

A SURVEY AND CHARACTERIZATION OF MICHIGAN'S COASTAL FEN COMMUNITIES



Prepared by: Bradford S. Slaughter and David L. Cuthrell

Michigan Natural Features Inventory
P.O. Box 30444
Lansing, MI 48909-7944

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EXECUTIVE SUMMARY

From 2009 – 2011, Michigan Natural Features Inventory (MNFI) completed a two-year project to study the biotic and abiotic characteristics and conservation status of coastal fen, an imperiled wetland community associated with the Great Lakes shoreline. MNFI biologists conducted vegetation sampling, floristic inventories, and rare species surveys at eight sites in summer 2010 and an additional eight sites in 2011. A total of 295 1 m x 1 m vegetation plots were sampled along a total of 16 transect lines. Approximately 142 vascular plant species were identified in plots, and approximately 181 total vascular plant taxa, including 167 native taxa, were identified in the 16 coastal fen sites during meander surveys. Vegetation at all sites was overwhelmingly dominated by herbs and shrubs < 0.5 m in height, although sampling was biased towards characterizing ground layer structure.

Assessment of abiotic variables indicated the coastal fen sites were characterized by diverse, patchy substrates of lacustrine sand, clay, limestone gravel and cobble, peat, and marl. All substrates ranged from circumneutral to moderately alkaline, reflecting the underlying limestone and dolostone substrates. Vegetation structure and dominance patterns were related to the nature of the substrate. Crayfish burrows, which may be an indicator of dragonfly presence, were generally uncommon, although one site was characterized by an abundance of burrows. The state and federally listed Hine's emerald dragonfly was not observed at any of the 16 coastal fen sample sites in 2010 – 2011. However, Hine's emerald dragonfly was newly documented from a coastal fen on Garden Island in August 2011, and many of the sampled coastal fens support similar, presumably suitable habitat for the species. We suspect that future surveys of coastal fens during the peak flight for this species will yield additional occurrences for this rare dragonfly. In particular, the coastal fens associated with Great Lakes islands (including those on Marquette, Garden, and Hog Islands) and the fens in the Horseshoe Harbor area appear to support particularly appropriate habitat.

A total of 21 new element occurrences were identified during 2010 – 2011 surveys, including nine communities, one rare plant population, and 11 rare insect populations. Insect occurrences consisted of eight occurrences of a leafhopper (*Flexamia delongi*, state special concern), one occurrence of red-legged spittlebug (*Flexamia ignipectus*, state special concern), and one occurrence of Kansan leafhopper (*Dorydiella kansana*, state special concern). None of the rare insect species were previously identified as survey targets in coastal fen. In addition to the new occurrences, a total of 23 previously identified element occurrences were observed, including nine coastal fens and 11 occurrences of rare plant taxa.

Coastal fens are impacted by a variety of stressors. Several of the coastal fens surveyed in 2010 – 2011 have experienced at least modest disturbance associated with recreational use of the Great Lakes shoreline, primarily in the form of off-road vehicle use. Invasive species threaten even the least-disturbed coastal fens. Fourteen non-native vascular plant taxa were documented during our surveys, including several species previously identified as particularly aggressive threats. Summaries of management and protection recommendations for coastal fens and associated natural communities surveyed during 2010 – 2011 are included in tabular form in the body of the report.

The collection and initial analyses of vegetation and abiotic data helped refine the classification of coastal fen, has provided for the review of the state and global conservation status of the community and associated taxa, and should serve as a valuable reference for any future work in coastal fens and other shoreline communities.

INTRODUCTION

Coastal fen is a Great Lakes coastal wetland community that was newly recognized as one of Michigan's 76 natural community types by the Michigan Natural Features Inventory (MNFI) (Kost et al. 2007, Cohen et al. 2010). This sedge-, rush-, and shrub-dominated community is restricted in Michigan to calcareous substrates along Lakes Huron and Michigan north of the climatic tension zone, where occurrences are concentrated in Mackinac, Charlevoix, Alpena, Cheboygan, and Presque Isle Counties (Kost et al. 2007, Cohen et al. 2010). Coastal fen occurs where marl and organic soils accumulate in protected coves and abandoned coastal embayments. The community supports a diversity of calciphilic plant species due to the limestone-derived soils.

At the inception of this study in 2009, fewer than 20 occurrences of coastal fen were documented across its North American range in Michigan, Wisconsin, and Ontario, Canada. Coastal fen is considered critically imperiled at the global scale (G1G2; see Appendix 1) and imperiled in Michigan (S2; see Appendix 1) due to the low number of documented sites (NatureServe 2010). Coastal fen sustains considerable biodiversity, including seven vascular plant species and 14 animal species currently listed as endangered, threatened, or special concern in Michigan (Cohen et al. 2010; Table 1). Among these species are one federally threatened plant, Houghton's goldenrod (*Solidago houghtonii*), one federally endangered animal, Hine's emerald dragonfly (*Somatochlora hineana*), and one reptile that is a candidate for federal listing, eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*). These species and the coastal fen community are threatened by a variety of stressors, including shoreline development, drainage, off-road vehicle use, invasive species, and climate change (Cohen et al. 2010, Franks Taylor et al. 2010). Invasive plant species that pose especially significant threats to coastal fens include common reed (*Phragmites australis*), narrow-leaved cat-tail (*Typha angustifolia*), hybrid cat-tail (*T. xglauca*), purple loosestrife (*Lythrum salicaria*), and glossy buckthorn (*Rhamnus frangula*) (Cohen et al. 2010).

Table 1. Rare species associated with coastal fen, modified from Cohen et al. (2010).

Plant Species	Common Name	State Status	Federal Status
<i>Cacalia plantaginea</i>	prairie Indian-plantain	SC	
<i>Carex richardsonii</i>	Richardson's sedge	SC	
<i>Carex scirpoidea</i>	bulrush sedge	T	
<i>Drosera anglica</i>	English sundew	SC	
<i>Iris lacustris</i>	dwarf lake iris	T	T
<i>Pinguicula vulgaris</i>	butterwort	SC	
<i>Solidago houghtonii</i>	Houghton's goldenrod	T	T
Animal Species	Common Name	State Status	Federal Status
<i>Botaurus lentiginosus</i>	American bittern	SC	
<i>Catinella exile</i>	Pleistocene catinella	T	
<i>Circus cyaneus</i>	northern harrier	SC	
<i>Emys blandingii</i>	Blanding's turtle	SC	
<i>Euconulus alderi</i>	land snail	T	
<i>Haliaeetus leucocephalus</i>	bald eagle	SC	
<i>Pandion haliaetus</i>	osprey	SC	
<i>Planogyra asteriscus</i>	eastern flat-whorl	SC	
<i>Sistrurus c. catenatus</i>	eastern massasauga	SC	candidate
<i>Somatochlora hineana</i>	Hine's emerald dragonfly	E/E	
<i>Somatochlora incurvata</i>	incurvate emerald	SC	

Animal Species	Common Name	State Status	Federal Status
<i>Vertigo elatior</i>	tapered vertigo	SC	
<i>Vertigo morsei</i>	six-whorl vertigo	E	
<i>Vertigo pygmaea</i>	crested vertigo	SC	

The development of appropriate protection and restoration strategies for coastal fen relies on the availability of a current status assessment of the community and its associated biota. Thus, this two-year status assessment of coastal fen was initiated with the following objectives:

- 1) Characterize vegetative structure, composition, soils, and landscape context of previously identified coastal fen occurrences throughout the range of the community by sampling sites representing a range of quality,
- 2) Improve our understanding of rare biota associated with coastal fen by conducting systematic surveys for target species, including the federally endangered Hine’s emerald dragonfly,
- 3) Identify, prioritize, and sample previously undocumented coastal fen occurrences through aerial photo interpretation of shoreline in the project area,
- 4) Produce detailed management and protection recommendations for coastal fen and associated rare biota, and
- 5) Revise classification and statewide and global conservation status of coastal fen.

METHODS

Surveys focused on coastal fens currently tracked in MNFI’s statewide database and potential coastal fens identified through interpretation of aerial photographs. Many of the previously documented sites were classified as northern fen prior to the revision of the natural community classification (Kost et al. 2007). Sites were selected to encompass the entire known Michigan distribution of coastal fen, and to represent the range of element occurrence ranks. A total of 16 sites were selected for vegetation sampling and rare species surveys, representing six counties and two ecoregional sub-subsections (Albert 1995) (Table 2, Figure 1).

Table 2. 2010 – 2011 sample sites, organized by Ecoregional Sub-subsection and county.

Survey Site	County	Ecoregional Sub-subsection	Community Type (pre-study)	EO Rank (pre-study)
El Cajon Bay	Alpena	VII.6.3	Coastal Fen	A
Squaw Bay	Alpena	VII.6.3	Coastal Fen/Great Lakes Marsh	B
Whitefish Bay	Alpena	VII.6.3	Great Lakes Marsh	BC
Cheboygan State Park North Fen	Cheboygan	VII.6.3	Great Lakes Marsh	AB
Cheboygan State Park South Fen	Cheboygan	VII.6.3	Great Lakes Marsh	AB
Waugoshance Point	Emmet	VII.6.3	Coastal Fen/Great Lakes Marsh	A
Thompson’s Harbor	Presque Isle	VII.6.3	Coastal Fen	A
Isaacson Lake	Chippewa	VIII.1.1	undocumented	undocumented

Survey Site	County	Ecoregional Sub-section	Community Type (pre-study)	EO Rank (pre-study)
Albany Creek Mouth	Mackinac	VIII.1.1	Interdunal Wetland	C
Dudley Bay East	Mackinac	VIII.1.1	undocumented	undocumented
Dudley Bay West	Mackinac	VIII.1.1	Coastal Fen	B
Horseshoe Bay East	Mackinac	VIII.1.1	undocumented	undocumented
Horseshoe Bay West	Mackinac	VIII.1.1	undocumented	undocumented
Meridian Fen	Mackinac	VIII.1.1	Coastal Fen	AB
Peck Bay	Mackinac	VIII.1.1	Coastal Fen	AB
St. Martin Point	Mackinac	VIII.1.1	undocumented	undocumented

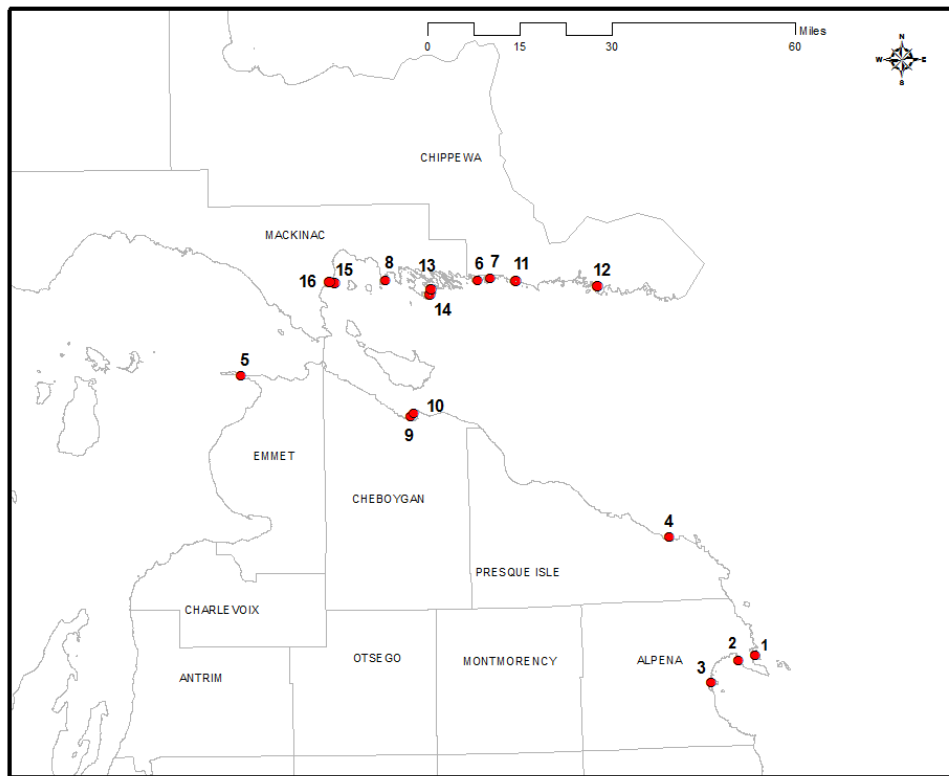


Figure 1. Map of coastal fen sample sites. 1, El Cajon Bay; 2, Whitefish Bay; 3, Squaw Bay; 4, Thompson’s Harbor; 5, Waugoshance Point; 6, Dudley Bay West; 7, Dudley Bay East; 8, St. Martin Point; 9, Cheboygan State Park South Fen; 10, Cheboygan State Park North Fen; 11, Albany Creek Mouth; 12, Isaacson Lake; 13, Peck Bay; 14, Meridian Fen; 15, Horseshoe Bay East; 16, Horseshoe Bay West.

