Detroit River and St. Clair River Areas of Concern: Coastal Wetland Habitat Assessment Report 2012 Update

March 2013




Environment Canada / Environnement Canada
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Executive Summary

The purpose of this document is to report on data collected in 2012 at selected coastal wetlands in the Detroit River Area of Concern (AOC), Area 1A of the St. Clair River AOC, and non-AOC wetlands along Lake St. Clair in order to assess the condition of coastal wetland habitat and biotic communities over time. Geophysical condition is assessed by calculating the Water Quality Index score and biotic condition is assessed using Index of Biotic Integrity scores for specific biotic communities; submerged aquatic vegetation, aquatic macroinvertebrates and breeding marsh birds at select wetlands in each AOC and non-AOC.

Water Quality Index Scores ranged from “highly degraded” to “good” and are typically “moderately degraded”. Water quality was consistent among AOCs and non-AOCs, and indicates impacted conditions. The submerged aquatic vegetation (SAV) community Index of Biotic Integrity (IBI) rank ranged from “fair” to “excellent” and is typically “very good”. Similar to water quality, SAV IBI scores were consistent among the regions. The breeding marsh bird community Index of Biotic Integrity (Bird-IBI) rank ranged from “poor” to “excellent”, and exhibits marked differences among AOCs and non-AOCs. The bird-IBI for Detroit River AOC is typically “fair”, whereas the non-AOC and St. Clair River AOC are typically “excellent”. This highlights a major difference in wildlife population condition in the region. The aquatic macroinvertebrate community IBI (Invert-IBI) rank ranged from “fair” to “very good” and is typically “good”. Similar to marsh birds, aquatic macroinvertebrate community condition is slightly poorer in the Detroit River AOC than either the non-AOC or St. Clair River AOC. This report augments the baseline data collected during recent sampling using the same standardized methods. These baseline data will continue to aid in the understanding of the natural variation and condition of these wetlands over time and aid in the development of quantifiable delisting criteria.

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1.0 Introduction

In 1987, the International Joint Commission (IJC) identified the Detroit River and St. Clair River as two of 42 Great Lakes Areas of Concern (AOC) because they "*failed to meet the general or specific objectives of the Great Lakes Water Quality Agreement (GLWQA) where such failure has caused or is likely to cause impairment of beneficial uses or of the area's ability to support aquatic life*". Failure to meet the objectives of the GLWQA in the Detroit River stemmed from contamination of sediment, point source pollution from urban and industrial sources, and non-point source inputs from surrounding watershed land uses. With respect to wildlife, concerns included changes in fish and wildlife community structure, loss of habitats, water and sediment quality impacts on biota, and exotic species. The St. Clair River failed to meet the objectives of the GLWQA due to contaminant levels and the loss and degradation of aquatic habitat.

A standardized common set of impairments called Beneficial Use Impairments (BUIs) were created by the International Joint Commission (IJC). BUIs cover a wide range of environmental and ecological concerns, and aim to include a number of stakeholders into the delisting process.

This report covers impairments as they pertain to wildlife; namely, BUI #3 *Degradation of fish and wildlife populations* and BUI #14 *Loss of fish and wildlife habitat*. Coastal wetlands provide wildlife habitat and also perform a number of ecological services, and are therefore an important component of AOC remediation effort. Past reporting has presented standardized methods for assessing the geophysical and biotic condition of wetlands. This report provides a continuation of this sampling to build upon baseline data by means of sampling conducted in 2012 at 12[1] select coastal wetlands within the Huron-Erie Corridor (HEC; Figure 1, Figure 2), further allowing for comparison among both AOCs and non-AOC wetlands within Lake St. Clair. The growing body of data within the region will aid in monitoring the long-term conditions and in developing specific and quantifiable delisting criteria for these AOCs.

[1] An additional portion of Detroit River Marshes was surveyed as a separate site in 2012 for water quality, macroinvertebrates and submerged aquatic vegetation. The data for Detroit River Marshes (North) is presented separately from Detroit River Marshes to permit comparisons to past years of data for the original site.

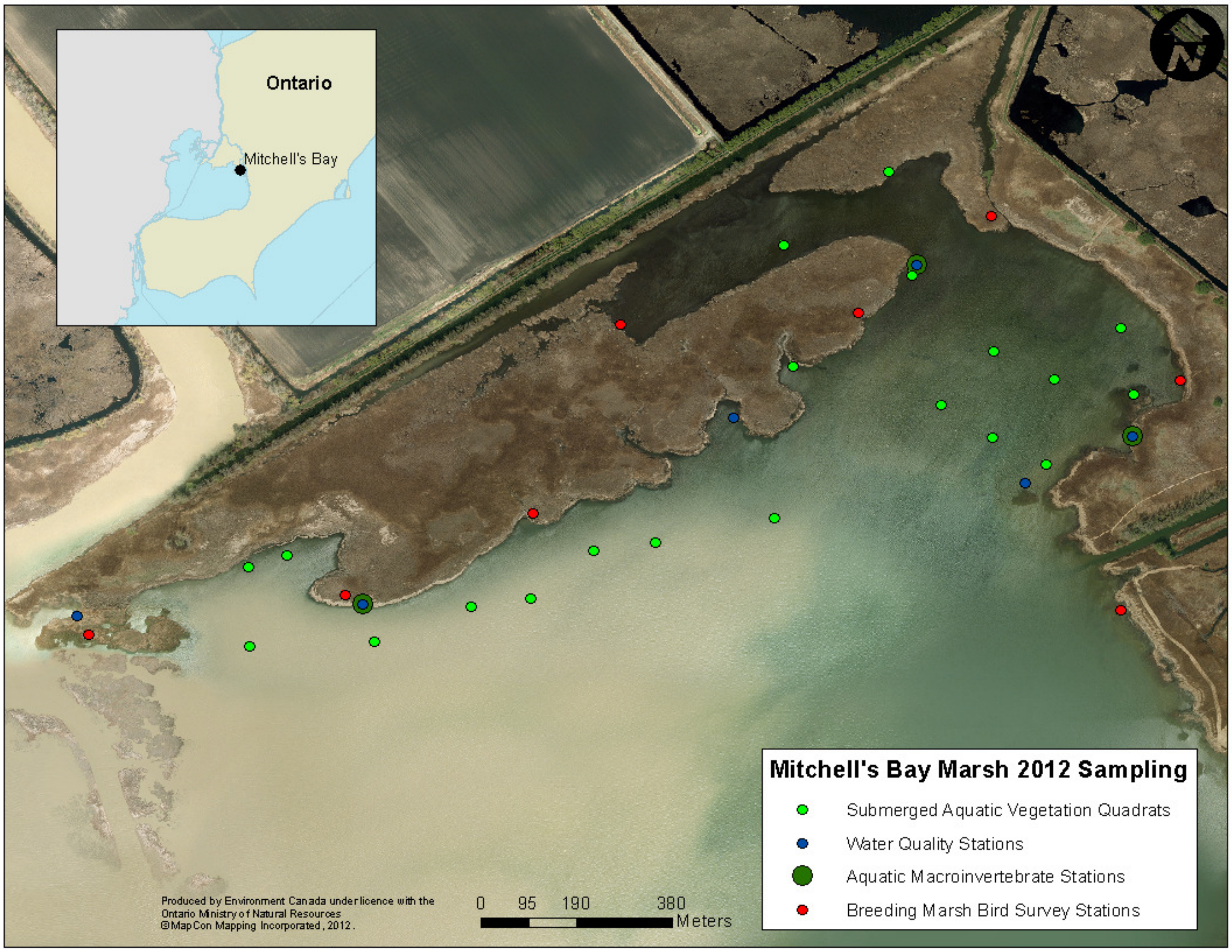

Figure 1. Representative wetland sampled in 2012 including all stations sampled for water quality, breeding marsh birds, submerged aquatic vegetation, and aquatic macroinvertebrates.

