St. Marys River Area of Concern:
Coastal Wetland Habitat Scoping Report

March 2013

Environment Canada
Canadian Wildlife Service

Environnement Canada
Service canadien de la faune

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Executive Summary

The St. Marys River is a 112 km connecting channel between Lake Superior and Lake Huron. In 1985, the International Joint Commission (IJC) identified the St. Marys River as one of the 43 Areas of Concern (AOC) on the Great Lakes. The health of wildlife populations, a subcomponent under BUI 3 (*Degradation of Fish and Wildlife Populations*) is currently listed as "requires further assessment" while BUI 14 (*Loss of Fist and Wildlife Habitat*) is currently listed as "impaired". Given coastal wetlands provide a number of functions including wildlife habitat, it is important to gain a better understanding of their current state within the AOC as well as the surrounding area. In 2012, a subset of coastal wetlands in the St. Marys River, both within and outside the AOC, were visited and surveyed for water quality, submerged aquatic vegetation, and marsh breeding birds in order to assess the condition of coastal wetland habitat and biotic communities.

The initial objective was to survey eight AOC sites and four non-AOC sites to allow for comparisons between AOC and non-AOC site conditions. However, due to access constraints and suitability of coastal wetlands for inclusion in this type of survey not all selected AOC sites could be surveyed and some additional potential sites were visited to assess their suitability for inclusion. Twelve AOC and four non-AOC sites were visited – 14 sampled for water quality, 10 for submerged aquatic vegetation and 5 for birds. The sampled sites represent the different sizes and geomorphic types of the coastal wetlands within the St. Marys River.

Water quality within St. Marys River coastal wetlands ranged from "moderately degraded" to "very good" with the majority of sites considered "good" or "very good". There is no apparent difference in AOC sites versus non-AOC sites. The degradation of water quality appears to be primarily a result of increased turbidity.

By percent cover and number of quadrats, slender naiad (*Najas flexilis*), fern pondweed (*Potamogeton robbinsii*) and wild celery (*Vallisneria americana*) were the most common submerged aquatic vegetation species observed. All three are turbidity intolerant species and are classified as native species.

All sites surveyed for marsh breeding birds had a relatively high proportion of non-aerial foragers whereas only Echo Bay had any area-sensitive marsh-nesting obligates. The proportion of marsh nesting obligates was highest for Echo Bay and lowest at Stobie Creek.

The results presented herein provide a snapshot of the condition of coastal wetlands in the St. Marys River. However, multi-year assessments and development of region-specific indices for submerged aquatic vegetation and bird communities are necessary to provide a better picture of the current condition of coastal wetlands. It is recommended any future surveys sample six AOC sites (Carpin Beach, Echo Bay, Lake George, Maskinonge Bay, Pumpkin Point, and West Shore, St. Joseph Island) and four non-AOC sites (Joe Dollar Bay, Desbarats Wetland, Hay Bay Wetland, and Stobie Creek).

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Acknowledgements

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1. Introduction

The St. Marys River is a 112 km connecting channel between Lake Superior and Lake Huron. In 1985, the International Joint Commission (IJC) identified the St. Marys River as one of the 43 Areas of Concern (AOC) on the Great Lakes. On the Canadian side, the AOC extends from the head of the river at Whitefish Bay to Quebec Bay and includes the waters around St. Joseph Island (Figure 1). The area was listed because of problems associated with phosphorus, bacteria, oil and grease, heavy metals, trace organics, contaminated sediment, fish consumption advisories and impacted biota (St. Marys River Binational Public Advisory Committee 2002).

A standardized set of impairments called Beneficial Use Impairments (BUIs) were created by the IJC and cover a wide range of environmental and ecological concerns and aim to include a number of stakeholders into the delisting process. Nine of the fourteen beneficial uses defined in the Great Lakes Water Quality Agreement (GLWQA) are listed as impaired including degradation of fish and wildlife populations and loss of fish and wildlife habitat.

The health of wildlife populations, a subcomponent under BUI 3 (*Degradation of Fish and Wildlife Populations*) is currently listed as "requires further assessment" while BUI 14 (*Loss of Fist and Wildlife Habitat*) is currently listed as "impaired". Given coastal wetlands provide a number of functions including wildlife habitat, it is important to gain a better understanding of their current state within the AOC as well as the surrounding area. Standardized methodologies for surveying in coastal wetlands have been developed (Environment Canada and Central Lake Ontario Conservation Authority 2007). Surveys include collection of information on marsh breeding birds, submerged aquatic vegetation, water quality, and aquatic macroinvertebrates. The results of these surveys can be used to provide components of information necessary for BUI assessments.

In 2012, a subset of coastal wetlands in the St. Marys River, both within and outside the AOC, were visited and surveyed for water quality, submerged aquatic vegetation, and marsh breeding birds. The area surveyed outside the AOC extended from Quebec Bay east through the North Channel to approximately eight kilometres east of Bruce Mines. These surveys are the first of three years to collect data to report on elements of BUI#3: *Degradation of fish and wildlife populations* and BUI #14: *Loss of fish and wildlife habitat*.

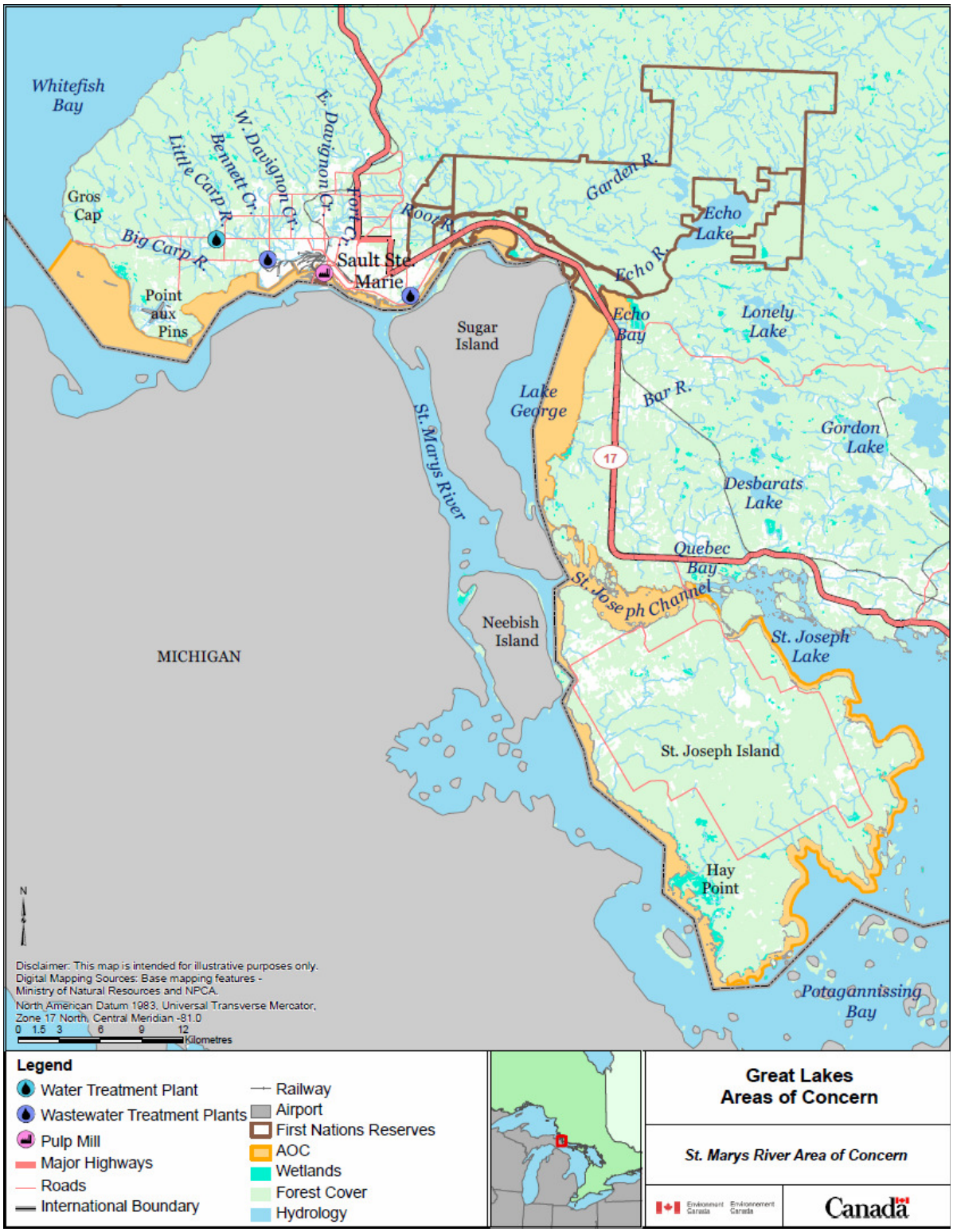

Figure 1. Boundary of the Canadian side of the St. Marys River Area of Concern.

2. Purpose of Report

The purpose of this document is to outline the site selection process, describe the coastal wetlands, briefly describe the sampling methodologies and report on findings of the scoping activities that took place in 2012.

3. Site Selection

All coastal wetlands within the St. Marys River cannot be surveyed, so several criteria were used to select sites for the scoping activities in 2012. Those criteria were:

- Sites larger than 10 hectares (sites need to be large enough to support the sampling methodologies),
- Sites representative of the geomorphic types (e.g., open embayment) and sizes of coastal wetlands present in the area,
- Sites that collectively provide a geographic spread throughout the entire AOC, and
- Sites that are accessible for surveys (e.g., if private, where landowner permission can be obtained or where access points are available close enough to the wetlands for surveys).

Given the time available for scoping activities, the objective was to select eight AOC and four non-AOC sites to allow for comparison of conditions in both areas within the St. Marys River.

Using the Great Lakes Coastal Wetland Inventory (Environment Canada and Ontario Ministry of Natural Resources 2004), all wetlands within the St. Marys River were selected in using Environmental Research Systems Institute (ESRI) ArcGIS 10.0 Platform (ESRI 2010). Wetlands were then classified as being inside or outside the AOC and the area was calculated for each wetland.[1] Wetlands with an area greater than 10 ha were retained for further consideration. Wetlands were then grouped by geomorphic type (Albert et al. 2003) and based on additional factors of size and site access, wetlands were selected proportionate to the geomorphic types.

Within the AOC, there are 31 potential sites ranging in size from 11 ha to 2439 ha. The predominant geomorphic types are open embayment and protected embayment (Table 1). Outside the AOC, six sites are greater than 10 ha ranging in size from 45 to 159 ha. Given there are no sites with a geomorphic type of open embayment, the ratio of geomorphic types cannot be match in and out of the AOC (Table 1). Matching was done as best as possible.

[1] One wetland, Shore Ridges Conservation Area is located in the AOC but not classified as St. Marys River. Given the wetland is not connected to the lake it was not included in the site selection process.

Table 1. Geomorphic type of sites greater than 10 hectares within the St. Marys River AOC and outside the AOC (Quebec Bay east to 8 km past Bruce Mines) and number of sites selected. Sites with more than one geomorphic type are listed based on the type with the largest area.