Vegetation and Environmental Sampling

At each site, a belt transect of variable length was placed from the inland margin of the open coastal wetland to emergent marsh, cobble shore, or open lakeshore. Belt transects were placed roughly perpendicular to the shoreline in order to adequately sample different vegetation zones that often develop parallel to the shoreline in response to water levels. Belt transects were placed

subjectively within each site to traverse the maximum number of vegetation zones per transect. Emphasis was placed on characterizing low shrub and ground layer vegetation, as tall shrub and tree distribution was highly variable and patchy within each site. Each belt transect was sampled using a 1 m x 1 m sampling frame, placed at random one-meter intervals on a randomly selected side of the transect. Plot locations were determined using a random numbers table consisting of values from 1 – 10 or 1 – 20 based on the length of the transect. Sample frequency was designed to capture multiple vegetation plots per vegetation zone.

In each plot, vascular plants were identified to species, and percent cover was visually estimated for each taxon. Taxa not identified in the field were collected for later identification. Nomenclature used in this report corresponds to usage in Kost et al. (2007), which generally follows Voss (1972, 1985, 1996) as summarized by Herman et al. (2001). Recent taxonomic and nomenclatural changes summarized by Reznicek et al. (2011) are reflected in Appendix 2. Cover values were separated into four strata: ground layer, low shrub (0.5 – 1 m height), tall shrub (1 – 3 m height), and understory (3 – 10 m height). A fifth stratum, overstory (>10 m height), was not represented by any samples so is not included in the summary data tables. Cover of shrub and tree species was visually estimated for each stratum present in each plot. Shrub and tree cover was also measured using line-intercept sampling, in which the total linear coverage of each shrub or tree species >0.5 m in height that intersected the transect line was measured.

Other environmental variables visually estimated within each plot included percent moss cover, percent bare mineral soil cover, percent marl cover, percent bare peat cover, percent cobble cover, percent wood cover, and percent open water. Bare substrate was defined as substrate not covered by vegetation or litter. Average water depth, measured in centimeters, was assessed by placing a metric ruler in the inundated zone of each plot, averaging multiple measurements if water depth varied within the plot. The number of crayfish burrows was counted in each plot. Crayfish burrows are utilized by larvae of the federally endangered Hine's emerald dragonfly (*Somatochlora hineana*), and may serve as indicators of potential habitat for that species (Lee et al. 2006). A 36" soil auger was used to assess the soil profile within each distinctive vegetation zone along each transect. Soil type, texture, pH, and depth of organic or marl layer(s) was recorded for each soil sample.

Following transect sampling, meander surveys were conducted to develop comprehensive vascular plant species lists for each site. These lists serve to characterize botanical diversity and can be used to determine whether plot sample intensity was sufficient to capture the majority of the plant species present at a site. In addition, meander surveys were conducted for rare plant species associated with coastal fen (Table 1).

Sample Data Analysis

For each plot, the following summary data were calculated:

- 1) total # vascular plant taxa
- 2) vascular plant cover
 - a. ground layer cover
 - b. woody cover 0.5 – 1m
 - c. woody cover 1 – 3m
 - d. woody cover 3 – 10m
 - e. overall woody cover >0.5m
 - f. overall vascular plant cover

For each transect, the following summary data were calculated:

- 1) woody cover 0.5 – 1m
- 2) woody cover 1 – 3m
- 3) woody cover 3 – 10m
- 4) overall woody cover >0.5m

For each site, the following summary data were calculated:

- 1) total # vascular plant taxa
- 2) average # taxa per plot
- 2) range in species number per plot
- 3) species frequency
- 4) species relative frequency
- 5) species average cover
- 6) species total cover
- 7) species relative cover
- 8) species importance value (Kron 1989)
- 9) Floristic Quality Assessment (Herman et al. 2001)
- 10) average percent moss cover
- 11) average percent bare mineral soil cover
- 12) average percent bare peat soil cover
- 13) average percent wood cover
- 14) average percent cobble cover
- 15) average percent standing water
- 16) average depth of water
- 17) average number of crayfish burrows

Rare Animal Surveys

The main emphasis of the study was to characterize the vegetation and abiotic characteristics associated with coastal fen. However, once transect sampling was completed at each site, targeted surveys for rare animals were conducted. Because each site was visited only once, only those rare species that had the best chance of occurring at a site were targeted (Table 1). At all times, however, we recorded incidental findings of rare species. For some of the bird species, presence was noted, but presence alone does not meet the specifications for Element Occurrence (EO) status. For example, we noted merlins at Dudley Bay East, but did not discover their nest site, which is required for EO status.

At all sites, we used meander surveys within the coastal fen habitat to identify dragonflies and butterflies. All species were recorded either by observation with close-focusing binoculars or netting with an aerial insect net, followed by identification and release. Some individuals were collected as voucher specimens. Some rare insects (such as spittlebugs and leafhoppers) are best sampled through a process known as sweep sampling. A standard sweep sample consisted of approximately 100 swings of a sweepnet, with one swing taken with each step. Warm season grasses and other specific host plants were swept when encountered during either the vegetation transect surveys or while meandering through the site to complete the plant species lists. The contents of the net were emptied into a large killing jar charged with ethyl acetate. When the specimens had stopped moving they were transferred to a zip-lock plastic bag and placed into a cooler. Bagged samples were then frozen until they could be processed in the lab. Processing consisted of sorting all insects from the vegetation, pinning larger specimens, and pointing

smaller ones. Those specimens that appeared similar to the targeted rare elements were labeled and keyed or directly compared to specimens contained in the Michigan Natural Features Inventory Reference Collection. All insect vouchers are currently in the MNFI Insect Reference Collection, Rose Lake Research Center, Bath, Michigan. Due to the intensity of the surveys we spent several hours at most of the sites, and at least one insect sweep sample was taken at every site.

RESULTS

Vegetation and Environmental Sampling

Across all sites, the number of species per plot ranged from 0 – 27, and average number of species per plot ranged from 5.2 at Cheboygan State Park South Fen to 15.3 at Thompson’s Harbor (Table 3). Average total vascular plant cover ranged from 23.4% per plot at Meridian Fen to 60.3% per plot at Thompson’s Harbor (Table 4). At all sites, the majority of vascular plant cover was comprised of ground layer species. In general, plot samples underestimated woody cover, likely due to the clumped distribution of woody species (compare Tables 4 and 5). See Appendix 3 for woody cover by taxon based on line intercept sampling.

Table 3. Minimum, maximum, and average (\pm S.E.) number of vascular plant species per plot per site.

Site	Min # species	Max # species	Avg # species \pm S.E.
2011			
Horseshoe Bay West	5	26	11.2 \pm 1.3
Horseshoe Bay East	9	14	10.7 \pm 0.5
Cheboygan State Park North Fen	4	18	10.1 \pm 1.2
Albany Bay	3	20	9.6 \pm 1.4
Peck Bay	1	27	9.3 \pm 1.4
Meridian Fen	1	22	7.6 \pm 1.4
Cheboygan State Park South Fen	3	10	5.2 \pm 0.4
2010			
Thompson’s Harbor	7	27	15.3 \pm 1.1
St. Martin Point	4	25	14.5 \pm 1.7
Dudley Bay East	4	22	13.1 \pm 1.3
El Cajon Bay	4	23	12.1 \pm 0.8
Whitefish Bay	3	23	12.0 \pm 1.1
Dudley Bay West	8	19	11.7 \pm 1.1
Squaw Bay	3	17	8.9 \pm 0.7
Waugoshance Point	0	16	7.7 \pm 1.3
Totals	0	27	10.6 \pm 0.7

Table 4. Average vascular plant cover (%) \pm S.E. of each stratum per site (plot method).

Site	Ground layer cover	Woody cover 0.5 – 1m	Woody cover 1 – 3m	Woody cover 3 – 10m	Total vascular plant cover \pm S.E.
2011					
Horseshoe Bay East	50.3 \pm 3.9	0.8 \pm 0.8	0	0	51.0 \pm 3.8

Site	Ground layer cover	Woody cover 0.5 – 1m	Woody cover 1 – 3m	Woody cover 3 – 10m	Total vascular plant cover ± S.E.
Horseshoe Bay West	46.3 ± 7.5	1.7 ± 1.5	0.4 ± 0.4	1.6 ± 1.6	50.1 ± 8.5
Cheboygan State Park North Fen	47.6 ± 9.1	0	0	0	47.6 ± 9.1
Peck Bay	35.5 ± 5.6	0	2.0 ± 1.4	0	37.5 ± 5.7
Albany Bay	31.4 ± 3.7	0.2 ± 0.2	0.7 ± 0.7	0	32.3 ± 4.2
Cheboygan State Park South Fen	34.8 ± 2.7	0	0	0	34.8 ± 2.7
Meridian Fen	19.5 ± 4.3	0.4 ± 0.4	0	3.6 ± 3.0	23.4 ± 6.5
2010					
Thompson's Harbor	57.4 ± 5.9	2.9 ± 1.7	0	0	60.3 ± 5.8
St. Martin Point	54.1 ± 6.5	2.9 ± 1.9	0	0	57.0 ± 6.4
Dudley Bay West	38.6 ± 8.1	5.9 ± 4.3	8.6 ± 8.6	2.5 ± 2.0	55.7 ± 9.4
Dudley Bay East	32.4 ± 5.9	7.3 ± 5.7	1.5 ± 1.1	0	41.2 ± 7.2
Whitefish Bay	33.8 ± 3.9	0.3 ± 0.2	4.5 ± 4.1	0.0 ± 0.0	38.6 ± 5.4
Squaw Bay	36.5 ± 4.0	0.0 ± 0.0	1.6 ± 1.6	0.0 ± 0.0	38.1 ± 4.2
Waugoshance Point	36.9 ± 6.3	0.6 ± 0.6	0	0	37.6 ± 6.3
El Cajon Bay	29.1 ± 2.1	0.3 ± 0.2	0.9 ± 0.6	0	30.3 ± 2.4
Averages	38.9 ± 2.6	1.6 ± 0.6	1.3 ± 0.6	0.5 ± 0.3	42.4 ± 2.8

Table 5. Percent woody cover >0.5m (line intercept method).