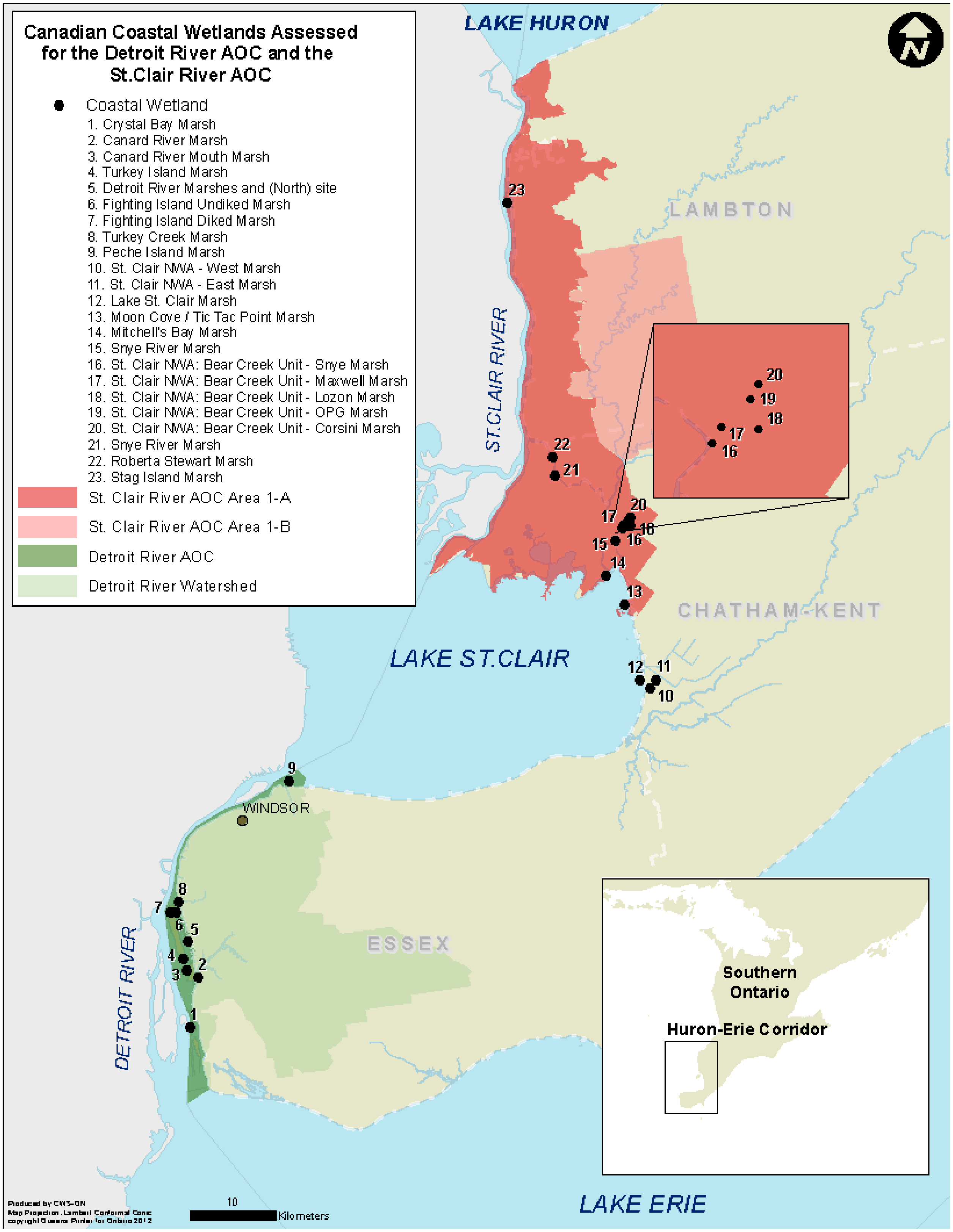

Figure 2. Coastal wetlands sampled from 2006 to 2012 in the Detroit River AOC, Lake St. Clair, and St. Clair River AOC.

2.0 Purpose of This Report

The purpose of this document is to report on the condition of coastal wetlands to assess the quality of coastal wetlands over time in the Detroit River and St. Clair River Areas of Concern (AOC). Habitat and biotic community data were collected in coastal wetlands within the Detroit River AOC, in Area 1A of the St. Clair River AOC, and in non-AOC sites along Lake St. Clair (Figure 2). The focus of this report is the current conditions of wetlands from 2012 surveys and, where available, the trends from earlier sampling.

A brief introduction and condensed methodologies are provided within each section. For more details about the Detroit River and St. Clair River AOCs, wildlife related Beneficial Use Impairments, coastal wetland study sites, and methods used for sampling and reporting, refer to Environment Canada – Canadian Wildlife Service (2008, 2009a, 2009b, 2012a; herein EC–CWS) and Green et al. (2010).

3.0 Water Quality

Methodology

Water quality was measured using both *in situ* probes and chemical analyses. *In situ* water quality determination included 4 parameters (pH, conductivity [µS/cm], temperature [°C], and turbidity [NTU]) and was collected using a Hydrolab MS5™ or Yellow Springs Institute (YSI) 6600V2™ multiprobe at mid depth of the water column adjacent to emergent vegetation. Multiprobe sampling was conducted at all water quality stations (typically 6 per wetland) and every measure was taken to resample past stations. The 4 parameters measured are used to calculate the Water Quality Index (WQI; Equation 1), a tool for determining coastal wetland water quality in the Great Lakes (Chow-Fraser 2006).

Equation 1:

$$WQI = (-1.367148 * \log TURB) - (1.577380 * \log COND) - (1.628048 * \log TEMP) - (2.371337 * \log pH) + 9.2663224$$

where TURB = turbidity, COND = conductivity, and TEMP = temperature

Water samples for three additional nutrient parameters (Table 1) were collected at 4 of the 6 stations at each wetland and include Total Nitrate Nitrogen (TNN), Total Ammonia Nitrogen (TAN), and Total Phosphorus (TP). TNN and TAN were analyzed in a field lab within 5 hours of sampling using colorimetry (Hach DR890 Colorimeter). Samples for TP were acidified and later analyzed by Environment Canada's National Laboratory for Environmental Testing (NLET; Burlington, Ontario).

Table 1. Water quality parameters measured in coastal wetlands including parameter relationships with increased disturbance.

Parameter	Units	Relationship with Increased Disturbance
In Situ		
Turbidity	NTU	↑ turbidity from algae, suspended sediments, and bioturbation
Conductivity	µS/cm	↑ conductivity from agricultural, industrial, urban inputs
Temperature	°C	↑ temperature from industrial/urban runoff and riparian vegetation removal
pH	pH	Changes in pH from photosynthesis affect nutrient availability
Nutrient		
Total Nitrate Nitrogen	mg/L	↑ nitrates from agricultural/urban runoff and wastewater and industrial discharge
Total Ammonia Nitrogen	mg/L	↑ ammonia from agricultural and industrial wastes, and from sewage and septic leachate
Total Phosphorus	µg/L	↑ phosphorus from agricultural runoff, urban stormwater, and industrial discharge

Ranking Water Quality

The WQI was developed as a relative ranking tool to report on coastal wetland water quality in the Great Lakes Basin. WQI scores range from -3 to +3, and these numerical values correspond with six ranked qualitative descriptor categories listed below (Table 2).

Table 2. Water Quality Index (WQI) score and associated category based on Chow-Fraser (2006).

WQI Score	Qualitative Descriptor
+3 to +2	Excellent
+2 to +1	Very good
+1 to 0	Good
0 to -1	Moderately degraded
-1 to -2	Very degraded
-2 to -3	Highly degraded

Results

Coastal wetlands in the Huron-Erie Corridor show signs of both degradation and good health with the majority of sites classified as “moderately degraded” (Table 3). More specifically, wetlands in the Detroit River AOC vary from “very degraded” to “good” but are typically degraded to some extent. Wetlands in Lake St. Clair (non-AOC) vary from “moderately degraded” or “good” but are typically “moderately degraded”. Wetlands in the St. Clair River AOC vary from “highly degraded” to “good” but are typically “moderately degraded” (Table 3). Impaired water quality from the WQI is typically the result of elevated conductivity and turbidity, and this is consistent among the bodies of water sampled (Table 4).

In general, over the time period sampled there are no clear trends in water quality across the region (Table 3). One new site, Detroit River Marshes (North), was added in 2012 and had the same “moderately degraded” classification as Detroit River Marshes. Some sites had similar WQI scores over multiple years, such as Canard River Marsh and Turkey Creek Marsh. Other sites showed improvements in water quality over the sample period, such as Lake St. Clair Marshes, Moon Cove / Tic Tac Point Marsh, and Snye River Marsh. Some sites showed variation in WQI score but remained within the same or adjacent descriptors (e.g., “moderately degraded” at St. Clair NWA: Bear Creek Unit – OPG Marsh).

Table 3. Water Quality Index (WQI) Score and Rank for selected coastal wetlands in the Detroit River and St. Clair River Areas of Concern (AOC) and non-AOC sites in Lake St. Clair.

Wetland Name	WQI						Descriptor*
	2006	2007	2008	2011	2012	Mean	
Detroit River							
Crystal Bay	-	-	0.20	-	-	**0.20**	Good
Canard River Marsh	-	-	-1.72	-1.76	-2.00	**-1.83**	Very Degraded
Canard River Mouth Marsh	-0.76	-	-0.10	-	-	**-0.43**	Moderately Degraded
Turkey Island Marsh	-0.79	-	-0.32	-	-	**-0.56**	Moderately Degraded
Detroit River Marshes	-0.90	-	-0.35	0.49	-0.39	**-0.29**	Moderately Degraded
Detroit River Marshes (North)	-	-	-	-	-0.83	**-0.83**	Moderately Degraded
Fighting Island Undiked Marsh	-	-	-0.47	-	-	**-0.47**	Moderately Degraded
Fighting Island Diked Marsh	-	-	-0.09	-	-	**-0.09**	Moderately Degraded
Turkey Creek Marsh	-1.07	-	-0.88	-1.08	-1.06	**-1.02**	Very Degraded
Peche Island Marsh	-	-	0.13	0.75	-0.05	**0.28**	Good
Non-AOC							
St. Clair NWA – West Marsh	-	0.25	-0.09	-	-	**0.08**	Good
St. Clair NWA – East Marsh	-	-	0.21	-0.29	-0.23	**-0.10**	Moderately Degraded
Lake St. Clair Marshes	-	-	-1.87	0.42	0.68	**-0.26**	Moderately Degraded
St. Clair River							
Moon Cove – Tic Tac Point Marsh	-1.01		-0.23	-0.17	0.01	**-0.35**	Moderately Degraded
Mitchell’s Bay - Mudcreek Marsh and Snye River Marsh	-0.84		-0.26	0.16	-0.10	**-0.26**	Moderately Degraded
St. Clair NWA: Bear Creek Unit – Snye Marsh	-1.26	-0.09	-0.86	-	-	**-0.74**	Moderately Degraded
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	-	0.04	-	-0.08	0.19	**0.05**	Good
St. Clair NWA: Bear Creek Unit – Lozon Marsh	-1.09	-0.04	-	-	-	**-0.57**	Moderately Degraded
St. Clair NWA: Bear Creek Unit – OPG Marsh	-0.86	-0.16	-0.04	-0.14	-0.10	**-0.26**	Moderately Degraded
St. Clair NWA: Bear Creek Unit – Corsini Marsh	-	-	-2.16	-	-	**-2.16**	Highly Degraded
Snye River South Marsh	-	-	-0.94	-	-	**-0.94**	Moderately Degraded
Snye River Marsh	-0.83	-	0.39	0.58	0.87	**0.25**	Good
Roberta Stewart Marsh	-1.03	-0.37	-1.43	-	-	**-0.94**	Moderately Degraded
Stag Island Marsh	-	-	-	0.90	0.61	**0.76**	Good