Geomorphic Type	AOC Sites		Non-AOC Sites	
	# Sites	# Selected	# Sites	# Selected
Beach Lagoon	3	1	0	0
Open Embayment	10	3	0	0
Open Shoreline	2	0	0	0
Sand-Spit Embayment	3	1	0	0
Protected Embayment	10	2	3	3
Drowned River Mouth	3	1	3	1
Total	**31**	**8**	**6**	**4**

Based on the desired number of sites in each geomorphic type, wetlands representing a range of sizes and spatial distribution throughout the AOC were selected. Known or suspected access limitations also weighed in on the site selection results (Table 2).

Table 2. Sites in the St. Marys River selected for scoping activities in 2012.

Wetland Name	Geomorphic Type	Area (ha)
AOC Sites		
Carpin Beach	Drowned River Mouth	17.5
Echo Bay	Beach Lagoon	587.0
Hay Marsh	Protected Embayment	2438.8
Lake George 1	Open Embayment	155.3
Maskinonge Bay 1 & 2	Open Embayment/Protected Embayment	71.5
Pumpkin Point 2	Sand-Spit Embayment	18.1
Stribling Point, St .Joseph Island 1	Protected Embayment	24.8
Tenby Bay, St. Joseph Island 1	Open Embayment	34.8
Non-AOC Sites		
Desbarats Wetland 2	Protected Embayment	89.7
Hay Bay Wetland	Protected Embayment	158.5
Joe Dollar Bay	Protected Embayment	48.5
Stobie Creek 1 & 2	Drowned River Mouth/Open Embayment	45.8

With a limited number of sites selected around Sault Ste. Marie, two sites – Point Louise and Whitefish Island – were identified as ones to be visited if time permitted to determine if they are sites suitable for surveys (indications are that they are not suitable for coastal wetland surveys). In addition, it was suspected that access to Tenby Bay may not be possible so West Shore, St. Joseph Island was selected as an alternate site (Tenby Bay was selected as sites on the south/east side of St. Joseph Island were lacking).

4. Site Descriptions

In July 2012, 12 sites within the AOC and four sites outside the AOC were visited (Figure 2). In addition to those listed in Table 2, Pointe Louise and Whitefish Island were investigated on foot to determine potential suitability and Findlay Point and Richmond Bay were visited by boat. Tenby Bay was not visited as no access point was located. West Shore, St. Joseph Island was surveyed as a replacement.

Figure 2. St. Marys River coastal wetland sites visited in July 2012.

This section provides a brief description of each of the sites surveyed in 2012 including general location and access information, geomorphic type, and wetland size. Geomorphic type and wetland size information was taken from the Great Lakes Coastal Wetland Inventory (Environment Canada and Ontario Ministry of Natural Resources. 2004). Sites are presented from west to east with the exception of sites not fully surveyed which are presented at the end of the section. The provided figures show the survey locations for water quality stations, submerged aquatic vegetation (SAV) quadrats, and bird survey stations (where applicable). Background imagery is 2008 Forest Resource Inventory (FRI). Additional site details are provided in Appendix 1.

Carpin Beach

Carpin Beach is a 178 ha drowned river mouth wetland located just west of Sault Ste. Marie. Access is at the boat launch at the end of Carpin Beach Road.

Along the St. Marys River, the habitat is shallow sandy beach with limited wetland habitat. Within the site, there are two creeks with wetland habitat. Sampling was concentrated along these creeks (Figure 3).

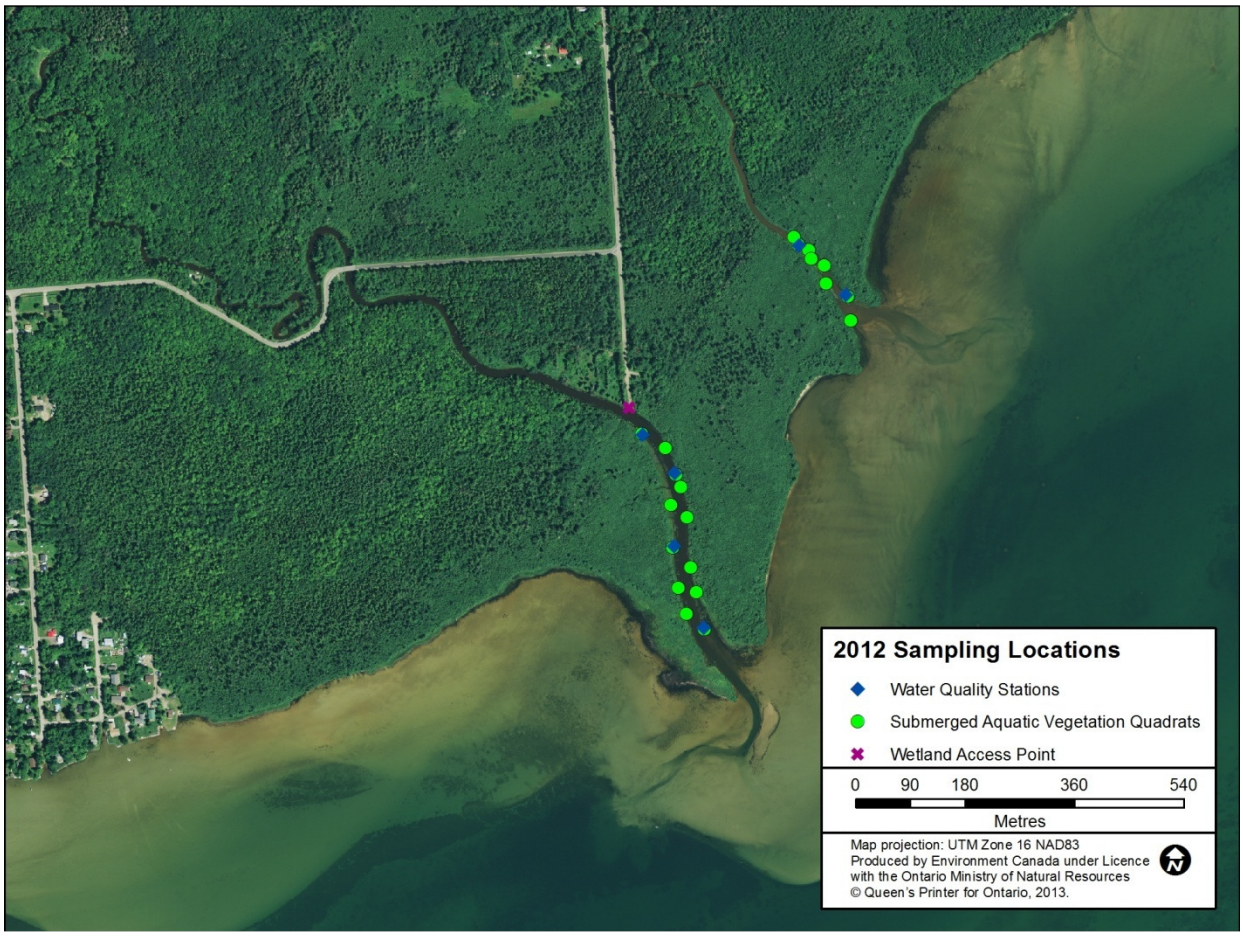

Figure 3. Carpin Beach sampling locations for 2012.

Echo Bay

Echo Bay is a 587 ha beach lagoon wetland located approximately 25 km east of Sault Ste. Marie. Access to the wetland is from a boat launch (which was dry at the time of scoping) on the south side of the wetland (Figure 4). The land north of the river that runs through the bay is owned by Garden River First Nation.

Given its size, the site could be divided into two sites. SAV and water quality sampling was spread around the entire wetland while bird surveys focused on the southern portion of the wetland. A Black Tern (*Chlidonias niger*) colony is present in the southern portion of the wetland.

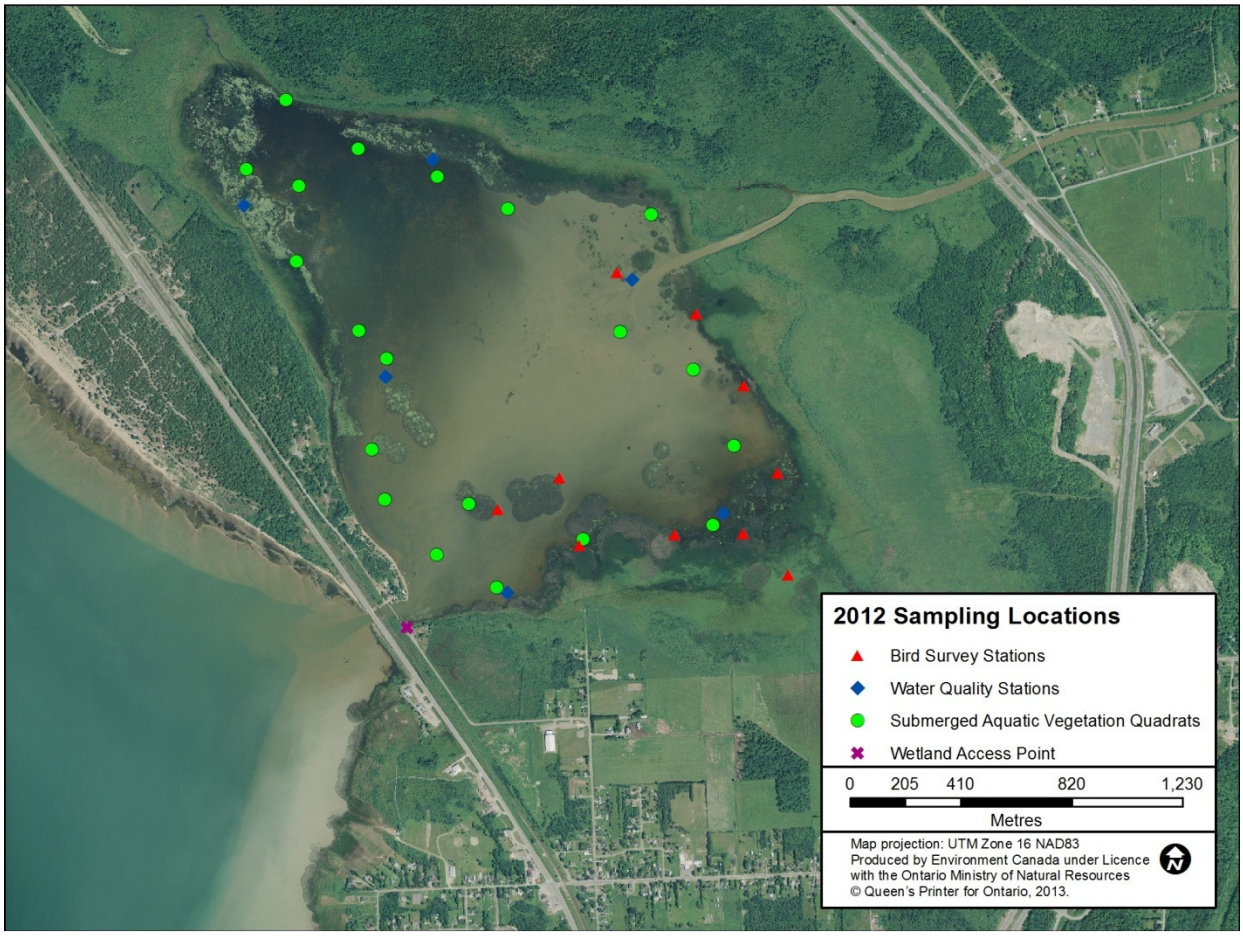

Figure 4. Echo Bay sampling locations for 2012.