Site	Woody cover 0.5 – 1m	Woody cover 1 – 3m	Woody cover 3 – 10m	Total woody cover
2011				
Meridian Fen	1.6	1.9	2.3	5.8
Albany Creek Mouth	2.5	1.6	0	4.2
Peck Bay	0.2	2.6	0.5	3.3
Cheboygan State Park South Fen	2.9	0	0	2.9
Horseshoe Bay East	1.3	0	0	1.3
Horseshoe Bay West	0.6	0.5	0	1.1
Cheboygan State Park North Fen	0	0	0	0
2010				
Dudley Bay East	8.5	8.6	0.5	17.5
Dudley Bay West	13.4	3.2	0	16.5
Whitefish Bay	0.4	2.8	5.3	8.5
St. Martin Point	7.5	0.4	0	7.9
Thompson's Harbor	2.5	1.8	0	4.3
Squaw Bay	0.0	1.3	0	1.3
Waugoshance Point	0.5	0	0	0.5
El Cajon Bay	0.0	0.4	0	0.4

Four species occurred in greater than 50% of all plots: twig-rush (*Cladium mariscoides*), shrubby cinquefoil (*Potentilla fruticosa*), Ohio goldenrod (*Solidago ohioensis*), and beak-rush (*Rhynchospora capillacea*) (Table 6). Seven species averaged >1% cover, led by beak-rush, twig-rush, beak-rush, beaked spike-rush (*Eleocharis rostellata*), and shrubby cinquefoil (Table 7). The most important species, as determined by averaging relative cover and relative frequency (Kron 1989), were beak rush, twig-rush, beaked spike-rush, shrubby cinquefoil, and Ohio goldenrod (Table 8). For each site, the ten most frequently encountered species, ten species comprising greatest average cover, and ten most important species are listed in tables associated with the individual site descriptions below. An overall list of all vascular plant species sampled ranked by importance value is provided in Appendix 4.

Table 6. Ten most frequently encountered vascular plant species, overall.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	75.3
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	56.9
<i>Solidago ohioensis</i>	Ohio goldenrod	54.9
<i>Rhynchospora capillacea</i>	beak-rush	53.6
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	38.6
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	38.3
<i>Eleocharis rostellata</i>	beaked spike-rush	35.3
<i>Parnassia glauca</i>	grass-of-Parnassus	34.9
<i>Tofieldia glutinosa</i>	false asphodel	31.2
<i>Panicum lindheimeri</i>	panic grass	29.2
<i>Juncus balticus</i>	Baltic rush	27.5

Table 7. Vascular plant species comprising >1% average cover, overall.

Species	Common name	Average cover (%) ± S.E.
<i>Rhynchospora capillacea</i>	beak-rush	7.6 ± 1.0
<i>Cladium mariscoides</i>	twig-rush	6.3 ± 0.8
<i>Eleocharis rostellata</i>	beaked spike-rush	6.2 ± 1.4
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	3.7 ± 0.7
<i>Juncus balticus</i>	Baltic rush	2.0 ± 0.7
<i>Solidago ohioensis</i>	Ohio goldenrod	1.6 ± 0.3
<i>Schizachyrium scoparium</i>	little bluestem	1.2 ± 0.8

Table 8. Ten most important vascular plant species, overall.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Rhynchospora capillacea</i>	beak-rush	18.6	5.1	11.8
<i>Cladium mariscoides</i>	twig-rush	15.4	7.1	11.2
<i>Eleocharis rostellata</i>	beaked spike-rush	15.1	3.3	9.2
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	9.0	5.4	7.2
<i>Solidago ohioensis</i>	Ohio goldenrod	3.9	5.2	4.5
<i>Juncus balticus</i>	Baltic rush	4.9	2.6	3.8
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	1.7	3.7	2.7
<i>Sarracenia purpurea</i>	pitcher-plant	2.1	2.4	2.3
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	0.3	3.6	2.0
<i>Schizachyrium scoparium</i>	little bluestem	2.8	1.0	1.9

Nearly half of the plots contained moss cover. Bare mineral soil and marl were encountered in approximately 25% of plots; unvegetated peat, cobble, and wood were less frequently encountered (Table 9). Approximately 50% of plots were at least partially inundated, although water depths were typically shallow. Site-specific environmental data and substrate descriptions are provided in the individual site descriptions.

Table 9. Environmental variables, frequency and average value per plot, overall.

Environmental variable	Frequency (%)	Average % cover \pm S.E.
Moss cover	43.4	10.3 \pm 1.9
Unvegetated mineral soil	19.3	2.5 \pm 1.2
Unvegetated marl	20.3	1.0 \pm 0.8
Unvegetated peat	2.0	0.0 \pm 0.0
Unvegetated cobble	16.3	2.8 \pm 1.9
Unvegetated wood	5.1	0.7 \pm 1.1
Standing water	47.1	31.5 \pm 2.2
Water depth (cm)	NA	1.5 \pm 0.2
Crayfish burrows	7.8	0.2 \pm 0.1 burrows

The number of native vascular plant species per site (not counting taxa identified only to genus) ranged from 37 to 99 (Table 9). Native mean *C* values were similar among sites, ranging from 6.0 to 7.3. Native FQI ranged from 40.2 to 62.8 (Table 10). Complete Floristic Quality Assessments for each site are provided in Appendix 5. A total of approximately 181 vascular plant taxa were documented from the eight sites, including 167 native taxa and 14 adventive taxa (Appendix 6).

Table 10. Floristic Quality Assessment (FQA) summary for all sites.

Site	Native species	Total species*	Native mean C	Mean C with adventives	Native FQI	FQI with adventives
2011						
Horseshoe Bay West	82	83	6.7	6.7	61.0	60.6
Meridian Fen	67	67	7.1	7.1	57.8	57.8
Peck Bay	66	66	6.9	6.9	56.1	56.1
Cheboygan State Park North and South Fens	63	63	6.9	6.9	55.1	55.1
Albany Creek Mouth	52	52	7.3	7.3	52.3	52.3
Horseshoe Bay East	36	37	6.7	6.5	40.2	39.6
2010						
El Cajon Bay	73	76	6.5	6.3	55.9	54.8
Whitefish Bay	70	74	6.9	6.5	57.8	56.3
Squaw Bay	61	62	6.2	6.1	48.8	48.4
Thompson's Harbor	99	103	6.3	6.1	62.8	61.6
Waugoshance Point	54	54	6.4	6.4	47.2	47.2
Dudley Bay West and East	77	79	6.0	5.8	52.3	51.6
St. Martin Point	75	76	6.1	6.1	53.2	52.9
Averages	67.3	68.6	6.6	6.5	53.9	53.4

*Total species does not include taxa identified to genus only (the totals reported in the individual site descriptions include all taxa, including unidentified taxa, and thus deviate slightly from the numbers reported above).

Rare Element Surveys

A total of 21 new element occurrences were identified during 2010 – 2011 surveys, including nine communities, one rare plant population, and 11 rare insect populations (Table 11). In addition to the new occurrences, a total of 23 previously identified element occurrences were observed, including nine coastal fens and 11 occurrences of rare plant taxa. Tables of all newly documented and updated element occurrences for each site are provided in the individual site descriptions. Data for newly documented and updated element occurrences will be transcribed and entered into the MNFI Biotics database.

Table 11. Newly documented element occurrences, 2010 – 2011.

Site	Scientific name	Common name	State Status
2011			
Cheboygan State Park*	coastal fen		S2
	<i>Flexamia delongi</i>	leafhopper	SC; S1S2
Horseshoe Bay East	interdunal wetland		S2
	<i>Flexamia delongi</i>	leafhopper	SC; S1S2
Horseshoe Bay West	coastal fen		S2
	<i>Pinguicula vulgaris</i>	butterwort	SC; S3
	<i>Flexamia delongi</i>	leafhopper	SC; S1S2
Isaacson Lake	northern fen		S2
	<i>Flexamia delongi</i>	leafhopper	SC; S1S2
Albany Creek Mouth	<i>Trimerotropis huroniana</i>	Lake Huron locust	T; S2S3
Meridian Fen	<i>Flexamia delongi</i>	leafhopper	SC; S1S2
Peck Bay	<i>Flexamia delongi</i>	leafhopper	SC; S1S2
2010			
El Cajon Bay	<i>Dorydiella kansana</i>	Kansan leafhopper	SC; S1S2
	<i>Prosapia ignipectus</i>	red-legged spittlebug	SC; S2S3
Whitefish Bay	coastal fen		S2
	northern fen		S2
	<i>Flexamia delongi</i>	leafhopper	SC; S1S2
Dudley Bay East	coastal fen		S2
St. Martin Point	coastal fen		S2
	limestone cobble shore		S3
	<i>Flexamia delongi</i>	leafhopper	SC; S1S2

*Coastal fen first surveyed and split from Great Lakes marsh occurrence in September 2010; vegetation sampled in 2011.

EL CAJON BAY

T31N R09E S27, 15, 14, 22, 23, 26

Alpena County (Ecoregional Sub-subsection VII.6.3)



El Cajon Bay supports an extensive coastal fen developed in a series of protected embayments. The community grades to Great Lakes marsh lakeward and rich conifer swamp landward. The coastal fen at this site occurs on fine lacustrine sands which are overlain in much of the area by moderately to strongly alkaline marl of variable depth. Limestone bedrock occurs at a shallow depth. Several vegetation zones are present, including marl flats and extensive alkaline sand flats.

Vegetation and Environmental Data

A total of 48 vascular plant species were encountered in plots along a 200-meter belt transect (Figure 2), comprising 62% of the 78 species identified in a meander survey of the site (Appendix 3a). Six species (13%) were encountered in 50% or more of the plots (Table 12). No species averaged greater than 10% cover; eight species averaged 1% or greater cover (Table 13). Beak-rush (*Rhynchospora capillacea*) and beaked spike-rush (*Eleocharis rostellata*) are the most important species, closely followed by twig-rush (*Cladium mariscoides*) and shrubby cinquefoil (*Potentilla fruticosa*) (Table 14).

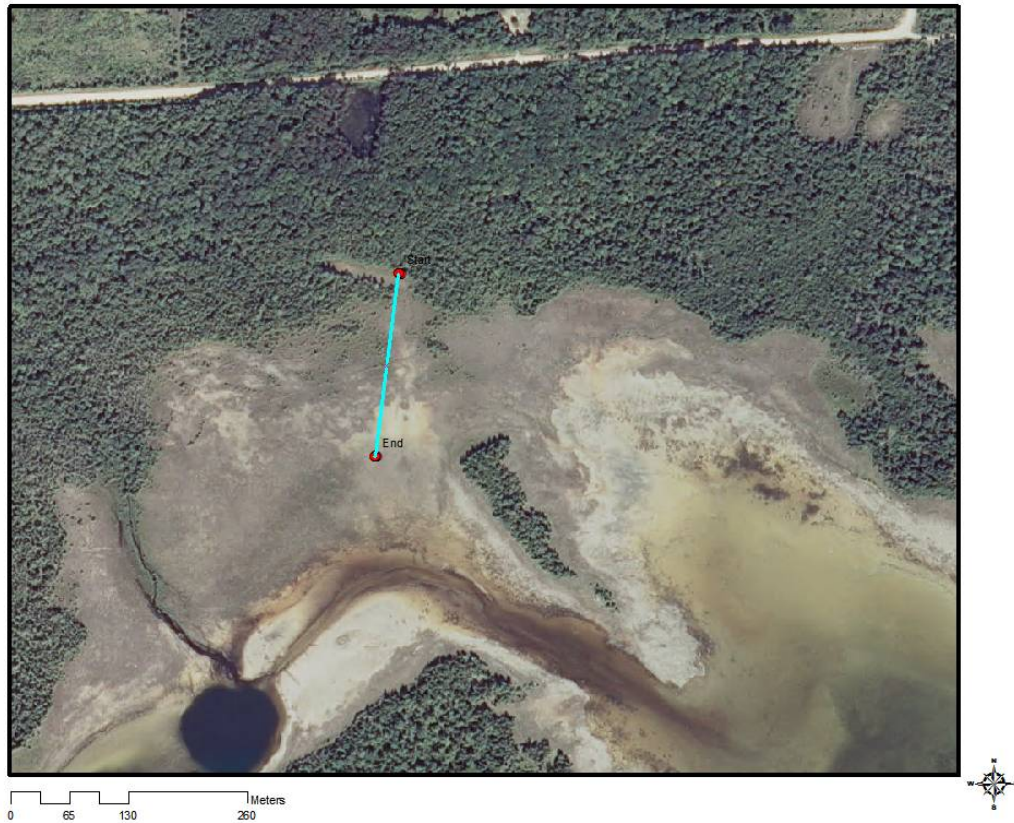


Figure 2. El Cajon Bay coastal fen and transect line.

