Central Lake Ontario Conservation

Aquatic Monitoring Annual Report 2008

What we do on the land is mirrored in the water.

Working In Partnership

DURHAM REGION

Conservation ONTARIO
Natural Champions

Report No.: 2009-02MR

2008 AQUATIC MONITORING PROGRAM REPORT

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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: aquatic habitat (e.g. habitat assessments and temperature monitoring); fish and benthic macroinvertebrates (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 kilometres and is defined by the area drained by fifteen 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, the townships of Scugog and Uxbridge.

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.

redd - the gravel nest of salmonid fishes.

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).

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.

Table 1 Salmonid spawning periods for southern Ontario.

Brown Trout	mid-October to late November[1]
Brook Trout	late October to mid-December[1]
Rainbow Trout	mid-April to late June[2]
Chinook Salmon	late September to early October[2]

[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 various watersheds including:

- Lynde Creek
- Pringle Creek
- Black/Harmony/Farewell Creek
- Robinson Creek
- Tooley Creek
- Darlington Creek
- Westside Creek.

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

Lynde Creek
Rainbow Trout and White Sucker were observed as far upstream as Taunton Rd.

Pringle Creek
Rainbow Trout and White Sucker were observed upstream of Taunton Rd. with Sucker being recorded upstream of Thickson Rd.

In recent years CLOCA has observed both migratory Rainbow Trout and Chinook Salmon during the respective spring and fall runs. Although these spawning adult fishes have been observed within the creek, no young-of-year fishes have been captured through fisheries sampling.

Harmony Creek
Rainbow Trout were observed downstream of Taunton Rd. in most subwatersheds. White Suckers were generally only observed as far upstream as Hwy 2 (Bond St./King St.).

Although young-of-year Rainbow Trout have been captured within Harmony Creek, generally their presence seems to be limited to the eastern, less developed subwatersheds.

Rainbows and redds (see right photo) were observed upstream of Harmony Rd. within Grandview Branch (Branch 3). This crossing was the location of a gabion basket structure that was considered to be a barrier to fish migration and was removed and replaced with a fish-friendly rocky ramp (see photos below).

Photo shows a redd that has been created by spawning rainbow trout. Notice the lack of algae.

The presence of Rainbow Trout upstream of Harmony Rd. demonstrates the success of this project. Monitoring of this location was recommended through the 2005 Aquatic Monitoring Report.

Left Photo: Pre-construction view of fish barrier (gabion basket) located on Harmony Creek (Branch 3) below Harmony Road.
Right Photo: Post-construction view of fish-friendly rocky ramp, same location.

No Rainbow Trout or White Suckers were observed upstream of Taunton Rd. within the Grandview Branch 3 (Branch 3). This was likely due to a rubble barrier that was located approximately 500 m upstream of Harmony Rd. (see photos below).

Farewell Creek
Numerous Rainbow Trout were observed downstream of the Taunton Rd. culvert. This culvert is perched and likely is a barrier to all fishes during low flow conditions. Even during high flows this culvert is likely only passable to Salmonid fish species i.e., Trout and Salmon. An adult Rainbow Trout was captured upstream of Taunton Rd. during 2002 CLOCA sampling (FA08).

Black Creek
Rainbow Trout and White Sucker were observed upstream (east) of Courtice Rd. In 2006 numerous Rainbow Trout were observed at the first crossing north of Nash Rd. on Rundle Rd. (SSBLA01).

Robinson Creek
No migratory fishes were observed although this is likely due to low effort i.e., too few sampling sites.

Tooley Creek
Rainbow Trout and White Sucker were observed downstream (south) of Hwy 401. Fishes likely accessed upstream habitat but this was not documented likely due to low effort i.e., too few sampling sites.

Darlington Creek
Two Rainbow Trout and one White Sucker were observed at the first crossing north of Baseline Rd. on Holt Rd. Fishes likely accessed similar habitat on other tributaries but this was not documented likely due to low effort i.e., too few sampling sites.

Westside Creek
No migratory fishes were observed although this is likely due to low effort i.e., too few sampling sites.

2.3 Results (Fall)

No fall spawning surveys were conducted.

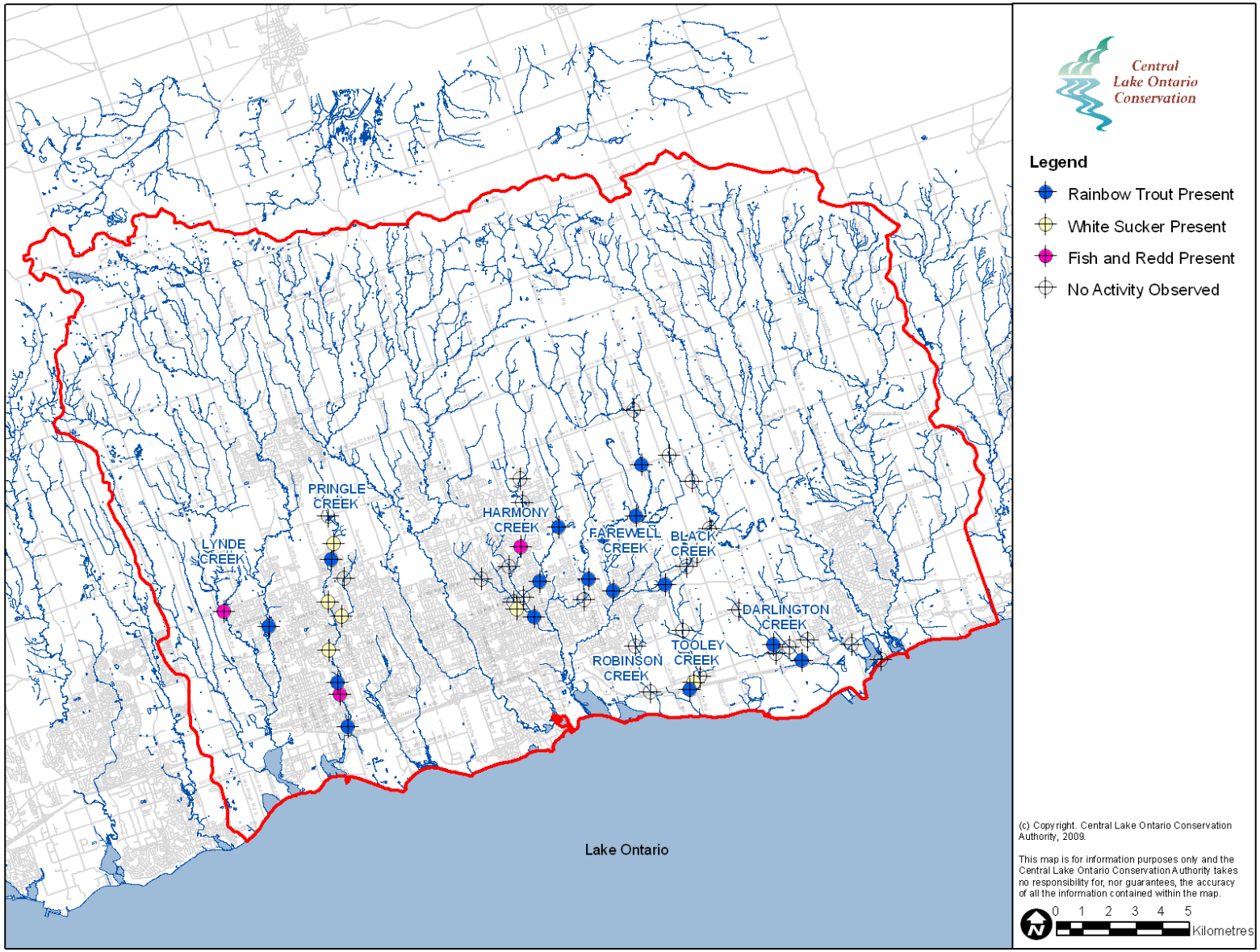


Figure 3 Location of 2008 migratory Rainbow Trout and White Sucker spawning survey observations.

3.0 Fisheries Sampling (Streams)

3.1 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 cold-water fish communities and a strong Brook Trout and Atlantic Salmon fishery. With increasing urbanization and changing land-use patterns, many of the cold water streams have become cool or warm-water 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). The Black/Harmony/Farewell watershed is the exception to this trend where known Brook Trout are limited to the mid-reaches of Black Creek in close proximity the Harmony-Farewell Iroquois Beach Wetland Complex where abundant natural cover is still present.

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. Some of these watersheds, like the Black/ Harmony/Farewell Creeks, support diverse fish communities including cold-, cool- and warm-water species. Angling opportunities include Rainbow Trout and White Sucker during the spring and fall spawning runs, and Brook Trout and Brown Trout fishing during the regular season. Anglers also take advantage of fishing popular warm-water species like Bass, Sunfish 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 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.

3.2 Monitoring Results and Fisheries Management

3.21 Black/Harmony/Farewell Watershed

The draft Central Lake Ontario Fisheries Management Plan (MNR/CLOCA 2007) outlines watershed and subwatershed-based goals and objectives for the fisheries resource and habitat within Black/Harmony/Farewell 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.

During 2008, 36 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 4). Fish species that were captured are listed in Table 2, Table 3 and Table 4.

The results of the 2008 CLOCA Aquatic Monitoring are consistent with the goals and objectives of the FMP. The main branches of Black and Farewell Creeks are still inhabited by migratory and resident Salmonids (Rainbow Trout, and Brown and Brook Trout respectively) and should remain managed as such (Figure 5). Harmony Creek still receives a run of migratory Rainbow Trout in Branches 1, 3 and 4 and there is evidence of increased recruitment in recent years (as indicated by young-of-the-year at three sites in 2008, compared to 1 site in 2002). As such, Harmony Creek should remain managed for migratory Salmonids and efforts to improve habitat in the watershed should be supported.

As with all CLOCA watersheds, aquatic invasive species were present during 2008 stream sampling. Invasive species included Goldfish and Common Carp. It is unknown at this time whether Round Goby (Figure 7) are present in the Black/Harmony/Farewell watershed. Based on 2007 and 2008 Round Goby monitoring results in neighbouring watersheds, and the similar habitat that exists in the lower reaches of Black/Harmony/Farewell Creeks, it is probable that Round Goby are present but were not detected due to low abundance or low sampling effort. Given the multitude of changes occurring in CLOCA watersheds including the ongoing introduction of invasive species, this project supports the recommendations in the CLOFMP to: 1) Continue ongoing annual aquatic monitoring throughout the watershed, particularly targeting the lower reaches, for invasive species; 2) participate in public outreach and education programs to raise awareness about the threat of invasive species; and, 3) investigate measures to control the introduction and spread of invasive species.

This year marks the first time that Green Sunfish, a relative of the Pumpkinseed, have been reported in the Black/Harmony/Farewell Creeks (Figure 6). CLOCA staff first caught this species in Oshawa Creek during 2007 sampling events; however, the presence of these fish in the Black/Harmony/Farewell system represented a new range expansion for this species. During 2002 sampling in this watershed, only Pumpkinseed were observed. However, following the 2008 sampling events CLOCA staff re-examined the voucher specimens taken from Black/Harmony/Farewell Creeks in 2002

and found that Green Sunfish were in fact present but misidentified as Pumpkinseed due to their similar identification characteristics. Nonetheless, the Green Sunfish range has expanded within the watershed since 2002 and they are now present in all subwatersheds from the lake to the headwaters north of Concession 6.

3.22 Small Watersheds

A number of small watersheds that drain directly into Lake Ontario were sampled in 2008. The results of this sampling show that these watersheds, including Bennett Creek, Warbler Creek, and Ash Creek which is a small tributary to Pringle Creek, provide fish habitat (Table 3). In Bennett Creek, the fish community included one adult Rainbow Trout which is evidence that these small tributaries are utilized by migratory coldwater species. In Warbler Creek, a Lake Chub was caught in the coastal wetland which is consistent with what has been observed in similar small creeks along Lake Ontario including Intrepid Creek and Osbourne Creek. In Ash Creek, tolerant fish species where caught which shows that while this creek has been significantly altered, it still provides fish habitat.

3.23 OSAP Training Course

The 2008 OSAP Training Course was held from June 7-13 at Durham College/UOIT. This was the second year that as part of the training program a selection of 7 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 4).

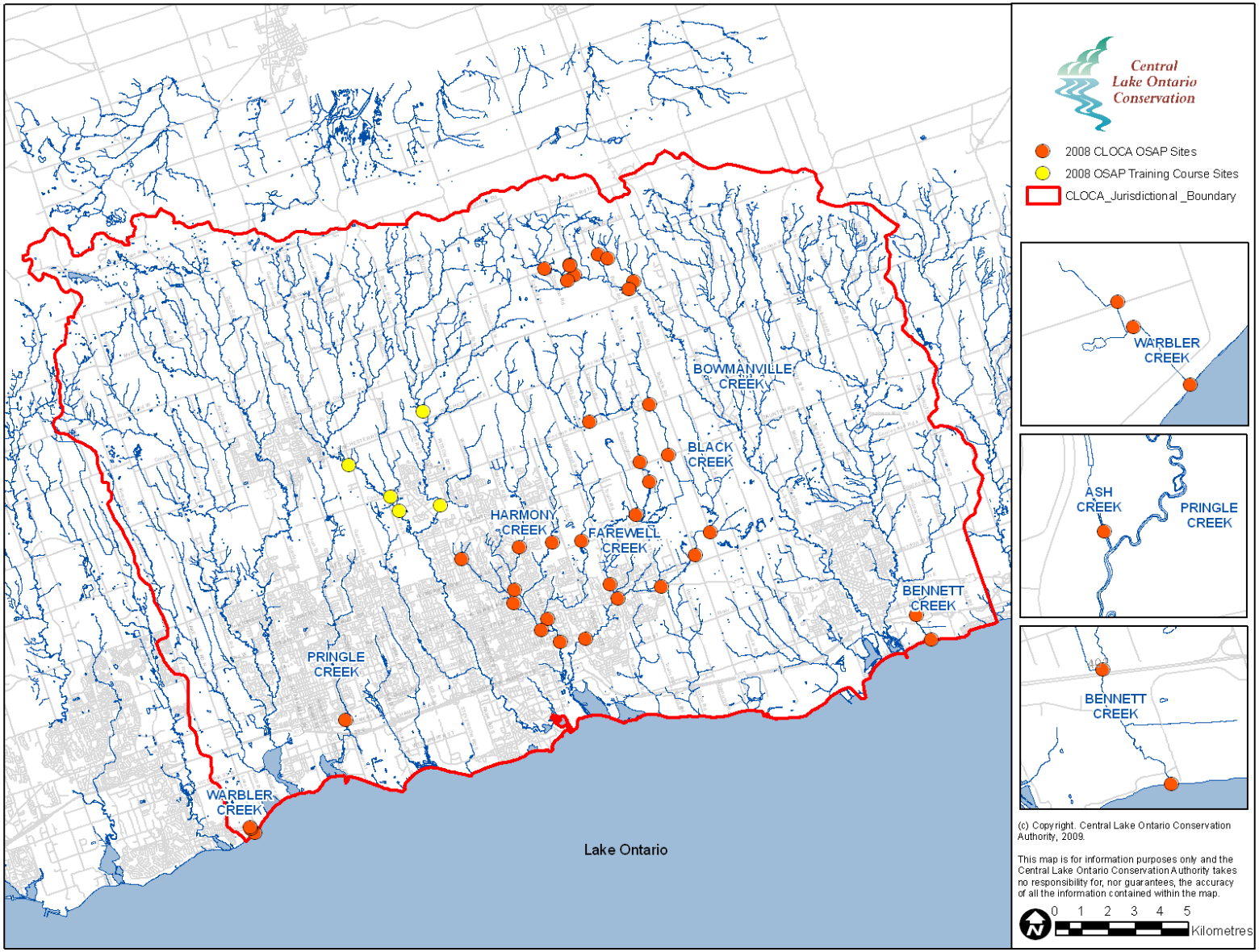


Figure 4 2008 stream fisheries site locations.