Lake George

The Lake George wetlands, situated south of Echo Bay, are divided into three areas. Surveys were undertaken in the southernmost area (Lake George 1) which is a 155 ha open embayment wetland. Access is from a boat launch (which was dry at the time of surveying) on Point Drive. Sampling was concentrated in the southern portion of this site (Figure 5). The wetland is predominantly a high energy shoreline with hardstem bulrush (*Schoenoplectus acutus*) as the dominant emergent vegetation although some areas of cattail (*Typha sp.*) were also present. The water tended to be deeper along the emergent vegetation and shallower further out (sand bars). The habitat near the access point was somewhat different as it was more protected than the rest of the surveyed area. It contained plant species such as white water lily (*Nymphaea odorata*) and pickerelweed (*Pontederia cordata*).

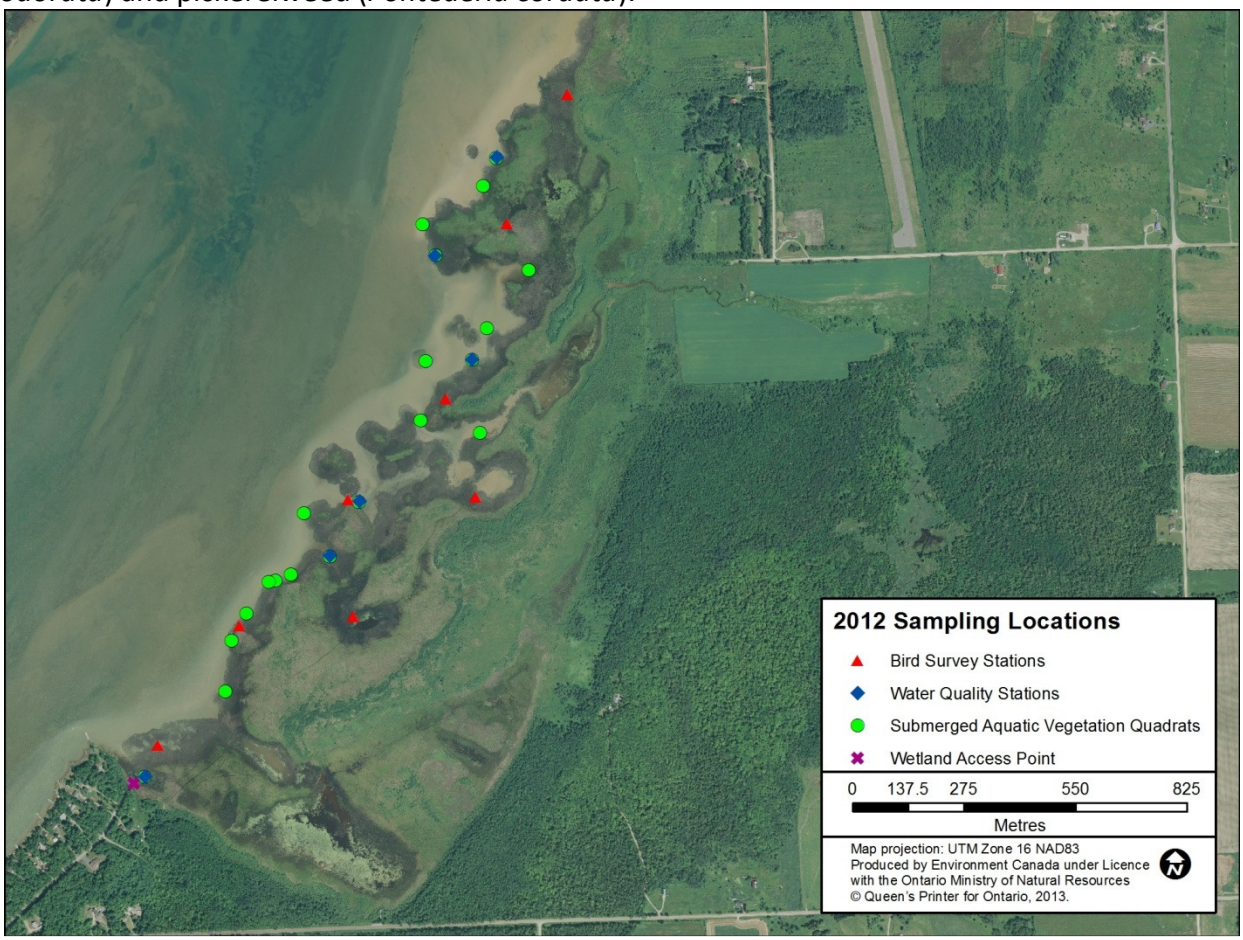

Figure 5. Lake George sampling locations for 2012.

Pumpkin Point

Pumpkin Point is an 18 ha sand-spit embayment located approximately 2 km south of Lake George. Access is from a park at the end of Point Drive. Sampling for SAV and water quality was spread along the full length of the wetland (Figure 6) although SAV surveys were focused nearer to shore as it was too deep (> 1.5 m) further out to relieably sample SAV.

The wetland is a high energy shoreline with hardstem bulrush as the dominant emergent vegetation although some areas of cattail were also present.

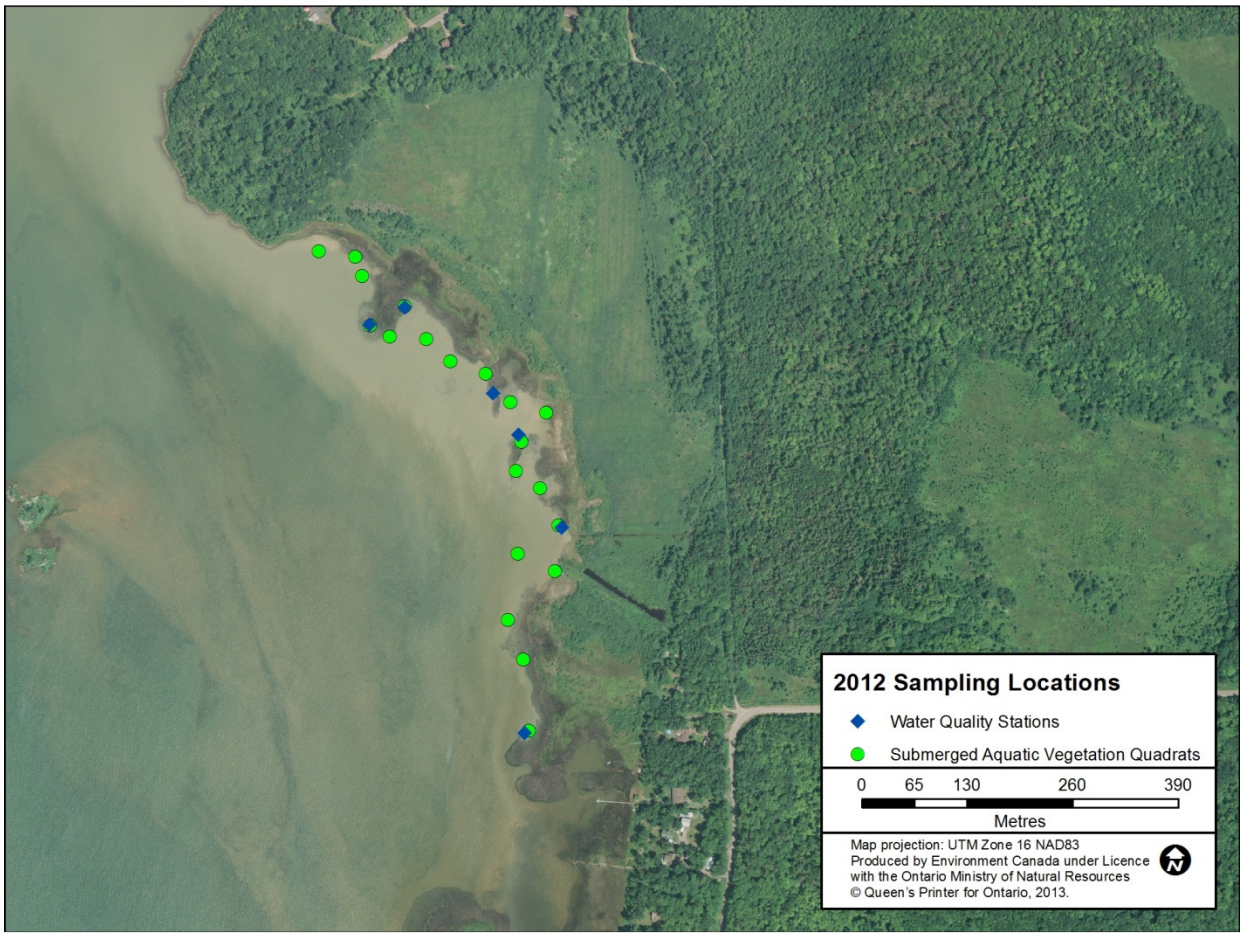

Figure 6. Pumpkin Point sampling locations for 2012.

Maskinonge Bay

Maskinonge Bay is a 72 ha open embayment/protected embayment located approximately 5 km west of the bridge to St. Joseph Island. Access for SAV and water quality surveys was from a private landowner at the south end of the wetland (Figure 7). Access for bird surveys was from the road at the north end of the wetland.

A variety of SAV species were present at the wetland. Dominant emergent vegetation at water quality stations was white water lily. A large area of cattail is present at the north end of the wetland. Filamentous Algae mats were noted in more than half the SAV quadrats and a landowner indicated algae coverage has been increasing over the years.