Table 12. Ten most frequently encountered vascular plant species, El Cajon Bay.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	97.1
<i>Solidago ohioensis</i>	Ohio goldenrod	82.9
<i>Rhynchospora capillacea</i>	beak-rush	74.3
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	71.4
<i>Eleocharis rostellata</i>	beaked spike-rush	68.6
<i>Juncus brachycephalus</i>	rush	62.9
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	48.6
<i>Sarracenia purpurea</i>	pitcher-plant	42.9
<i>Parnassia glauca</i>	grass-of-Parnassus	42.9
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	42.9

Table 13. Ten vascular plant species with highest average cover, El Cajon Bay.

Species	Common name	Average cover (%) ± S.E.
<i>Rhynchospora capillacea</i>	beak-rush	6.7 ± 2.0
<i>Eleocharis rostellata</i>	beaked spike-rush	5.7 ± 1.3
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	3.6 ± 1.0
<i>Cladium mariscoides</i>	twig-rush	3.2 ± 0.5
<i>Juncus balticus</i>	Baltic rush	2.6 ± 1.0
<i>Sarracenia purpurea</i>	pitcher-plant	2.1 ± 0.8

Species	Common name	Average cover (%) ± S.E.
<i>Solidago ohioensis</i>	Ohio goldenrod	1.4 ± 0.4
<i>Calamagrostis canadensis</i>	bluejoint grass	1.0 ± 0.7
<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	0.9 ± 0.6
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	0.6 ± 0.2

Table 14. Ten most important vascular plant species, El Cajon Bay.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Rhynchospora capillacea</i>	beak-rush	22.1	6.4	14.2
<i>Eleocharis rostellata</i>	beaked spike-rush	18.9	5.9	12.4
<i>Cladium mariscoides</i>	twig-rush	10.6	8.3	9.4
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	11.7	6.1	8.9
<i>Juncus balticus</i>	Baltic rush	8.7	4.6	6.7
<i>Solidago ohioensis</i>	Ohio goldenrod	4.7	7.1	5.9
<i>Sarracenia purpurea</i>	pitcher-plant	6.7	3.7	5.2
<i>Juncus brachycephalus</i>	rush	1.1	5.4	3.2
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	1.9	4.2	3.0
<i>Calamagrostis canadensis</i>	bluejoint grass	3.4	1.0	2.2

Among environmental variables, El Cajon Bay was characterized by widespread bare marl, though it comprised low average coverage (Table 15). Fifty crayfish burrows were documented from plots in this site, by far the most burrows observed during 2010 surveys.

Table 15. Environmental variables, frequency and average value per plot, El Cajon Bay.

Environmental variable	Frequency (%)	Average cover (%) ± S.E.
Moss cover	42.9	3.8 ± 1.8
Unvegetated mineral soil	22.9	6.3 ± 2.3
Unvegetated marl	62.9	3.3 ± 1.5
Unvegetated peat	0	0
Unvegetated cobble	14.3	0.2 ± 0.1
Unvegetated wood	0	0
Standing water	2.9	0.1 ± 0.1
Water depth (cm)	2.9	0.0 ± 0.0
Crayfish burrows	54.3	1.4 ± 0.3 burrows

Element Occurrences

The known occurrences for coastal fen and dwarf lake iris were updated in 2010. In addition, two new occurrences for rare insects were documented at El Cajon Bay (Table 16).

Table 16. Known and newly documented element occurrences, El Cajon Bay.

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Coastal fen		S2	1989	2010
<i>Iris lacustris</i>	dwarf lake iris	T/LT; S3/G3	1981	2010
<i>Dorydiella kansana</i>	Kansan leafhopper	SC; S1S2	2010	2010
<i>Prosapia ignipectus</i>	red-legged spittlebug	SC; S2S3	2010	2010

WHITEFISH BAY

T31N R09E S29, 20, 17, 19

Alpena County (Ecoregional Sub-subsection VII.6.3)



Whitefish Bay supports extensive development of coastal fen on moderately alkaline marl and sandy marl over lacustrine sands. This site is notable for the high percentage of standing water over much of the fen surface. In addition, portions of the fen are impacted by dumped and/or lake-deposited logs and stumps, which provide substrate for plant species that are otherwise restricted to relatively dry sedge hummocks within the marl flats. Although marl flats are the most important vegetation zone, open and forested low cobble rises within the fen provide substrate for a significant number of plant species not found elsewhere in the fen. This site is at least partly protected from wind, wave, and ice action by a low open dune ridge near the shoreline.

Vegetation and Environmental Data

A total of 60 vascular plant species were encountered in plots along the 230-meter belt transect (Figure 3), comprising 78% of the 77 species identified in a meander survey of the site (Appendix 3b). Six species (10%) were encountered in 50% or more of the plots (Table 17). One species averaged greater than 10% cover; eight species averaged 1% or greater cover (Table 18). Beaked spike-rush (*Eleocharis rostellata*) was by far the most important species, due largely to its high relative cover (Table 19).



Figure 3. Whitefish Bay coastal fen and transect line.

Table 17. Ten most frequently encountered vascular plant species, Whitefish Bay.

Species	Common name	Frequency (%)
<i>Eleocharis rostellata</i>	beaked spike-rush	85.2
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	70.4
<i>Schoenoplectus pungens</i>	three-square	63.0
<i>Parnassia glauca</i>	grass-of-Parnassus	59.3
<i>Sarracenia purpurea</i>	pitcher-plant	55.6
<i>Solidago ohioensis</i>	Ohio goldenrod	51.9
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	48.2
<i>Cladium mariscoides</i>	twig-rush	44.4
<i>Rhynchospora alba</i>	white beak-rush	44.4
<i>Juncus balticus</i>	Baltic rush	40.7

Table 18. Ten vascular plant species with highest average cover, Whitefish Bay.

Species	Common name	Average % cover ± S.E.
<i>Eleocharis rostellata</i>	beaked spike-rush	20.6 ± 4.4
<i>Larix laricina</i> 1 – 3m	tamarack	2.4 ± 2.4
<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	2.1 ± 1.7
<i>Schoenoplectus pungens</i>	three-square	1.8 ± 0.9
<i>Juncus balticus</i>	Baltic rush	1.6 ± 0.7
<i>Trichophorum cespitosum</i>	tufted bulrush	1.4 ± 0.7

Species	Common name	Average % cover ± S.E.
<i>Sarracenia purpurea</i>	pitcher-plant	1.2 ± 0.3
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	1.0 ± 0.4
<i>Carex stricta</i>	tussock sedge	0.9 ± 0.6
<i>Rhynchospora capillacea</i>	beak-rush	0.9 ± 0.6

Table 19. Ten most important vascular plant species, Whitefish Bay.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Eleocharis rostellata</i>	beaked spike-rush	53.2	6.8	30.0
<i>Schoenoplectus pungens</i>	three-square	4.7	5.0	4.9
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	2.7	5.6	4.2
<i>Sarracenia purpurea</i>	pitcher-plant	3.1	4.5	3.8
<i>Juncus balticus</i>	Baltic rush	4.1	3.3	3.7
<i>Larix laricina</i> 1 – 3m	tamarack	6.2	0.6	3.4
<i>Trichophorum cespitosum</i>	tufted bulrush	3.7	2.7	3.2
<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	5.4	0.9	3.1
<i>Rhynchospora alba</i>	white beak-rush	1.6	3.6	2.6
<i>Parnassia glauca</i>	grass-of-Parnassus	0.3	4.8	2.5

Among environmental variables, Whitefish Bay was characterized by significant areas of woody substrate (mostly artificial) and open water (Table 20). Only one crayfish burrow was observed in the sample plots.

Table 20. Environmental variables, frequency and average value per plot, Whitefish Bay.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	51.9	3.7 ± 1.0
Unvegetated mineral soil	7.4	2.3 ± 1.9
Unvegetated marl	18.5	0.4 ± 0.1
Unvegetated peat	7.4	0.1 ± 0.1
Unvegetated cobble	0	0
Unvegetated wood	44.4	7.2 ± 2.9
Standing water	77.8	42.5 ± 8.5
Water depth (cm)	77.8	3.1 ± 0.5
Crayfish burrows	3.7	0.1 ± 0.0 burrows

Element Occurrences

The previously documented Great Lakes marsh at this site was remapped and reclassified as coastal fen based on the 2010 survey. In addition, a small area of the previously mapped Great Lakes marsh was reclassified as northern fen. The previously documented population of dwarf lake iris was observed in 2010, and a population of a rare leafhopper was discovered (Table 21).

Table 21. Known and newly documented element occurrences, Whitefish Bay.

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Great Lakes marsh		S3	1989	2010*
Coastal fen		S2	2010	2010
Northern fen		S3	2010	2010

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
<i>Iris lacustris</i>	dwarf lake iris	T/LT; S3/G3	1895	2010
<i>Flexamia delongi</i>	leafhopper	SC; S1S2	2010	2010

*Great Lakes marsh reclassified as coastal fen and northern fen based on 2010 survey.



Extensive marl flats with interspersed peat hummocks characterize much of the coastal fen at Whitefish Bay.

SQUAW BAY
T30N R08E S15, 9, 16
Alpena County (Ecoregional Sub-subsection VII.6.3)



Squaw Bay supports an extensive coastal fen developed in a large protected embayment. The community grades to Great Lakes marsh lakeward and rich conifer swamp and boreal forest landward. US-23 bisects the wetland and has significantly disrupted the natural hydrologic regime. The coastal fen at this site occurs on mildly to moderately alkaline fine lacustrine sands that are overlain in places by a thin layer of sapric peat. The fen is primarily characterized by open, low diversity alkaline sand flats, with hummock development concentrated in areas of groundwater seepage near the inland margin.

Vegetation and Environmental Data

A total of 37 vascular plant species were encountered in plots along the 300-meter belt transect (Figure 4), comprising 57% of the 65 species identified in a meander survey of the site (Appendix 3c). Five species (14%) were encountered in 50% or more of the plots (Table 22). Two species averaged greater than 10% cover; five species averaged 1% or greater cover (Table 23). Twig-rush (*Cladium mariscoides*) and beak-rush (*Rhynchospora capillacea*) were the most important species, comprising nearly 80% of total vascular plant cover (Table 24).



Figure 4. Squaw Bay coastal fen and transect.

Table 22. Ten most frequently encountered vascular plant species, Squaw Bay.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	100.0
<i>Lycopus uniflorus</i>	northern bugleweed	68.0
<i>Rhynchospora capillacea</i>	beak-rush	64.0
<i>Panicum lindheimeri</i>	panic grass	56.0
<i>Solidago ohioensis</i>	Ohio goldenrod	56.0
<i>Calamagrostis canadensis</i>	bluejoint grass	48.0
<i>Carex livida</i>	livid sedge	48.0
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	48.0
<i>Equisetum variegatum</i>	variegated scouring rush	40.0
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	40.0

Table 23. Ten vascular plant species with highest average cover, Squaw Bay.