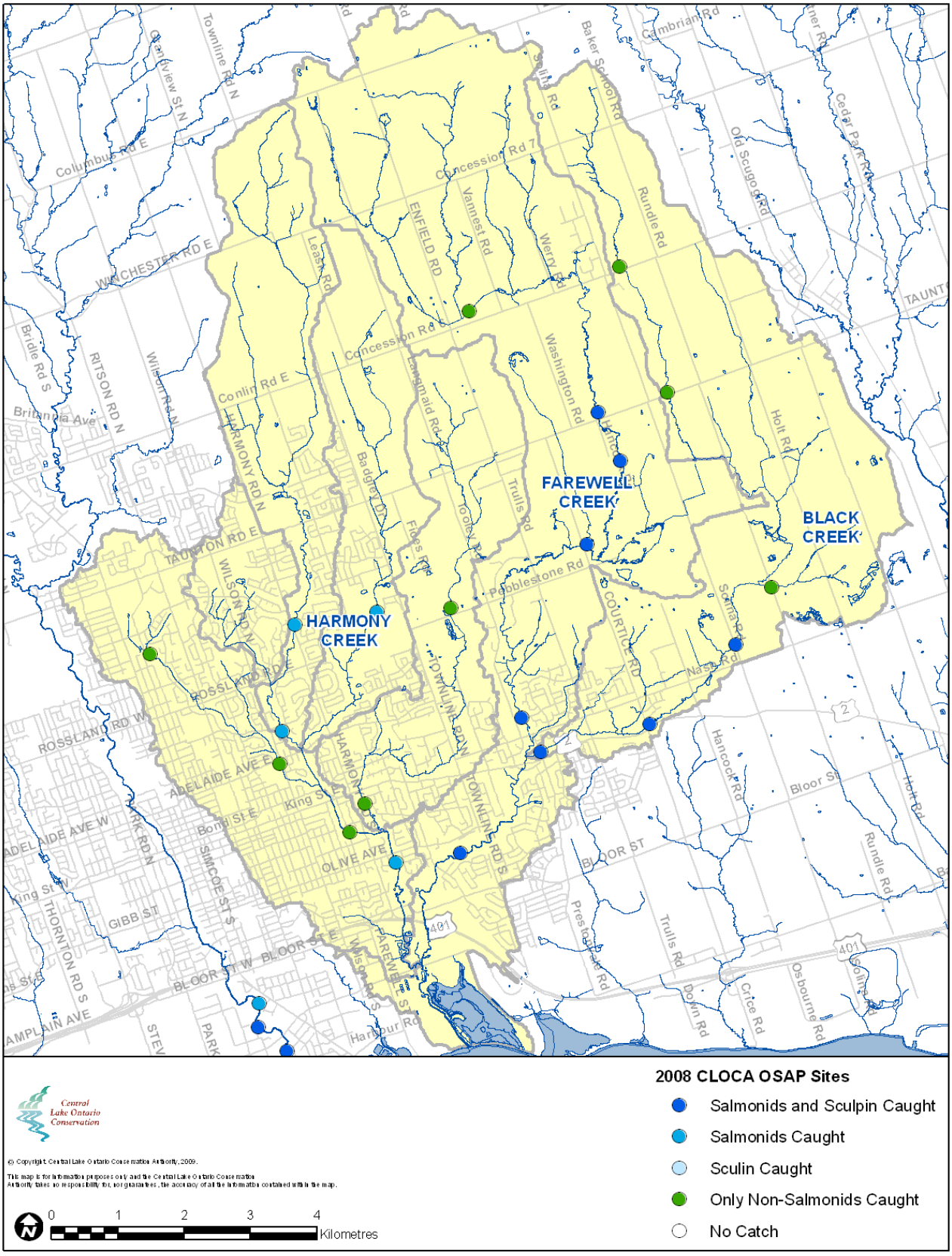


Figure 5 2008 stream fisheries site locations where Salmonids and Sculpin were caught within Black, Harmony, Farewell Creek.

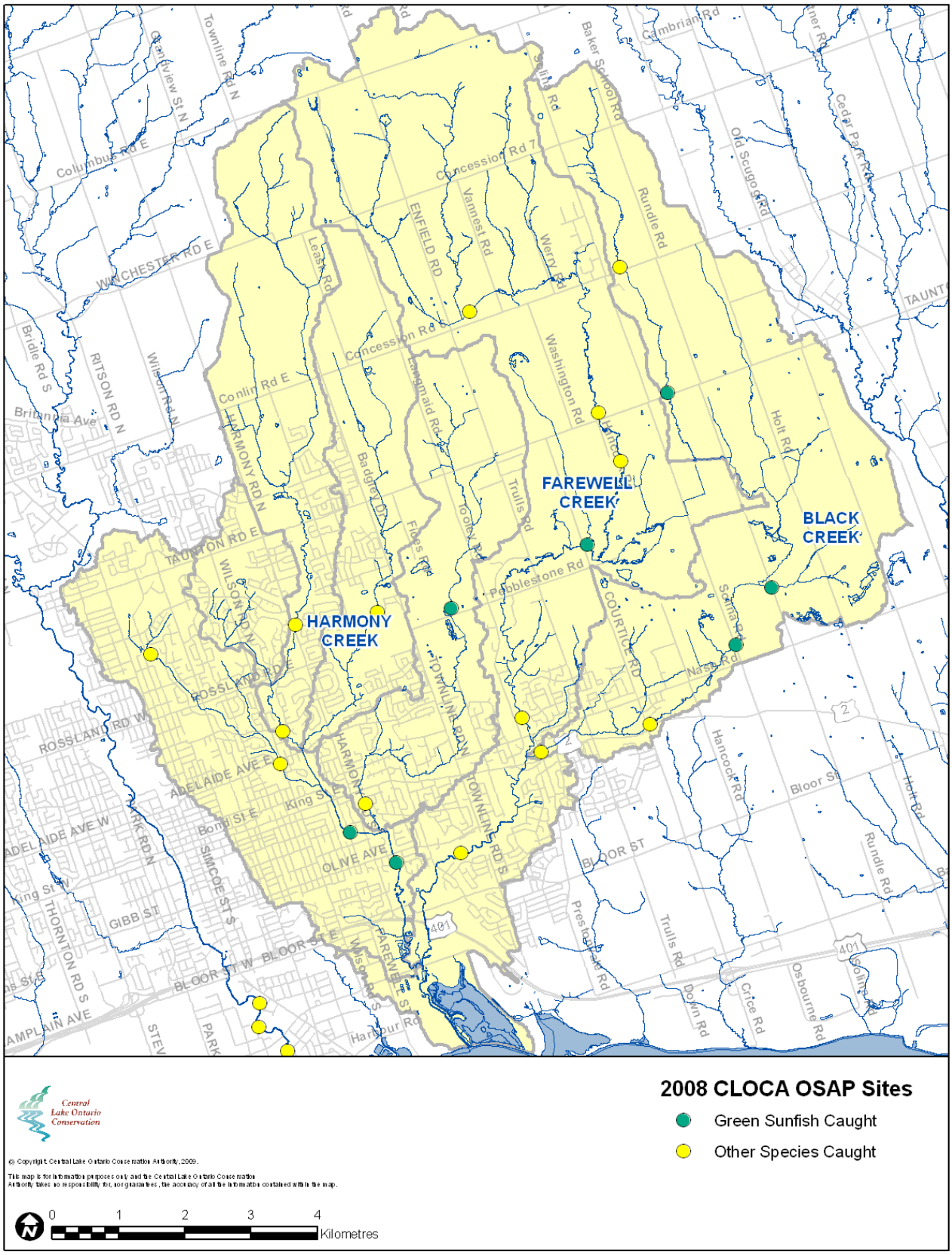


Figure 6 2008 stream fisheries site locations where Green Sunfish were caught within Black, Harmony, Farewell Creek.

Table 2 Number of fish species and individuals caught at OSAP sites within the Black, Harmony, Farewell Creek watershed during 2008 sampling compared to historical sampling results (where available).

	Sites																							
	H101		H102		H103		H201		H302		H403		H501		H504		HYS2		BL01		BL04		BL07	
Fish Species (common name)	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008
Brook Trout (YOY)																								
Brook Trout																								
Rainbow Trout (YOY)								5		12		2							55	24	1	2		
Rainbow Trout																		1		4		1		
Brown Trout (YOY)																								
Brown Trout																								
Chinook Salmon (YOY)																								
Creek Chub		2	1	2	5	1	36	27	24	13		4	27	8	32	6	19	12	16	10	23	30	45	7
Blacknose Dace	504	8	334	6	32		188	26	99	42	30	18	286	61	18	3	210	38	20	11			76	20
Longnose Dace	80	26					2	2					5	17			19	17	2					
Fathead Minnow	1						1						93									1		
Common Shiner														3							5	1		1
Bluntnose Minnow													10				2				49	21		
Northern Redbelly Dace																							1	
White Sucker							5						2	5		1	25	4	2		10	42		1
Largemouth Bass																	2							
Mottled Sculpin																			5	10	9	6		
Green Sunfish		2												17		10		5		1				1
Goldfish										1														
Pumpkinseed													2	1					2		5	2	2	
Johnny Darter														1		3			7	2	43	30		1
Brook Stickleback														2				1						
Banded Killifish														1										
Sea Lamprey																								
Rainbow Darter																		1						
Brown Bullhead																						2		
Individual Total	585	38	335	8	37	1	232	60	123	68	30	24	425	116	50	23	277	79	109	62	145	138	124	31
Species Total	3	4	2	2	2	1	5	4	2	4	1	3	7	10	2	5	6	8	8	7	8	10	4	6
Effort (seconds per m^2)	7.5	2.8	5.9	3.4	4.96	2.5	4.51	2.52	8.36	2.75	21.28	3.61	7.51	4.89	7.15	4.27	4.8	2.71	5.32	2.39	6.14	4.43	10.63	5.49

Note: YOY or young of year refers to fish that are in their first year of life i.e. < 100mm.

Table 2 Number of fish species and individuals caught at OSAP sites within the Black, Harmony, Farewell Creek watershed during 2008 sampling compared to historical sampling results (where available) con'd.

	Sites																	
	BL10		BLS2		BLSP		FA03		FA04		FA06		FA08		FA11		FAS2	
Fish Species (common name)	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008
Brook Trout (YOY)																		
Brook Trout			4		15													
Rainbow Trout (YOY)			1					12	5	10		10	27	6			17	5
Rainbow Trout			10	6			5	79	25	42	6	19	17	10			10	5
Brown Trout (YOY)														1			1	
Brown Trout													3	5			8	1
Chinook Salmon (YOY)																		
Creek Chub		2	17	1	1	3	2		4		2							
Blacknose Dace	1	27	20	2	5	3	37	18	19	1	35	2			6			
Longnose Dace							100	57	3	3								
Fathead Minnow																		
Common Shiner																		
Bluntnose Minnow							2											
Northern Redbelly Dace																		
White Sucker			16	1				1								1		1
Largemouth Bass			1							1								
Mottled Sculpin	2		27	23			6	8	23	14	74	24	85	7			47	26
Green Sunfish		1		2		5						4						
Goldfish																		
Pumpkinseed			14	1	5	3			2			1					1	2
Johnny Darter			3	2			3	6			7	3						
Brook Stickleback																		
Banded Killifish																		
Sea Lamprey			2								1							
Rainbow Darter				1				1			1	4						
American Brook Lamprey				1														1
Individual Total	3	30	115	40	26	14	155	182	81	71	126	67	132	29	6	1	85	41
Species Total	2	3	11	10	4	4	7	7	6	5	7	7	4	3	1	1	4	6
Effort (seconds per m^2)	13.8	5.7	4.9	2.7	4.8	6.6	3.9	2.9	4.3	3.6	4.2	3.0	7.1	2.9	3.4	4.3	7.1	2.9

Note: YOY or young of year refers to fish that are in their first year of life i.e. < 100mm.

Table 3 Number of fish species and individuals caught at OSAP sites within various watershed during 2008.

	Sites					
	BN01	BN03	PR14	WA01	WA02	WA03
Fish Species (common name)	2008	2008	2008	2008	2008	2008
Brook Trout (YOY)						
Brook Trout						
Rainbow Trout (YOY)						
Rainbow Trout	1					
Brown Trout (YOY)						
Brown Trout						
Chinook Salmon (YOY)						
Creek Chub					3	1
Blacknose Dace			4			
Longnose Dace						
Fathead Minnow	11		1	1	14	4
Common Shiner						
Bluntnose Minnow						
Northern Redbelly Dace						
White Sucker	3					
Largemouth Bass						
Mottled Sculpin						
Green Sunfish						
Lake Chub				1		
Pumpkinseed					6	1
Johnny Darter						
Brook Stickleback	14	1	14	5	42	1
Banded Killifish						
Rock Bass		1				
Rainbow Darter						
Brown Bullhead						
Individual Total	29	2	19	7	65	7
Species Total	4	2	3	3	4	4
Effort (seconds per m^2)	2.1	5.4	5.7	5.1	4.4	2.4

Note: YOY or young of year refers to fish that are in their first year of life i.e. < 100mm.

Table 4 Number of fish species caught at OSAP Training Course sites within Oshawa Creek watershed during 2007 and 2008.

	Sites									
	OA09	OA10	OA12		OA13		OA15	OE04		OE07
Fish Species (common name)	2007	2007	2007	2008	2007	2008	2008	2007	2008	2008
Brook Trout (YOY)										
Brook Trout										✓
Rainbow Trout (YOY)										
Rainbow Trout	✓	✓	✓	✓	✓	✓	✓	✓		✓
Brown Trout (YOY)										
Brown Trout	✓		✓		✓	✓			✓	✓
Chinook Salmon (YOY)										
Creek Chub	✓	✓		✓	✓		✓	✓	✓	
Blacknose Dace	✓	✓	✓	✓	✓	✓		✓	✓	
Longnose Dace	✓	✓		✓	✓	✓	✓	✓	✓	
Fathead Minnow									✓	
Common Shiner					✓					
Bluntnose Minnow										
Northern Redbelly Dace										
White Sucker	✓	✓		✓	✓	✓	✓	✓	✓	
Largemouth Bass										
Smallmouth Bass	✓					✓				
Salmon family	✓		✓						✓	
Sculpin	✓	✓		✓	✓	✓	✓	✓	✓	✓
Green Sunfish										
Rock Bass	✓	✓	✓							
Pumpkinseed		✓			✓					
Johnny Darter	✓	✓	✓	✓	✓	✓	✓			
Brook Stickleback										
Banded Killifish										
Fantail Darter		✓								
Rainbow Darter										
Lamprey						✓	✓		✓	✓
Minnow family									✓	
Phoxinus sp. (minnow)								✓		
Etheostoma (perch)								✓		
Individual Total	--	--	--	--	--	--	--	--	--	--
Species Total	11	10	6	7	10	9	7	8	10	5
Effort (seconds per m^2)	--	--	--	--	--	--	--	--	--	--

Note: YOY or young of year refers to fish that are in their first year of life i.e. < 100mm.

✓ - site was not sampled with consistent effort therefore only presence information is reported.

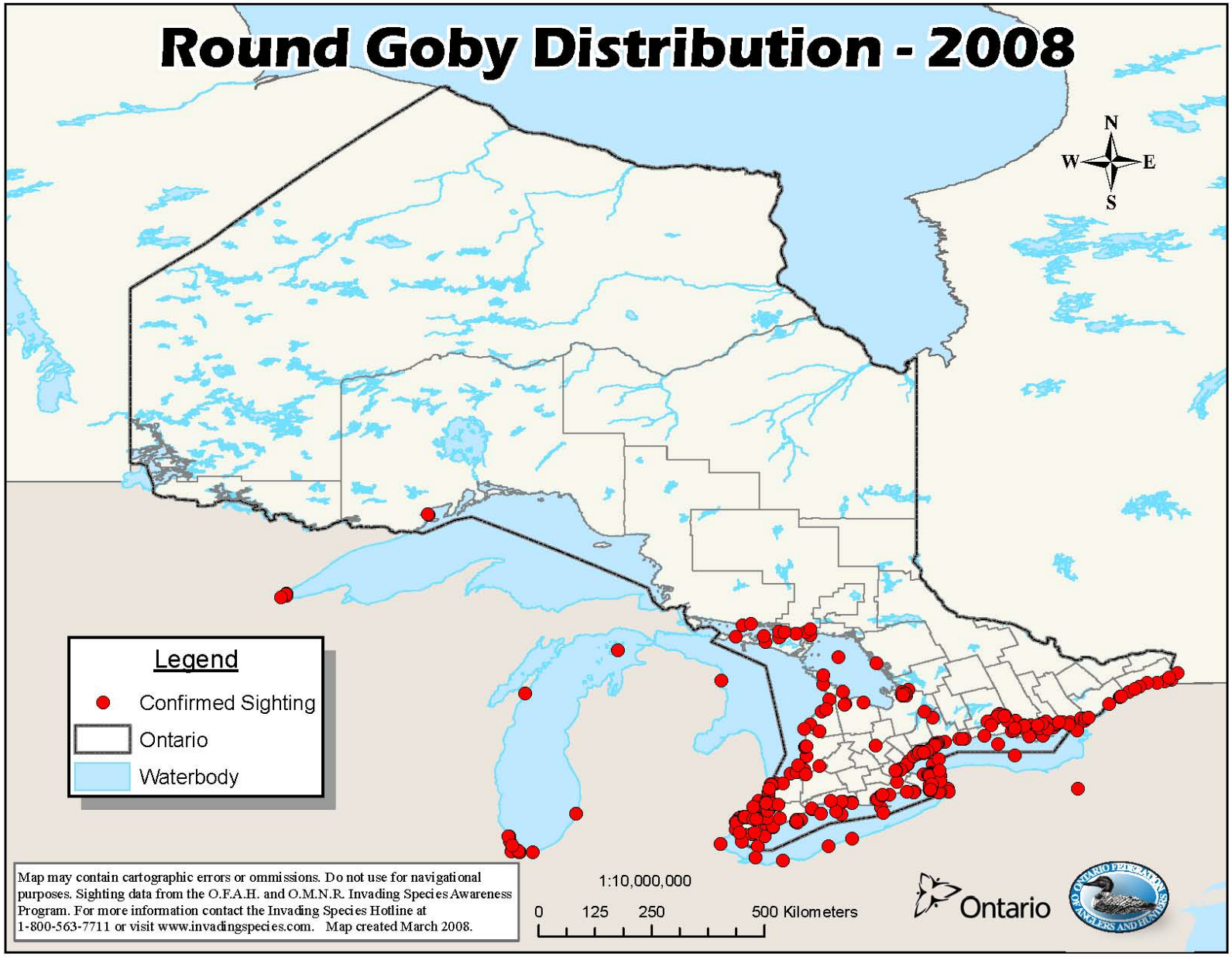


Figure 7 Round Goby distribution in Ontario as of 2008.