* based upon mean WQI value for years sampled

There were no consistent patterns among the levels of ammonium-nitrogen, nitrate-nitrogen, and total phosphorus (Table 5). In general, low levels of ammonia were measured during sampling events among wetlands and regions and also across years sampled. Nitrate levels are variable among wetlands, regions, and years sampled, although nitrate levels measured in 2012 were higher than nitrate levels measured in 2011 across all corresponding sites. Of particular note, Canard River Marsh showed an elevated nitrate level of 0.627 mg/L in 2012 sampling. It should be noted that total ammonium nitrogen and total nitrate nitrogen data (Table 5) from previous sampling years (2006-2011) were refined in 2012, and therefore values listed below do not necessarily correspond to values listed in previous versions of this report.

Total phosphorus levels for six sites were at or below the Provincial Water Quality Objectives (PWQO) limit of 0.03 mg/L while seven were above the threshold. The highest total phosphorus level was recorded at Canard River Marsh (0.311 mg/L). Water analyzed from 2007 samples exhibited abnormally high levels of phosphorus, which may indicate analytical errors and/or contamination.

Table 4. Mean water quality parameters used in the Water Quality Index (WQI) for selected coastal wetlands in the Detroit River and St. Clair River Areas of Concern (AOC) and non-AOC sites in Lake St. Clair.

Wetland Name	Conductivity ($\mu S \cdot cm^{-1}$)					Turbidity (NTU)					Temperature (ºC)					pH				
	2006	2007	2008	2011	2012	2006	2007	2008	2011	2012	2006	2007	2008	2011	2012	2006	2007	2008	2011	2012
Detroit River																				
Crystal Bay	-	-	220.3	-	-	-	-	4.0	-	-	-	-	25.76	-	-	-	-	8.91	-	-
Canard River Marsh	-	-	452.5	522.7	627.2	-	-	50.7	43.1	52.9	-	-	28.03	29.60	27.27	-	-	7.79	7.79	8.12
Canard River Mouth Marsh	213.3	-	234.7	-	-	22.0	-	7.5	-	-	25.27	-	24.40	-	-	8.73	-	8.29	-	-
Turkey Island Marsh	218.3	-	219.1	-	-	25.6	-	10.4	-	-	23.37	-	24.18	-	-	8.56	-	8.84	-	-
Detroit River Marshes	202.3	-	237.2	215.1	223.9	27.8	-	14.5	3.1	12.3	24.94	-	21.15	26.19	26.85	9.15	-	7.84	7.85	7.96
Detroit River Marshes North	-	-	-	-	242.7	-	-	-	-	20.0	-	-	-	-	28.89	-	-	-	-	8.28
Fighting Island Undiked Marsh	-	-	222.0	-	-	-	-	14.7	-	-	-	-	25.35	-	-	-	-	8.11	-	-
Fighting Island Diked Marsh	-	-	413.6	-	-	-	-	4.8	-	-	-	-	23.81	-	-	-	-	7.36	-	-
Turkey Creek Marsh	312.3	-	304.3	477.7	495.3	26.4	-	16.4	14.6	10.7	23.87	-	25.92	27.18	29.07	8.59	-	9.00	8.39	9.14
Peche Island Marsh	-	-	218.1	217.2	228.5	-	-	5.2	2.3	7.1	-	-	25.50	23.79	25.77	-	-	8.28	7.71	7.93
Non-AOC																				
St. Clair NWA – West Marsh	-	427.6	348.6	-	-	-	2.9	5.1	-	-	-	18.20	28.27	-	-	-	8.38	7.03	-	-
St. Clair NWA – East Marsh	-	421.9	326.5	344.3	363.0	-	5.1	4.1	6.7	5.5	-	24.41	23.42	28.76	25.37	-	-	7.12	7.33	8.18
Lake St. Clair Marshes	-	354.7	436.9	249.8	264.2	-	2.3	57.3	2.3	1.4	-	28.58	29.47	28.00	24.10	-	-	8.24	8.56	9.41
St. Clair River																				
Moon Cove – Tic Tac Point Marsh	213.3	199.3	217.3	223.2	208.9	32.7	17.7	7.9	6.3	6.7	26.04	20.34	26.59	29.48	22.56	8.68	-	9.01	8.83	8.98
Mitchell's Bay – Mudcreek Marsh and Syne River Marsh	269.8	219.5	254.0	221.2	224.0	23.0	8.8	10.1	4.5	6.5	24.94	22.91	23.08	27.2	25.93	8.01	-	8.01	8.24	8.87
St. Clair NWA: Bear Creek Unit – Snye Marsh	524.0	451.6	362.1	-	-	23.3	3.6	17.9	-	-	24.31	24.71	26.37	-	-	7.78	8.04	7.45	-	-
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	-	373.5	-	323.3	378.9	-	4.4	-	7.3	3.4	-	21.97	-	22.09	22.16	-	7.78	-	7.09	7.60
St. Clair NWA: Bear Creek Unit – Lozon Marsh	350.3	381.3	-	-	-	31.4	5.5	-	-	-	22.68	20.05	-	-	-	7.57	7.71	-	-	-
St. Clair NWA: Bear Creek Unit – OPG Marsh	307.0	352.2	384.9	237.3	280.3	18.8	5.5	4.5	7.9	6.0	26.82	22.84	25.01	25.18	24.58	8.00	8.34	7.36	8.09	8.32
St. Clair NWA: Bear Creek Unit – Corsini Marsh	-	765.8	685.7	-	-	-	-	65.9	-	-	-	26.12	27.62	-	-	-	-	7.87	-	-
Snye River South Marsh	-	-	245.7	-	-	-	-	26.9	-	-	-	-	25.07	-	-	-	-	8.51	-	-
Snye River Marsh	221.3	278.3	221.1	204.7	228.4	27.0	3.5	4.4	2.7	1.7	26.64	24.16	23.67	26.7	24.67	7.81	-	7.42	7.92	7.76
Roberta Stewart Marsh	318.0	412.8	412.8	-	-	24.8	5.6	27.9	-	-	25.17	23.29	29.86	-	-	8.19	8.99	8.42	-	-
Stag Island Marsh	-	-	-	276.6	244.2	-	-	-	1.2	2.4	-	-	-	24.92	22.67	-	-	-	7.84	8.21

Table 5. Additional water quality parameters collected for selected coastal wetlands in the Detroit River and St. Clair River Areas of Concern (AOC) and non-AOC sites in Lake St. Clair.