Species	Common name	Average cover (%) ± S.E.
<i>Cladium mariscoides</i>	twig-rush	19.3 ± 3.9
<i>Rhynchospora capillacea</i>	beak-rush	10.9 ± 3.8
<i>Myrica gale</i> <0.5m	sweet gale	2.0 ± 1.0
<i>Alnus rugosa</i> 1 – 3m	tag alder	1.6 ± 1.6
<i>Carex livida</i>	livid sedge	1.5 ± 0.8
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	0.9 ± 0.6

Species	Common name	Average cover (%) ± S.E.
<i>Sarracenia purpurea</i>	pitcher-plant	0.6 ± 0.3
<i>Rhynchospora alba</i>	white beak-rush	0.3 ± 0.2
<i>Solidago ohioensis</i>	Ohio goldenrod	0.2 ± 0.1
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	0.2 ± 0.1

Table 24. Ten most important vascular plant species, Squaw Bay.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Cladium mariscoides</i>	twig-rush	50.6	11.2	30.9
<i>Rhynchospora capillacea</i>	beak-rush	28.7	7.1	17.9
<i>Carex livida</i>	livid sedge	4.0	5.4	4.7
<i>Myrica gale</i> <0.5m	sweet gale	5.3	4.0	4.7
<i>Lycopus uniflorus</i>	northern bugleweed	0.1	7.6	3.8
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	2.4	4.5	3.4
<i>Solidago ohioensis</i>	Ohio goldenrod	0.6	6.3	3.4
<i>Panicum lindheimeri</i>	panic grass	0.0	6.3	3.1
<i>Calamagrostis canadensis</i>	bluejoint grass	0.4	5.4	2.9
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	0.2	5.4	2.8

Among environmental variables, only unvegetated marl was observed in greater than 50% of plots, and it comprised low coverage (Table 25). No crayfish burrows were observed in the sample plots.

Table 25. Environmental variables, frequency and average value per plot, Squaw Bay.

Environmental variable	Frequency (%)	Average cover (%) ± S.E.
Moss cover	20.0	1.2 ± 0.7
Unvegetated mineral soil	24.0	0.6 ± 0.3
Unvegetated marl	56.0	1.7 ± 0.5
Unvegetated peat	0	0
Unvegetated cobble	0	0
Unvegetated wood	8.0	0.1 ± 0.1
Standing water	28.0	12.5
Water depth (cm)	NA	0.4 ± 0.2
Crayfish burrows	0	0.0 burrows

Element Occurrences

The previously documented occurrences of coastal fen and Great Lakes marsh at this location were updated in 2010 (Table 26). In addition, eastern massasauga (*Sistrurus catenatus catenatus*) was documented within or near the coastal fen in a separate site visit in 2010.

Table 26. Known and newly documented element occurrences, Squaw Bay.

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Coastal fen		S2	1996	2010
Great Lakes marsh		S3	1981	2010
<i>Iris lacustris</i>	dwarf lake iris	T/LT; S3/G3	1981	1987

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
<i>Sistrurus c. catenatus</i>	eastern massasauga	SC/C; S3S4/G3G4T3T4Q	2010	2010
<i>Sterna hirundo</i>	common tern	T; S2	1962	1962



The interior zone of the coastal fen at Squaw Bay supports groundwater-influenced, saturated alkaline sand flats that support beak-rush (*Rhynchospora capillacea*), pitcher-plant (*Sarracenia purpurea*), and other characteristic species of coastal fen.

THOMPSON'S HARBOR

T34N R07E S15, 9, 16

Presque Isle County (Ecoregional Sub-subsection VII.6.3)



Thompson's Harbor supports a species-rich, well-zoned coastal fen in a narrow protected embayment, where it is associated with Great Lakes marsh, limestone cobble shore, and boreal forest. The coastal fen has developed on moderately alkaline lacustrine deposits, with areas of marl concentrated near the inland margin of the embayment, and patchy zones of sapric peats, often associated with underlying limestone cobble. Vegetative zones include marl flats with sedge-dominated hummocks, broad, low peat mounds, and shallowly inundated sandy flats with emergent vegetation.

Vegetation and Environmental Data

A total of 76 vascular plant species were encountered in plots along the 200-meter belt transect (Figure 5), comprising 69% of the 110 species identified in a meander survey of the site (Appendix 3d). Eight species (11%) were encountered in 50% or more of the plots (Table 27). One species averaged greater than 10% cover; 12 species averaged 1% or greater cover (Table 28). Beak-rush (*Rhynchospora capillacea*) was the most important species, due largely to its high relative cover (Table 29).



Figure 5. Thompson's Harbor coastal fen and transect.

Table 27. Ten most frequently encountered vascular plant species, Thompson's Harbor.

Species	Common name	Frequency (%)
<i>Solidago ohioensis</i>	Ohio goldenrod	81.0
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	71.4
<i>Schoenoplectus pungens</i>	three-square	66.7
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	61.9
<i>Parnassia glauca</i>	grass-of-Parnassus	61.9
<i>Rhynchospora capillacea</i>	beak-rush	57.1
<i>Muhlenbergia glomerata</i>	marsh wild-timothy	57.1
<i>Lobelia kalmii</i>	Kalm's lobelia	52.4
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	47.6
<i>Sarracenia purpurea</i>	pitcher-plant	42.9

Table 28. Ten vascular plant species with highest average cover, Thompson's Harbor.

Species	Common name	Average cover (%) ± S.E.
<i>Rhynchospora capillacea</i>	beak-rush	20.1 ± 5.8
<i>Calamagrostis canadensis</i>	bluejoint grass	9.9 ± 5.4
<i>Juncus balticus</i>	Baltic rush	5.8 ± 3.4
<i>Solidago ohioensis</i>	Ohio goldenrod	3.0 ± 0.9
<i>Sarracenia purpurea</i>	pitcher-plant	2.4 ± 0.9
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	2.1 ± 0.9

Species	Common name	Average cover (%) ± S.E.
<i>Hypericum kalmianum</i> 0.5 – 1m	Kalm's St. John's-wort	2.0 ± 1.7
<i>Eleocharis rostellata</i>	beaked spike-rush	1.5 ± 0.9
<i>Rhynchospora alba</i>	white beak-rush	1.4 ± 0.8
<i>Carex flava</i>	yellow sedge	1.3 ± 0.5

Table 29. Ten most important vascular plant species, Thompson's Harbor.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Rhynchospora capillacea</i>	beak-rush	33.3	3.7	18.5
<i>Calamagrostis canadensis</i>	bluejoint grass	16.4	1.8	9.1
<i>Juncus balticus</i>	Baltic rush	9.6	2.4	6.0
<i>Solidago ohioensis</i>	Ohio goldenrod	5.0	5.2	5.1
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	3.5	4.6	4.0
<i>Sarracenia purpurea</i>	pitcher-plant	3.9	2.7	3.3
<i>Schoenoplectus pungens</i>	three-square	1.0	4.3	2.6
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	0.6	4.0	2.3
<i>Carex flava</i>	yellow sedge	2.2	2.1	2.2
<i>Parnassia glauca</i>	grass-of-Parnassus	0.4	4.0	2.2

Among environmental variables, Thompson's Harbor was characterized by significant areas of moss cover (Table 30). Only one crayfish burrow was observed in the sample plots.

Table 30. Environmental variables, frequency and average value per plot, Thompson's Harbor.

Environmental variable	Frequency (%)	Average cover (%) ± S.E.
Moss cover	61.9	23.2 ± 8.1
Unvegetated mineral soil	23.8	0.7 ± 0.3
Unvegetated marl	9.5	0.1 ± 0.1
Unvegetated peat	9.5	0.1 ± 0.1
Unvegetated cobble	0	0
Unvegetated wood	0	0
Standing water	19.1	9.0 ± 4.6
Water depth (cm)	19.1	0.5 ± 0.2
Crayfish burrows	4.8	0.0 ± 0.0 burrows

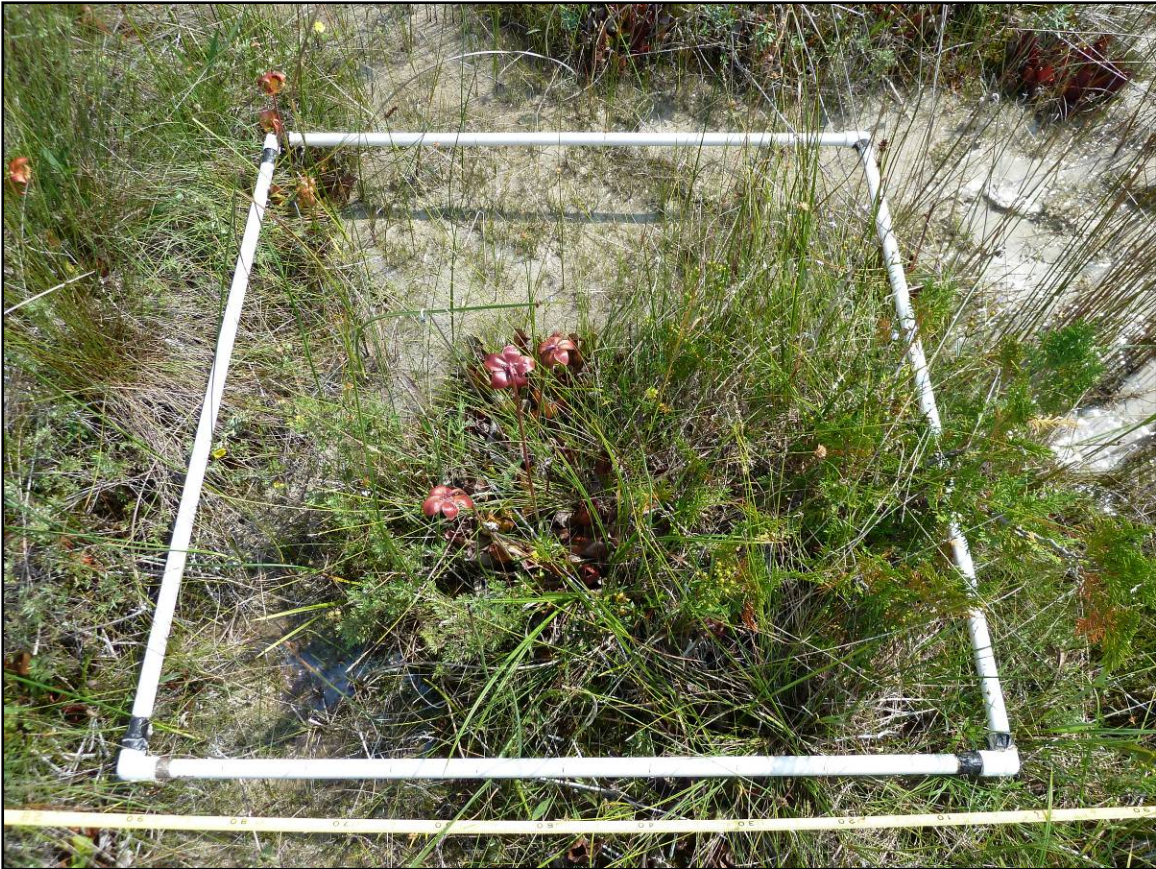
Element Occurrences

Four previously documented element occurrences at this location were redocumented during 2010 surveys (Table 31). A fifth rare element known from this site, bulrush sedge (*Carex scirpoidea*), was not documented in 2010.

Table 31. Known and newly documented element occurrences, Thompson's Harbor (coastal fen area only).

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Coastal fen		S2	1987	2010
<i>Cacalia plantaginea</i>	prairie Indian-plantain	SC; S3	1987	2010

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
<i>Iris lacustris</i>	dwarf lake iris	T/LT; S3/G3	1977	2010
<i>Pinguicula vulgaris</i>	butterwort	SC; S3	1987	2010



Thompson's Harbor supported the highest average number of vascular plant species per plot (15.3) and the highest number of species sampled in an individual plot (27).

WAUGOSHANCE POINT

T39N R06W S25, 23, 24; T39N R05W S19, 30

Emmet County (Ecoregional Sub-subsection VII.6.3)



Waugoshance Point is an extensive complex of several natural communities developed on a headland at the western margin of Wilderness State Park. Here, coastal fen is interspersed within a broad area of limestone cobble shore and Great Lakes marsh, and abuts open dunes, interdunal wetland, and boreal forest. Significant substrate heterogeneity characterizes the coastal fen, which has developed on moderately alkaline lacustrine sands, gravels, and cobble, with local marl accumulation in areas protected from frequent wind, wave, and ice action. The vegetative communities here exhibit broad, patchy zonation, with coastal fen best developed where layers of fine sediments overlie cobble.