4.0 Fisheries Sampling (Coastal Wetlands)

4.1 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 Program (DRCWMP) is designed to be a long-term monitoring program that enables reporting on the condition of coastal wetlands in the Region. 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).

As part of the DRCWMP, fish communities in wetlands are assessed using a sampling method called boat electrofishing (see photo on right; see page 8 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 5). Each wetland receives an IBI score between 0 and 100 each year/time that it is sampled (Table 6) (Environment Canada and Central Lake Ontario Conservation Authority, 2004b).

Table 5 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.

4.2 Durham Results

4.2.1 Lynde Creek Marsh

This is the sixth season that Lynde Creek Marsh has been sampled through the DRCWMP using CLOCA's boat electrofisher. Sampling resulted in an IBI score of 42 which is fairly consistent with past year's sampling. Interesting results include the presence of a White Perch (see photo on right), a young-of-year Northern Pike (see photo below/left) and a Largemouth Bass (see photo below/right). This is the first time that White Perch has been captured in Lynde Creek Marsh through DRCWMP sampling. Northern Pike and Largemouth Bass are both species that have not been commonly found within this wetland through the DRCWMP (Table 7).

4.2.2 Whitby Harbour Wetland Complex

For the second year as part of the DRCWMP, fish sampling was conducted within the Whitby Harbour Wetland Complex. Results again showed poor catch but unlike last year, fish were captured at all locations sampled within the marsh. Interesting results include the presence of a young-of-year Walleye (see photo below). The IBI scores

from 2007 and 2008 were low at 9 and 29 respectively. Since this is only the second time that the marsh has been sampled, no data trends or conclusions can be made. These results indicate that habitat degradation is a likely cause for the poor catch (see historical summary below).

Note that water levels allowed for CLOCA staff to navigate as far upstream as the Watson Street bridge which was under construction at the time (see photo above).

Below is a summary of some historical sampling within the Whitby Harbour area:

> *High levels of Dioxins and Furans have been found in soils, sediment and biota collected from the Study Area. Contamination in Whitby Harbour was first investigated by Environment Canada in the late 1970's. Studies by the Ministry's Environmental Monitoring and Reporting Branch from the mid 1990's through 2006 have delineated Dioxins and Furans contamination in the creek and harbour sediments, soils on the creek floodplain, and in areas where dredgate has been deposited. Elevated levels of Dioxins and Furans have also been found in the tissues of juvenile and sport fish and caged mussels from the creek and harbour.*
>
> *Historically, Whitby Harbour was an active industrial port which has been gradually redeveloped for mainly recreational uses including 2 marinas, adjacent parkland and sports facilities. There is evidence that dredgate and lake fill were historically used as fill for the development of the harbour lands and since the late 1970's, the routine dredging of Whitby Harbour has used confined disposal cells to manage the dredgate. In contrast, Pringle Creek and Pringle Creek floodplain, south of Watson Street, remain largely undeveloped and include natural wetland areas. Pringle Creek widens as it flows into Whitby Harbour at Brock Street and the sediment deposits at the creek mouth are seasonally exposed during summer low flow conditions.*
>
> (MOE, 2009)

4.2.3 Corbett Creek Marsh

This is the fifth season that Corbett Creek Marsh has been sampled through the DRCWMP using CLOCA's boat electrofisher. Although this marsh has not typically scored well in the past, this year's IBI score of 23 is the lowest score to date. Interesting results include the fact that only six individual fish were captured. Possible explanations for low catch and poor water quality over the years may include the fact that a large proportion of this watershed is developed with a lack of stormwater management, and the increased rain events during June and July of 2008 which may have also influenced monitoring results (Figure 8).

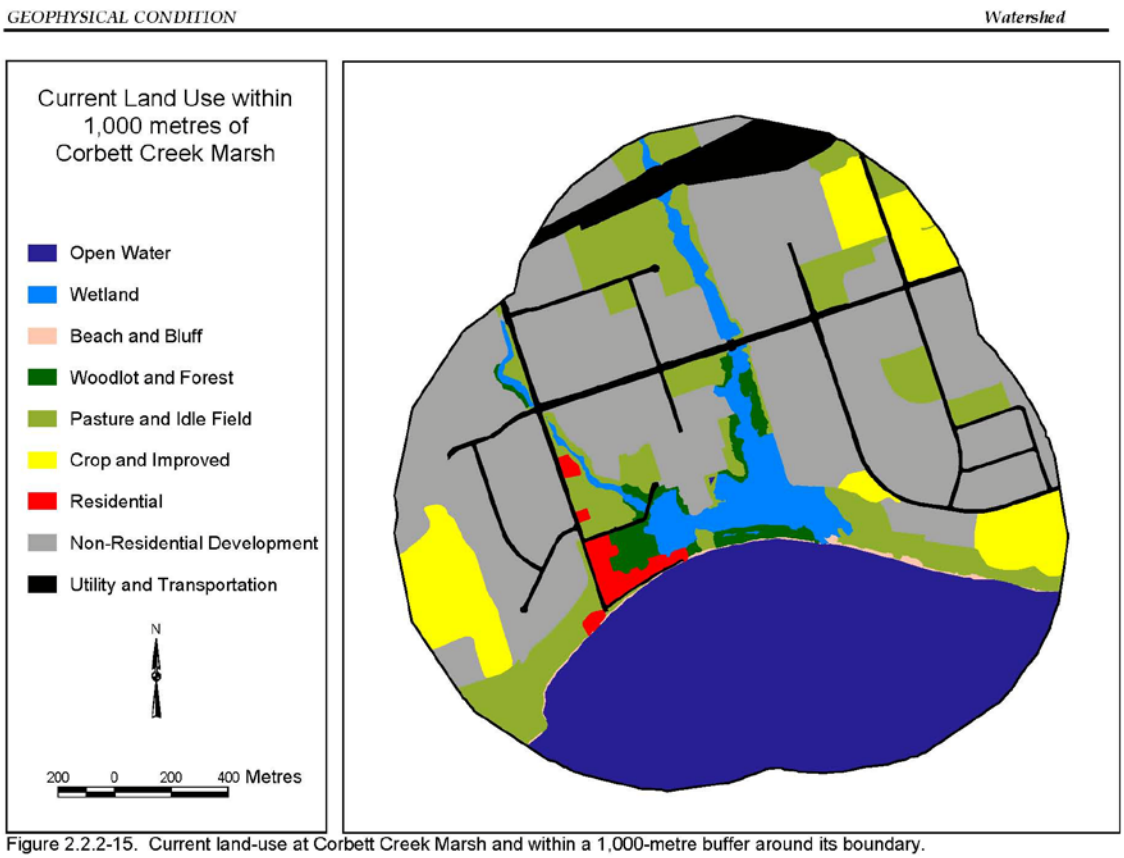


Figure 8 Current land-use at Corbett Creek Marsh and within a 1000-metre buffer around its boundary.

4.2.4 Pumphouse Marsh

The summer of 2007 had very little precipitation and as a result, Pumphouse Marsh was completely dry by August. It is unlikely that any fish survived this event as no refuge pools were observed by CLOCA staff. During 2008 sampling, one Brown Bullhead and 25 Fathead Minnow were captured at various locations within the marsh. Although this year's IBI score of 24 is the lowest score to date it is similar to past scores of 27 (2003) and 34 (2006).

It is unknown how fishes were able to re-populate Pumphouse Marsh. Explanations include:

1. Fishes may have been able to access Pumphouse Marsh from Lake Ontario through the main outlet that drains onto the barrier beach via a culvert located on the west side of the Region of Durham Water Filtration Plant (see photos below). As the

photos show, this connection to Lake Ontario may only be available at certain times of the year i.e., high flow events.
Upstream of the main outlet there is also a concrete control structure designed to control the marsh water level through simple stop-log adjustments (see right photo). Some culvert information taken from Gartner Lee Ltd., 2005.

2. Another outlet culvert exists west of the first location but part of it appears to be completely buried within the barrier beach creating a permanent barrier to fish movement (see bottom right photo showing marsh side).
3. A third outlet culvert also exists on the southwest part of the marsh but its condition is unknown.
4. Another option is that someone may have released fishes into Pumphouse Marsh from another source e.g., bait bucket.

4.2.5 Oshawa Creek Coastal Wetland Complex

For the first time as part of the DRCWMP, fish sampling was conducted within the Oshawa Creek Coastal Wetland Complex. Sampling resulted in an IBI score of 54 with 13 different species of fish caught. An impressive nine Northern Pike (see photo below/right) were captured, eight of which were found in a well vegetated section east of the Montgomery Creek outlet. Since this is the first time that the marsh has been sampled, future year's results will be interesting with regards to data trends.

4.2.6 Oshawa Second Marsh

This is the fourth season that this marsh has been sampled through the DRCWMP using CLOCA's boat electrofisher. Sampling resulted in an IBI score of 36 with 10 different fish species. This is the highest number of species recorded to date.

One Northern Pike was captured. This fish was likely born in the spring of 2007 based on size and colour pattern. Young-of-year pike will generally have light coloured vertical bars where as older fish have light coloured dots (see photo on right).

Since sampling began, Goldfish (see photo below) have been consistently captured in high numbers. Indigenous to eastern Asia they are a non-native species that has been introduced by the release of aquarium pets. This is an ongoing problem as Goldfish compete with native species for food and habitat, contribute to turbidity and damage vegetation (Richardson et al., 1995). Goldfish often find suitable conditions in various wetlands and ponds.

All fishes that enter or leave the marsh must pass through a water-level control structure that connects Oshawa Second Marsh to Farewell Creek. An adjustable grate is used to manage fish passage allowing for control of undesirable fish species such as Common Carp (see photo above/right) which is part of the Goldfish family. Unfortunately, this grate can also exclude desirable fishes such as adult Northern Pike if not positioned correctly. Managers are able to make informed decisions regarding the grate setting by using data collected through the DRCWMP fish sampling each year. This method of decision making is often referred to as adaptive management.

4.2.7 McLaughlin Bay Marsh

On April 16th CLOCA staff discovered that the barrier beach at McLaughlin Bay Marsh had partially broken (see photo on right). A Brown Bullhead was observed attempting to access the marsh from Lake Ontario via the newly created outlet. Also, discovered within the marsh along the shore was the remains of an adult Northern Pike that had been dead for some time (see photo below/left). A White Perch was also discovered dead within the marsh on May 7th (see photo below/right). It is unknown why these fish died but the cause was likely related to poor water quality (e.g., turbid water). Although there was a partial break in the barrier beach the 2008 sampling results did not reflect this change as it did in 2005. This may be because this barrier beach break was relatively small compared to the break in 2005 which was much larger and stayed open longer allowing various fish species more opportunity to enter the marsh to spawn.

4.2.8 Westside Marsh

This is the fourth season that Westside Marsh has been sampled through the DRCWMP for fish. Sampling resulted in an IBI score of 42 with 8 different fish species which is consistent with past results. Five adult Northern Pike (see photo on right) were captured marking the first time that this species has been reported in Westside Marsh through the DRCWMP since sampling began in 2005. This is encouraging due to the fact that a large portion of habitat restoration effort at this site has focused on Pike spawning habitat. During sampling the barrier beach was open (see photo) allowing fish access both in and out of the marsh from Lake Ontario.

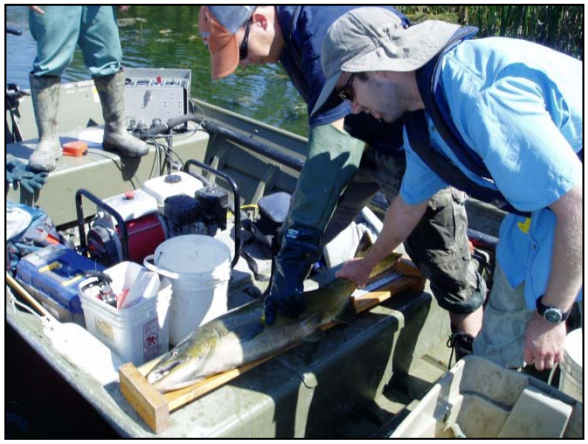
Once fish have been captured they are transferred from the boat electrofisher to the processing boat where biological data is collected i.e., species of fish, length, weight, etc. After all needed information has been collected; staff release the fish back into the marsh. This typical process is shown in the photos below.

4.2.9 Bowmanville Marsh

This is the sixth season that Bowmanville Marsh has been sampled through the DRCWMP using CLOCA's boat electrofisher for fish. Sampling resulted in an IBI score of 63 with 8 different fish species which is the highest IBI score for Bowmanville Marsh to date.

4.2.10 Wilmot Creek Marsh

This is the fifth season that Wilmot Creek Marsh has been sampled through the DRCWMP using CLOCA's boat electrofisher for fish. Sampling resulted in an IBI score of 73 with 11 different fish species which is the highest IBI score to date for any Durham marsh. Interesting results include the presence of a young-of-year Walleye (see photo below/left), a staging adult Chinook Salmon being measured by CLOCA and Ganaraska Region Conservation Authority (GRCA) staff (see photo below/right) and five Northern Pike.



Through the GRCA and CLOCA, on August 28th, an access area was installed primarily to facilitate launching CLOCA's electrofishing boat annually into Wilmot Creek Marsh (see photo below/left). Installation was completed by Public Works staff from the Municipality of Clarington. The boat launch will provide access to the marsh for all future DRCWMP monitoring making it an invaluable asset. Disturbance from construction to the area was minimal and in the future the casual observer will be unaware of its existence (see photo below/right). The fish sampling portion of the project would not have been able to continue without this effort and once again it shows how valuable partnerships are! This access location is not available for public boat launch.

4.2.11 Port Newcastle Marsh

In 2006, for the first time since the project began, Round Goby (see photo on right) were captured in Port Newcastle Marsh (Table 9) and Frenchman's Bay Marsh (Table 8). Round Goby are an invasive species from Eastern Europe that were first discovered in the St. Clair River in 1990. It is believed that they were introduced through ballast water from ships (Ontario Federation of Anglers and Hunters, 2007). Round Goby distribution in Ontario, as of 2008, is shown in Figure 7.

While preparing equipment for sampling, CLOCA staff were informed by children fishing with their father at the public boat launch (Bond Head Park) that they were catching countless Round Goby. Consequently numerous Round Goby were captured near the outlet through a qualitative supplemental sample. This was the first time that Round Goby had been officially documented at this location. Although caught in the wetland, between 2006 - 2008, no Round Goby have been caught on official DRCWMP transects within Port Newcastle Marsh. Although boat electrofishing may not be the most effective sampling method for capturing Round Goby due to their benthic nature and lack of swim bladders; it will be interesting to see what future data trend emerges regarding the goby population.