Wetland Name	Total Ammonia Nitrogen (mg/L)					Total Nitrate Nitrogen (mg/L)					Total Phosphorus (mg/L)				
	2006	2007	2008	2011	2012	2006	2007	2008	2011	2012	2006	2007	2008	2011	2012
Detroit River															
Crystal Bay	-	-	0.027	-	-	-	-	0.015	-	-	-	-	0.015	-	-
Canard River Marsh	-	-	0.132	0.196	0.018	-	-	0.258	0.113	0.627	-	-	0.169	0.174	0.311
Canard River Mouth Marsh	0.011	-	0.042	-	-	0.173	-	0.060	-	-	0.027	-	0.023	-	-
Turkey Island Marsh	0.016	-	0.018	-	-	0.294	-	0.048	-	-	0.025	-	0.023	-	-
Detroit River Marshes	0.016	-	0.011	0.000	0.018	0.083	-	0.052	0.034	0.075	0.030	-	0.025	0.044	0.033
Detroit River Marshes North	-	-	-	-	0.040	-	-	-	-	0.150	-	-	-	-	0.023
Fighting Island Undiked Marsh	-	-	0.018	-	-	-	-	0.078	-	-	-	-	0.015	-	-
Fighting Island Diked Marsh	-	-	0.047	-	-	-	-	0.075	-	-	-	-	0.116	-	-
Turkey Creek Marsh	0.031	-	0.016	0.062	0.005	0.136	-	0.103	0.040	0.250	0.035	-	0.020	0.070	0.057
Peche Island Marsh	-	-	0.018	0.029	0.030	-	-	0.035	0.057	0.075	-	-	0.042	0.065	0.091
Non-AOC															
St. Clair NWA – West Marsh	-	0.023	0.008	-	-	-	0.008	0.141	-	-	-	0.082	-	-	-
St. Clair NWA – East Marsh	-	0.034	0.005	0.023	0.023	-	0.181	0.000	0.017	0.100	-	0.039	-	0.066	0.060
Lake St. Clair Marshes	-	0.031	0.041	0.016	0.025	-	0.211	0.039	0.011	0.100	-	0.043	0.084	0.030	0.035
St. Clair River															
Moon Cove – Tic Tac Point Marsh	0.060	0.083	0.011	0.053	0.020	0.204	0.105	0.034	0.000	0.125	0.031	0.049	0.042	0.049	0.026
Mitchell's Bay – Mudcreek Marsh and Syne River Marsh	0.025	0.027	0.013	0.012	0.013	0.467	0.192	0.009	0.017	0.125	0.039	0.030	0.034	0.029	0.043
St. Clair NWA: Bear Creek Unit – Snye Marsh	0.028	0.026	0.010	-	-	0.211	0.083	0.119	-	-	0.037	0.142	0.040	-	-
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	-	0.026	-	0.002	0.018	-	0.098	-	0.017	0.100	-	0.204	-	0.029	0.032
St. Clair NWA: Bear Creek Unit – Lozon Marsh	0.028	0.023	-	-	-	0.753	0.053	-	-	-	0.268	0.224	-	-	-
St. Clair NWA: Bear Creek Unit – OPG Marsh	0.003	0.036	0.008	0.002	0.020	0.226	0.023	0.081	0.012	0.075	0.050	0.276	0.052	0.067	0.051
St. Clair NWA: Bear Creek Unit – Corsini Marsh	-	-	0.074	-	-	-	-	0.251	-	-	-	-	0.082	-	-
Snye River South Marsh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Snye River Marsh	0.013	0.010	0.005	0.008	0.028	0.294	0.241	0.000	0.017	0.175	0.013	0.024	0.015	0.036	0.018
Roberta Stewart Marsh	0.070	0.117	0.021	-	-	0.277	0.075	0.000	-	-	0.262	0.400	0.200	-	-
Stag Island Marsh	-	-	-	0.039	0.033	-	-	-	0.023	0.200	-	-	-	0.012	0.014

Discussion

Water Quality Index scores indicate that HEC coastal wetlands are typically “moderately degraded” although there are some wetlands that are “very degraded” and others that are in “good” condition. In general, AOC sites were comparable to non-AOC Lake St. Clair coastal wetlands. These data indicate that the condition of coastal wetlands in the region has been fairly consistent over time.

Prior to European settlement in Southern Ontario, Southwestern Ontario was one of the most wetland-rich regions and has suffered the greatest rates of wetland loss from conversion to alternate land uses (Snell 1987, Ducks Unlimited Canada 2010). The remaining wetlands experience disturbance from nutrient and sediment loadings from high intensity agriculture throughout the region and from dense industry and urban centres along the Detroit and upper St. Clair rivers (Maynard and Wilcox 1997, Green et al. 2010). The ancillary water quality parameters collected (TAN, TNN, and TP) indicate non-point source pollution in the form of nitrogen derivatives and phosphorus, which are consistent with agricultural and urban runoff. The more disturbed wetlands tend to be those that have the greatest connectivity to the watershed (i.e., drowned river mouths), and the least disturbed wetlands tend to be along islands in large rivers.

Vegetated riparian buffers could play a large role in the improvement of tributary water quality, which would ultimately enhance wetland water quality downstream. Their nutrient and sediment sequestering qualities as well their ability to moderate water temperature would greatly benefit the region’s wetlands. As suggested in past reporting, creating wetland habitat at the end of drains would greatly limit the nutrient and sediment load on wetlands downstream.

4.0 Submerged Aquatic Vegetation Community

Methodology

The submerged aquatic vegetation community (SAV) was surveyed by sampling a one-metre square quadrat at 20 random locations in the open water basin of each wetland. Quadrat locations were randomly generated in a Geographic Information System (GIS; ESRI 2010) prior to sampling. Within each quadrat, total areal coverage and species-specific coverages for submerged and floating-leaved species were recorded (see Appendix 1 for a list of SAV species).

SAV community condition is determined using an Index of Biotic Integrity (IBI). SAV species were grouped into two plant guilds based on growing tolerance (e.g., turbidity tolerant and turbidity intolerant) and native designation (Environment Canada and Central Lake Ontario Conservation Authority (herein, EC and CLOCA) 2004; Grabas et al. 2012). Species were also assigned a coefficient of conservatism (Oldham et al. 1995); values range from 0 to 10 where higher scores are given to vegetation species having lower disturbance tolerance and greater fidelity to a certain habitat. Four metrics were shown to significantly respond to disturbance (SINT – number of turbidity-intolerant species, CC – Coefficient of Conservatism, PCOV – total coverage, and SNAT – total number of native species). Metrics were then standardized into a range from 0 to 10 (EC and CLOCA 2004; Grabas et al. 2012). They were then added, multiplied by 10 and divided by the total number of metrics to create an IBI with scores between 0 and 100. Five classes were identified in which minimum detectable differences could be distinguished (Table 6).

Table 6. Index of biotic integrity (IBI) score and associated category based on EC-CLOCA (2004).

IBI Score	Qualitative Descriptor
81-100	Excellent
61-80	Very good
41-60	Good
21-40	Fair
0-20	Poor

The SAV metrics and IBI presented here were developed using Lake Ontario wetlands and shown to be applicable in Lake Erie. However, in HEC, IBI scores show no clear relationship with disturbance (Environment Canada 2012b). Efforts are underway to develop a new IBI for HEC and as such the values presented herein should be used with caution.

Results

In general, SAV community condition in the Huron-Erie Corridor is “very good” (Table 7). With the exception of Canard River Marsh, Turkey Island Marsh, Turkey Creek Marsh and Stag Island Marsh, wetlands scored in the “very good” and “excellent” categories. Some wetlands, however, showed large variation in IBI scores over time and are worth noting. Specifically, Canard River Mouth Marsh SAV IBI scores decreased from 86.68 (2006) to 49.56 (2008), Canard River Marsh values remained low (scores of 29.17 and 34.10 for years 2011 and 2012, respectively) compared to the 2008 score of 55.69, and Turkey Creek Marsh decreased in from 82.06 (2006) to 49.44 (2012). The SAV IBI for Snye River Marsh declined from its high of 85.62 in 2006 to 43.47 in 2011 but saw improvement in 2012 with a value of 70.48. A substantial increase was seen for Stag Island Marsh with an increase from 25.37 in 2011 to 71.62 in 2012

Wetlands in good condition typically have greater species richness of turbidity intolerant and native taxa, coefficient of conservatism, and high total coverage. These sites were classified as “good”, “very good”, and “excellent” (Table 8). Wetlands in poorer condition exhibited low richness of turbidity intolerant taxa, and are less vegetated with high proportions of turbidity intolerant species. These wetlands were classified as “poor” and “fair” (Table 8).

Table 7. Index of Biotic Integrity (IBI) score and rank for the condition of the submerged aquatic vegetation (SAV) community for selected coastal wetlands in the Detroit River and St. Clair River Areas of Concern (AOC) and non-AOC sites in Lake St. Clair.

Wetland Name	SAV Index of Biotic Integrity						Descriptor*
	2006	2007	2008	2011	2012	Mean	
Detroit River							
Canard River Marsh	-	-	55.69	29.17	34.10	**39.65**	Fair
Canard River Mouth Marsh	86.68	-	49.56	-	-	**68.12**	Very Good
Turkey Island Marsh	66.35	-	51.76	-	-	**59.06**	Good
Detroit River Marshes	94.18	-	83.19	67.59	92.12	**84.27**	Excellent
Detroit River Marshes (North)	-	-	-	-	81.71	**81.71**	Excellent
Fighting Island Undiked Marsh	-	-	68.03	-	-	**68.03**	Very Good
Fighting Island Diked Marsh	-	-	62.58	-	-	**62.58**	Very Good
Turkey Creek Marsh	82.06	-	57.48	31.39	49.44	**55.09**	Good
Peche Island Marsh	-	-	68.16	61.97	71.59	**67.24**	Very Good
Non-AOC							
St. Clair NWA – West Marsh	-	81.91	-	-	-	**81.91**	Excellent
St. Clair NWA – East Marsh	-	81.86	-	71.83	87.39	**80.36**	Very Good
Lake St. Clair Marshes	-	87.86	58.18	58.98	83.28	**72.08**	Very Good
St. Clair River							
Moon Cove / Tic Tac Point Marsh	66.77	74.71	51.88	59.24	70.01	**64.52**	Very Good
Mitchell's Bay – Mudcreek Marsh and Syne River Marsh	75.87	81.30	69.89	83.51	92.09	**80.53**	Very Good
St. Clair NWA: Bear Creek Unit – Snye Marsh	84.45	80.66	71.68	-	-	**78.93**	Very Good
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	-	83.45	-	85.66	87.18	**85.43**	Excellent
St. Clair NWA: Bear Creek Unit – Lozon Marsh	81.95	89.02	-	-	-	**85.49**	Excellent
St. Clair NWA: Bear Creek Unit – OPG Marsh	64.00	69.12	62.36	72.02	79.99	**64.50**	Very Good
St. Clair NWA: Bear Creek Unit – Corsini Marsh	-	-	-	-	-	**-**	-
Snye River Marsh	85.62	81.69	52.53	43.47	70.48	**66.76**	Very Good
Roberta Stewart Marsh	60.19	62.51	58.54	-	-	**60.41**	Very Good
Stag Island Marsh	-	-	-	25.37	71.62	**48.50**	Good

*based on mean or most recent data

Note: In EC-CWS 2012a, SAV IBI scores were based on EC and CLOCA (2004) whereas these scores are based on Grabas et al. 2012.