Vegetation and Environmental Data

A total of 32 vascular plant species were encountered in plots along the 200-meter belt transect (Figure 6), comprising 57% of the 58 species identified in a meander survey of the site (Appendix 3e). Four species (13%) were encountered in 50% or more of the plots (Table 32). One species averaged greater than 10% cover; four species averaged 1% or greater cover (Table 33). Twig-rush (*Cladium mariscoides*) was by far the most important species, followed by Ohio goldenrod (*Solidago ohioensis*), beak-rush (*Rhynchospora capillacea*), and shrubby cinquefoil (*Potentilla fruticosa*) (Table 34).



Figure 6. Waugoshance Point coastal fen and transect.

Table 32. Ten most frequently encountered vascular plant species, Waugoshance Point.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	68.4
<i>Schoenoplectus pungens</i>	three-square	57.9
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	52.6
<i>Solidago ohioensis</i>	Ohio goldenrod	52.6
<i>Calamintha arkansana</i>	low calamint	47.4
<i>Panicum lindheimeri</i>	panic grass	42.1
<i>Primula mistassinica</i>	dwarf Canadian primrose	42.1
<i>Rhynchospora capillacea</i>	beak-rush	42.1
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	31.6
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	31.6

Table 33. Ten vascular plant species with highest average cover, Waugoshance Point.

Species	Common name	Average cover (%) ± S.E.
<i>Cladium mariscoides</i>	twig-rush	19.4 ± 7.6
<i>Solidago ohioensis</i>	Ohio goldenrod	6.9 ± 2.5
<i>Rhynchospora capillacea</i>	beak-rush	5.1 ± 2.7
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	2.3 ± 0.8
<i>Solidago houghtonii</i>	Houghton's goldenrod	0.7 ± 0.3
<i>Potentilla fruticosa</i> 0.5-1m	shrubby cinquefoil	0.6 ± 0.6

Species	Common name	Average cover (%) ± S.E.
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	0.5 ± 0.4
<i>Juncus balticus</i>	Baltic rush	0.5 ± 0.2
<i>Panicum lindheimeri</i>	panic grass	0.4 ± 0.3
<i>Primula mistassinica</i>	dwarf Canadian primrose	0.2 ± 0.1

Table 34. Ten most important vascular plant species, Waugoshance Point.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Cladium mariscoides</i>	twig-rush	51.7	8.7	30.2
<i>Solidago ohioensis</i>	Ohio goldenrod	18.4	6.7	12.5
<i>Rhynchospora capillacea</i>	beak-rush	13.6	5.4	9.5
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	6.2	6.7	6.5
<i>Schoenoplectus pungens</i>	three-square	0.3	7.4	3.8
<i>Calamintha arkansana</i>	low calamint	0.5	6.0	3.3
<i>Panicum lindheimeri</i>	panic grass	1.1	5.4	3.2
<i>Primula mistassinica</i>	dwarf Canadian primrose	0.5	5.4	3.0
<i>Juncus balticus</i>	Baltic rush	1.3	3.4	2.3
<i>Solidago houghtonii</i>	Houghton's goldenrod	1.8	2.7	2.3

Among environmental variables, Waugoshance Point was characterized by scattered moss cover and bare mineral soil and large areas of unvegetated cobble and standing water (Table 35). No crayfish burrows were observed in the sample plots.

Table 35. Environmental variables, frequency and average value per plot, Waugoshance Point.

Environmental variable	Frequency (%)	Average cover (%) ± S.E.
Moss cover	42.1	2.0 ± 0.9
Unvegetated mineral soil	31.6	1.0 ± 0.4
Unvegetated marl	10.5	4.9 ± 4.7
Unvegetated peat	0	0
Unvegetated cobble	47.4	31.2 ± 9.8
Unvegetated wood	5.3	0.4 ± 0.4
Standing water	47.4	33.3 ± 10.7
Water depth (cm)	47.4	3.9 ± 1.6
Crayfish burrows	0	0 burrows

Element Occurrences

The coastal fen and Great Lakes marsh occurrences were updated during 2010 surveys. In addition, previously documented populations of butterwort and Houghton's goldenrod were encountered in 2010 (Table 36).

Table 36. Known and newly documented element occurrences, Waugoshance Point (listed rare species known from coastal fen or associated wetlands).

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Coastal fen		S2	2009	2010

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Great Lakes marsh		S3	1985	2010
<i>Pinguicula vulgaris</i>	butterwort	SC; S3	1948	2010
<i>Solidago houghtonii</i>	Houghton's goldenrod	T/LT; S3/G3	1952	2010



A large population of the state and federally threatened Houghton's goldenrod (*Solidago houghtonii*) occurs in the coastal fen, limestone cobble shore, and Great Lakes marsh at Waugoshance Point.

DUDLEY BAY WEST
T41N R02E S3
Mackinac County (Ecoregional Sub-subsection VIII.1.1)



This small area of coastal fen occurs at the mouth of a small stream in the western portion of Dudley Bay, and is associated with limestone bedrock lakeshore and limestone cobble shore along Lake Huron. The fen occurs on a patchy, heterogeneous substrate of circumneutral to moderately alkaline lacustrine sand, gravel, cobble, and clay, overlain in places by shallow sapric peat. Vegetation zones range from peaty sand flats with sedge hummocks to low-shrub dominated zones on shallow peat over cobble to a relatively narrow emergent zone in shallow standing water.

Vegetation and Environmental Data

A total of 42 vascular plant species were encountered in plots along the 110-meter belt transect (Figure 7), comprising 51% of the 83 species identified in a meander survey of the site¹ (Appendix 3f). Eight species (19%) were encountered in 50% or more of the plots (Table 37). One species averaged greater than 10% cover; 12 species averaged 1% or greater cover (Table 38). The most important plant species were shrubby cinquefoil (*Potentilla fruticosa*), beak-rush (*Rhynchospora capillacea*), and northern white-cedar (*Thuja occidentalis*) (Table 39).

¹ The overall species list for Dudley Bay includes the coastal fens at Dudley Bay East and Dudley Bay West.



Figure 7. Dudley Bay West coastal fen and transect.

Table 37. Thirteen most frequently encountered vascular plant species, Dudley Bay West.

Species	Common name	Frequency (%)
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	81.8
<i>Cladium mariscoides</i>	twig-rush	72.7
<i>Schoenoplectus pungens</i>	three-square	72.7
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	72.7
<i>Myrica gale</i> <0.5m	sweet gale	54.6
<i>Rhynchospora capillacea</i>	beak-rush	54.6
<i>Solidago ohioensis</i>	Ohio goldenrod	54.6
<i>Tofieldia glutinosa</i>	false asphodel	54.6
<i>Lobelia kalmii</i>	Kalm's lobelia	45.5
<i>Aster umbellatus</i>	tall flat-top white aster	36.4
<i>Carex stricta</i>	tussock sedge	36.4
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	36.4
<i>Juncus balticus</i>	Baltic rush	36.4

Table 38. Ten vascular plant species with highest average cover, Dudley Bay West.

Species	Common name	Average cover (%) ± S.E.
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	11.1 ± 5.9
<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	8.6 ± 8.6
<i>Rhynchospora capillacea</i>	beak-rush	8.4 ± 3.0

<i>Juncus balticus</i>	Baltic rush	4.9 ± 3.6
<i>Cladium mariscoides</i>	twig-rush	3.6 ± 1.3
<i>Myrica gale</i> 0.5 – 1m	sweet gale	3.5 ± 3.2
<i>Myrica gale</i> <0.5m	sweet gale	2.7 ± 1.2
<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	2.0 ± 1.4
<i>Alnus rugosa</i> 3 – 10m	tag alder	2.0 ± 2.0
<i>Carex stricta</i>	tussock sedge	1.7 ± 0.9

Table 39. Ten most important vascular plant species, Dudley Bay West.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	19.9	6.7	13.3
<i>Rhynchospora capillacea</i>	beak-rush	15.0	4.4	9.7
<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	15.5	0.7	8.1
<i>Cladium mariscoides</i>	twig-rush	6.5	5.9	6.2
<i>Juncus balticus</i>	Baltic rush	8.8	3.0	5.9
<i>Myrica gale</i> <0.5m	sweet gale	4.9	4.4	4.7
<i>Schoenoplectus pungens</i>	three-square	1.8	5.9	3.9
<i>Myrica gale</i> 0.5 – 1m	sweet gale	6.2	1.5	3.8
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	0.2	5.9	3.1
<i>Carex stricta</i>	tussock sedge	3.1	3.0	3.0

Among environmental variables, Dudley Bay West was characterized by significant areas of moss cover and unvegetated mineral soil (Table 40). No crayfish burrows were documented in the sample plots.

Table 40. Environmental variables, frequency and average value per plot, Dudley Bay West.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	63.6	24.5 ± 11.2
Unvegetated mineral soil	54.6	10.0 ± 6.4
Unvegetated marl	0	0
Unvegetated peat	0	0
Unvegetated cobble	0	0
Unvegetated wood	0	0
Standing water	18.2	2.5 ± 2.3
Water depth (cm)	NA	0.7 ± 0.5
Crayfish burrows	0	0.0 burrows

Element Occurrences

This coastal fen was previously surveyed in 1992 (Table 41). The previously documented population of dwarf lake iris (*Iris lacustris*) was redocumented in 2010.

Table 41. Known and newly documented element occurrences, Dudley Bay West.

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Coastal fen		S2	1991	2010
<i>Iris lacustris</i>	dwarf lake iris	T/LT; G3/S3	1981	2010

DUDLEY BAY EAST
T41N R02E S2
Mackinac County (Ecoregional Sub-subsection VIII.1.1)



This relatively small coastal fen occurs in a protected embayment in the eastern portion of Dudley Bay, where it is associated with limestone cobble shore and limestone bedrock lakeshore along Lake Huron. The coastal fen has developed on circumneutral to moderately alkaline fine lacustrine sands, overlain in places by a thin veneer of organic matter. Large cobble and boulders occur primarily along the shoreline. Vegetation zones range from infrequently disturbed alkaline sand flats with clumps of trees and shrubs to shallowly inundated emergent zones on the Lake Huron shoreline.

Vegetation and Environmental Data

A total of 50 vascular plant species were encountered in plots along the 180-meter belt transect (Figure 8), comprising 60% of the 83 species identified in a meander survey of the site² (Appendix 3f). Ten species (20%) were encountered in 50% or more of the plots (Table 42). No species averaged greater than 10% cover; nine species averaged 1% or greater cover (Table 43). The most important plant species were beak-rush (*Rhynchospora capillacea*), twig-rush (*Cladium mariscoides*), and shrubby cinquefoil (*Potentilla fruticosa*) (*Thuja occidentalis*) (Table 44).

² The overall species list for Dudley Bay includes the coastal fens at Dudley Bay East and Dudley Bay West.



Figure 8. Dudley Bay East coastal fen and transect.

Table 42. Ten most frequently encountered vascular plant species, Dudley Bay East.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	75.0
<i>Solidago ohioensis</i>	Ohio goldenrod	75.0
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	68.8
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	56.3
<i>Parnassia glauca</i>	grass-of-Parnassus	56.3
<i>Primula mistassinica</i>	dwarf Canadian primrose	56.3
<i>Rhynchospora capillacea</i>	beak-rush	56.3
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	56.3
<i>Calamintha arkansana</i>	low calamint	50.0
<i>Juncus balticus</i>	Baltic rush	50.0

Table 43. Ten vascular plant species with highest average cover, Dudley Bay East.