4.2.12 Frenchman's Bay Marsh

In Frenchman's Bay Marsh, six Round Goby were caught in 2006 on the same sampling transect along the barrier beach that separates the marsh from Lake Ontario. It should be noted that while only six were caught, numerous were observed along the beach in excess of 1-2 per square metre in some areas. In 2007 and 2008, Round Goby were captured throughout the marsh and were not localized to one area as they were in 2006 e.g., barrier beach. It will be interesting to see what future data trend emerges regarding the goby population.

4.3 Bay of Quinte RAP

4.3.1 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 (Table 6). 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 13 wetlands over a 3-year period. 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)

4.3.2 Results

This past summer, fisheries sampling as part of the BQRAP began on August 18th and finished August 25th with five Quinte wetlands being sampled:

1. Sawguin Creek Marsh
2. Big Island Marsh (East)
3. Hay Bay South
4. Hay Bay North
5. Big Island Marsh (West)

Of the five marshes, Sawguin Creek Central Marsh had the lowest IBI score of 55.4 with Big Island West Marsh receiving the highest score of 96.3 (Table 6). Difficult conditions

such as high winds and mechanical failure were experienced during the sampling of Sawguin Creek Marsh and likely contributed to the poor result relative to the other four marshes. Big Island West Marsh received a maximum score of 10 in all metric categories with the exception of BYPE which was 7.8. This is one of the best results of any wetland sampled through the DRCWMP since it began in 2003.








Table 6 IBI results of DRCWMP Fish Sampling from 2003 – 2008.

		2008 Metrics						IBI Score						
Wetland Name	**Location**	**SNAT**	**SCEN**	**PPIS**	**NNAT**	**PBNI**	**BYPE**	**2008**	**2007**	**2006**	**2005**	**2004**	**2003**	**Average**
Parrott's Bay	Quinte Area	-	-	-	-	-	-	-	-	-	-	-	85.4	85.4
Hay Bay South Marsh		10.0	10.0	6.4	10.0	8.6	9.5	90.9	-	-	78.5	-	-	84.7
Hay Bay North Marsh		8.1	10.0	10.0	1.7	9.7	6.7	76.9	-	-	84.5	-	-	80.7
Big Island East Marsh		8.0	10.0	10.0	3.8	10.0	10.0	86.2	-	-	99.9	-	-	93.1
Big Island West Marsh		10.0	10.0	10.0	10.0	10.0	7.8	96.3	-	-	-	-	-	96.3
Robinson's Cove Marsh		-	-	-	-	-	-	-	-	-	84.6	-	-	84.6
Sawguin Creek Central Marsh		6.8	10.0	0.0	2.2	10.0	4.2	55.4	-	-	70.4	-	-	62.9
Huyck's Bay Marsh		-	-	-	-	-	-	-	-	-	-	-	74.0	74.0
Port Newcastle Marsh	Durham	4.8	4.6	1.6	2.7	6.5	10.0	50.4	55.6	31.0	52.0	-	26.4	43.1
Wilmot Creek Marsh		7.5	6.3	7.2	3.3	10.0	9.7	73.3	46.8	35.9	-	45.4*	56.5	51.6
Bowmanville Marsh		6.9	7.4	10.0	2.4	10.0	0.9	62.5	59.7	26.5	49.0	36.3*	43.7	46.3
Westside Marsh		5.3	4.1	0.0	2.0	10.0	3.9	42.2	51.5	35.1	30.1	-	-	39.7
McLaughlin Marsh		2.4	0.9	0.0	0.3	8.3	2.4	23.8	35.3	30.5	57.1	-	36.0	36.5
Oshawa Second Marsh		7.6	9.8	1.3	2.7	0.0	0.3	36.1	26.5	40.9	45.6	-	-	37.3
Oshawa Creek Costal Wetland		6.6	4.6	9.4	2.0	6.8	3.2	54.2	-	-	-	-	-	54.2
Pumphouse Marsh		2.4	0.0	0.0	1.8	10.0	0.0	23.6	-	34.4	-	-	26.6	28.2
Corbett Creek Marsh		1.3	1.6	0.0	0.2	10.0	0.9	23.4	40.2	31.1	65.9	-	27.1	37.5
Whitby Harbour Wetland		5.4	0.9	0.1	10.0	0.0	1.0	29.0	9.4	-	-	-	-	19.2
Lynde Creek Marsh		3.7	1.6	10.0	2.0	7.2	0.6	41.9	50.0	47.6	59.8	34.3*	40.7	45.7
Carruthers Creek Marsh		-	-	-	-	-	-	-	47.3	32.9	-	-	29.5	36.6
Duffins Creek Marsh		3.6	2.8	10.0	1.0	9.7	0.3	45.6	49.0	23.2	37.6	32.4*	26.0	35.6
Hydro Marsh		6.9	5.5	10.0	1.9	0.0	2.6	44.9	52.4	47.5	47.3	-	17.2	41.9
Frenchman's Bay Marsh		5.6	4.9	10.0	3.5	5.9	2.4	53.8	48.7	30.0	56.4	-	44.9	46.8
Rouge River Marsh		4.2	2.8	0.0	1.7	10.0	5.4	40.1	25.0	48.7	49.9	-	31.5	39.0

* average IBI from two sampling events.

Table 7 Number of fish and species caught at CLOCA coastal wetlands from 2002 – 2008.

	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**	**2007**	**2008**	**2003**	**2005**	**2006**	**2007**	**2008**	**2003**	**2006**	**2007**	**2008**
Alewife		1	1	1		12				6								Marsh Completely Dry	
Banded Killifish											1			2					
Black Crappie	4			1		4	1										3		
Bluegill												5					6		
Bluntnose Minnow		3		7		1	1		2	4									
Bowfin	1																		
Brook Silverside																			
Brook Stickleback												1							
Brown Bullhead	12	18	11	118	19	9	56	2			6	55	32	4	2	5	5		1
Central Mudminnow																32			
Common Carp	2			4	5	1	1		5	9	3	6	2						
Common Shiner					1		5	2											
Emerald Shiner			2	31		11	2		2	157									
Fathead Minnow	46	24	1	2		4	4	20	1	3	21	3	15	9		484	10		25
Freshwater Drum																			
Gizzard Shad		10	6		30	4	1	38	19	4									
Golden Shiner		6	1	2		1	2	2				17							
Goldfish													1			37	60		
Johnny Darter				2					1										
Largemouth Bass				1				1											
Logperch			3	6					1										
Northern Pike					3	1		1				1	1						
Pumpkinseed	92	38	6	26	45	11	7	1		3	8	23	3	13	3		36		
Rock Bass																			
Round Goby†																			
Smallmouth Bass	2					1													
Spotfin Shiner																			
Spottail Shiner	23	18	1		1	6		1		1									
Walleye		1		1						1									
White Perch								1											
White Sucker				5		1	5		3										
Yellow Perch	1		1		9	3	13	4		4		1		2	1				
Individual Total	**183**	**119**	**33**	**207**	**113**	**70**	**98**	**73**	**34**	**189**	**39**	**112**	**54**	**30**	**6**	**558**	**120**	**--**	**26**
Species Total	**9**	**9**	**10**	**14**	**8**	**15**	**12**	**11**	**8**	**10**	**5**	**9**	**6**	**5**	**3**	**4**	**6**	**--**	**2**
IBI Score	**--**	**41**	**34**		**60**	**48**	**50**	**42**	**9**	**29**	**27**	**66**	**31**	**40**	**23**	**27**	**34**	**--**	**24**

Table 7 Number of fish and species caught at CLOCA coastal wetlands from 2002 – 2008 con'd.

	Oshawa Creek Coastal Wetland Complex	Oshawa Second Marsh					McLaughlin Bay Marsh					Westside Marsh				Bowmanville Marsh							
Fish Species (common name)	**2008**	**2002**	**2005**	**2006**	**2007**	**2008**	**2003**	**2005**	**2006**	**2007**	**2008**	**2005**	**2006**	**2007**	**2008**	**2002**	**2003**	**2004(1)**	**2004(2)**	**2005**	**2006**	**2007**	**2008**
Alewife	2							1								6	1	2				1	
Banded Killifish			28	1	2	3																	
Black Crappie					1		13	2	12	7		1		1	10								
Bluegill						13							1										
Bluntnose Minnow								3					2				4	1		9		2	
Bowfin																							
Brook Silverside																							
Brook Stickleback			4																				
Brown Bullhead	3	3	22	49	67	12	17	16	4	8		23	5	99	5	2	13	1	6	24	1	16	
Central Mudminnow																							
Chinook Salmon	1																						
Common Carp	3						1	2	3	4		3	1						1		3		
Common Shiner																							2
Emerald Shiner	22														1			12	12				1
Fathead Minnow		154	167	12	1	4						17	7						1	3		15	1
Freshwater Drum								3															
Gizzard Shad	4							212	36	19	8	37	5	11	33	1				8	1	13	1
Golden Shiner						1						1				2	16	1	3	33		12	30
Goldfish		10	69	30	67	18																	
Johnny Darter																	1						
Largemouth Bass									1				1	1									
Logperch																							
Northern Pike	9					1									5						1		
Pumpkinseed	12		50	97	24	23	6	24	4	6	1	7	18	24	8	11	28	23	13	42		88	18
Rock Bass	2																						
Round Goby†																							
Smallmouth Bass	1																		1				
Spotfin Shiner																							
Spottail Shiner	2							1				1					7	10	9	2	1	31	1
Walleye																		1					
White Perch								4		1	2												
White Sucker	3		1			1		1						1	1			1					
Yellow Perch	5	20		4	1	1	5	11	5	5	6	2	4	7	8		5			1	1	1	15
Individual Total	**69**	**187**	**341**	**193**	**163**	**77**	**42**	**280**	**64**	**51**	**17**	**92**	**44**	**144**	**71**	**22**	**75**	**52**	**46**	**122**	**8**	**179**	**69**
Species Total	**13**	**4**	**7**	**6**	**7**	**10**	**5**	**12**	**6**	**8**	**4**	**9**	**9**	**7**	**8**	**5**	**8**	**9**	**8**	**8**	**6**	**9**	**8**
IBI Score	**54**	**--**	**46**	**41**	**27**	**36**	**36**	**57**	**30**	**35**	**24**	**30**	**35**	**52**	**42**	**--**	**44**	**36**		**49**	**26**	**60**	**63**

Table 8 Number of fish and species caught at TRCA coastal wetlands from 2002 – 2008.

	Rouge River Marsh					Frenchman's Bay Marsh					Hydro Marsh					Duffins Creek Marsh								Carruthers Creek Marsh				
Fish Species (common name)	**2003**	**2005**	**2006**	**2007**	**2008**	**2003**	**2005**	**2006**	**2007**	**2008**	**2003**	**2005**	**2006**	**2007**	**2008**	**2002**	**2003**	**2004[1]**	**2004[2]**	**2005**	**2006**	**2007**	**2008**	**2002**	**2003**	**2006**	**2007**	**2008**
Alewife						11			41		4		3					1	1				13					Not Sampled
Banded Killifish																												
Black Crappie											1			1					1					5		3	1	
Bluegill						4																			2			
Bluntnose Minnow	2		2			7	6		4	3		2			4	31	6		7		5	1	3	37	6	3		
Bowfin			2																									
Brook Silverside																												
Brook Stickleback																												
Brown Bullhead	64	21	14	33	1	2		9		2	66			33	2	38	1	11	118			1	3	12	8	1	31	
Chinook Salmon																							2					
Common Carp	3	1	5	1		5	1	1		5	3	3		6	4		3		4		2			7	7	1	12	
Common Shiner	1	1	18	3								2			18	41	14			4	1			32				
Emerald Shiner	5	1			4	35	9	1	20	9			4				1	2	31			4	6		1			
Fathead Minnow	2		3	2				6		1	22		18				13	1	2		29		6		37	12	48	
Freshwater Drum						1																						
Gizzard Shad	3	10	7	3	13	1	23	6		1	1	3	24		1	59	12	6		13	20	24		87	6	1	158	
Golden Shiner				2	2				28	33	5	18	7	1	3			1	2									
Goldfish			1																									
Johnny Darter						1										5	1		2			1		6				
Largemouth Bass		2				5	4	4	12	16		1	1	7	6	4			1					4			1	
Logperch																	5	3	6									
Northern Pike			1												2							1	3					
Pumpkinseed	8	58	22	16	14	57	36	3	12	14	4	15	20	54	4	45	8	6	26		5	3	7	66	31	12	16	
Rock Bass									2							91	1											
Round Goby[†]								6	12	9																		
Smallmouth Bass						2						1																
Spotfin Shiner						5																						
Spottail Shiner			1				1									36	2	1				17						
Walleye																			1									
White Perch									2																			
White Sucker			1			1		1	2				1	1			1		5		2		2					
Yellow Perch	9	6	3		16	2	50		6	12		4	2	5	17	2	5	1		6	2	7	1	5		1	6	
Individual Total	**97**	**100**	**80**	**60**	**50**	**139**	**130**	**37**	**141**	**105**	**106**	**49**	**80**	**108**	**61**	**352**	**73**	**33**	**207**	**26**	**66**	**59**	**46**	**270**	**98**	**34**	**273**	**--**
Species Total	**9**	**8**	**13**	**7**	**6**	**15**	**8**	**9**	**11**	**11**	**8**	**9**	**9**	**8**	**10**	**10**	**14**	**10**	**14**	**3**	**8**	**9**	**10**	**10**	**8**	**8**	**8**	**--**
IBI Score	**32**	**50**	**49**	**25**	**40**	**45**	**56**	**30**	**49**	**54**	**17**	**47**	**48**	**52**	**45**	**--**	**26**	**32**		**38**	**23**	**49**	**46**	**--**	**30**	**33**	**47**	**--**

[†] - invasive species

Table 9 Number of fish and species caught at GRCA coastal wetlands from 2002 - 2008.

	Wilmot Creek Marsh					Port Newcastle Marsh				
Fish Species (common name)	**2003**	**2004**	**2006**	**2007**	**2008**	**2003**	**2005**	**2006**	**2007**	**2008**
Alewife									16	
Banded Killifish										1
Black Crappie					1					
Bluegill										
Bluntnose Minnow	2	36	1	1			8	1	3	14
Bowfin				1						
Brook Silverside										
Brook Stickleback										
Brown Bullhead	12	13	26	1	2		2	16	102	1
Central Mudminnow										
Chinook Salmon					1					2
Common Carp	5	13	37	3		1	9	2	1	2
Common Shiner				2			3	14	2	1
Emerald Shiner		51	1						3	
Fathead Minnow		1	5				3	1		1
Freshwater Drum										
Gizzard Shad							4	3	3	4
Golden Shiner	2		6	2	20		97	1		
Goldfish										
Johnny Darter	19	4	8		13	4	1	3		
Largemouth Bass	1	1					1			1
Logperch									1	
Northern Pike	4	2		1	5					
Pumpkinseed	31	4	11	25	16	24	85	12	46	12
Rock Bass	1			1			5		2	
Round Goby†								✓		4
Smallmouth Bass									2	
Spotfin Shiner										
Spottail Shiner	1	2		1	1			3	3	
Walleye					1					1
White Perch										
White Sucker	2	57	11	6	3	1	1	1	3	8
Yellow Perch	3	5	9	1	13	3	6	8	4	62
Individual Total	**85**	**195**	**115**	**45**	**76**	**33**	**225**	**65**	**191**	**114**
Species Total	**12**	**12**	**10**	**12**	**11**	**5**	**13**	**12**	**14**	**14**
IBI Score	**56**	**45**	**36**	**47**	**73**	**26**	**52**	**31**	**56**	**50**

† - invasive species, ✓ - observed through a qualitative supplemental sample

5.0 Biological Water Quality

5.1 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 macroinvertebrates ("aquatic bugs"; see photos below) and fish, found living within the aquatic environment. Benthic macroinvertebrates 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 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 like Trout and Sculpins.

5.2 Results

During May 2008, CLOCA staff sampled 14 OBBN sites in total throughout 4 watersheds (Figure 9). Four of the sites sampled were reference sites and the remaining 10 sites were test sites, generally at long-term monitoring sites. This was the fourth season that CLOCA has sampled benthos using the recently developed OBBN protocol.

Photo Above: Summer staff collecting benthos using a kick net.

5.21 2005 OBBN Sampling

This was the first year that CLOCA participated in the OBBN and sampling sites were chosen throughout the jurisdiction (**Figure 10**). A consistent trend is evident showing higher EPT percentages in the north and eastern sections of the jurisdiction. This is not surprising considering that the CLOCA jurisdiction is largely urbanized in the south with more natural cover in the eastern and northern parts.