Table 8. SAV community IBI scores (out of 100) and standardized metrics (out of 10) for coastal wetlands sampled in 2012 in the Detroit River AOC, Lake St. Clair, and St. Clair River AOC based on Grabas et al. 2012.

Wetland Name	SAV 2012 Metrics				IBI
	SINT	CC	PCOV	SNAT	2012
Detroit River					
Canard River Marsh	1.03	8.10	2.34	2.17	**34.10**
Detroit River Marshes	10.00	9.83	7.43	9.59	**92.12**
Detroit River Marshes (North)	9.29	8.91	7.34	7.15	**81.71**
Turkey Creek Marsh	3.10	7.49	3.40	5.79	**49.44**
Peche Island Marsh	5.35	8.40	7.94	6.94	**71.59**
Non-AOC					
St. Clair NWA – East Marsh	6.54	8.92	10.00	9.50	**87.39**
Lake St. Clair Marshes	8.94	9.90	7.50	6.97	**83.28**
St. Clair River					
Moon Cove / Tic Tac Point Marsh	8.94	9.49	4.13	5.43	**70.01**
Mitchell's Bay – Mudcreek Marsh and Syne River Marsh	10.00	9.45	9.61	7.78	**92.09**
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	7.22	8.60	10.00	9.05	**87.18**
St. Clair NWA: Bear Creek Unit – OPG Marsh	3.78	8.21	10.00	10.00	**69.50**
Snye River Marsh	6.88	8.20	6.32	6.79	**70.48**
Stag Island Marsh	8.94	8.06	6.49	5.16	**71.62**

SINT	Number of turbidity-intolerant species
CC	Coefficient of Conservatism
PCOV	Total coverage
SNAT	Total number of native species

Discussion

Among the three regions sampled, average SAV IBI scores are similar and are ranked as "very good". Detroit River and St. Clair River AOCs show similarity in the levels of variation in SAV community condition from sites ranking as "fair" or "good" to "excellent". Similarly, several wetlands exhibit stability in SAV condition and others exhibit considerable change over time. In this report, consistent trends in SAV community condition are not observed. It is therefore recommended that SAV community sampling continue in order to better understand the natural levels of variability in SAV community conditions over time to aid in developing robust delisting criteria. Major contributors to poor SAV community health are turbid conditions impeding plant growth as well as the exclusion of native species by invasive species. Improvements in water quality, especially turbidity, would greatly improve the condition of SAV communities and highlight the added benefits of enhancing wetland condition and connectedness of wetland functions.

5.0 Breeding Bird Community

Methodology

Breeding marsh bird communities were surveyed using a modification to the Marsh Monitoring Program (MMP) protocol (Meyer et al. 2006) to report on site-level or specific AOC wetland bird communities. The primary purpose of the MMP is to assess population trends of common marsh bird species across broad geographic scales and/or long timeframes. Bird survey stations were identified using aerial photographs and set up at least 250 metres apart. Only those stations that had at least 50% of marsh habitat (i.e., non-woody emergent plants) within the sampling radius (100 m) were surveyed. Marsh bird surveys were conducted using a 15 minute point count: five minutes of passive surveying followed by five minutes of call broadcasting for secretive species (e.g., Virginia Rail, Sora, Least Bittern, Common Moorhen/American Coot, and Pied-billed Grebe), finally followed by five minutes of passive surveying (see Appendix 2 for a list of bird species).

Surveyed birds have been categorized into one of two guilds: marsh nesting birds and marsh foraging birds (Grabas et al. 2008). In studies in the Canadian Mixedwood Plains Ecozone (extending from the southern part of lakes Huron and Michigan and including all of lakes St. Clair, Erie and Ontario with their connecting channels), three metrics were shown to significantly respond to disturbance (SAMNO – Number of area-sensitive marsh-nesting obligates, PMNO – Proportion of marsh-nesting obligates and PNAF – Proportion of non-aerial foragers). These metrics are expected to decrease with increasing disturbance. However, in HEC, IBI scores show no clear relationship with disturbance (Environment Canada 2012b). Efforts are underway to develop a new IBI for HEC and as such the values presented herein should be used with caution.

Results

Overall, breeding bird community condition ranged from “poor” to “good” condition in the Detroit River AOC wetlands, “good” to “excellent” in St. Clair River AOC and “excellent” in Lake St. Clair (Table 9). This separation appears to be the result of a lack of area-sensitive marsh-nesting obligates and a small proportion of marsh-nesting obligates in Detroit River wetlands (Table 10). The St. Clair River AOC wetlands are approaching the condition of the non-AOC Lake St. Clair wetlands; however, Lake St. Clair coastal wetlands support some of the highest quality marsh bird communities in the Lower Great Lakes.

Bird IBI values from 2012 appeared to be significantly lower than for the same sites in 2011. With the exception of Detroit River Marshes, all bird IBI values declined from 2011 to 2012. Lake St. Clair Marshes, Moon Cove/Tic Tac Point and Mitchell’s Bay Marsh experienced the strongest declines of 100 to 55.62, 91.44 to 40.74, and 86.90 to 61.94, respectively. However, based on the mean data of all years samples, the descriptors did not change for Lake St. Clair Marshes and Moon Cove/Tic Tac Point (that is, remained “excellent” and “very good”, respectively) while Mitchell’s Bay Marsh had its descriptor drop by one category (“excellent” to “very good”), indicating the biotic community for these sites is still of high quality. Stag Island Marsh also experienced a sharp decline in bird IBI values (from 67.31 in 2011 to 29.53 in 2012), causing it to drop a category from “very good” to “good”. However, Stag Island Marsh was sampled for only two years, and it is not clear at this time if this is a significant trend.

Table 9. Marsh breeding bird community IBI (Bird-IBI) score and rank for selected coastal wetlands in the Detroit River and St. Clair River Areas of Concern (AOC) and non-AOC sites in Lake St. Clair.

	Bird-IBI					
Wetland by AOC	**2007**	**2008**	**2011**	**2012**	**Mean**	**Descriptor***
Detroit River						
Canard River Marsh	-	40.34	55.50	41.91	**45.92**	Good
Canard River Mouth Marsh	-	54.83	-	-	**54.83**	Good
Turkey Island Marsh	-	0.43	-	-	**0.43**	Poor
Detroit River Marshes	-	35.73	42.02	51.26	**43.00**	Good
Fighting Island Diked Marsh	-	28.94	-	-	**28.94**	Fair
Turkey Creek Marsh	-	35.71	40.74	28.46	**34.97**	Fair
Peche Island Marsh	-	27.70	33.33	24.63	**28.55**	Fair
Non-AOC						
St. Clair NWA – West Marsh	100	-	-	-	**100**	Excellent
St. Clair NWA – East Marsh	100	-	100	81.11	**93.70**	Excellent
Lake St. Clair Marshes	98.61	-	100	55.62	**84.74**	Excellent
St. Clair River						
Moon Cove / Tic Tac Point Marsh	80.81	-	91.44	40.74	**71.00**	Very Good
Mitchell's Bay – Mudcreek Marsh and Syne River Marsh	90.27	-	86.90	61.94	**79.70**	Very Good
St. Clair NWA: Bear Creek Unit – Snye Marsh	81.25	-	-	-	**81.25**	Excellent
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	66.67	-	99.30	65.99	**77.32**	Very Good
St. Clair NWA: Bear Creek Unit – Lozon Marsh	81.25	-	-	-	**81.25**	Excellent
St. Clair NWA: Bear Creek Unit – OPG Marsh	86.01	-	93.85	91.25	**90.37**	Excellent
Snye River Marsh	85.00	-	80.50	78.21	**81.24**	Excellent
Roberta Stewart Marsh	76.39	-	-	-	**76.39**	Very Good
Stag Island Marsh	-	-	67.31	29.53	**48.42**	Good

* based upon mean IBI value for years sampled

Table 10. Breeding bird community IBIs (out of 100) and standardized metrics (out of 10) for coastal wetlands sampled in 2012.