Species	Common name	Average cover (%) ± S.E.
<i>Rhynchospora capillacea</i>	beak-rush	8.8 ± 5.6
<i>Cladium mariscoides</i>	twig-rush	7.2 ± 3.0
<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	6.6 ± 5.3
<i>Carex stricta</i>	tussock sedge	3.0 ± 2.5
<i>Solidago ohioensis</i>	Ohio goldenrod	2.7 ± 0.8
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	2.2 ± 0.9

Species	Common name	Average cover (%) ± S.E.
<i>Myrica gale</i> <0.5m	sweet gale	1.8 ± 0.7
<i>Calamintha arkansana</i>	low calamint	1.4 ± 0.6
<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	1.1 ± 1.1
<i>Juncus balticus</i>	Baltic rush	0.8 ± 0.5

Table 44. Ten most important vascular plant species, Dudley Bay East.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Rhynchospora capillacea</i>	beak-rush	21.4	4.2	12.8
<i>Cladium mariscoides</i>	twig-rush	17.5	5.5	11.5
<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	16.1	1.8	9.0
<i>Solidago ohioensis</i>	Ohio goldenrod	6.6	5.5	6.1
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	5.4	5.1	5.2
<i>Carex stricta</i>	tussock sedge	7.4	1.8	4.6
<i>Calamintha arkansana</i>	low calamint	3.5	3.7	3.6
<i>Myrica gale</i> <0.5m	sweet gale	4.4	2.8	3.6
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	1.6	4.2	2.9
<i>Juncus balticus</i>	Baltic rush	2.0	3.7	2.8

Among environmental variables, Dudley Bay East was characterized by significant areas of unvegetated mineral soil (Table 45). No crayfish burrows were documented in the sample plots.

Table 45. Environmental variables, frequency and average value per plot, Dudley Bay East.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	50.0	2.7 ± 1.1
Unvegetated mineral soil	50.0	12.2 ± 7.4
Unvegetated marl	0	0
Unvegetated peat	12.5	0.3 ± 0.2
Unvegetated cobble	12.5	0.6 ± 0.5
Unvegetated wood	0	0
Standing water	12.5	12.5 ± 8.5
Water depth (cm)	NA	1.5 ± 1.1
Crayfish burrows	0	0 burrows

Element Occurrences

The coastal fen surveyed at this site in 2010 was previously undocumented, and will be incorporated into the previously documented occurrence at Dudley Bay West (Table 46). No state-listed plant or animal species were documented from this site.

Table 46. Known and newly documented element occurrences, Dudley Bay East.

Community/species	State Status	Year First Observed	Year Last Observed
Coastal fen	S2	2010	2010

ST. MARTIN POINT
T41N R02W S2
Mackinac County (Ecoregional Sub-subsection VIII.1.1)



St. Martin Point, at the western edge of the Les Cheneaux region of Mackinac County, supports relatively small areas of coastal marsh that have developed in protected embayments that are partially buffered from Lake Huron by bands of limestone cobble shore. Areas of limestone cobble are frequent within the coastal fen, creating a patchy matrix of the two communities. Soils in the coastal fen zones range from mildly to moderately alkaline, shallow sapric peat over gravel and clay to mildly alkaline peaty sands in the crevices of moderate to large-sized cobble. Large limestone cobble underlies the fen at shallow depths. Several vegetation zones are present, including seepage zones with shallow peat, low shrub-dominated meadow on limestone cobble, and an emergent zone in shallow water.

Vegetation and Environmental Data

A total of 50 vascular plant species were encountered in plots along the 150-meter belt transect (Figure 9), comprising 62% of the 81 species identified in a meander survey of the site (Appendix 3g). Eight species (16%) were encountered in 50% or more of the plots (Table 47). Two species averaged greater than 10% cover; ten species averaged 1% or greater cover (Table 48). Shrubby cinquefoil (*Potentilla fruticosa*) and twig-rush (*Cladium mariscoides*) were the most important species (Table 49).



Figure 9. St. Martin Point coastal fen and transect.

Table 47. Twelve most frequently encountered vascular plant species, St. Martin Point.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	80.0
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	73.3
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	73.3
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	60.0
<i>Panicum lindheimeri</i>	panic grass	60.0
<i>Parnassia glauca</i>	grass-of-Parnassus	53.3
<i>Viola</i> sp.	violet sp.	53.3
<i>Calamintha arkansana</i>	low calamint	53.3
<i>Solidago ohioensis</i>	Ohio goldenrod	46.7
<i>Danthonia spicata</i>	poverty oats	46.7
<i>Eleocharis rostellata</i>	beaked spike-rush	46.7
<i>Tofieldia glutinosa</i>	false asphodel	46.7

Table 48. Ten vascular plant species with highest average cover, St. Martin Point.

Species	Common name	Average cover (%) \pm S.E.
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	15.1 \pm 5.2
<i>Cladium mariscoides</i>	twig-rush	10.6 \pm 4.4
<i>Myrica gale</i> <0.5m	sweet gale	5.0 \pm 3.7
<i>Solidago ohioensis</i>	Ohio goldenrod	3.7 \pm 1.3

Species	Common name	Average cover (%) ± S.E.
<i>Schizachyrium scoparium</i>	little bluestem	3.5 ± 3.3
<i>Danthonia spicata</i>	poverty oats	3.2 ± 2.3
<i>Eleocharis rostellata</i>	beaked spike-rush	2.7 ± 1.2
<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	2.6 ± 1.8
<i>Eleocharis elliptica</i>	golden-seeded spike-rush	1.6 ± 0.9
<i>Juncus balticus</i>	Baltic rush	1.1 ± 0.5

Table 49. Ten most important vascular plant species, St. Martin Point.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	26.6	4.9	15.8
<i>Cladium mariscoides</i>	twig-rush	18.6	5.4	12.0
<i>Myrica gale</i> <0.5m	sweet gale	8.8	2.2	5.5
<i>Solidago ohioensis</i>	Ohio goldenrod	6.6	3.1	4.9
<i>Danthonia spicata</i>	poverty oats	5.6	3.1	4.4
<i>Schizachyrium scoparium</i>	little bluestem	6.2	1.8	4.0
<i>Eleocharis rostellata</i>	beaked spike-rush	4.8	3.1	4.0
<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	4.6	1.8	3.2
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	0.5	4.9	2.7
<i>Parnassia glauca</i>	grass-of-Parnassus	1.7	3.6	2.6

Among environmental variables, St. Martin Point was characterized by significant areas of moss cover, unvegetated cobble, and open water (Table 50). No crayfish burrows were documented in the sample plots.

Table 50. Environmental variables, frequency and average value per plot, St. Martin Point.

Environmental variable	Frequency (%)	Average cover (%) ± S.E.
Moss cover	73.3	25.3 ± 8.1
Unvegetated mineral soil	6.7	0.0 ± 0.0
Unvegetated marl	0	0
Unvegetated peat	0	0
Unvegetated cobble	40.0	11.7 ± 7.1
Unvegetated wood	0	0
Standing water	26.7	26.7 ± 11.8
Water depth (cm)	NA	1.5 ± 0.7
Crayfish burrows	0	0.0 burrows

Element Occurrences

New occurrences for coastal fen, limestone cobble shore, and a rare leafhopper were documented at St. Martin Point in 2010. The previously identified occurrence of Houghton's goldenrod was redocumented in the 2010 survey (Table 51).

Table 51. Known and newly documented element occurrences, St. Martin Point.

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Coastal fen		S2	2010	2010
Limestone cobble shore		S3	2010	2010
<i>Solidago houghtonii</i>	Houghton's goldenrod	T/LT; S3/G3	1984	2010
<i>Flexamia delongi</i>	leafhopper	SC; S1S2	2010	2010



The coastal fen at St. Martin Point grades into bands of limestone cobble shore along Lake Huron.

CHEBOYGAN STATE PARK SOUTH FEN
T38N R01W S27, 34
Cheboygan County (Ecoregional Sub-subsection VII.6.3)



Cheboygan State Park South Fen occurs within an extensive coastal complex consisting of Great Lakes marsh, interdunal wetland, open dunes, Great Lakes barrens, boreal forest, and northern fen. The south fen consists of shallowly inundated alkaline sand flats covered by a thin veneer of marl. This site is at least partly protected from wind, wave, and ice action by a low open dune ridge near the shoreline. A powerline cut passes through a portion of the fen and has caused localized disturbance. Otherwise, the site appears undisturbed. Species richness is low, with beak-rush (*Rhynchospora capillacea*) and twig-rush (*Cladium mariscoides*) comprising much of the vegetative biomass. Shrubs and stunted conifers occur on hummocks that are distributed sparsely throughout the fen.

Vegetation and Environmental Data

A total of 22 vascular plant species were encountered in plots along the 150-meter belt transect (Figure 10), comprising 33% of the 67 species identified in a meander survey of this site and the discontinuous Cheboygan State Park North Fen site (Appendix 5h). Four species (18%) were encountered in 50% or more of the plots (Table 52). One species averaged greater than 10% cover; only four species averaged 1% or greater cover (Table 53). Beak-rush (*Rhynchospora capillacea*) was by far the most important species, due largely to its high relative cover (Table 54).



Figure 10. Cheboygan State Park South coastal fen and transect line.

Table 52. Eleven most frequently encountered vascular plant species, Cheboygan State Park South Fen.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	100.0
<i>Rhynchospora capillacea</i>	beak-rush	92.3
<i>Utricularia cornuta</i>	horned bladderwort	80.8
<i>Solidago ohioensis</i>	Ohio goldenrod	53.9
<i>Sarracenia purpurea</i>	pitcher-plant	26.9
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	23.1
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	19.2
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	19.2
<i>Tofieldia glutinosa</i>	false asphodel	19.2
<i>Eleocharis rostellata</i>	beaked spike-rush	11.5
<i>Rhynchospora alba</i>	white beak-rush	11.5

Table 53. Ten vascular plant species with highest average cover, Cheboygan State Park South Fen.

Species	Common name	Average cover (%) ± S.E.
<i>Rhynchospora capillacea</i>	beak-rush	25.2 ± 2.4
<i>Cladium mariscoides</i>	twig-rush	4.7 ± 0.6
<i>Myrica gale</i> <0.5m	sweet gale	1.4 ± 1.3

Species	Common name	Average cover (%) ± S.E.
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	1.1 ± 1.0
<i>Solidago ohioensis</i>	Ohio goldenrod	0.6 ± 0.4
<i>Utricularia cornuta</i>	horned bladderwort	0.4 ± 0.1
<i>Eleocharis rostellata</i>	beaked spike-rush	0.4 ± 0.4
<i>Rhynchospora alba</i>	white beak-rush	0.3 ± 0.2
<i>Sarracenia purpurea</i>	pitcher-plant	0.3 ± 0.1
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	0.2 ± 0.1

Table 54. Ten most important vascular plant species, Cheboygan State Park South Fen.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Rhynchospora capillacea</i>	beak-rush	72.5	17.7	45.1
<i>Cladium mariscoides</i>	twig-rush	13.5	19.1	16.3
<i>Utricularia cornuta</i>	horned bladderwort	1.2	15.4	8.3
<i>Solidago ohioensis</i>	Ohio goldenrod	1.8	10.3	6.0
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	3.1	3.7	3.4
<i>Sarracenia purpurea</i>	pitcher-plant	0.7	5.2	2.9
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	0.7	4.4	2.5
<i>Myrica gale</i> <0.5m	sweet gale	3.9	0.7	2.3
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	0.1	3.7	1.9
<i>Tofieldia glutinosa</i>	false asphodel	0.0	3.7	1.9

Among environmental variables, Cheboygan State Park South Fen was characterized by shallow standing water over most of the wetland surface (Table 55). Moss and unvegetated substrate were infrequently encountered.

Table 55. Environmental variables, frequency and average value per plot, Cheboygan State Park South Fen.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	7.7	0.5 ± 0.4
Unvegetated mineral soil	0	0
Unvegetated marl	7.7	0.1 ± 0.0
Unvegetated peat	0	0
Unvegetated cobble	0	0
Unvegetated wood	0	0
Standing water	100	92.2 ± 3.9
Water depth (cm)	NA	3.6 ± 0.4
Crayfish burrows	0	0 burrows

Element Occurrences

This park was surveyed in 2010, and portions of the previously documented Great Lakes marsh were remapped and reclassified as coastal fen. No other element occurrences were documented within this site.

Table 56. Known and newly documented element occurrences, Cheboygan State Park South Fen.