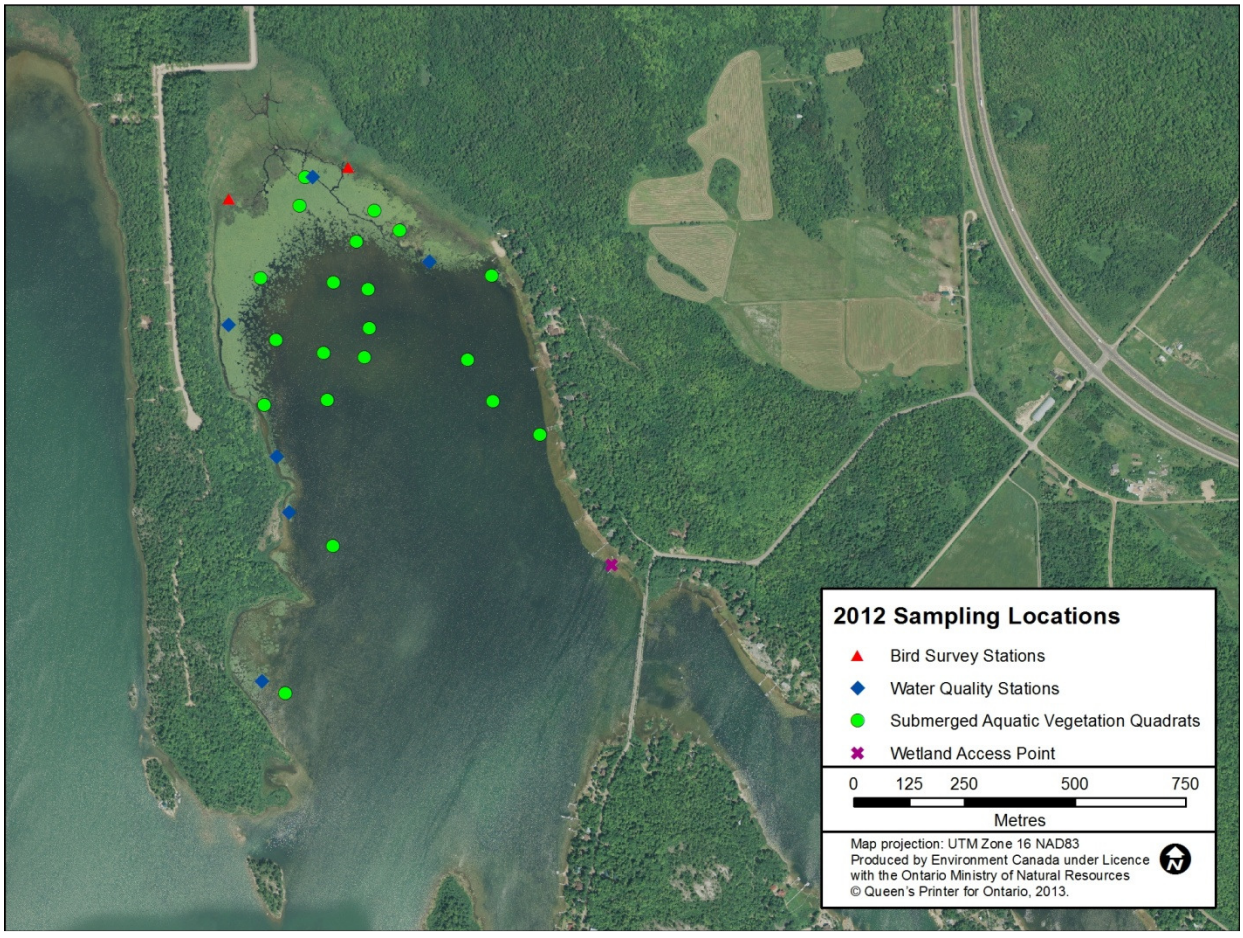

Figure 7. Maskinonge Bay sampling locations for 2012.

West Shore, St. Joseph Island

West Shore, St. Joseph Island is an 11 ha open embayment wetland located on the west side of St. Joseph Island approximately 18 km from Richard's Landing. Access is at the end of Huron Line (Figure 8).

It is a high energy shoreline dominated by hardstem bulrush. It was very shallow closer to shore and as such, some areas were not accessible by canoe.

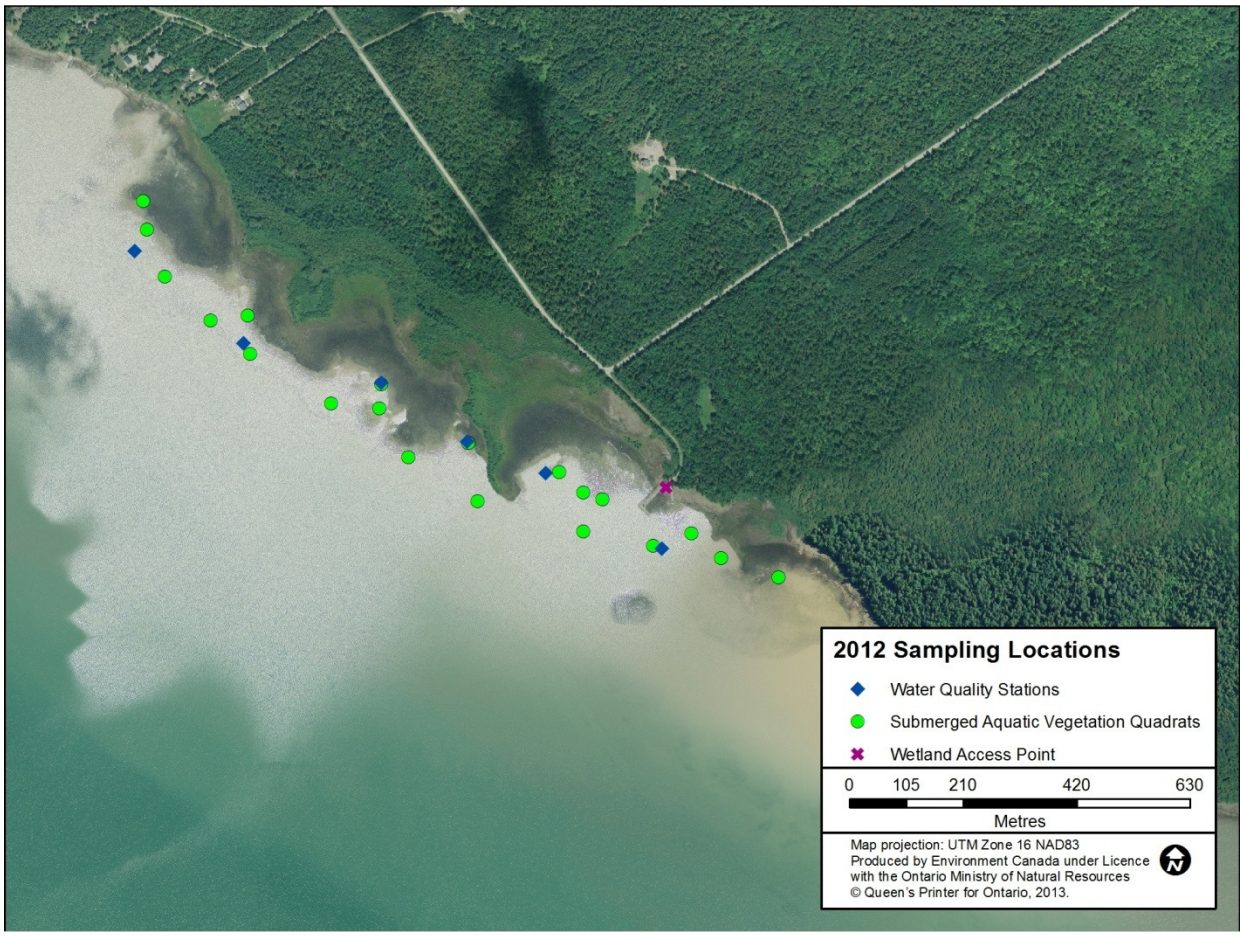

Figure 8. West Shore, St. Joseph Island sampling locations for 2012.

Desbarats

Desbarats is a 90 ha protected embayment wetland located south of the Trans Canada Highway in Desbarats. Access is at the public boat launch near the highway. Both boat and canoe are needed for surveys.

A beaver dam is located near the southernmost bird survey station (Figure 9). Much of the area behind the island is shallow so chest waders were necessary to complete the SAV and water quality sampling. A variety of SAV species were present at the wetland. Emergent vegetation at water quality stations included white water lily, hardstem bulrush, stiff arrowhead (*Sagittaria rigida*), broad-leaved arrowhead (*Sagittaria latifolia*) and giant burred (*Sparganium eurycarpum*).

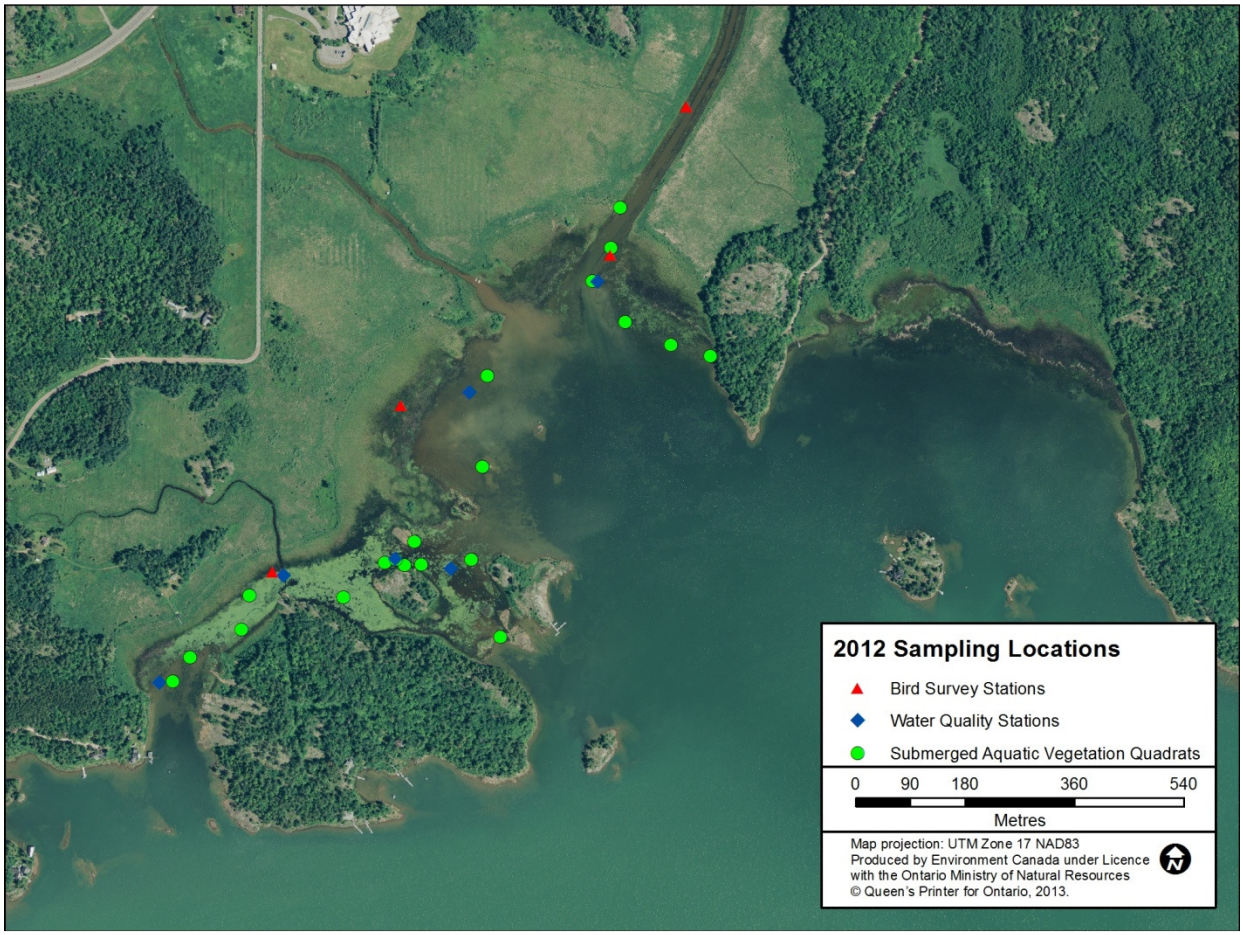

Figure 9. Desbarats sampling locations for 2012.

Stobie Creek

Stobie Creek is a 46 ha open embayment/drowned river mouth wetland located approximately 3 km east of Desbarats. Access to the wetland is by boat from the launch in Desbarats. A closer access point would be helpful.

Sampling was concentrated along the shoreline as it was too deep (> 1.5 m) further out to reliably sample SAV (Figure 10).