Wetland by AOC	SAMNO	PMNO	PNAF	2012 Bird-IBI
Detroit River				
Canard River Marsh	2.92	1.71	7.95	**41.91**
Detroit River Marshes	4.38	2.32	8.68	**51.26**
Turkey Creek Marsh	0.00	1.06	7.48	**28.46**
Peche Island Marsh	0.00	0.00	7.39	**24.63**
Non-AOC				
St. Clair NWA – East Marsh	10.00	6.99	7.34	**81.11**
Lake St. Clair Marshes	5.00	3.00	8.68	**55.62**
St. Clair River				
Moon Cove / Tic Tac Point Marsh	2.92	2.94	6.36	**40.74**
Mitchell's Bay – Mudcreek Marsh and Syne River Marsh	4.38	5.89	8.31	**61.94**
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	5.83	5.47	8.49	**65.99**
St. Clair NWA: Bear Creek Unit – OPG Marsh	10.00	9.81	7.57	**91.25**
Snye River Marsh	10.00	5.39	8.07	**78.21**
Stag Island Marsh	0.00	1.03	7.83	**29.53**

Metrics: SAMNO: Number of area-sensitive marsh-nesting obligates
PMNO: Proportion of marsh-nesting obligates
PNAF: Proportion of non-aerial foragers

Discussion

There is a major difference in the condition of breeding marsh bird communities between the Detroit River AOC and St. Clair River AOC. The Detroit River wetlands exhibit communities indicative of disturbed conditions whereas marsh bird communities in the St. Clair River AOC (with the exception of Stag Island Marsh) and Lake St. Clair score near or at the top of the IBI scale. These differences cannot be attributed to a single factor; however, habitat encroachment from urban development and habitat loss from shoreline hardening are of significant importance. As a result of encroachment and loss, the remaining coastal wetlands are reduced to small fringing units, which are unable to support many area-sensitive and marsh obligate species. Larger wetlands that remain, such as Canard River, are heavily impacted by watershed inputs and do not support the quality of habitat necessary for these species.

The wetlands remaining in the St. Clair River AOC exist as small units in the river proper, but together comprise a network of wetlands along the Snye River and along the large marshes of the St. Clair River Delta, which is known to support many target guilds and species. Lake St. Clair wetlands act as a contiguous swath of wetland along a portion of the shoreline and scored extremely high bird IBI values, thereby emphasizing the importance of the St. Clair National Wildlife Areas in providing high quality habitat for marsh birds.

6.0 Aquatic Macroinvertebrate Community

Methodology

For each wetland, three replicate sub-samples of approximately 150 nektonic and epiphytic aquatic macroinvertebrates (≥ 500 µm) were taken by sweep-netting through the water column in the cattail-dominated or flooded common reed emergent communities. Macroinvertebrates were identified to the lowest taxonomic group possible.

Burton et al. (2008) include recommendations for an aquatic macroinvertebrate community IBI through the Great Lakes Coastal Wetland Consortium (www.glc.org/wetlands). Five metrics were used that have shown a significant association with disturbance (Table 9). Most metrics (e.g., number of Odonata genera [NODO] and percent Trichoptera [PTRI]) have been shown to decrease with disturbance while others (e.g., percent Diptera [PDIP]) have been shown to increase with disturbance (Merrit and Cummins 1996, EC and CLOCA 2004). However, in HEC, IBI scores show no clear relationship with disturbance (Environment Canada 2012b). Efforts are underway to develop a new IBI for HEC and as such the values presented herein should be used with caution.

Results

The macroinvertebrate IBI scores changed slightly by region. The Detroit River AOC wetlands scored from “fair” to “very good” but are typically “good”. The non-AOC Lake St. Clair wetlands scored from “good” to “very good” but are typically “very good”. The St. Clair River AOC wetlands scored from “good” to “very good” but are typically “very good”. There is considerable variation in IBI scores over time with no consistent trend among wetlands. Regionally, the Detroit River wetlands scored lower than both the non-AOC and St. Clair River AOC wetlands (Table 11). The variation in IBI scores does not appear to be driven by specific metric values, as variation exists among sites and regions (Table 12).

Table 11. Index of Biotic Integrity (IBI) for the condition of the aquatic macroinvertebrate community for selected coastal wetlands in the Detroit River and St. Clair River Areas of Concern (AOC) and non-AOC sites in Lake St. Clair.

	Aquatic Macroinvertebrate IBI						
Wetland by AOC	**2006**	**2007**	**2008**	**2011**	**2012**	**Mean**	**Descriptor ***
Detroit River							
Crystal Bay	-	-	-	-	-	**-**	-
Canard River Marsh	-	-	31.90	41.13	60.20	**44.41**	Good
Canard River Mouth Marsh	48.36	-	28.03	-	-	**38.20**	Fair
Turkey Island Marsh	65.37	-	8.92	-	-	**37.15**	Fair
Detroit River Marshes	54.18	-	71.41	60.68	64.46	**62.68**	Very good
Detroit River Marshes (North)	-	-	-	-	62.05	**62.05**	Very good
Fighting Island Undiked Marsh	-	-	44.62	-	-	**44.62**	Good
Fighting Island Diked Marsh	-	-	47.01	-	-	**47.01**	Good
Turkey Creek Marsh	60.32	-	44.96	34.52	64.96	**51.19**	Good
Peche Island Marsh	-	-	55.74	54.71	67.12	**59.19**	Good
Non-AOC							
St. Clair NWA – West Marsh	-	71.71	-	-	-	**71.71**	Very good
St. Clair NWA – East Marsh	-	73.67	-	79.20	64.11	**72.33**	Very good
Lake St. Clair Marsh	-	51.00	58.64	58.46	62.00	**57.52**	Good
St. Clair River							
Moon Cove / Tic Tac Point Marsh	70.77	70.69	61.09	69.55	70.08	**68.43**	Very good
Mitchell's Bay – Mudcreek Marsh and Syne River Marsh	40.33	54.11	56.42	78.59	45.08	**54.91**	Good
St. Clair NWA: Bear Creek Unit – Snye Marsh	44.59	68.55	49.20	-	-	**54.11**	Good
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	-	60.09	-	83.36	58.78	**67.40**	Very good
St. Clair NWA: Bear Creek Unit – Lozon Marsh	45.57	85.58	-	-	-	**65.57**	Very good
St. Clair NWA: Bear Creek Unit – OPG Marsh	48.41	69.46	52.53	62.50	68.09	**60.20**	Very good
Snye River Marsh	68.18	86.88	72.11	48.50	68.07	**68.75**	Very good
Roberta Stewart Marsh	50.31	65.13	53.99	-	-	**56.48**	Good
Stag Island Marsh	-	-	-	82.12	57.30	**69.71**	Very good

* based upon mean IBI value for years sampled

Note: The macroinvertebrate taxonomy has been updated based on recent taxonomic changes and as such, values presented here may differ from those presented in EC-CWS 2012a.

Table 12. Aquatic Macroinvertebrate community IBIs (out of 100) and standardized metrics (out of 10) for coastal wetlands sampled in 2012.

Wetland by AOC	NETG	NODO	NFAM	PTRI	PDIP	2012 IBI
Detroit River						
Canard River Marsh	8.07	8.82	3.21	0.00	10.00	**60.20**
Detroit River Marshes	10.00	10.00	4.39	0.00	7.84	**64.46**
Detroit River Marshes (North)	9.68	7.84	4.00	8.09	1.41	**62.05**
Turkey Creek Marsh	10.00	8.82	2.03	5.94	5.69	**64.96**
Peche Island Marsh	6.45	6.86	2.43	10.00	7.82	**67.12**
Non-AOC						
St. Clair NWA – East Marsh	8.07	4.90	8.72	0.97	9.40	**64.11**
Lake St. Clair Marshes	9.68	4.90	1.64	7.93	6.85	**62.00**
St. Clair River						
Moon Cove / Tic Tac Point Marsh	10.00	4.90	2.03	10.00	8.11	**70.08**
Mitchell's Bay – Mudcreek Marsh and Syne River Marsh	4.84	5.88	4.00	0.00	7.82	**45.08**
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	6.45	5.88	10.00	1.54	5.50	**58.76**
St. Clair NWA: Bear Creek Unit – OPG Marsh	10.00	7.84	5.18	2.59	8.44	**68.09**
Snye River Marsh	10.00	5.88	7.93	3.32	6.91	**68.07**
Stag Island Marsh	10.00	3.92	3.61	1.83	9.29	**57.03**

Metrics:
NETG: Number of Ephemeroptera and Trichoptera
NODO: Number of Odonata
NFAM: Number of families
PTRI: Proportion of Trichoptera
PDIP: Proportion of Diptera

Discussion

The results from the aquatic macroinvertebrate IBI highlight the importance of using a multimetric approach in IBI development, as no single metric appeared to drive IBI scores. This also illustrates that despite wetlands being characterized as being in “good” or “very good” condition, certain metrics are still negatively impacted, and disturbance remains.

The utility of using aquatic macroinvertebrates to assess coastal wetland health cannot be understated, as these organisms spend a large proportion of their life cycle in water and act as indicators of conditions on a longer time scale than discrete water quality sampling. In addition, the GLCWC methodology utilized here is standardized for the Great Lakes and can be used in regional comparisons across the basin. This is important in the development of specific delisting criteria and for comparisons with non-AOC conditions. It is recommended that aquatic macroinvertebrate community monitoring continue in order to support the reporting on coastal wetland habitat condition in this region to fully understand variability in condition at multiple time scales.

7.0 Summary

This report describes the condition of coastal wetlands in the Huron-Erie Corridor (Detroit River AOC, Lake St. Clair, and St. Clair River AOC) using values of water chemistry and three separate IBIs for SAV, aquatic macroinvertebrates, and breeding bird communities. Overall, wetland condition ranged widely from “highly degraded” to “excellent”, with a large proportion of sites exhibiting evidence of being in “good” condition (Table 13).

Table 13. Summary of index scores and ranks for water quality (from -3 to +3), submerged aquatic vegetation (SAV), aquatic macroinvertebrates (Invert), and breeding marsh bird communities (Bird) (from 0 to 100) of selected coastal wetlands in the Detroit River and St. Clair River Areas of Concern (AOC) and non-AOC sites in Lake St. Clair.