5.22 2006 OBBN Sampling

Aquatic monitoring effort was primarily focused in the Bowmanville and Soper Watershed during 2006 and OBBN sampling site locations reflected this (**Figure 11**). Again a consistent trend is evident showing higher EPT percentages in the northern sections of the watershed. Unlike many other watersheds, results were still strong within the southern parts of Bowmanville and Soper. This is not surprising considering that Bowmanville and Soper watershed has approximately 36% natural cover (CLOCA, 2008).

5.23 2007 OBBN Sampling

Aquatic monitoring effort was primarily focused in the Oshawa Creek Watershed during 2007 and OBBN sampling site locations reflected this (**Figure 12**). Again a consistent trend is evident showing higher EPT percentages in the northern sections of the watershed. Despite the positive northern results, this was not the case for the part of the watershed south of Taunton Rd. These poor results are likely the result of high urban land cover in this area. Overall this watershed has approximately 23% natural cover (CLOCA, 2008).

5.24 2008 OBBN Sampling

Aquatic monitoring effort was primarily focused in the Black, Harmony, Farewell Creek Watershed although considerable time was spent sampling within the Enniskillen Conservation Area during 2008 and OBBN sampling site locations reflected this (**Figure 9**). Again a consistent trend is evident showing higher EPT percentages in the northern sections of these watersheds.

Encouraging results were evident within the valley sections of Black, Harmony, Farewell watershed where natural cover was present. This was not the case for more urbanized sections in the southern portion of the watershed. These poor results are likely the result of high urban land cover in this area. Overall this watershed has approximately 24% natural cover (CLOCA, 2008).

The headwaters of the Bowmanville Creek showed high percentages of EPT which is not surprising considering the amount of natural cover. Overall Bowmanville watershed has approximately 41% natural cover (CLOCA, 2008).

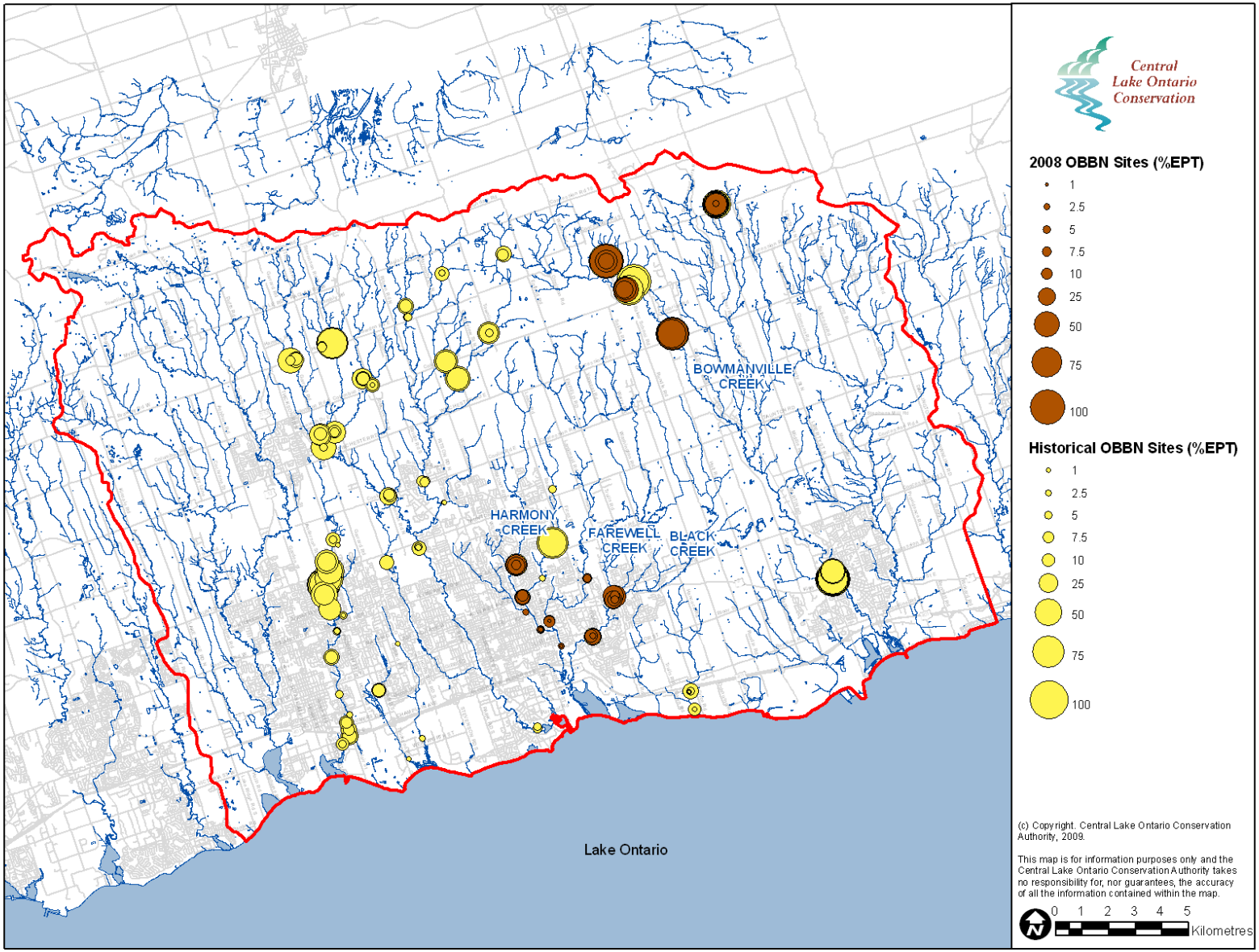


Figure 9 Percent EPT from OBBN site locations sampled during 2008 compared to historical sites.

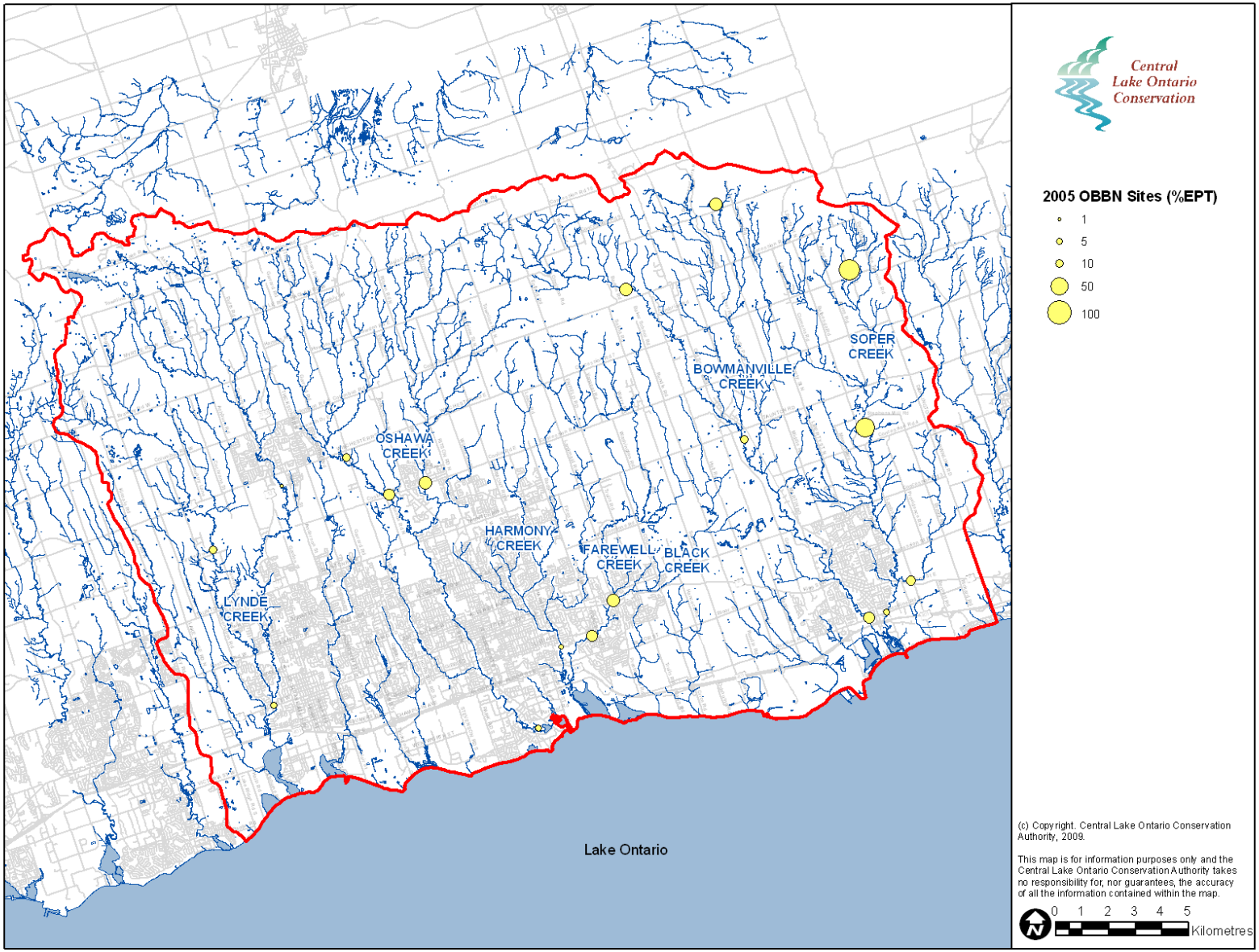


Figure 10 Percent EPT from OBBN site locations sampled during 2005.

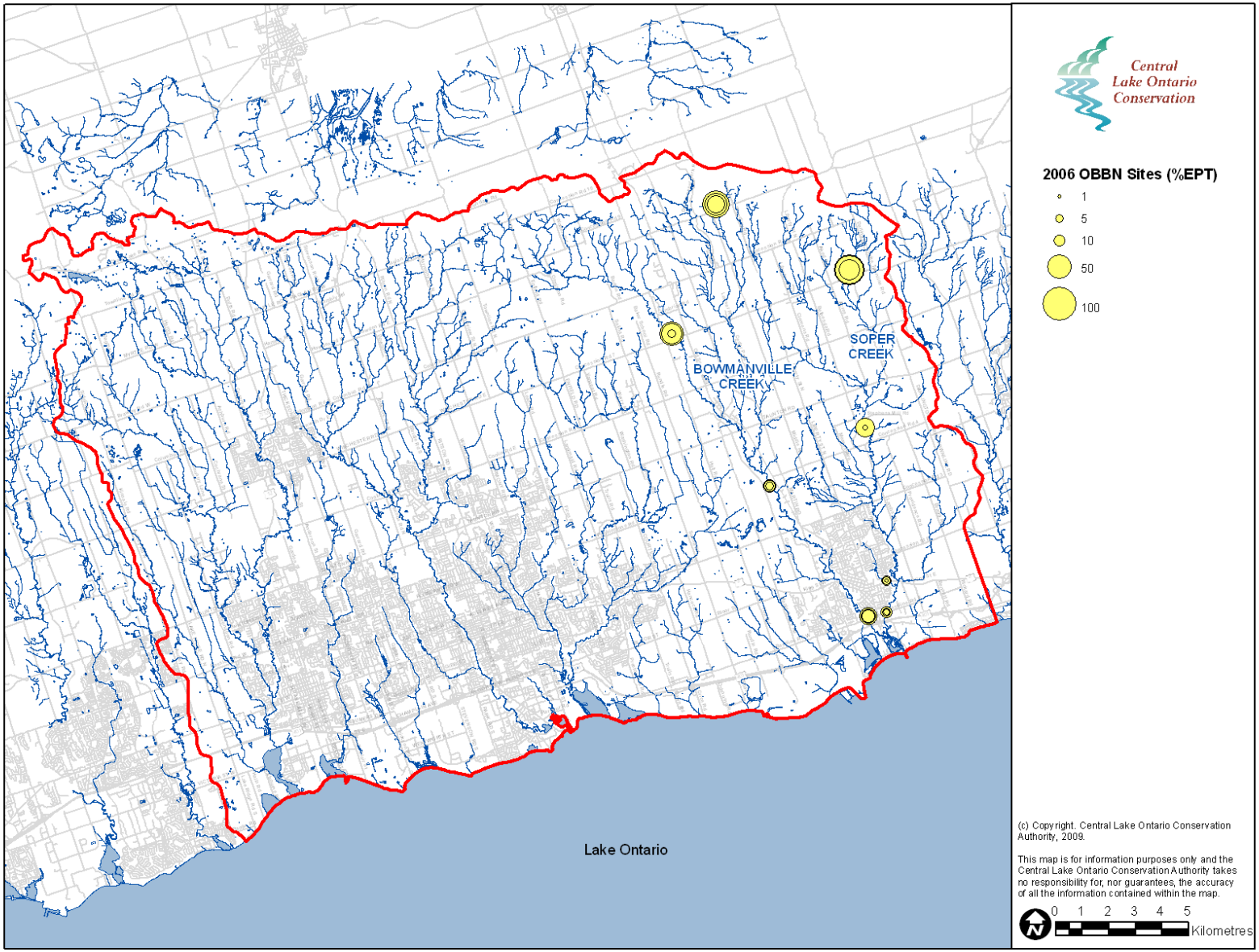


Figure 11 Percent EPT from OBBN site locations sampled during 2006.

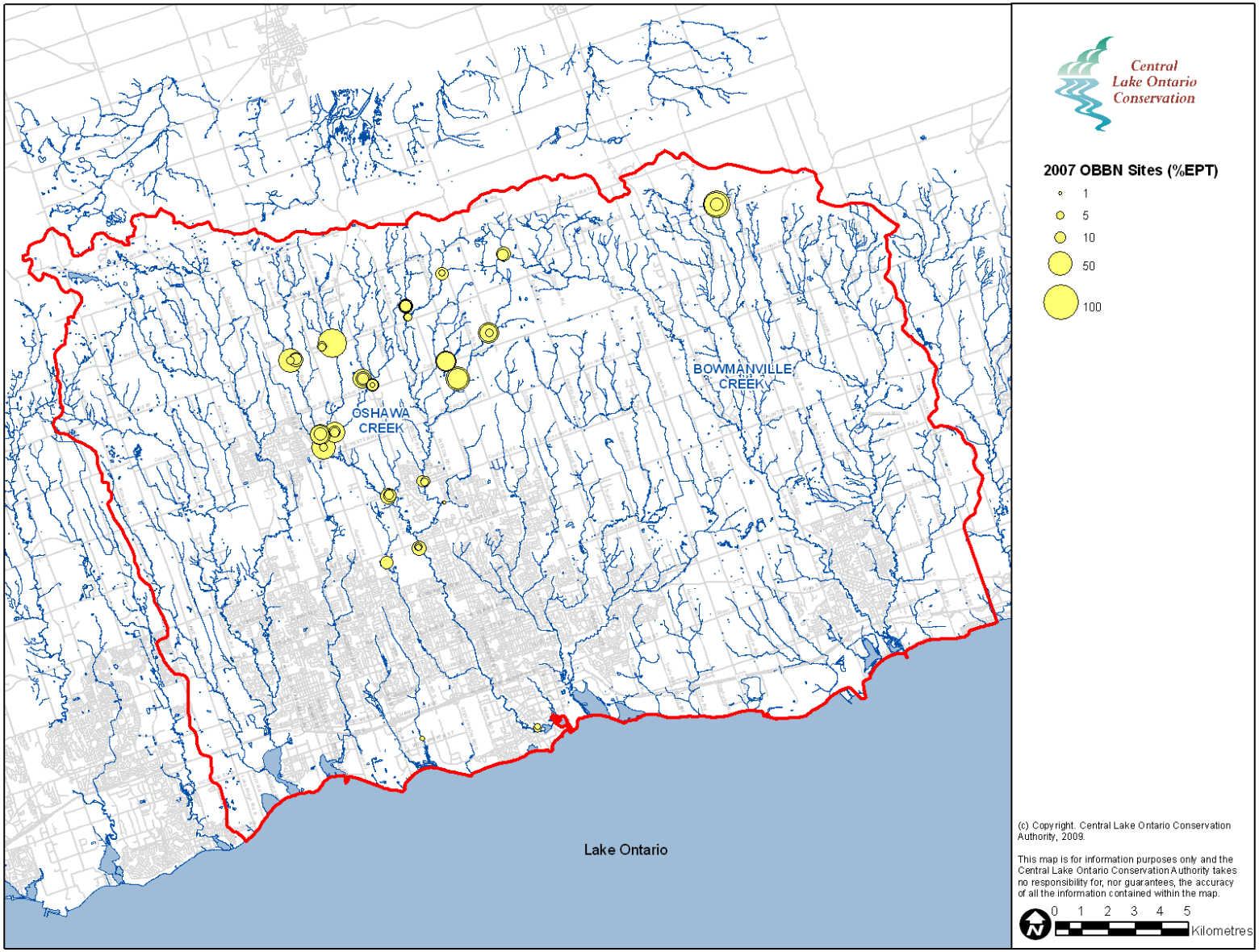


Figure 12 Percent EPT from OBBN site locations sampled during 2007.