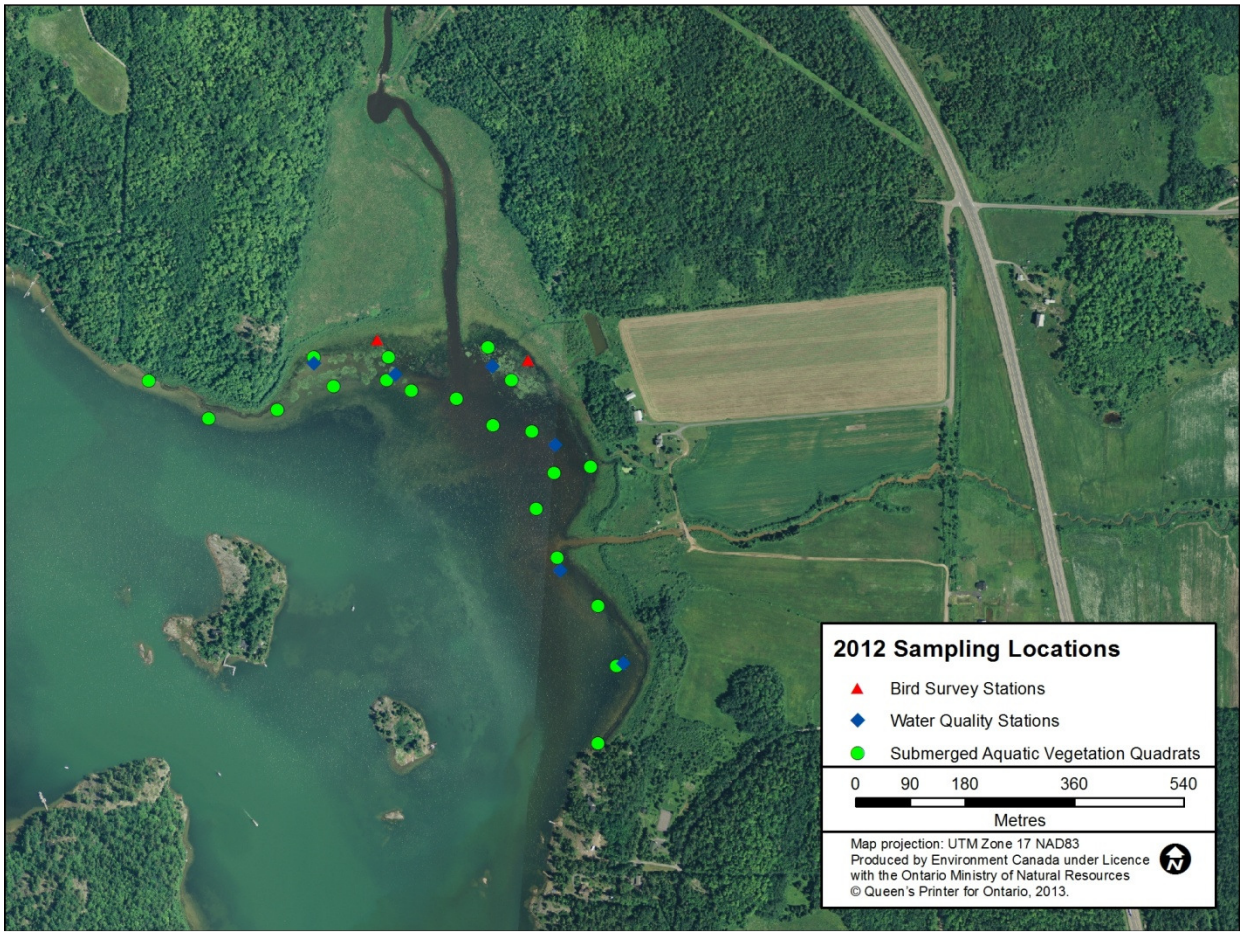

Figure 10. Stobie Creek sampling locations for 2012.

Hay Bay Wetland

Hay Bay Wetland is a 158 ha protected embayment located along the Trans Canada Highway approximately 3.5 km east of Bruce Mines. The majority of the wetland (the entire portion north of the highway) is not currently accessible; the accessible portion is approximately 12 ha. There is a large quarry to the north of the wetland and there is evidence of water being pumped out of the wetland. Access is by canoe at the culvert along the highway (there is a beaver dam before reaching the wetland; Figure 11).

Dominant emergent vegetation at the water quality station was hardstem bulrush and cattail.

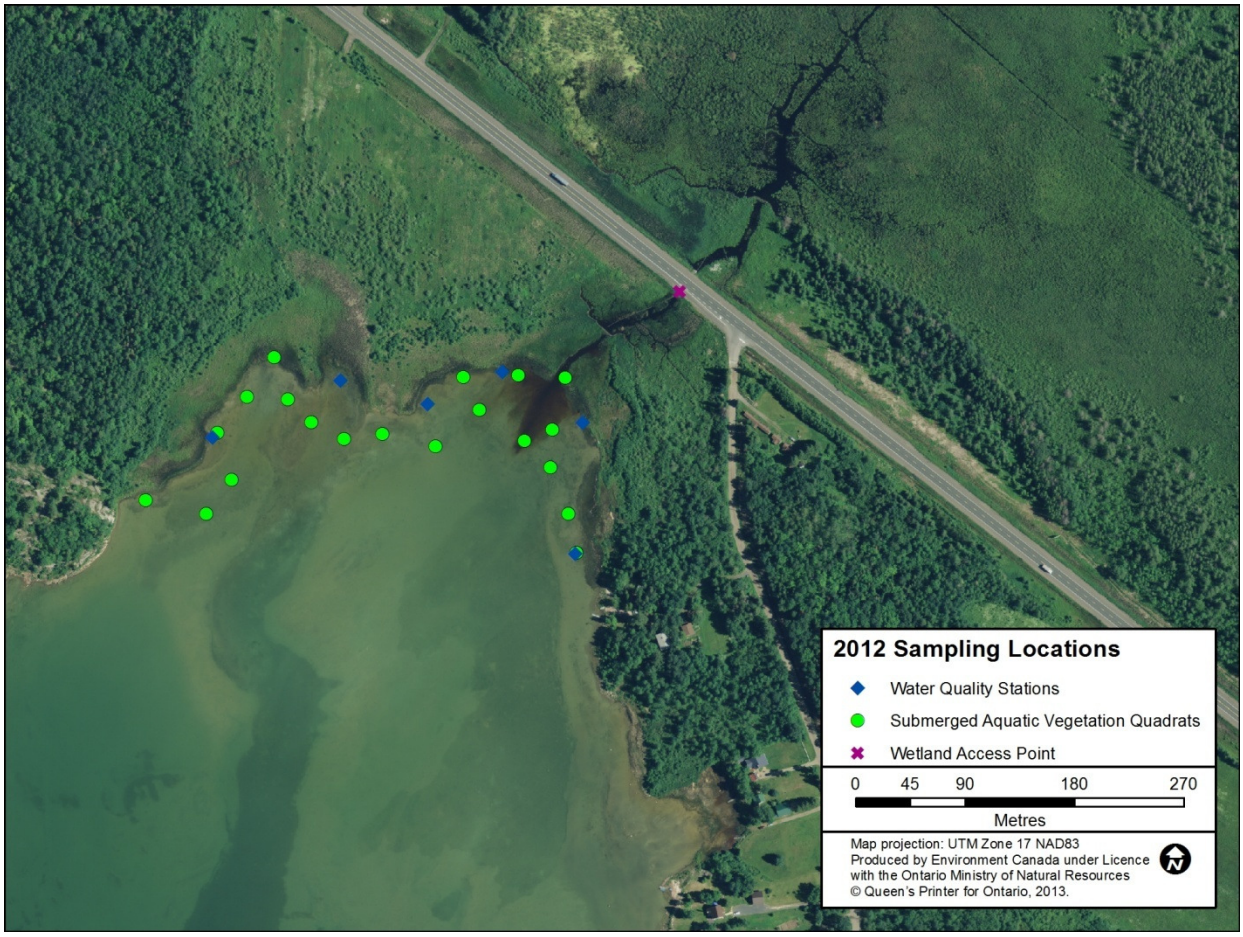

Figure 11. Hay Bay Wetland sampling locations for 2012.

Joe Dollar Bay

Joe Dollar Bay is a 48 ha protected embayment located approximately 7 km east of Bruce Mines, south of the Trans Canada Highway off Big Perch Bay Road. The wetland spans over 3 km along the north shoreline. Sampling was focused along a 2 km stretch near the access point (Figure 12) Access is by canoe from a private landowner's dock.

At water quality stations, the dominant emergent vegetation was hardstem bulrush and pickerelweed. The presence of common carp (*Cyprinus carpio*) was noted.

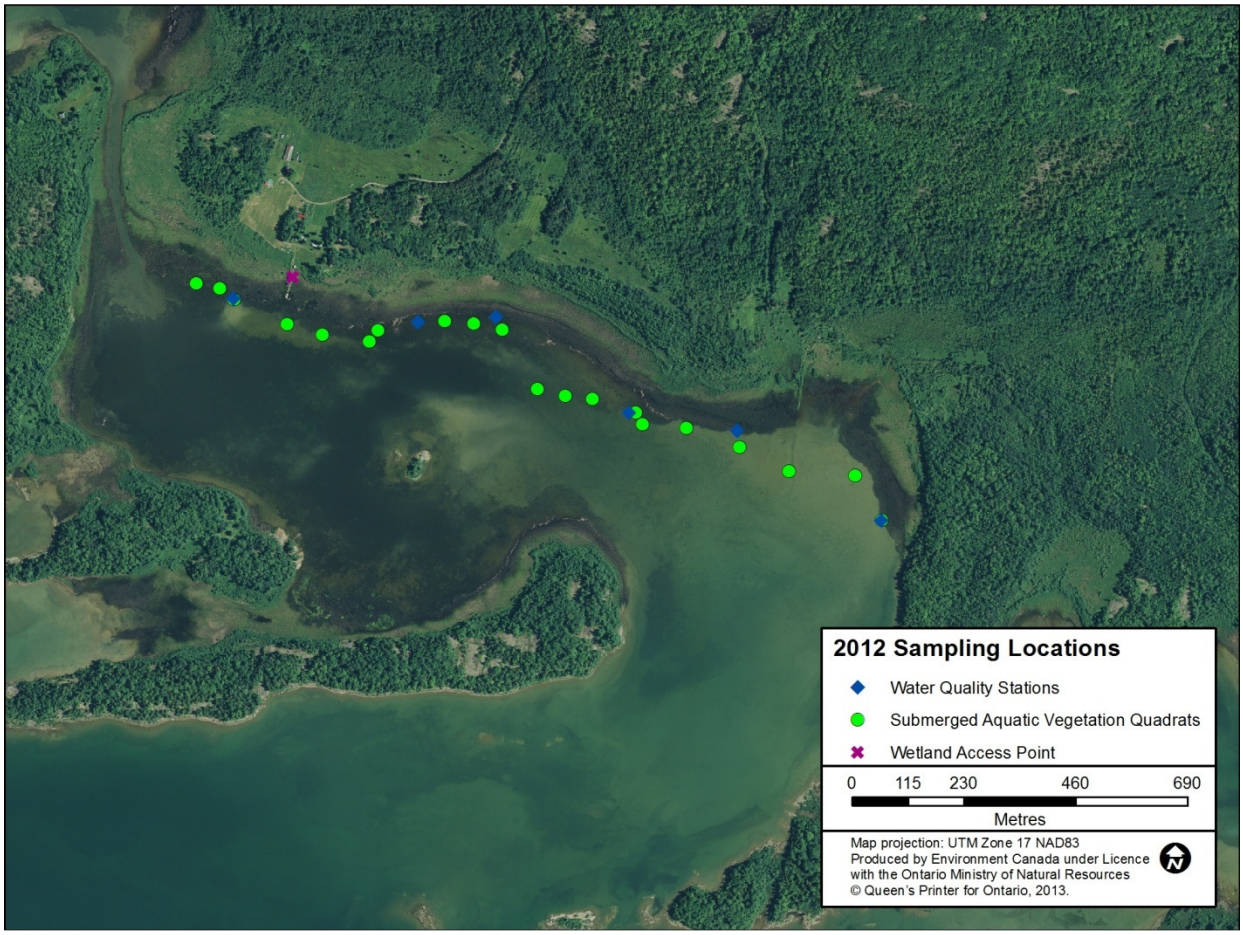

Figure 12. Joe Dollar Bay sampling locations for 2012.