	Mean Index Score[1]			
Wetland by AOC	**WQI**	**SAV-IBI**	**Bird-IBI**	**Invert-IBI**
Detroit River				
Crystal Bay	0.20	-	-	-
Canard River Marsh	-1.83	39.65	45.92	44.41
Canard River Mouth Marsh	-0.43	68.12	54.83	38.20
Turkey Island Marsh	-0.56	59.06	0.43	37.15
Detroit River Marshes	-0.29	84.27	43.00	62.68
Detroit River Marshes (North)	-0.83	81.71	-	62.05
Fighting Island Undiked Marsh	-0.47	62.58	-	44.62
Fighting Island Diked Marsh	-0.09	68.03	28.94	47.01
Turkey Creek Marsh	-1.02	55.09	34.97	51.19
Peche Island Marsh	0.28	67.24	28.55	59.19
Non-AOC				
St. Clair NWA – West Marsh	0.08	81.91	100	71.71
St. Clair NWA – East Marsh	-0.10	80.36	93.70	72.33
Lake St. Clair Marshes	-0.26	72.08	84.74	57.52
St. Clair River				
Moon Cove / Tic Tac Point Marsh	-0.35	64.52	71.00	68.43
Mitchell’s Bay – Mudcreek Marsh and Syne River Marsh	-0.26	80.53	79.70	54.91
Snye River South Marsh	-0.94	58.96	-	-
St. Clair NWA: Bear Creek Unit – Snye Marsh	-0.74	79.13	81.25	54.11
St. Clair NWA: Bear Creek Unit – Maxwell Marsh	0.05	64.50	77.32	67.40
St. Clair NWA: Bear Creek Unit – Lozon Marsh	-0.57	85.49	81.25	65.57
St. Clair NWA: Bear Creek Unit – OPG Marsh	-0.26	80.74	90.37	60.20
St. Clair NWA: Bear Creek Unit – Corsini Marsh	-2.16	72.47	-	-
Snye River Marsh	0.25	22.55	81.24	68.75
Roberta Stewart Marsh	-0.94	39.13	76.39	56.48
Stag Island Marsh	0.76	79.80	48.42	69.71

IBI Key:	Poor	Fair	Good	Very Good	Excellent

WQI Key	Highly Degraded	Very Degraded	Moderately Degraded	Good	Very Good	Excellent

[1] based upon mean index value for years sampled

Water quality was similar among AOCs and non-AOCs. In general, index scores have indicated moderate levels of degradation in the Huron-Erie Corridor. Similarly, submerged aquatic vegetation condition exhibits some variability but is consistent among waterbodies. The majority of sites ranked “very good” in submerged aquatic vegetation index scores with few wetlands showing signs of high levels of disturbance. Breeding marsh bird community condition exhibits a major difference between AOCs. The Detroit River AOC wetlands have poorer marsh bird community condition than both the non-AOC and St. Clair River AOC wetlands. The St. Clair River bird communities are in “excellent” condition, and highlight the importance of this area for bird populations. Similarly, aquatic macroinvertebrate community condition is slightly poorer in the Detroit River AOC than either the non-AOC or St. Clair River AOC, and provides insight into the long-term water quality conditions of the region. This report outlines the conditions in the Huron-Erie Corridor coastal wetlands and provides key baseline monitoring data for the region.

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Appendix 1

List of species observed during 2012 submerged aquatic vegetation (SAV) surveys.

.

Common Name	Genus/Species	Native	Turbidity-Tolerant	Coefficient of Conservatism
American lotus	*Nelumbo lutea*	√		10
Bladderwort	*Utricularia* sp.	√		
Brittlewort	*Nitella* sp.	√		
Broad-leaved Arrowhead	*Sagittaria latifolia*	√		4
Burreed	*Sparganium* sp.	√		
Canada Waterweed	*Elodea canadensis*	√	√	4
Common Bladderwort, Spatterdock	*Utricularia vulgaris*	√		4
Common burreed	*Sparganium eurycarpum*	√		3
Common Reed (Invasive)	*Phragmites australis*	X		
Common Three-square	*Schoenoplectus pungens*	√		6
Coontail, Hornwort	*Ceratophyllum demersum*	√	√	4
Curly Pondweed	*Potamogeton crispus*	X	√	
Curly White Water Crowfoot	*Ranunculus longirostris*	√	√	5
Dead Typha	Dead *Typha*	√		
Eurasian Water Milfoil	*Myriophyllum spicatum*	X	√	
European Frog-bit	*Hydrocharis morsus-ranae*	X		
Filamentous algae surface	*Algae* sp. (fil. surface)	√		
Filamentous algae underwater	*Algae* sp. (fil. underwater)	√		
Flat-stemmed Pondweed	*Potamogeton zosteriformis*	√	X	5
Floating Slender Liverwort	*Riccia fluitans*	√		
Floating-leaved Pondweed	*Potamogeton natans*	√		5
Flowering Rush	*Butomus umbellatus*	X		
Greater Duckweed	*Spirodela polyrhiza*	√		4
Hardstem Bulrush	*Schoenoplectus acutus*	√		6
Hybrid Cattail	*Typha x glauca*	√		3
Large-leaved Pondweed	*Potamogeton amplifolius*	√	X	5
Leafy Pondweed	*Potamogeton foliosus*	√	√	4
Lesser Duckweed	*Lemna minor*	√		2
Narrow-leaved Cattail	*Typha angustifolia*	√		3
Northern Water Milfoil	*Myriophyllum sibiricum*	√	X	6
Pickerelweed	*Pontederia cordata*	√		7
Richardson's, Clasping Leaved Pondweed	*Potamogeton richardsonii*	√		5
Sago Pondweed	*Potamogeton pectinatus*	√	√	4
Slender Naiad	*Najas flexilis*	√	X	5
Slender Pondweed	*Potamogeton pusillus*	√	√	5
Slender Waterweed	*Elodea nuttallii*	√		8
Softstem Bulrush	*Schoenoplectus tabernaemontani*	√		5
Spikerush	*Eleocharis* sp.	√		
Star Duckweed	*Lemna trisulca*	√		4

Common Name	Genus/Species	Native	Turbidity-Tolerant	Coefficient of Conservatism
Stiff Arrowhead	*Sagittaria rigida*	√		6
Stonewort, Muskgrass	*Chara* sp.	√		
Swamp Loosestrife	*Decodon verticillatus*	√		7
Tape Grass, Wild Celery, Water Celery	*Vallisneria americana*	√	X	6
Variable-leaved Pondweed	*Potamogeton gramineus*	√		4
Water Star-grass	*Heteranthera dubia*	√	√	7
Watermeal	*Wolffia* sp.	√		
White Water Lily, Fragrant Water Lily	*Nymphaea odorata*	√		5
Wild Rice	*Zizania palustris*	√		9
Yellow Pond Lily, Bullhead Lily, Spatterdock	*Nuphar lutea* ssp. *variegata*	√		4

Appendix 2

Bird species observed during 2012 surveys, grouped into metrics that were included for calculating the IBI: a) area-sensitive marsh-nesting obligate species, b) marsh-nesting obligate species, and c) non-aerial foragers.

a) Area-sensitive marsh-nesting obligate bird species

Code	Common Name	Species
AMBI	American bittern	*Botaurus lentiginosus*
AMCO	American Coot	*Fulica americana*
BLTE	black tern	*Chlidonias niger*
FOTE	Forster's tern	*Sterna forsteri*
LEBI	least bittern	*Ixobrychus exilis*

b) Marsh-nesting obligate bird species

Code	Common Name	Species
AMBI	American bittern	*Botaurus lentiginosus*
AMCO	American coot	*Fulica americana*
BLTE	black tern	*Chlidonias niger*
COMO	common moorhen	*Gallinula chloropus*
FOTE	Forster's tern	*Sterna forsteri*
LEBI	least bittern	*Ixobrychus exilis*
MAWR	marsh wren	*Cistothorus palustris*
PBGR	pied-billed grebe	*Podilymbus podiceps*
SORA	sora	*Porzana carolina*
SWSP	swamp sparrow	*Melospiza georgiana*
VIRA	Virginia rail	*Rallus limicola*

c) Non-aerial forager bird species

Code	Common Name	Species
AMCR	American crow	*Corvus brachyrhynchos*
AMGO	American goldfinch	*Carduelis tristis*
AMRO	American robin	*Turdus migratorius*
BAOR	Baltimore oriole	*Icterus galbula*
BHCO	brown-headed cowbird	*Molothrus ater*
BLJA	blue jay	*Cyanocitta cristata*
BRTH	brown thrasher	*Toxostoma rufum*
COGR	common grackle	*Quiscalus quiscula*
COYE	common yellowthroat	*Geothlypis trichas*
DOWO	downy woodpecker	*Picoides pubescens*
EUST	European starling	*Sturnus vulgaris*
HOSP	house sparrow	*Passer domesticus*
INBU	indigo bunting	*Passerina cyanea*

Code	Common Name	Species
MAWR	marsh wren	*Cistothorus palustris*
MODO	mourning dove	*Zenaida macroura*
NOCA	northern cardinal	*Cardinalis cardinalis*
NOFL	northern flicker	*Colaptes auratus*
RWBL	red-winged blackbird	*Agelaius phoeniceus*
SORA	sora	*Porzana carolina*
SOSP	song sparrow	*Melospiza melodia*
SPSA	spotted sandpiper	*Actitis macularia*
SWSP	swamp sparrow	*Melospiza georgiana*
VIRA	Virginia rail	*Rallus limicola*
WAVI	warbling vireo	*Vireo gilvus*
YWAR	yellow warbler	*Dendroica petechia*

Appendix 3

List of Aquatic Macroinvertebrate species identified to the lowest taxonomic unit possible from 2012 samples.