Table 10 Percent EPT for OBBN sites sampled between 2005 and 2008.

Site Code	Date	Methodology	%EPT	Family Richness
BKOB01	05/25/05	Combined	26.6	9
BKOB01	05/26/08	Riffle 1	25.0	11
		Riffle 2	12.7	6
		Pool 1	3.9	10
BOWOB01	05/10/05	Combined	18.9	9
BOWOB01	05/23/06	Riffle 1	25.5	9
		Riffle 2	14.0	9
		Pool 1	18.6	7
BOWOB02	05/18/05	Combined	9.7	10
BOWOB03	05/27/05	Combined	24.0	9
BOWOB03	05/30/06	Riffle 1	27.2	7
		Riffle 2	62.8	10
		Pool 1	42.3	10
BOWOB03	08/05/07	Riffle 1	59.6	11
		Riffle 2	48.7	7
		Pool 1	14.3	8
BOWOB03	05/30/08	Riffle 1	40.4	10
		Riffle 2	46.5	7
		Pool 1	2.9	8
BOWOB04	05/24/05	Combined	23.3	10
BOWOB04	05/30/08	Riffle 1	47.6	11
		Riffle 2	38.8	10
		Pool 1	25.0	9
BOWOB05	05/29/06	Riffle 1	13.6	7
		Riffle 2	5.7	6
		Pool 1	10.8	8
BOWOB06	05/29/06	Riffle 1	50.9	10
		Riffle 2	36.6	10
		Pool 1	5.1	10
BOWOB06	05/30/08	Riffle 1	64.0	9
		Riffle 2	77.7	6
		Pool 1	65.2	4
BOWOB07	05/29/08	Riffle 1	86.1	9
		Riffle 2	40.2	8
		Pool 1	20.6	7
FLOB01	05/16/05	Combined	20.0	7
FLOB01	05/26/08	Riffle 1	11.0	10
		Riffle 2	20.0	9
		Pool 1	2.7	4
FLOB02	05/28/08	Riffle 1	31.5	8

Site Code	Date	Methodology	%EPT	Family Richness
FLOB02	05/28/08	Riffle 2	37.2	9
		Pool 1	7.0	5
GNOB01	04/05/07	Riffle 1	0.0	10
		Riffle 2	0.0	9
		Pool 1	0.0	6
GNOB02	10/05/07	Riffle 1	14.7	12
		Riffle 2	0.0	9
		Pool 1	0.0	5
HYOB01	05/25/05	Combined	3.9	12
HYOB01	05/27/08	Riffle 1	0.9	8
		Riffle 2	2.7	9
		Pool 1	0.0	4
HYOB02	05/27/08	Riffle 1	0.0	2
		Riffle 2	3.1	4
		Pool 1	0.0	7
HYOB03	05/27/08	Riffle 1	3.7	6
		Riffle 2	2.0	4
		Pool 1	2.6	6
HYOB04	05/27/08	Riffle 1	8.3	7
		Riffle 2	8.7	7
		Pool 1	0.9	6
HYOB05	05/28/08	Riffle 1	15.9	10
		Riffle 2	9.7	9
		Pool 1	0.0	7
HYOB06	05/28/08	Riffle 1	22.9	8
		Riffle 2	35.6	7
		Pool 1	7.4	8
HYOB07	05/28/08	Riffle 1	6.2	11
		Riffle 2	7.1	7
		Pool 1	4.9	9
LYOB01	05/26/05	Combined	5.8	10
LYOB02	05/19/05	Combined	8.0	9
LYOB03	05/26/05	Combined	1.9	9
MYOB01	07/05/07	Riffle 1	0.0	4
		Riffle 2	0.0	3
		Pool 1	0.0	1
OAOB01	05/25/05	Combined	8.0	9
OAOB01	04/05/07	Riffle 1	5.4	11
		Riffle 2	3.3	10
		Pool 1	0.0	8
OAOB02	05/20/05	Combined	24.3	10
OAOB02	07/05/07	Riffle 1	14.8	8

Site Code	Date	Methodology	%EPT	Family Richness
OAOB02	07/05/07	Riffle 2	4.9	9
		Pool 1	3.0	6
OAOB03	05/20/05	Combined	20.4	10
OAOB03	09/05/07	Riffle 1	1.0	3
		Riffle 2	0.9	5
		Pool 1	0.0	3
OAOB04	11/05/07	Riffle 1	12.0	6
		Riffle 2	21.0	6
		Pool 1	7.4	7
OAOB05	11/05/07	Riffle 1	5.8	10
		Riffle 2	7.1	8
		Pool 1	9.3	13
OAOB06	05/15/07	Riffle 1	2.9	8
		Riffle 2	13.0	9
		Pool 1	0.0	3
OAOB07	05/15/07	Riffle 1	4.4	7
		Riffle 2	4.3	7
		Pool 1	0.0	3
OAOB08	05/18/07	Riffle 1	12.6	8
		Riffle 2	8.9	9
		Pool 1	1.3	10
OAOB09	05/18/07	Riffle 1	68.3	9
		Riffle 2	68.3	10
		Pool 1	70.3	10
OAOB10	05/23/07	Riffle 1	5.4	6
		Riffle 2	6.7	9
		Pool 1	0.0	3
OAOB11	05/23/07	Riffle 1	11.1	6
		Riffle 2	29.1	13
		Pool 1	15.0	6
OAOB12	05/24/07	Riffle 1	29.0	6
		Riffle 2	12.0	10
		Pool 1	36.8	9
OAOB13	05/24/07	Riffle 1	44.2	10
		Riffle 2	4.8	8
		Pool 1	No Data	0
OAOB14	05/28/07	Riffle 1	33.0	12
		Riffle 2	24.0	13
		Pool 1	4.7	10
OAOB15	05/28/07	Riffle 1	9.1	6
		Riffle 2	18.2	3
		Pool 1	0.0	2

Site Code	Date	Methodology	%EPT	Family Richness
OAOB16	05/28/07	Riffle 1	37.4	11
		Riffle 2	47.8	8
		Pool 1	34.6	13
OAOB17	05/29/07	Riffle 1	36.9	12
		Riffle 2	11.2	10
		Pool 1	6.5	10
OAOB18	01/06/07	Riffle 1	31.4	10
		Riffle 2	37.5	10
		Pool 1	0.0	3
OAOB19	01/06/07	Riffle 1	12.5	3
		Riffle 2	18.3	6
		Pool 1	9.8	5
OAOB20	01/06/07	Riffle 1	46.2	5
		Riffle 2	5.3	6
		Pool 1	0.0	5
OAOB21	01/06/07	Riffle 1	16.7	11
		Riffle 2	10.5	7
		Pool 1	0.0	2
PROB01	05/12/05	Combined	9.5	9
SOPOB01	05/17/05	Combined	7.6	9
SOPOB01	05/24/06	Riffle 1	3.8	9
		Riffle 2	11.4	7
		Pool 1	5.1	8
SOPOB02	05/17/05	Combined	66.0	9
SOPOB02	05/25/06	Rifle 1	30.0	6
		Riffle 2	31.7	9
		Pool 1	2.27	6
SOPOB03	05/09/05	Combined	75.0	10
SOPOB03	05/31/06	Riffle 1	80.0	10
		Riffle 2	72.8	9
		Pool 1	39.6	9
SOPOB04	05/11/05	Combined	14.3	6
SOPOB04	05/24/06	Riffle 1	6.9	7
		Riffle 2	1.0	7
		Pool 1	5.0	9

6.0 Stream Temperature

6.1 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 generally between May and December of 2008. 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 until winter, CLOCA staff are 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, 73 portable temperature loggers (Figure 13) were installed throughout the CLOCA jurisdiction in 2008 (Figure 14). Of the 73 loggers, 13 were part of the Enniskillen Conservation Area Management Plan. CLOCA acquired an additional 6 temperature loggers from the DFO. All of the loggers, with the exception of two older loggers within Soper Creek, were programmed to collect water temperature every half-hour generally between May and December.

Figure 13 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 the Stream Temperature Analysis Tool and Exchange (STATE) (Table 6; Jones and Chu, 2007). 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 and so these zones represent coldwater streams in the traditional sense (Bowlby, 2008).

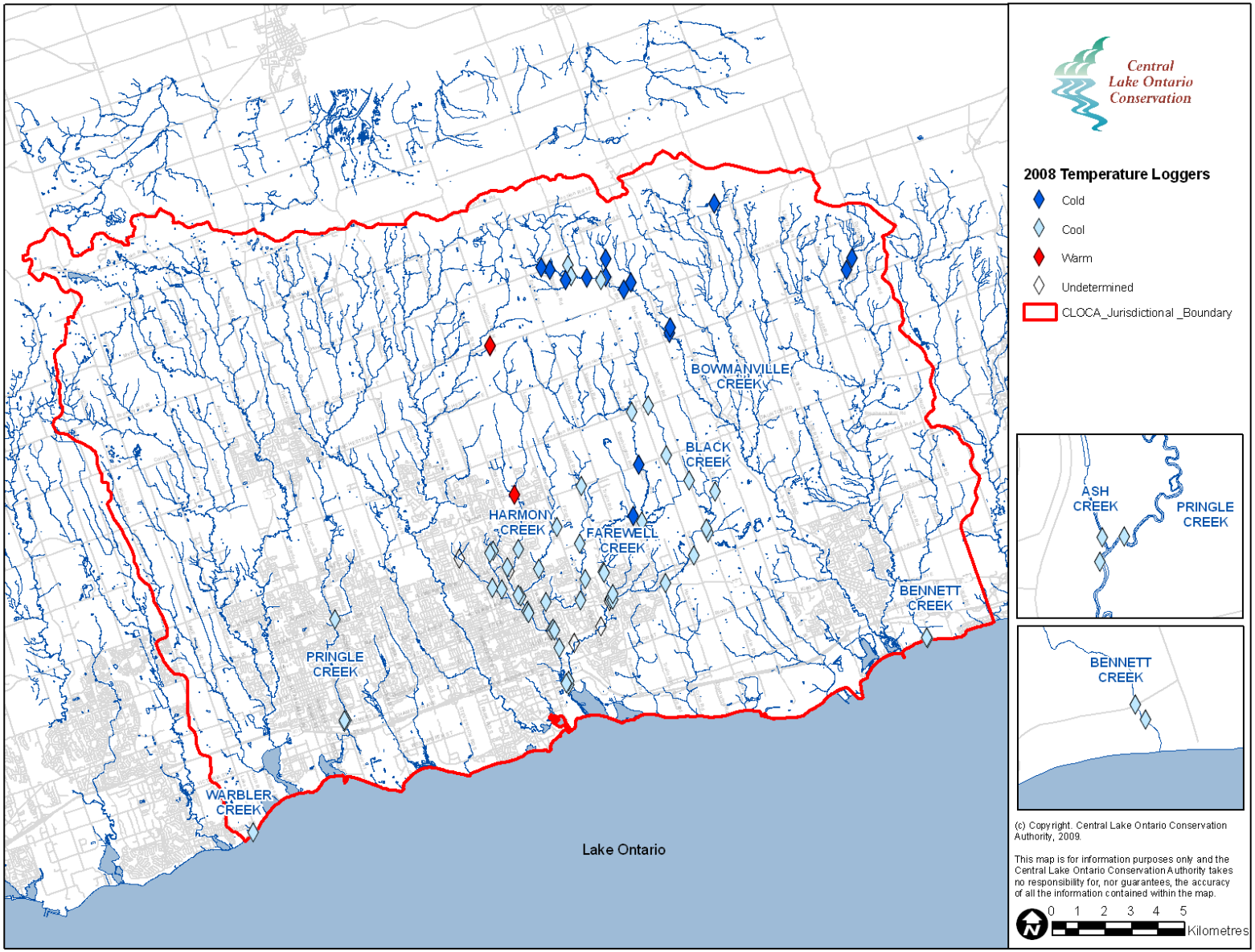


Figure 14 Location and thermal classification of stream temperature loggers during 2008.

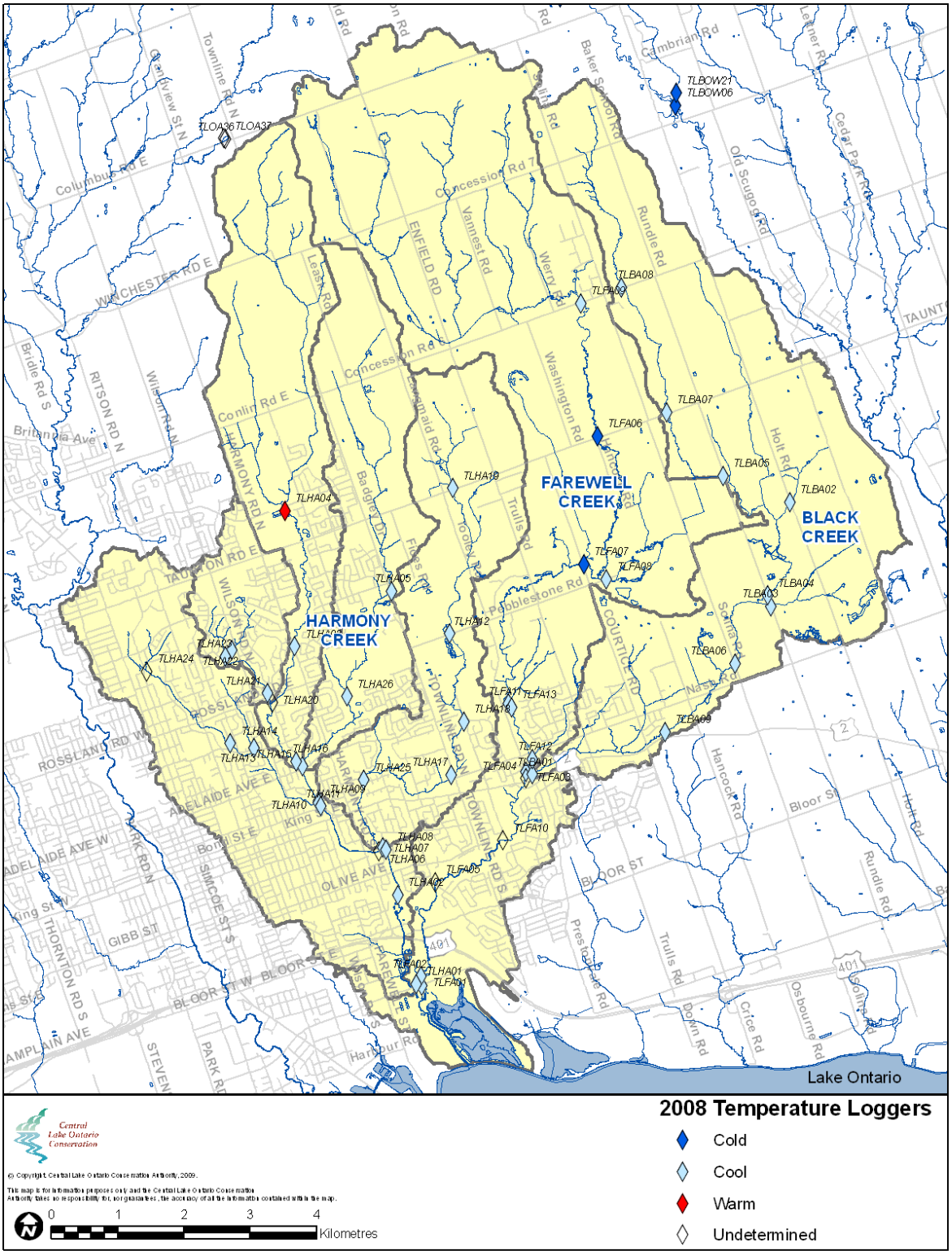


Figure 15 Location and thermal classification of stream temperature loggers within the Black, Harmony, Farewell Creek watersheds during 2008.