Point Louise
Point Louise is the western most coastal wetland in the St. Marys River AOC on the Canadian side. It is a 31 ha beach lagoon. This site was briefly visited where the creek meets the river at Alagash Drive. Limited to no coastal marsh habitat visible along the creek and as such site is not considered suitable for coastal wetland surveys.

Whitefish Island
Whitefish Island is located in Sault Ste. Marie south of the lock station. It is a 32 ha protected embayment. There is no boat access to the island as it is the locks on one side and rapids on the other. There is some very nice constructed wetland habitat present which seems to be maintained (i.e., beaver dam is maintained). The site is not considered suitable for coastal wetland surveys.

Stribling Point
Stribling Point is a 25 ha protected embayment located on the northwest side of St. Joseph Island. The site is very shallow with sandy bottom and limited to no coastal wetland habitat present. The site is not considered suitable for coastal wetland surveys.

Hay Marsh
Hay Marsh is a 2,439 ha protected embayment located on the west side of St. Joseph Island. Access to the marsh is very limited – the closest access point (by canoe) is at Fort St. Joseph which is approximately 1 km from the southernmost portion of the wetland (the wetland extends for approximately 10 km along the shoreline). No boat launches were located nearby and even if there was one, it is very shallow and unlikely to access via a larger boat. The portion of the wetland visited (approximately the southernmost 3 km of shoreline) was a high energy shoreline with limited to no coastal wetland habitat. Although it is possible that other portions of the wetland may be suitable for coastal wetland surveys, due to access limitations, this site is not considered suitable for coastal wetland surveys.

Richmond Bay
Richman Bay is an 81 ha open embayment located on the southern site of St. Joseph Island. The site was briefly visited as a potential alternate site. The site is suitable although current access point is approximately 5 km away and in order to be included, a closer access point is required.

Findlay Point
Findlay Point is a 19 ha protected embayment located south of the Trans Canada Highway just west of the bridge to St. Joseph Island. It was explored as a potential replacement site. However, coastal wetland habitat is limited and as such this site is not considered suitable for coastal wetland surveys.

5. Water Quality

Methodology

Water quality was measured using both *in situ* probes and chemical analyses. *In situ* water quality determination included four parameters (pH, conductivity [µS/cm], temperature [°C], and turbidity [NTU]) and was collected using a Hydrolab MS5™ multiprobe at mid depth of the water column adjacent to emergent vegetation.

Multiprobe sampling was conducted at all water quality stations (three to six per wetland). The four 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 3; Table 4) were collected at four of the six 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 five hours of sampling using colorimetry (Hach DR890 Colorimeter); and samples for TP were stabilize through acidification and later analyzed by Environment Canada's National Laboratory for Environmental Testing (NLET; Burlington, Ontario).

Table 3. 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 (e.g., fertilizer salts and road salt)
Temperature	°C	↑ temperature from industrial/urban runoff and riparian vegetation removal
pH	pH	Changes in pH from photosynthesis affects 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 sewage and septic leachate
Total Phosphorus	mg/L	↑ phosphorus from agricultural runoff, urban stormwater, and industrial discharge

Table 4. Descriptions of water quality parameters used to score and rank water quality.

Disturbance Variable	Description
Total Phosphorus	The concentration (mgL^{-1}) of all forms of phosphorus dissolved in the sample. This is an important indicator of enrichment in surface waters.
Ammonia	The concentration (mgL^{-1}) of ammonia nitrogen in the sample. Ammonia can be toxic to aquatic organisms and is released into waterways by many industries, primarily municipal wastewater treatment plants.
Nitrate	The concentration of nitrate nitrogen (mgL^{-1}) in the sample. The primary sources of nitrates in the environment are sewage, fertilizer, and manure.
Turbidity	A measure of the degree to which light traveling through a water column is scattered by the suspended organic (including algae) and inorganic particles measured in Nephelometric Turbidity Units (NTU).
Conductivity	A measure of the dissolved ions in water measured in microSiemens per centimetre (μScm^{-1}) or milliSiemens per centimetre ($mScm^{-1}$). Conductivity is a good indicator of urban run-off – especially from road salt.

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 fit into six categories which correspond with values ranging from -3 to +3 (Table 5).

Table 5. 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

In the St. Marys River AOC, coastal wetlands vary from “very degraded” to “very good” with the majority of sites considered “good” or “very good” (Table 6). Non-AOC wetlands vary from “moderately degraded” to “good” with the majority of sites considered “good”. Impaired water quality from the WQI is typically the result of elevated turbidity. Wetlands considered “moderately degraded” or “very degraded” had turbidity values greater than 10 NTUs.

Table 6. Mean water quality parameters and Water Quality Index (WQI) score and rank for selected coastal wetlands in the St. Marys River Area of Concern (AOC) and non-AOC sites in the St. Marys River. Wetlands are ordered from west to east.

Wetland Name	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)	WQI	Qualitative Descriptor
AOC Sites						
Carpin Beach	23.4	7.33	130.5	6.3	0.55	Good
Echo Bay	25.7	8.46	115.2	4.5	0.63	Good
Lake George	23.5	7.82	150.0	50.6	-0.85	Moderately Degraded
Pumpkin Point	29.1	9.13	123.1	51.3	-1.03	Very Degraded
Maskinonge Bay	24.0	8.46	110.3	1.7	1.30	Very Good
Stribling Point	26.8	8.61	104.2	5.2	0.56	Good
West Shore, St. Joseph Island	22.9	8.46	190.0	37.9	-0.90	Moderately Degraded
Hay Marsh	26.0	8.73	122.1	9.2	0.12	Good
Richmond Bay	26.1	8.77	152.4	13.6	-0.27	Moderately Degraded
Findlay Point	25.7	8.47	100.7	2.3	1.12	Very Good
Non-AOC Sites						
Desbarats Wetland	25.5	8.09	129.3	3.2	0.79	Good
Stobie Creek	30.7	9.23	152.8	2.5	0.56	Good
Hay Bay Wetland	24.3	8.19	195.1	31.9	-0.82	Moderately Degraded
Joe Dollar Bay Wetland	26.4	8.35	156.1	8.8	0.01	Good

Total phosphorus values were below 0.05 mg/L (Table 7) for all wetlands except Maskinonge Bay which had a total phosphorus count of 0.18 mg/L. Total ammonia nitrogen values were 0.08 mg/L or less and total nitrate nitrogen values varied from 0.03 mg/L to 0.18 mg/L.

Table 7. Additional water quality collected in six St. Marys River Area of Concern (AOC) and four non-AOC wetlands in the St. Marys River. TP=Total Phosphorus, NH_3-N=Total Ammonia Nitrogen, NO_3-N = Total Nitrate Nitrogen.

Wetland Name	NH_3-N (mg/L)	NO_3-N (mg/L)	TP (mg/L)
AOC Sites			
Carpin Beach	0.03	0.13	0.02
Echo Bay	0.00	0.15	0.02
Lake George	0.03	0.05	0.04
Pumpkin Point	0.06	0.03	0.03
Maskinonge Bay	0.02	0.10	0.18
West Shore, St. Joseph Island	0.01	0.10	0.03
Non-AOC Sites			
Desbarats Wetland	0.00	0.16	0.04
Stobie Creek	0.00	0.15	0.04
Hay Bay Wetland	0.08	0.05	0.02
Joe Dollar Bay Wetland	0.00	0.18	0.02

Discussion

Based on the collected water quality data, coastal wetlands in the St. Marys River, both AOC and non-AOC sites may have good or degraded water quality. There is no apparent difference in AOC sites versus non-AOC sites. The degradation of water quality appears to be primarily a result of increased turbidity at these sites (Table 6). The high turbidity at Hay Bay Wetland may be a result of to impacts from the aggregate quarry located to the north of the wetland. Higher turbidity values at Lake George, Pumpkin Point, Richmond Bay, and West Shore, St. Joseph Island may be a result of wave action from large vessels resuspending fine mineral (clay, silt) substrates into the water column. The passage of large vessels in the river increases wave action and the resulting turbidity may negatively affect emergent wetlands (Kauss 1991). A large ship was observed passing nearby while surveying at West Shore, St. Joseph Island (A. Darwin, pers. obs.; see photo in site description for West Shore, St. Joseph Island). Other wetlands along the shipping channel such as Echo Bay, Carpin Beach and Maskinonge Bay have, to some degree, a level of 'protection' from wave action from the passage of large vessels. For example, Echo Bay is protected from wave action as it has an opening of approximately 30 metres at the base of the wetland into the river (Figure 4).

Conductivity levels recorded in St. Marys River (average: 138 µS/cm) are below levels observed through surveyed by Environment Canada – Canadian Wildlife Service in other Great Lakes coastal wetlands (e.g., Environment Canada 2012). For example, surveys conducted as part of the Coastal Habitat Assessment and Monitoring Program in the Huron-Erie corridor, which includes the Detroit River and St. Clair River AOCs, showed an average conductivity value of 293 µS/cm. This suggests that inputs from agricultural, industrial and urban inputs are less than in other areas. The average conductivity reading for AOC sites was 158 µS/cm and 130 µS/cm for non-AOC sites.

With the exception of Maskinonge Bay, total phosphorus levels were 0.04 mg/L or less. Ministry of Environment and Energy (1999) presents an interim provincial water quality objective indicating that to avoid nuisance concentrations of algae in lakes, average total phosphorous concentrations should not exceed 0.02 mg/L. Four of the ten sites meet this objective. Maskinonge Bay had the highest total phosphorous concentration at 0.18 mg/L. The elevated total phosphorus level is likely the cause of the filamentous algae mats that were noted in more than half the SAV quadrats. A landowner in Maskinonge Bay noted that the presence of algae had been increasing in the bay and it was higher in 2012 than in past years.

6. Submerged Aquatic Vegetation Community

Methodology

The submerged aquatic vegetation community 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) using ArcGIS 10.0 (ESRI

2010) prior to sampling[2]. Within each quadrat, total areal coverage and species-specific coverages for submerged and floating-leaved species were recorded (see Appendix 2 for a list of plant species observed).