Phylum	Class	Order	Family	Genus/Species
Annelida	Clitellata	Arhynchobdellida	Erpobdellidae	
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	*Alboglossiphonia heteroclita*
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	*Desserobdella phalera*
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	*Helobdella* sp.
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	*Helobdella stagnalis*
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	*Helobdella triserialis*
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	*Placobdella ornata*
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	*Placobdella* sp.
Annelida	Oligochaeta			
Arthropoda	Arachnida	Hydracarina		
Arthropoda	Crustacea	Amphipoda		
Arthropoda	Crustacea	Amphipoda	Crangonyctidae	*Crangonyx* sp.
Arthropoda	Crustacea	Amphipoda	Gammaridae	
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Echinogammarus ischnus*
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Gammarus fasciatus*
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Gammarus* sp.
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Gammarus tigrinus*
Arthropoda	Crustacea	Amphipoda	Hyalellidae	*Hyalella azteca*
Arthropoda	Crustacea	Decapoda	Cambaridae	*Orconectes* sp.
Arthropoda	Crustacea	Isopoda	Asellidae	*Caecidotea* sp.
Arthropoda	Insecta	Coleoptera	Chrysomelidae	
Arthropoda	Insecta	Coleoptera	Curculionidae	
Arthropoda	Insecta	Coleoptera	Dytiscidae	*Hydroporinae* sp.
Arthropoda	Insecta	Coleoptera	Dytiscidae	*Hygrotus* sp.
Arthropoda	Insecta	Coleoptera	Dytiscidae	*Laccophilus* sp.
Arthropoda	Insecta	Coleoptera	Dytiscidae	*Liodessu*s sp.
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia* sp.
Arthropoda	Insecta	Coleoptera	Gyrinidae	*Dineutus* sp.
Arthropoda	Insecta	Coleoptera	Haliplidae	*Haliplus* sp.
Arthropoda	Insecta	Coleoptera	Haliplidae	*Peltodytes* sp.
Arthropoda	Insecta	Coleoptera	Hydrophilidae	*Anacaena* sp.
Arthropoda	Insecta	Coleoptera	Hydrophilidae	*Enochrus* sp.
Arthropoda	Insecta	Coleoptera	Hydrophilidae	*Paracymus* sp.
Arthropoda	Insecta	Coleoptera	Hydrophilidae	*Tropisternus* sp.
Arthropoda	Insecta	Coleoptera	Noteridae	*Hydrocanthus* sp.
Arthropoda	Insecta	Coleoptera	Scirtidae	*Elodes* sp.

Phylum	Class	Order	Family	Genus/Species
Arthropoda	Insecta	Collembola		
Arthropoda	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*
Arthropoda	Insecta	Diptera	Chironomidae	
Arthropoda	Insecta	Diptera	Chironomidae	*Chironomini* sp.
Arthropoda	Insecta	Diptera	Chironomidae	*Tanypodinae* sp.
Arthropoda	Insecta	Diptera	Culicidae	*Anopheles* sp.
Arthropoda	Insecta	Diptera	Sciomyzidae	
Arthropoda	Insecta	Diptera	Stratiomyidae	*Odontomyia/Hedriodiscus*
Arthropoda	Insecta	Diptera	Tipulidae	*Helius* sp.
Arthropoda	Insecta	Ephemeroptera	Baetidae	
Arthropoda	Insecta	Ephemeroptera	Baetidae	*Callibaetis* sp.
Arthropoda	Insecta	Ephemeroptera	Baetidae	*Procloeon/Centroptilum*
Arthropoda	Insecta	Ephemeroptera	Baetidae	*Procloeon/Centroptilum/Cloeon*
Arthropoda	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.
Arthropoda	Insecta	Hemiptera	Belostomatidae	*Belostoma* sp.
Arthropoda	Insecta	Hemiptera	Corixidae	
Arthropoda	Insecta	Hemiptera	Corixidae	*Hesperocorixa* sp.
Arthropoda	Insecta	Hemiptera	Corixidae	*Palmacorixa sp.*
Arthropoda	Insecta	Hemiptera	Corixidae	*Sigara* sp.
Arthropoda	Insecta	Hemiptera	Corixidae	*Trichocorixa* sp.
Arthropoda	Insecta	Hemiptera	Gerridae	
Arthropoda	Insecta	Hemiptera	Hebridae	*Merragata* sp.
Arthropoda	Insecta	Hemiptera	Mesoveliidae	*Mesovelia* sp.
Arthropoda	Insecta	Hemiptera	Nepidae	
Arthropoda	Insecta	Hemiptera	Nepidae	*Ranatra* sp.
Arthropoda	Insecta	Hemiptera	Notonectidae	
Arthropoda	Insecta	Hemiptera	Notonectidae	*Buenoa* sp.
Arthropoda	Insecta	Hemiptera	Notonectidae	*Notonecta* sp.
Arthropoda	Insecta	Hemiptera	Pleidae	*Neoplea* sp.
Arthropoda	Insecta	Hemiptera	Veliidae	*Microvelia* sp.
Arthropoda	Insecta	Lepidoptera		
Arthropoda	Insecta	Lepidoptera	Pyralidae	*Acentria* sp.
Arthropoda	Insecta	Lepidoptera	Pyralidae	*Elophila* sp.
Arthropoda	Insecta	Lepidoptera	Pyralidae	*Parapoynx* sp.
Arthropoda	Insecta	Megaloptera	Corydalidae	*Chauliodes* sp.
Arthropoda	Insecta	Odonata	Aeshnidae	
Arthropoda	Insecta	Odonata	Aeshnidae	*Anax* sp.
Arthropoda	Insecta	Odonata	Coenagrionidae	
Arthropoda	Insecta	Odonata	Coenagrionidae	*Enallagma* sp.
Arthropoda	Insecta	Odonata	Coenagrionidae	*Enallagma/Coenagrion* sp.
Arthropoda	Insecta	Odonata	Coenagrionidae	*Ischnura* sp.
Arthropoda	Insecta	Odonata	Corduliidae	
Arthropoda	Insecta	Odonata	Libellulidae	

Phylum	Class	Order	Family	Genus/Species
Arthropoda	Insecta	Odonata	Libellulidae	*Erythemis* sp.
Arthropoda	Insecta	Odonata	Libellulidae	*Sympetrum* sp.
Arthropoda	Insecta	Odonata	Libellulidae	*Tramea* sp.
Arthropoda	Insecta	Odonata	Libellulidae/Corduliidae	
Arthropoda	Insecta	Trichoptera		
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Agraylea* sp.
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Orthotrichia* sp.
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Oxyethira* sp.
Arthropoda	Insecta	Trichoptera	Leptoceridae	
Arthropoda	Insecta	Trichoptera	Leptoceridae	*Oecetis* sp.
Arthropoda	Insecta	Trichoptera	Phryganeidae	*Fabria* sp.
Arthropoda	Insecta	Trichoptera	Polycentropodidae	*Polycentropus* sp.
Mollusca	Bivalvia	Veneroida	Dreisseniidae	*Dreissena polymorpha*
Mollusca	Bivalvia	Veneroida	Dreisseniidae	*Dreissena* sp.
Mollusca	Bivalvia	Veneroida	Pisidiidae	
Mollusca	Bivalvia	Veneroida	Pisidiidae	*Musculium* sp.
Mollusca	Gastropoda	Basommatophora	Ancylidae	
Mollusca	Gastropoda	Basommatophora	Ancylidae	*Laevapex* sp.
Mollusca	Gastropoda	Basommatophora	Lymnaeidae	
Mollusca	Gastropoda	Basommatophora	Lymnaeidae	*Fossaria* sp.
Mollusca	Gastropoda	Basommatophora	Lymnaeidae	*Pseudosuccinea* sp.
Mollusca	Gastropoda	Basommatophora	Lymnaeidae	*Stagnicola* sp.
Mollusca	Gastropoda	Basommatophora	Physidae	*Physa/Physella*
Mollusca	Gastropoda	Basommatophora	Planorbidae	
Mollusca	Gastropoda	Basommatophora	Planorbidae	*Gyraulus* sp.
Mollusca	Gastropoda	Basommatophora	Planorbidae	*Helisoma/Planorbella*
Mollusca	Gastropoda	Basommatophora	Planorbidae	*Promenetus* sp.
Mollusca	Gastropoda	Mesogastropoda	Bithyniidae	*Bithynia tentaculata*
Mollusca	Gastropoda	Mesogastropoda	Pleuroceridae	*Pleurocera* sp.
Mollusca	Gastropoda	Mesogastropoda	Valvatidae	*Valvata* sp.
Mollusca	Gastropoda	Mesogastropoda	Valvatidae	*Valvata tricarinata*
Mollusca	Gastropoda	Neotaenioglossa	Hydrobiidae	
Mollusca	Gastropoda	Stylommatophora	Succineidae	*Succinea* sp.
Nematoda				
Platyhelminthes	Turbellaria	Tricladida		