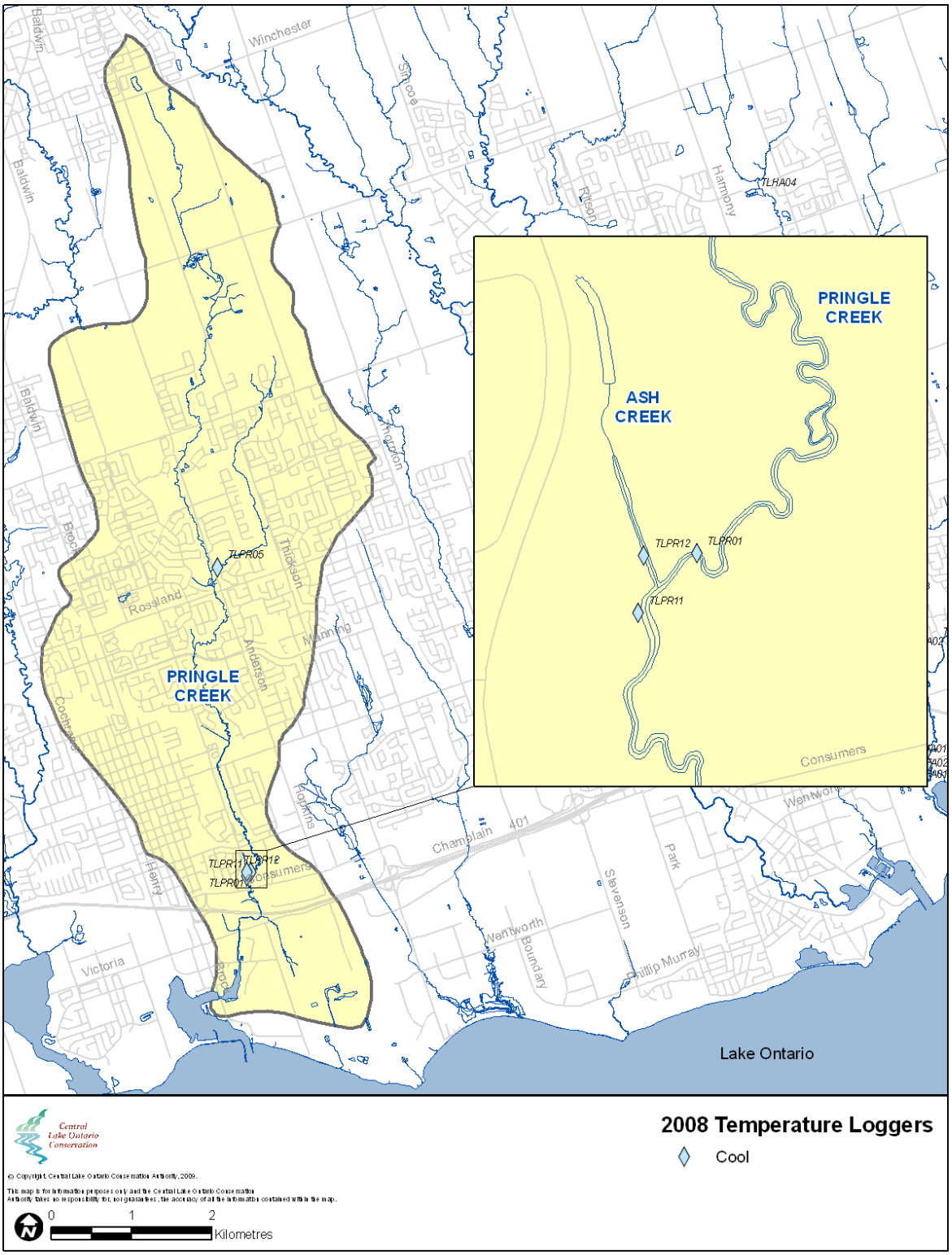


Figure 16 Location and thermal classification of stream temperature loggers within the Pringle Creek watershed during 2008.

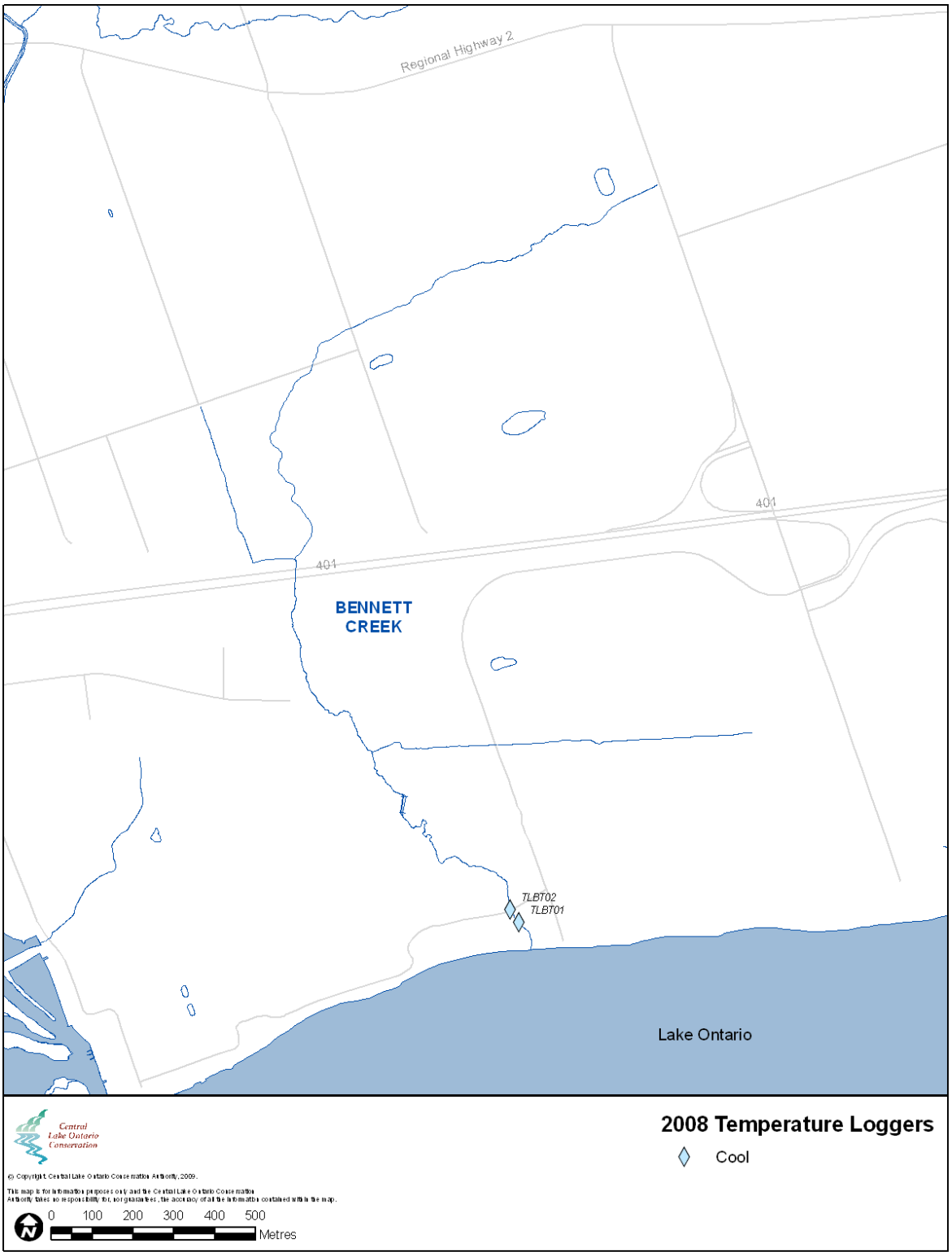


Figure 17 Location and thermal classification of stream temperature loggers within the Bennett Creek watershed during 2008.

Table 11 Summary of temperature logger data collected from CLOCA jurisdiction during 2008 with comparison to some 2005, 2006 and 2007 data.

	Site Code	Year	Logger Serial No.	Period of Record	Cold	Cool	Warm	Max. (°C)	Min. (°C)	Days Above Upper Lethal					Classification
									Entire Data Set	Atlantic Salmon (> 23 °C)	Brook Trout (> 24 °C)	Brown Trout (> 24 °C)	Chinook Salmon (> 25 °C)	Rainbow Trout (> 26 °C)	
1	TLBA01	2008	1134295	June 1, 2008 to August 31, 2008	59	33	0	26.0	0	0	0	0	0	0	Coolwater
2	TLBA02	2008	1134286	June 1, 2008 to August 31, 2008	71	21	0	24.8	0	0	0	0	0	0	Coolwater
3	TLBA03	2008	1019280	June 1, 2008 to August 31, 2008	86	6	0	20.7	0	0	0	0	0	0	Coolwater
4	TLBA04	2008	1134291	June 1, 2008 to August 31, 2008	56	36	0	23.7	0	0	0	0	0	0	Coolwater
5	TLBA05	2008	1134276	June 1, 2008 to August 31, 2008	64	28	0	25.7	0	0	0	0	0	0	Coolwater
6	TLBA06	2008	1134279	June 1, 2008 to August 31, 2008	82	10	0	22.0	0	0	0	0	0	0	Coolwater
7	TLBA07	2008	1134271	June 1, 2008 to August 31, 2008	41	51	0	25.8	0	0	0	0	0	0	Coolwater
8	TLBA08	2008	1134285	June 1, 2008 to August 31, 2008	80	12	0	23.8	0.1	0	0	0	0	0	Coolwater
9	TLBA09	2008	2000187	June 13, 2008 to August 31, 2008	55	24	0	24.8	0	0	0	0	0	0	Coolwater
10	TLBOW01	2005	787477	June 10, 2005 to Jan 12, 2005	217	0	0	16.4	0.1	0	0	0	0	0	**Coldwater**
11		2008	2001401	July 1, 2008 to August 31, 2008	62	0	0	15.7	0	0	0	0	0	0	**Coldwater**
12	TLBOW02	2005	787475	June 8, 2005 to Aug 31, 2005	63	22	0	22.5	0.2	0	0	0	0	0	Coolwater
13		2008	2000191	July 1, 2008 to August 31, 2008	62	0	0	19.7	0	0	0	0	0	0	**Coldwater**
14	TLBOW03	2005	842229	July 1, 2005 to August 31, 2005	62	0	0	14.7	5.2	0	0	0	0	0	**Coldwater**
15		2006	877051	May 31, 2006 to Jan 4, 2007	219	0	0	16.4	4.5	0	0	0	0	0	**Coldwater**
16		2007	842228	July 1, 2007 to August 31, 2007	62	0	0	14.9	3.8	0	0	0	0	0	**Coldwater**
17		2008	1019261	July 1, 2008 to August 31, 2008	62	0	0	14.8	3.7	0	0	0	0	0	**Coldwater**
18	TLBOW06	2006	787473	May 30, 2006 to Jan 4, 2007	218	2	0	21.0	0	0	0	0	0	0	**Coldwater**
19		2008	2000178	July 1, 2008 to August 31, 2008	62	0	0	18.4	0.1	0	0	0	0	0	**Coldwater**
20	TLBOW14	2008	2000185	July 1, 2008 to August 31, 2008	54	8	0	23.3	0	0	0	0	0	0	Coolwater
21	TLBOW15	2008	2000176	July 1, 2008 to August 31, 2008	58	4	0	21.4	0	0	0	0	0	0	Coolwater
22	TLBOW16	2008	2000190	July 1, 2008 to August 31, 2008	62	0	0	16.7	0	0	0	0	0	0	**Coldwater**
23	TLBOW17	2008	2000177	July 1, 2008 to August 31, 2008	58	4	0	22.0	0	0	0	0	0	0	Coolwater

	Site Code	Year	Logger Serial No.	Period of Record	Cold	Cool	Warm	Max. (°C)	Min. (°C)	Days Above Upper Lethal					Classification
									Entire Data Set	Atlantic Salmon (> 23 °C)	Brook Trout (> 24 °C)	Brown Trout (> 24 °C)	Chinook Salmon (> 25 °C)	Rainbow Trout (> 26 °C)	
24	TLBOW18	2008	2001402	July 1, 2008 to August 31, 2008	62	0	0	19.1	0	0	0	0	0	0	**Coldwater**
25	TLBOW19	2008	1134294	July 1, 2008 to August 31, 2008	62	0	0	18.0	0	0	0	0	0	0	**Coldwater**
26	TLBOW20	2008	2000184	July 1, 2008 to August 31, 2008	60	2	0	20.8	0	0	0	0	0	0	**Coldwater**
27	TLBOW21	2008	2001410	July 1, 2008 to August 31, 2008	62	0	0	20.3	0	0	0	0	0	0	**Coldwater**
28	TLBOW22	2008	637810	July 11, 2008 to August 31, 2008	52	0	0	20.2	0	0	0	0	0	0	**Coldwater**
29	TLBOW23	2008	637811	July 11, 2008 to August 31, 2008	52	0	0	16.4	0	0	0	0	0	0	**Coldwater**
30	TLBT01	2008	842238	June 1, 2008 to August 31, 2008	61	31	0	30.6	0	0	0	0	0	0	Coolwater
31	TLBT02	2008	2013204	June 18, 2008 to August 31, 2008	56	19	0	24.1	0	0	0	0	0	0	Coolwater
32	TLFA01	2008	1134281	June 1, 2008 to August 31, 2008	54	38	0	25.2	0	0	0	0	0	0	Coolwater
33	TLFA02	2008	1134288	June 1, 2008 to August 31, 2008	59	33	0	25.1	0	0	0	0	0	0	Coolwater
34	TLFA03	2008	1134293	June 1, 2008 to August 31, 2008	76	16	0	25.5	0	0	0	0	0	0	Coolwater
35	TLFA04	2008	1134277	**Defective – Communication error. Sent to manufacturer for data retrieval but was unsuccessful.**											
36	TLFA05	2008	1134289	**Not Retrieved**											
37	TLFA06	2008	1019270	June 1, 2008 to August 31, 2008	91	1	0	20.4	0	0	0	0	0	0	Coldwater
38	TLFA07	2008	877050	June 1, 2008 to August 31, 2008	88	4	0	20.4	0	0	0	0	0	0	Coldwater
39	TLFA08	2008	842239	June 1, 2008 to August 31, 2008	56	36	0	24.7	0	0	0	0	0	0	Coolwater
40	TLFA09	2008	1134282	June 5, 2008 to August 31, 2008	56	31	0	25.0	0	0	0	0	0	0	Coolwater
41	TLFA10	2008	1134287	**Not Retrieved**											
42	TLFA11	2008	1134280	June 7, 2008 to August 31, 2008	72	14	0	22.4	0	0	0	0	0	0	Coolwater
43	TLFA12	2008	1020772	June 7, 2008 to August 31, 2008	76	10	0	26.8	0	0	0	0	0	0	Coolwater
44	TLFA13	2008	2000174	June 19, 2008 to August 31, 2008	64	10	0	22.0	0	0	0	0	0	0	Coolwater
45	TLHA01	2008	1134275	June 1, 2008 to August 31, 2008	48	44	0	25.7	0	0	0	0	0	0	Coolwater
46	TLHA02	2008	1019277	June 1, 2008 to August 31,2008	56	36	0	26.0	0	0	0	0	0	0	Coolwater
47	TLHA03	2008	905538	June 1, 2008 to August 31, 2008	53	39	0	25.0	0	0	0	0	0	0	Coolwater
48	TLHA04	2008	1134278	June 1, 2008 to August 31, 2008	28	57	7	28.2	0	14	9	9	7	1	**Warmwater**