SAV species were grouped into two plant guilds based on growing tolerance (i.e., turbidity tolerant and turbidity intolerant) and native designation (Environment Canada and Central Lake Ontario Conservation Authority 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. In studies in Lake Ontario, four metrics were shown to significantly respond to disturbance (SINT – number of turbidity-intolerant species, CC – Coefficient of conservatism, and PCOV – total coverage and SNAT – total number of native species; Grabas et al. 2012). These metrics are expected to decrease with increasing disturbance. SAV community condition may be determined using an Index of Biotic Integrity (IBI). However, at present no IBI has been developed for St. Marys River coastal wetlands.

Results

All surveyed wetlands have one or more turbidity intolerant species present (Table 8). Similarly, each wetland had one or more native species present. Submerged aquatic vegetation community metrics known to respond to disturbance in Lake Ontario are variable among both AOC and non-AOC sites. Total cumulative coverage ranged from 10.8 % (West Shore, St. Joseph Island) to 98 % (Desbarats Wetland).

By percent cover and number of quadrats, slender naiad (*Najas flexilis*), fern pondweed (*Potamogeton robbinsii*) and wild celery (*Vallisneria americana*) were the most common SAV species observed. All three are turbidity intolerant species and are classified as native species. Slender naiad was found at all sites except Carpin Beach although in fairly low amount in West Shore, St. Joseph Island and Maskinonge Bay; fern pondweed was found at five sites (Maskinonge Bay, Stobie Creek, Echo bay, Desbarats Wetland and Joe Dollar Bay Wetland); and wild celery was found at all sites.

[2] SAV quadrats for Lake George and Carpin Beach were not randomly located as the area surveyed differed from the area for which SAV quadrats were established; they were placed so as to get a representative sample of the wetland. In some cases for other wetlands, some additional quadrats were added when predetermined sites could not be surveyed (e.g., when water was too deep (> 1.5 m) to accurately sample or too shallow to reach the location by canoe).

Table 8. SAV community metrics known to respond to disturbance in Lake Ontario for coastal wetlands sampled in 2012 in the St. Marys River.

Wetland Name	SINT	SNAT	CC	PCOV
AOC Sites				
Carpin Beach	0.05	1.00	4.03	22.85
Echo Bay	1.70	3.05	5.21	89.70
Lake George	0.75	1.75	4.00	50.50
Pumpkin Point	1.00	1.60	5.04	33.95
Maskinonge Bay	1.65	3.75	5.64	87.25
West Shore, St. Joseph Island	0.50	0.70	2.58	10.80
Non-AOC Sites				
Desbarats Wetland	1.60	3.60	5.62	98.00
Stobie Creek	1.45	2.70	5.42	75.40
Hay Bay Wetland	0.45	1.60	3.40	35.80
Joe Dollar Bay Wetland	1.20	1.95	3.74	50.55

SINT	Number of turbidity-intolerant species
SNAT	Number of native species
CC	Coefficient of conservatism
PCOV	Total cumulative coverage

The total areal coverage of SAV species per quadrat varied from 0 to 100 % (Table 9). When divided into bins (0 %, 1-25 %, 26-50 %, 51-75 % and 76-100 %), there are some clear differences between wetlands. For example, West Shore, St. Joseph Island has ten quadrats with 0 % areal coverage and no quadrat has greater than 50 % areal coverage whereas Desbarats Wetland has no quadrats with 0 % areal coverage and has 17 quadrats with greater than 75 % areal coverage.

Table 9. Count of SAV quadrats in each category of SAV total areal coverage by quadrat (per wetland, n=20).

Wetland Name	Count of SAV Quadrats				
	0 %	1 to 25 %	26 to 50 %	51 to 75 %	76 to 100 %
AOC Sites					
Carpin Beach	5	7	5	3	0
Echo Bay	0	1	3	2	14
Lake George	2	7	2	2	7
Pumpkin Point	1	9	7	0	3
Maskinonge Bay	0	4	1	3	12
West Shore, St. Joseph Island	10	6	4	0	0
Non-AOC Sites					
Desbarats Wetland	0	0	2	1	17
Stobie Creek	1	1	2	5	11
Hay Bay Wetland	2	7	6	3	2
Joe Dollar Bay Wetland	3	5	4	1	7

Discussion

All four SAV metrics showed variation between AOC and non-AOC sites suggesting no clear difference between groupings of site. A ranked sum of the raw SAV metrics suggests that Maskinonge Bay, Desbarats Wetland and Echo Bay have a good SAV community whereas Hay Bay Wetland, Carpin Beach and West Shore, St. Joseph Island have a poorer SAV community.

Cross-referencing the turbidity values observed in the water quality surveys, sites with higher turbidity values would be expected to have lower SINT. This is more or less the case with noted exception of Carpin Beach which has the lowest SINT value yet has a relatively low turbidity value of 6.3 NTU. However, given its low areal coverage, it is likely there are other components impacting the growth of SAV at this wetland such as substrate type (all quadrats were on sand; Table 10), and the flow of the creek running through.

Table 10. Count of SAV quadrats by dominant substrate (per wetland, n=20).

Wetland Name	Count of SAV Quadrats			
	Clay	Silt	Sand*	Gravel
AOC Sites				
Carpin Beach			20	
Echo Bay		16	4	
Lake George	5		15	
Pumpkin Point	14		6	
Maskinonge Bay		19	1	
West Shore, St. Joseph Island	3	1	16	
Non-AOC Sites				
Desbarats Wetland		19	1	
Stobie Creek		15	5	
Hay Bay Wetland	4		15	1
Joe Dollar Bay Wetland		2	18	

**Sand includes fine sand and coarse sand.*

Dominant substrate type also seems to play a role in at least the total percent coverage of SAV. Wetlands with a dominant substrate predominantly of silt (Stobie Creek, Maskinonge Bay, Echo Bay and Desbarats Wetland) tended to have a higher total percent cover compared to those wetlands with dominant substrate predominantly sand or clay.

Sampling Challenges

Sampling SAV in St. Marys River had two main challenges: water depth and consistency in survey location accessibility. In several instances (e.g., West Shore, St. Joseph Island) potentially suitable SAV areas were not surveyed as water depth was insufficient to reach the area by canoe. In some instances, it would have been possible to survey by walking into these areas as the bottom tended to be sandy. This was done for a few quadrats in Desbarats Wetland. With a continued decrease in water levels, this will remain a challenge. Exiting the canoe to survey and/or reach shallower areas may increase survey time. This option should be considered and done consistently in all wetlands were low water level is impeding access to suitable SAV locations.

Prior to surveying, a potential SAV area was delineated in ArcGIS 10.0 (ESRI 2010) and 50 to 80 points were randomly placed within the area (greater number of points for larger wetlands). Given many of the wetlands are sandy bottom high energy shorelines, SAV is absent in many areas. SAV is more likely to be present within areas of hardstem bulrush. Sometimes the 'better' SAV areas were located between the shoreline and the fringe of bulrush occupying deeper water. However, depending on where the SAV area was drawn in advance in the GIS, this area may or may not have been included. Decisions on whether to sample outside of or within bulrush stands was not consistent between wetlands.

7. 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 m apart. Only those that had at least 50% of marsh habitat (i.e., non-woody emergent plants) within the sampling radius (100m) were surveyed. Marsh bird surveys were conducted using a 15-min point count - five minutes of passive surveying followed by five minutes of call broadcasting for secretive species (e.g., Least Bittern (*Ixobrychus exilis)*, Sora (*Porzana Carolina)*, Virginia Rail (*Rallus limicola)*, Common Moorhen (*Gallinula chloropus)* / American Coot (*Fulica Americana)*, Pied-billed Grebe (*Podilymbus podiceps)*, and Yellow Rail (*Coturnicops noveboracensis*)) followed by five minutes of passive surveying. The protocol was modified slightly so that only marsh birds were recorded rather than all birds.

Surveyed birds have been categorized into one of two guilds – marsh nesting birds and marsh foraging birds (**Figure 13**; see Grabas et al. 2008 for more details). 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). Marsh breeding bird community condition may be determined using an Index of Biotic Integrity (IBI). However, at present no IBI has been developed for St. Marys River coastal wetlands.

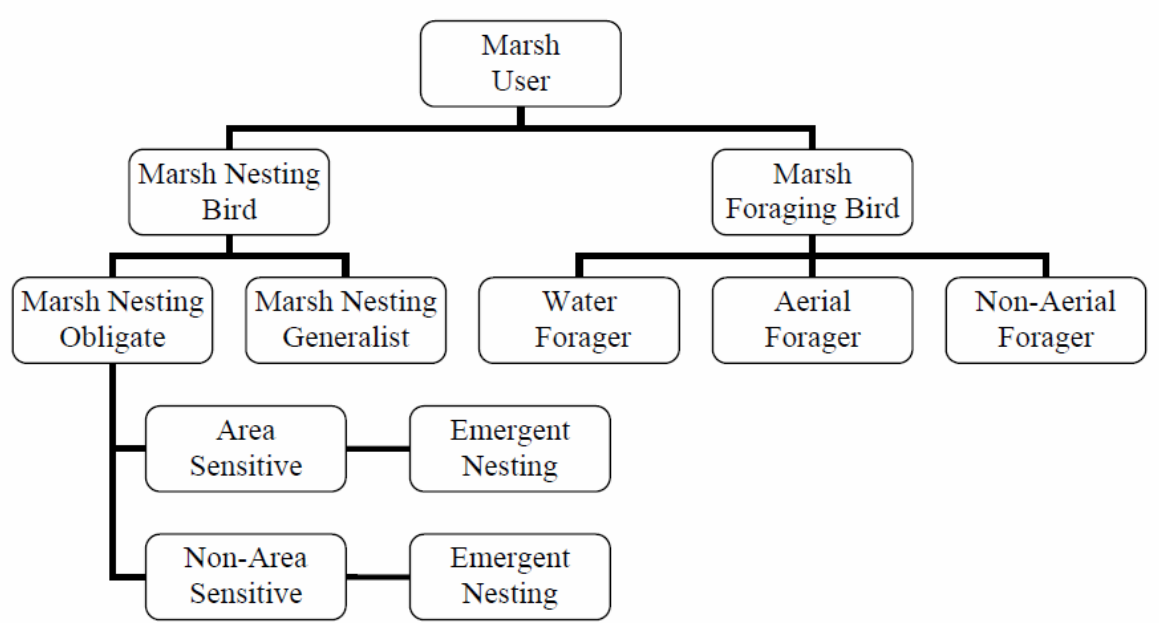

Figure 13. Illustration of marsh user categories for bird species based on marsh use (Grabas et al. 2008)

Results

Five wetlands were surveyed for birds – three AOC sites and two non-AOC sites. All sites had a relatively high proportion of non-aerial foragers (Table 11) whereas only Echo Bay had any area-sensitive marsh-nesting obligates (Black Tern, American Bittern (*Botaurus lentiginosus)*). The proportion of marsh nesting obligates was highest for Echo Bay and lowest at Stobie Creek. A full list of species recorded during the survey within 100 m can be found in Appendix 3.

Table 11. Marsh breeding bird community field values for coastal wetlands sampled in 2012 in St. Marys River.

