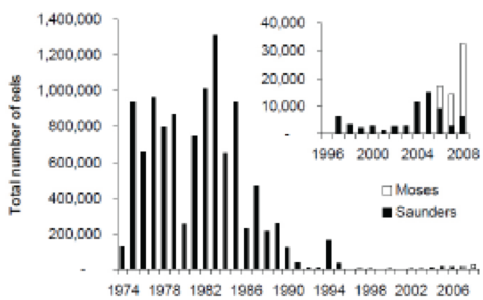

Figure 4. Total number of eels ascending the eel ladder(s) at the Moses Saunders Dam from 1974 to 2008. No counts are available for 1996.

To support recovery efforts, 3.9 million young eels have been stocked by OPG in Ontario since 2006. In addition, a pilot project was initiated in 2008 to explore whether safe downstream passage of eels could be accomplished through transporting mature eels around hydroelectric dams in Ontario and Quebec. Work on these projects is continuing.

The MNR is currently working with partners to prepare a recovery strategy for the American eel. Additionally, several projects on American eel have been funded through the MNR's Species at Risk Stewardship Fund. These stewardship projects include studies on population abundance and downstream migration as well as developing a guide to best management practices for waterpower operators. Governments and partners throughout the eel's North American range will need to continue to coordinate and collaborate on their efforts to recover American eel populations.

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