	Site Code	Year	Logger Serial No.	Period of Record	Cold	Cool	Warm	Max. (°C)	Min. (°C)	Days Above Upper Lethal					Classification
									Entire Data Set	Atlantic Salmon (> 23 °C)	Brook Trout (> 24 °C)	Brown Trout (> 24 °C)	Chinook Salmon (> 25 °C)	Rainbow Trout (> 26 °C)	
49	TLHA05	2008	1019281	June 1, 2008 to August 31, 2008	77	15	0	23.4	0	0	0	0	0	0	Coolwater
50	TLHA06	2008	905539	**Defective – Communication error. Sent to manufacturer for data retrieval but was unsuccessful.**											
51	TLHA07	2008	818797	June 1, 2008 to August 31, 2008	70	22	0	26.6	0	0	0	0	0	0	Coolwater
52	TLHA08	2008	905536	June 1, 2008 to August 31, 2008	54	38	0	26.5	0	0	0	0	0	0	Coolwater
53	TLHA09	2008	877052	June 1, 2008 to August 31, 2008	57	35	0	26.2	0	0	0	0	0	0	Coolwater
54	TLHA10	2008	842237	June 1, 2008 to August 31, 2008	57	35	0	26.1	0	0	0	0	0	0	Coolwater
55	TLHA11	2008	877051	June 1, 2008 to August 31, 2008	64	28	0	25.9	0.1	0	0	0	0	0	Coolwater
56	TLHA12	2008	1134284	June 1, 2008 to August 31, 2008	83	9	0	21.6	0.1	0	0	0	0	0	Coolwater
57	TLHA13	2008	905537	June 1, 2008 to August 31, 2008	76	16	0	28.4	0.7	0	0	0	0	0	Coolwater
58	TLHA14	2008	842228	June 1, 2008 to August 31, 2008	76	16	0	26.2	0.1	0	0	0	0	0	Coolwater
59	TLHA15	2008	787475	June 1, 2008 to August 31, 2008	75	17	0	26.8	0.1	0	0	0	0	0	Coolwater
60	TLHA16	2008	787477	June 1, 2008 to August 31, 2008	54	38	0	26.3	0	0	0	0	0	0	Coolwater
61	TLHA17	2008	1134290	June 1, 2008 to August 31, 2008	90	2	0	27.2	0.1	0	0	0	0	0	Coolwater
62	TLHA18	2008	787473	June 1, 2008 to August 31, 2008	51	11	0	24.8	0	0	0	0	0	0	Coolwater
63	TLHA19	2008	1134283	June 1, 2008 to August 31, 2008	68	24	0	24.5	0.1	0	0	0	0	0	Coolwater
64	TLHA20	2008	905535	**Defective – Communication error. Sent to manufacturer for data retrieval but was unsuccessful.**											
65	TLHA21	2008	1134292	June 6, 2008 to August 31, 2008	60	27	0	25.8	0	0	0	0	0	0	Coolwater
66	TLHA22	2008	842236	June 6, 2008 to August 31, 2008	57	30	0	26.5	0	0	0	0	0	0	Coolwater
67	TLHA23	2008	818793	June 6, 2008 to August 31, 2008	79	8	0	27.3	0	0	0	0	0	0	Coolwater
68	TLHA24	2008	1134272	**Not Retrieved**											
69	TLHA25	2008	1134274	June 7, 2008 to August 31, 2008	73	13	0	26.2	0	0	0	0	0	0	Coolwater
70	TLHA26	2008	2013208	June 20, 2008 to August 31, 2008	61	12	0	22.0	0	0	0	0	0	0	Coolwater
71	HAR2_01	2007	1135941	August 14, 2007 to August 31, 2007	13	5	0	22.6	10.2*	0	0	0	0	0	Coolwater
72	HAR5_02	2007	1135946	August 14, 2007 to August 31, 2007	8	10	0	22.4	11.4*	0	0	0	0	0	Coolwater
73	HAR1_05	2007	1135932	Lost During Rain Event											
74	HAR1_02	2007	1135956	Vandalized											

	Site Code	Year	Logger Serial No.	Period of Record	Cold	Cool	Warm	Max. (°C)	Min. (°C)	Days Above Upper Lethal					Classification
									Entire Data Set	Atlantic Salmon (> 23°C)	Brook Trout (> 24°C)	Brown Trout (> 24°C)	Chinook Salmon (> 25°C)	Rainbow Trout (> 26°C)	
75	TLOA36	2008	2013240	July 16, 2008 to August 31, 2008	47	0	0	9.9	8.8	0	0	0	0	0	**Coldwater**
76	TLOA37	2008	2013228	July 16, 2008 to August 31, 2008	23	21	3	28.2	0.6	5	4	4	3	0	**Warmwater**
77	TLPR01	2005	842230	**No Data - Logger Missing**											
78		2006	842229	May 24, 2006 to Jan 4, 2007	154	72	0	25.7	0.4	7	3	3	0	0	Coolwater
79		2007	1134283	July 1, 2007 to August 31, 2007	14	47	1	28.5	0	7	4	4	1	0	Coolwater
80		2008	877053	June 1, 2008 to August 31, 2008	34	58	0	25.1	0	0	0	0	0	0	Coolwater
81	TLPR05	2007	1134280	July 1, 2007 to August 31, 2007	23	39	0	27.0	0	1	0	0	0	0	Coolwater
82		2008	2013209	June 26, 2008 to August 31, 2008	52	16	0	26.2	0	0	0	0	0	0	Coolwater
83	TLPR11	2008	905540	June 1, 2008 to August 31 , 2008	36	56	0	25.2	0	0	0	0	0	0	Coolwater
84	TLPR12	2008	842229	June 1, 2008 to August 31, 2008	76	16	0	25.3	0.6	0	0	0	0	0	Coolwater
85	TLSOP09	2005	739513	July 1, 2005 to August 31, 2005	62	0	0	17.5	2.9†	0	0	0	0	0	**Coldwater**
86		2006	739513	June 1, 2006 to Nov 13, 2006	166	0	0	16.0	4.6†	0	0	0	0	0	**Coldwater**
87		2007	739513	July 1, 2007 to August 31, 2007	62	0	0	15.6	1.2†	0	0	0	0	0	**Coldwater**
88		2008	739513	July 1, 2008 to August 31, 2008	62	0	0	16.0	0	0	0	0	0	0	**Coldwater**
89	TLSOP10	2005	739517	July 1, 2005 to August 31, 2005	62	0	0	17.9	3.7†	0	0	0	0	0	**Coldwater**
90		2006	739517	June 10, 2006 to Nov 22, 2006	166	0	0	16.8	4.2†	0	0	0	0	0	**Coldwater**
91		2007	739517	July 1, 2007 to August 31, 2007	62	0	0	16	2.5†	0	0	0	0	0	**Coldwater**
92		2008	739517	July 1, 2008 to August 31, 2008	62	0	0	16.0	0	0	0	0	0	0	**Coldwater**
93	TLWA01	2008	2013207	June 20, 2008 to August 31, 2008	35	37	0	26.1	0	0	0	0	0	0	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
†Minimum temperature does not completely reflect cold-weather conditions since the Period of Record ended mid-November
*Minimum temperature does not reflect cold-weather conditions since the Period of Record ended mid-Fall

6.2 Results

Please refer to Table 11 regarding temperature logger data discussion below.

A total of nine temperature loggers were deployed throughout the Black Creek watershed. All nine logger locations were classified as coolwater habitat.

A total of 26 temperature loggers were deployed throughout the Harmony Creek watershed. Data indicates that coolwater habitat dominates the watershed with the exception of site TLHA04 (warmwater) located north of Taunton Rd. and east of Harmony Rd. This site is immediately downstream of the recently constructed Coldstream Drive and a stormwater facility located on the west side of the creek. In the past it has been observed by CLOCA staff that this section of creek experiences low baseflow conditions and was discussed in the 2005 Aquatic Monitoring Report. The Grandview Branch subwatershed experiences many landscape pressures that influence stream temperatures. Thermal degradation can be attributed to land use, which is almost entirely urban downstream of Conlin Rd. and predominantly agricultural in the headwaters. The warmwater site found in 2008 is located within a rapidly urbanizing area including residential development and business areas with large impervious parking lots. In addition, there are a number of stormwater ponds that drain directly to this branch, most of which are not designed to mitigate thermal impacts. This subwatershed also has insufficient riparian buffers.

A total of 13 temperature loggers were deployed throughout the Farewell Creek watershed. Data indicates that coolwater habitat exists throughout much of the watershed with the exception of two coldwater sites located south of Taunton Rd. This may be the influence of groundwater within the Iroquois Beach physiographic region.

Four loggers were deployed within Pringle Creek watershed: one within Ash Creek, two within the main branch of Pringle Creek upstream and downstream of the Ash Creek confluence, and one north of Rossland Rd. east of Anderson St. Data indicates that coolwater habitat exists at all four locations.

A total of 14 temperature loggers were deployed throughout the Enniskillen Conservation Area and surrounding area as part of the management plan. Specifically, two temperature loggers were deployed upstream of the Conservation Area to assess the impacts of the Enfield Pond on the thermal regime of the Bowmanville Creek headwaters downstream. In addition, for reference purposes one logger (TLBOW03) was also deployed in the Long Sault Conservation Area located in a neighbouring subwatershed. Data indicates that the Enniskillen Conservation Area contains coldwater habitat with evidence of thermal degradation associated with the Enfield Pond. For more details please refer to the Enniskillen Conservation Area Stewardship Plan (Feb, 2009) and future Enniskillen Conservation Area Management Plan.

Site TLBOW03 is located within Long Sault Conservation Area in a section of headwater stream. This site was selected because it is a long-term reference site for various CLOCA monitoring activities, e.g., surface water quality, fisheries, temperature, etc. 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. The minimum average temperature between 2005 to 2008 was approximately 4°C indicating that this coldwater location has a substantial amount of groundwater entering the stream. To further this point the maximum average temperature during the same time period was approximately 15°C.

As mentioned above, the presence of groundwater moderating stream temperature can be detected through temperature logger data. This data can be used to help validate CLOCA's modeling of potential groundwater discharge. Although a few locations indicated the influence of groundwater, generally these did not show a strong result.

In 2005 two loggers (TLSOP09 and TLSOP10) were purchased by Irv Harrell for his stewardship property (Hawkridge Farm) located within Soper Creek watershed (Gibb Rd./Con. Rd. 7). A section of Soper Creek flows through Hawkridge Farm and data from 2005 to 2008 indicates that it is coldwater. No cool or warmwater days have been recorded during this time. Brook Trout have been captured through recent fisheries sampling conducted in 2006 through the OSAP Training Course. Trout are known to require good water quality; Brook Trout, also known as speckled Trout (a cold-water species) in particular occur in clear, cool, well-oxygenated waters (Scott and Crossman, 1973).

A total of two temperature loggers were deployed within the Bennett Creek watershed. One logger was located on the upstream side of the coastal wetland and the second was located upstream of East Beach Rd. Data indicates that coolwater habitat exists at both locations. Although no warmwater days were recorded, data from logger TLBT01 located upstream of the coastal wetland indicated a maximum temperature of 30.6°C. This warm temperature can likely be attributed to the functions of the wetland, including slow moving water and fluctuating water levels associated with the barrier beach.

One temperature logger was deployed within the Warbler Creek watershed. It was located within the coastal wetland downstream of Ontoro Rd. Data indicates that coolwater habitat exists at this location. No warmwater days were recorded and the maximum temperature was only 26.1°C.

Two temperature loggers were purchased by Brad Baker and installed in a pond located within the Oshawa Creek watershed near Columbus Rd. and Townline Rd. Loggers were positioned to capture the surface and bottom water temperatures. These loggers were purchased for a stewardship initiative to investigate the habitat suitability for Salmonid stocking. Data indicates that coldwater habitat exists within the deeper sections of the pond while warmwater habitat dominates the surface area.

Due to habitat changes during the 2008/2009 monitoring year, including large rain events which caused significant channel alterations, a total of three temperature loggers had not yet been retrieved at the time of writing this report. If recovered, the information from these loggers will be reported on in the 2009 Aquatic Monitoring Report.

7.0 Recommendations

Section	Results	Recommendations
1.0 Spawning Survey	During 2008, spawning surveys targeting migratory adult Rainbow Trout and White Sucker were conducted on various CLOCA watersheds: 1. Lynde Creek 2. Pringle Creek 3. Black/Harmony/Farewell Creek 4. Robinson Creek 5. Tooley Creek 6. Darlington Creek 7. Westside Creek Fishes were observed within all watersheds surveyed with the exception of Robinson and Westside Creek which was likely due to low sampling effort.	Overall stream monitoring efforts during the 2009 season will be focused in the Lynde Creek watershed. It is recommended that spawning surveys continue as this information is complimentary to standard fish community surveys. Effort should be concentrated within the Lynde Creek watershed but it is acknowledged that monitoring will also be needed within various other watersheds e.g. Pringle Creek, Harmony Creek etc.
	No Rainbow Trout or White Suckers were observed upstream of Taunton Rd. within the Grandview Branch 3 (Branch 3). This was likely due to a rubble barrier that was located approximately 500 m upstream of Harmony Rd. CLOCA fisheries staff were previously unaware of this barrier.	Each instream barrier should be considered individually as to its impact on fish communities and fish habitat, and whether the barrier should be maintained, removed or retrofitted.

2.0 Fisheries - Streams	During 2008, 36 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 4). Fish species that were captured are listed in Table 2, Table 3 and Table 4. The results of the 2008 CLOCA Aquatic Monitoring are consistent with the goals and objectives of the FMP. The main branches of Black and Farewell Creeks are still inhabited by migratory and resident Salmonids (Rainbow Trout, and Brown and Brook Trout respectively) and should remain managed as such (Figure 5). Harmony Creek still receives a run of migratory Rainbow Trout in Branches 1, 3 and 4 and there is evidence of increased recruitment in recent years (as indicated by young-of-the-year at three sites in 2008, compared to 1 site in 2002). As such, Harmony Creek should remain managed for migratory Salmonids and efforts to improve habitat in the watershed should be supported.	Overall stream monitoring efforts during the 2009 season will be focused in the Lynde Creek watershed. It is recommended that a selection of Aquatic Resource Management Plan fisheries sites (OSAP) first sampled in 2001 be re-sampled. It is also recommended that supplemental sites be conducted to further explore Redside Dace and Slimy Sculpin range within the Lynde Creek watershed.
3.0 Fisheries - Wetlands	In Durham, fisheries sampling was conducted within 15 coastal wetlands through the Durham Region Coastal Wetland Monitoring Project (DRCWMP), (Table 6).	Sampling through the DRCWMP in 2009 will include all wetlands in the project.
	In the Bay of Quinte, fisheries sampling was conducted within 5 coastal wetlands for the Bay of Quinte Remedial Action Plan (BQRAP) through (DRCWMP). Fisheries sampling as part of the BQRAP began on August 18th and finished August 25th with five Quinte wetlands being sampled (Table 6).	Sampling in the Bay of Quinte area in 2009 through the DRCWMP will include 5 different BQRAP wetlands.

	As recommended in the 2007 Aquatic Resource Monitoring Report Oshawa Creek Coastal Wetland Complex (Oshawa Harbour) was added to the DRCWMP fish sampling component in 2008.	It is recommended that the Gold Point Coastal Wetland be added to the DRCWMP fish sampling component in 2009.
	As recommended in the 2007 Aquatic Resource Monitoring Report Round Goby locations (i.e., Frenchman's Bay Marsh and Port Newcastle Marsh) were monitored to track changing population trends.	It is also recommended that currently known Round Goby locations (i.e., Frenchman's Bay Marsh and Port Newcastle Marsh) continue to be monitored to track any changing population trends.
	As recommended in the 2007 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 also 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 2007 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. Public education regarding the harmful effects of releasing non-native species into waterways was continued through the DRCWMP and public outreach events in which CLOCA was involved.	It is also recommended that currently known Goldfish locations (i.e., Rouge River Marsh, Corbett Creek Marsh, Pumphouse Marsh and 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 and public outreach events in which CLOCA is involved.
4.0 Biological Water Quality	During May CLOCA staff sampled 14 OBBN sites in total throughout 4 watersheds (Figure 9). Four of the sites sampled were reference sites and the remaining 10 sites were test sites, generally at long-term monitoring sites. This was the fourth season that CLOCA has sampled benthos using the recently developed OBBN protocol.	Overall stream monitoring efforts during the 2009 season will be focused in the Lynde Creek watershed. In order to complement this, it is recommended that the OBBN test site locations be selected with regard to OSAP site locations.

	Results were reported in percent EPT for data collected between 2005 to 2008. A consistent trend showed higher EPT percentages in the north and eastern sections of the CLOCA jurisdiction.	Continue to monitor and report on benthos within these sites over the long-term following the CLOCA Aquatic Monitoring Schedule.
5.0 Stream Temperature	In total, 73 portable temperature loggers (Figure 13) were installed throughout the CLOCA jurisdiction in 2008 (Figure 14).	Overall stream monitoring efforts during the 2009 season will be focused in the Lynde Creek 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 the exception of two warmwater sites (Figure 14)	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 also recommended that fisheries staff coordinate logger sites with engineering staff as their respective programs complement each other i.e., thermal impacts of stormwater ponds on fish and fish habitat.
	Ten new temperature loggers were purchased by CLOCA and an additional six loggers were acquired from the DFO.	It is also recommended that additional temperature loggers be acquired as needed to replenish aging stock.
	As recommended in the 2007 Aquatic Resource Monitoring Report temperature loggers continued to collect minimum temperature data in order to validate groundwater modeling.	It is also recommended that temperature loggers continue to collect minimum temperature data in order to validate groundwater modeling.

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