Wetland Name	# Stations	SAMNO	PMNO	PNAF
AOC Sites				
Echo Bay	10	0.6	65.88	61.74
Lake George	8	0	42.92	85.56
Maskinonge Bay	3	0	33.33	83.33
Non-AOC Sites				
Desbarats Wetland	4	0	32.45	79.05
Stobie Creek	3	0	22.62	76.19

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

Discussion

Area sensitive marsh nesting obligates such as Black Tern and American Bittern are species that are known to prefer larger wetlands and are less likely to be found in smaller wetland sites. Of the surveyed wetlands, Echo Bay and Lake George are the largest wetlands. A Black Tern colony is present at Echo Bay and American Bittern was also observed there. Although no area sensitive marsh nesting obligates were observed at Lake George within the survey window and distance, an American Bittern was observed at a distance greater than 100 m during the survey indicating they are present in the area.

8. Summary and Recommendations

Site Selection

The initial objective was to survey eight AOC sites and four non-AOC sites to allow for comparisons between AOC and non-AOC site conditions. However, due to access constraints and suitability of coastal wetlands for inclusion in this type of survey, the AOC site list was reduced to six. The AOC sites surveyed provide a good geographic spread (from west of Sault Ste. Marie to St. Joseph Island) and wetland size (11 ha to 587 ha). However, the geomorphic type of the selected wetlands is primarily open embayment for AOC sites and protected embayment for non-AOC sites.

Given the challenges of finding replacement wetlands with suitable access, it is recommended the following wetlands be surveyed for any further wetland assessments:

- AOC sites:
  - Carpin Beach
  - Echo Bay
  - Lake George
  - Maskinonge Bay
  - Pumpkin Point
  - West Shore, St. Joseph Island
- Non-AOC sites:
  - Joe Dollar Bay
  - Desbarats Wetland
  - Hay Bay Wetland
  - Stobie Creek

Given the size of Echo Bay, it is recommended the site be split into two and surveys concentrated in the southern portion. If time permits, surveys may be conducted in the northern portion for SAV and water quality.

Water Quality and Biotic Community

Based on data collected in this first year, there is no clear trend in water quality or the biotic community for AOC and non-AOC sites. Both areas show a range of conditions for water quality and SAV and the limited number of marsh breeding bird sites makes drawing any conclusions difficult.

The results presented herein provide a snapshot of the condition of coastal wetlands in the St. Marys River. However, multi-year assessments and development region-specific indicators are necessary to provide a better picture of the current condition of coastal wetlands.

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Appendices

Appendix 1. Geomorphic types and access points for St. Marys River coastal wetlands visited in 2012.

Wetland Name	Geomorphic Type*	Area (ha)	Launch Type	Access Point (UTM)			Site Status	# WQ reps	# SAV quadrats	# Bird stations
				Zone	Easting	Northing				
AOC Sites										
Carpin Beach	DRM	177.5	canoe	16	696 114	5 153 235	Keep	6	20	n/a
Echo Bay	BL	587.0	canoe	16	724 341	5 153 049	Keep	6	20	10
Hay Marsh	PE	2438.8	canoe	17	272 284	5 105 374	Drop	3	n/a	n/a
Lake George 1	OE	155.3	canoe	16	721 179	5 142 702	Keep	6	20	8
Maskinonge Bay 1 &2	OE/PE	71.5	canoe	16	724 830	5 135 633	Keep	6	20	2
Pumpkin Point 2	SSE	18.1	canoe	16	720 601	5 142 287	Keep	6	20	n/a
Stribling Point, St. Joseph Island 1	PE	24.8	canoe	16	722 489	5 132 031	Drop	3	n/a	n/a
West Shore, St. Joseph Island	OE	11.2	canoe	16	730 145	5 116 657	Keep	6	20	n/a
Pointe Louise	BL	30.8	n/a	17	693 760	5 149 160	Drop	n/a	n/a	n/a
Whitefish Island	PE	31.9	n/a	17	243 027	5 156 489	Drop	n/a	n/a	n/a
Findlay Point Wetland	PE	19.1	canoe	16	267 750	5 133 562	Drop	3	n/a	n/a
Richmond Bay	OE	81.4	boat	17	281 409	5 115 379	Drop	3	n/a	n/a
Non-AOC Sites										
Desbarats Wetland 2	PE	89.7	boat	17	275 087	5 136 420	Keep	6	20	4
Hay Bay Wetland	PE	158.5	canoe	17	288 277	5 130 737	Keep	6	20	n/a
Joe Dollar Bay	PE	48.5	canoe	17	290 784	5 128 531	Keep	6	20	n/a
Stobie Creek 1 & 2	OE/DRM	45.8	boat	17	275 087	5 136 420	Keep	6	20	2

**DRM = Drowned River Mouth, BL = Beach Lagoon, OE = Open Embayment, SSE = Sand-Spit Embayment, PE = Protected Embayment*
Details on site access and landowner contact information are on file with CWS-ON.

Appendix 2. List of taxa recorded on submerged aquatic vegetation surveys showing nativeness, turbidity tolerance and coefficient of conservatism (for vascular species).

Genus/Species	Common Name	Native	Turbidity-Tolerant	Coefficient of Conservatism
Algae sp. (fil. surface)	Filamentous algae surface	√		
Algae sp. (fil. underwater)	Filamentous algae underwater	√		
Bidens beckii	Water-Marigold	√	X	8
Brasenia schreberi	Water Shield	√		7
Ceratophyllum demersum	Coontail, Hornwort	√	√	4
Chara sp.	Stonewort, Muskgrass	√		
Eleocharis smallii	Spike-Rush	√		6
Elodea canadensis	Canada Waterweed	√	√	4
Heteranthera dubia	Water Star-grass	√	√	7
Hydrocharis morsus-ranae	European Frog-bit	X		
Isoetes tenella	Spiny-spore quillwort	√		7
Lemna minor	Lesser Duckweed	√		2
Lemna trisulca	Star Duckweed	√		4
Myriophyllum sibiricum	Northern Water Milfoil	√	X	6
Myriophyllum spicatum	Eurasian Water Milfoil	X	√	
Najas flexilis	Slender Naiad	√	X	5
Nuphar variegate	Yellow Pond Lily, Spatterdock	√		4
Nymphaea odorata	White Water Lily	√		5
Potamogeton amplifolius	Large-leaved Pondweed	√	X	5
Potamogeton gramineus	Variable-leaved Pondweed	√		4
Potamogeton natans	Floating-leaved Pondweed	√		5
Potamogeton nodosus	Long-leaf pondweed	√		7
Potamogeton pectinatus	Sago Pondweed	√	√	4
Potamogeton pusillus	Slender Pondweed	√	√	5
Potamogeton richardsonii	Richardson's, Clasping Leaved Pondweed	√		5
Potamogeton robbinsii	Fern Pondweed	√	X	7
Potamogeton vaseyi	Vasey's pondweed	√		8
Potamogeton zosteriformis	Flat-stemmed Pondweed	√	X	5
Ranunculus longirostris	Curly White Water Crowfoot	√	√	5
Riccia fluitans	Floating Slender Liverwort	√		
Sagittaria graminea	Grass-leafed arrowhead	√		8
Sagittaria latifolia	Broad-leaved Arrowhead	√		4
Sagittaria rigida	Stiff Arrowhead	√		6
Sagittaria sp.	Arrowhead	√		
Schoenoplectus acutus	Hardstem Bulrush	√		6
Sparganium eurycarpum	Common burreed	√		3
Sparganium fluctuans	Floating-leaved Burreed	√		9
Spirodela polyrhiza	Greater Duckweed	√		4
Typha angustifolia	Narrow-leaved Cattail	√		3
Typha x glauca	Hybrid Cattail	√		3

Genus/Species	Common Name	Native	Turbidity-Tolerant	Coefficient of Conservatism
Utricularia sp.	Bladderwort	√		
Utricularia vulgaris	Common Bladderwort	√		4
Vallisneria americana	Tape Grass, Wild Celery	√	X	6
Zizania palustris	Wild Rice	√		9

Appendix 3. List of species recorded within 100m on marsh breeding bird surveys in 2012.

Species Common Name	Scientific Name	Marsh User	Forager	Wetland				
				Echo Bay	Lake George	Maskinonge Bay	Desbarats Wetland	Stobie Creek
Alder Flycatcher	*Empidonax alnorum*	-	AF					y
American Bittern	*Botaurus lentiginosus*	AEMNO	WF	y				
American Golden-Plover	*Pluvialis dominica*	-	NAF	y	y			
American Green-winged Teal	*Anas crecca*	-	WF		y			
American Wigeon	*Anas americana*	-	WF	y	y			
Bald Eagle	*Haliaeetus leucocephalus*	-	AF	y	y	y		
Barn Swallow	*Hirundo rustica*	-	AF	y				y
Black Tern	*Chlidonias niger*	AEMNO	AF	y				
Blue-winged Teal	*Anas discors*	-	WF		y			
Caspian Tern	*Sterna caspia*	-	AF	y	y		y	y
Common Grackle	*Quiscalus quiscula*	-	NAF	y		y	y	
Common Tern	*Sterna hirundo*	-	AF		y			y
Common Yellowthroat	*Geothlypis trichas*	MNG	NAF	y	y	y	y	y
Double-crested Cormorant	*Phalacrocorax auritus*	-	WF				y	
Hooded Merganser	*Lophodytes cucullatus*	-	WF		y			
Killdeer	*Charadrius vociferus*	-	NAF				y	
Lesser Yellowlegs	*Tringa flavipes*	-	NAF	y	y			
Mallard	*Anas platyrhynchos*	-	WF	y	y	y	y	y
Marsh Wren	*Cistothorus palustris*	EMNO	NAF	y	y	y		
Merlin	*Falco columbarius*	-	AF				y	
Northern Harrier	*Circus cyaneus*	MNG	AF	y		y	y	
Osprey	*Pandion haliaetus*	-	AF				y	
Pied-billed Grebe	*Podilymbus podiceps*	EMNO	WF			y		
Red-winged Blackbird	*Agelaius phoeniceus*	MNG	NAF	y	y	y	y	y
Ring-billed Gull	*Larus delawarensis*	-	AF	y			y	
Sandhill Crane	*Grus canadensis*	MNG	WF	y	y		y	
Sedge Wren	*Cistothorus platensis*	MNG	NAF				y	
Song Sparrow	*Melospiza melodia*	-	NAF				y	
Sora	*Porzana carolina*	EMNO	NAF	y				
Spotted Sandpiper	*Actitis macularia*	-	NAF				y	
Swamp Sparrow	*Melospiza georgiana*	MNO	NAF	y	y	y	y	y
Tree Swallow	*Tachycineta bicolor*	-	AF	y			y	
Virginia Rail	*Rallus limicola*	EMNO	NAF	y	y		y	y

Species Common Name	Scientific Name	Marsh User	Forager	Wetland				
				Echo Bay	Lake George	Maskinonge Bay	Desbarats Wetland	Stobie Creek
Wilson's Snipe	*Capella gallinago delicata*	MNG	NAF	y	y		y	
Wood Duck	*Aix sponsa*	-	WF			y		
Yellow Warbler	*Dendroica petechia*	-	NAF		y	y	y	y

AEMNO	Area Sensitive Emergent Marsh Nesting Obligate
EMNO	Emergent Marsh Nesting Obligate
MNG	Marsh Nesting Generalist
MNO	Marsh Nesting Obligate
AF	Aerial Forager
NAF	Non-Aerial Forager
WF	Water Forager