Community/species	Common name	State Status	Year First Observed	Year Last Observed
Coastal fen		S2	2010	2011
<i>Botaurus lentiginosus</i>	American bittern	SC, S3S4	1998	1998



Cheboygan State Park South Fen is comprised of an inundated alkaline sand flat partially protected by open dune ridges along Lake Huron.

CHEBOYGAN STATE PARK NORTH FEN
T38N R01W S22
Cheboygan County (Ecoregional Sub-subsection VII.6.3)



The Cheboygan State Park North Fen consists of two primary discontinuous areas of shallowly inundated alkaline flats that are situated between an extensive Great Lakes marsh towards Lake Huron and a second-growth boreal forest inland. The substrate is primarily moderately alkaline fine lacustrine sands, in places overlain by a thin veneer of marl with local areas of sapric peat under sedge-covered hummocks. The fen openings here are largely undisturbed, and no non-native plant taxa were documented in the immediate area.

Vegetation and Environmental Data

A total of 48 vascular plant species were encountered in plots along the 100-meter belt transect (Figure 11), comprising 72% of the 67 species identified in a meander survey of this site and the discontinuous Cheboygan State Park South Fen site (Appendix 5h). Six species (8%) were encountered in 50% or more of the plots (Table 57). Two species averaged greater than 10% cover; nine species averaged 1% or greater cover (Table 58). Baltic rush (*Juncus balticus*) and shrubby cinquefoil (*Potentilla fruticosa*) were the most important species (Table 59).



Figure 11. Cheboygan State Park North coastal fen and transect line.

Table 57. Ten most frequently encountered vascular plant species, Cheboygan State Park North Fen.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	71.4
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	64.3
<i>Juncus balticus</i>	Baltic rush	57.1
<i>Solidago ohioensis</i>	Ohio goldenrod	57.1
<i>Rhynchospora capillacea</i>	beak-rush	50.0
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	50.0
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	35.7
<i>Carex buxbaumii</i>	Buxbaum's sedge	35.7
<i>Utricularia cornuta</i>	horned bladderwort	35.7
<i>Lycopus uniflorus</i>	northern bugleweed	35.7

Table 58. Ten vascular plant species with highest average cover, Cheboygan State Park North Fen.

Species	Common name	Average cover (%) ± S.E.
<i>Juncus balticus</i>	Baltic rush	12.8 ± 4.3
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	11.0 ± 4.3
<i>Rhynchospora capillacea</i>	beak-rush	4.6 ± 2.4
<i>Cladium mariscoides</i>	twig-rush	3.5 ± 0.9

Species	Common name	Average cover (%) ± S.E.
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	2.6 ± 2.5
<i>Myrica gale</i> <0.5m	sweet gale	2.4 ± 1.8
<i>Solidago ohioensis</i> / <i>S. uliginosa</i> *	Ohio goldenrod/bog goldenrod	2.1 ± 1.5
<i>Carex buxbaumii</i>	Buxbaum's sedge	1.9 ± 1.5
<i>Solidago ohioensis</i>	Ohio goldenrod	1.1 ± 0.5
<i>Solidago uliginosa</i>	bog goldenrod	0.9 ± 0.9

*Where basal leaves of *Solidago ohioensis* and *S. uliginosa* co-occurred, individuals were not identified to species.

Table 59. Ten most important vascular plant species, Cheboygan State Park North Fen.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Juncus balticus</i>	Baltic rush	26.9	5.6	16.3
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	23.1	6.3	14.7
<i>Rhynchospora capillacea</i>	beak-rush	9.7	4.9	7.3
<i>Cladium mariscoides</i>	twig-rush	7.4	7.0	7.2
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	5.5	3.5	4.5
<i>Solidago ohioensis</i>	Ohio goldenrod	2.4	5.6	4.0
<i>Carex buxbaumii</i>	Buxbaum's sedge	4.1	3.5	3.8
<i>Myrica gale</i> <0.5m	sweet gale	5.0	1.4	3.2
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	1.0	4.9	3.0
<i>Solidago ohioensis</i> / <i>S. uliginosa</i> *	Ohio goldenrod/bog goldenrod	4.5	1.4	3.0

*Where basal leaves of *Solidago ohioensis* and *S. uliginosa* co-occurred, individuals were not identified to species.

Among environmental variables, Cheboygan State Park North Fen was characterized by very shallow standing water over much of the wetland surface (Table 60). Unvegetated marl and cobble were locally distributed along the transect. Moss cover was relatively high, especially in sedge meadow that comprised a portion of the sample unit.

Table 60. Environmental variables, frequency and average value per plot, Cheboygan State Park North Fen.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	64.3	39.4 ± 11.7
Unvegetated mineral soil	0	0
Unvegetated marl	14.3	0.1 ± 0.1
Unvegetated peat	0	0
Unvegetated cobble	21.4	1.6 ± 1.4
Unvegetated wood	0	0
Standing water	71.4	44.4 ± 11.8
Water depth (cm)	NA	0.7 ± 0.2
Crayfish burrows	0	0 burrows

Element Occurrences

This park was surveyed in 2010, and a portion of the previously documented Great Lakes marsh was remapped and reclassified as coastal fen. The coastal fen transect sampled in 2011 extended into the Great Lakes marsh occurrence. The previously documented occurrence of Houghton's goldenrod was observed in 2010 but not in 2011, likely due to the earlier season survey in 2011.

Table 61. Known and newly documented element occurrences, Cheboygan State Park North Fen.

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Great Lakes marsh		S3	1985	2011*
Coastal fen		S2	2010	2011
<i>Solidago houghtonii</i>	Houghton's goldenrod	T/LT; S3/G3	1981	2010
<i>Flexamia delongi</i>	leafhopper	SC, S1S2	2011	2011

*A portion of the Great Lakes marsh was reclassified and remapped as coastal fen in 2010.



Alkaline sand flats, often covered with a thin marly biological crust, support pitcher-plant (*Sarracenia purpurea*) and horned bladderwort (*Utricularia cornuta*).

ALBANY CREEK MOUTH
T41N R03E S8
Mackinac County (Ecoregional Sub-subsection VIII.1.1)



Albany Creek Mouth is a saturated interdunal panne located between open foredunes bordering Lake Huron and low forested beach ridges inland along M-134. This site was selected for sampling due to its similarity to documented coastal fens in substrate and vegetative structure and composition. The substrate is generally moist to saturated moderately alkaline fine sand, in places overlain by a thin marly biocrust or shallow circumneutral sapric peat. The wetland is heavily impacted by the use of off-road vehicles; established trails are frequent throughout the site, and off-road vehicle use was also noted outside the established two-tracks. This site is protected from wind, wave, and ice action by open dune ridges near the shoreline.

Vegetation and Environmental Data

A total of 36 vascular plant species were encountered in plots along the 100-meter belt transect (Figure 12), comprising 69% of the 52 species identified in a meander survey of the site (Appendix 5i). Four species (11%) were encountered in 50% or more of the plots (Table 62). One species averaged greater than 10% cover; five species averaged 1% or greater cover (Table 63). Twig-rush (*Cladium mariscoides*), beak-rush (*Rhynchospora capillacea*), and shrubby cinquefoil (*Potentilla fruticosa*) were the most important species (Table 64).



Figure 12. Albany Creek Mouth intertidal wetland and transect line.

Table 62. Eleven most frequently encountered vascular plant species, Albany Creek Mouth.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	100.0
<i>Utricularia cornuta</i>	horned bladderwort	66.7
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	60.0
<i>Rhynchospora capillacea</i>	beak-rush	53.3
<i>Solidago ohioensis</i>	Ohio goldenrod	46.7
<i>Muhlenbergia glomerata</i>	marsh wild timothy	40.0
<i>Panicum lindheimeri</i>	panic grass	40.0
<i>Tofieldia glutinosa</i>	false asphodel	40.0
<i>Schoenoplectus pungens</i>	three-square	33.3
<i>Rhynchospora alba</i>	white beak-rush	33.3
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	33.3

Table 63. Ten vascular plant species with highest average cover, Albany Creek Mouth.

Species	Common name	Average cover (%) ± S.E.
<i>Cladium mariscoides</i>	twig-rush	12.6 ± 2.7
<i>Rhynchospora capillacea</i>	beak-rush	6.1 ± 3.1
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	4.7 ± 3.1
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	1.2 ± 1.0

Species	Common name	Average cover (%) ± S.E.
<i>Sarracenia purpurea</i>	pitcher-plant	1.0 ± 0.5
<i>Myrica gale</i> <0.5m	sweet gale	0.9 ± 0.6
<i>Solidago ohioensis</i>	Ohio goldenrod	0.7 ± 0.5
<i>Schoenoplectus pungens</i>	three-square	0.7 ± 0.4
<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	0.7 ± 0.7
<i>Rhynchospora alba</i>	white beak-rush	0.6 ± 0.5

Table 64. Ten most important vascular plant species, Albany Creek Mouth.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Cladium mariscoides</i>	twig-rush	41.5	10.3	25.9
<i>Rhynchospora capillacea</i>	beak-rush	19.8	5.5	12.7
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	15.8	6.2	11.0
<i>Utricularia cornuta</i>	horned bladderwort	0.4	6.9	3.6
<i>Solidago ohioensis</i>	Ohio goldenrod	1.9	4.8	3.3
<i>Schoenoplectus pungens</i>	three-square	2.4	3.4	2.9
<i>Rhynchospora alba</i>	white beak-rush	2.1	3.4	2.8
<i>Eleocharis quinqueflora</i>	spike-rush	4.2	1.4	2.8
<i>Myrica gale</i> <0.5m	sweet gale	3.0	2.1	2.5
<i>Muhlenbergia glomerata</i>	marsh wild timothy	0.6	4.1	2.4

Among environmental variables, Albany Creek Mouth was characterized by small areas of bare sand over most of the wetland surface (Table 65). Moss was infrequently encountered; no standing water or unvegetated marl, peat, cobble, or wood was present along the transect.

Table 65. Environmental variables, frequency and average value per plot, Albany Creek Mouth.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	20.0	0.4 ± 0.3
Unvegetated mineral soil	93.3	6.2 ± 1.5
Unvegetated marl	0	0
Unvegetated peat	0	0
Unvegetated cobble	0	0
Unvegetated wood	0	0
Standing water	0	0
Water depth (cm)	NA	0
Crayfish burrows	0	0 burrows

Element Occurrences

The previously documented occurrences of interdunal wetland and butterwort were observed in 2011 (Table 66). The interdunal wetland was remapped based on the field survey.

Table 66. Known and newly documented element occurrences, Albany Creek Mouth.

Community/species	Common name	State Status	Year First Observed	Year Last Observed
Interdunal wetland		S2	1979	2011
<i>Pinguicula vulgaris</i>	butterwort	SC/S3	1960	2011

PECK BAY
T41N R01W S13; T41N R01E S18
Mackinac County (Ecoregional Sub-subsection VIII.1.1)



Peck Bay supports a small calcareous fen that grades into Great Lakes marsh and open water. The site is similar to inland occurrences of northern fen in the Straits region, characterized by large areas of marl flats with low sedge tussocks and clumps of dwarfed conifers on raised peat islands. Moderately alkaline marl is the predominant substrate; it is occasionally mixed with sand and small gravel. Sapric peat underlying hummocks ranges from circumneutral to moderately alkaline. Trails in adjacent forested areas and occasional tire tracks were noted during the survey, but these disturbances were local. The western and northern portions of the fen appeared to be largely protected from wind, wave, and ice action. However, driftwood and evidence of storm surges was noted in the eastern portion of the fen.

Vegetation and Environmental Data

A total of 48 vascular plant species were encountered in plots along the 150-meter belt transect (Figure 13), comprising 68% of the 71 species identified in a meander survey of the site (Appendix 5j). Three species (6%) were encountered in 50% or more of the plots (Table 67). One species averaged greater than 10% cover; six species averaged 1% or greater cover (Table 68). Beaked spike-rush (*Eleocharis rostellata*) was the dominant species, due especially to its very high relative cover (Table 69).

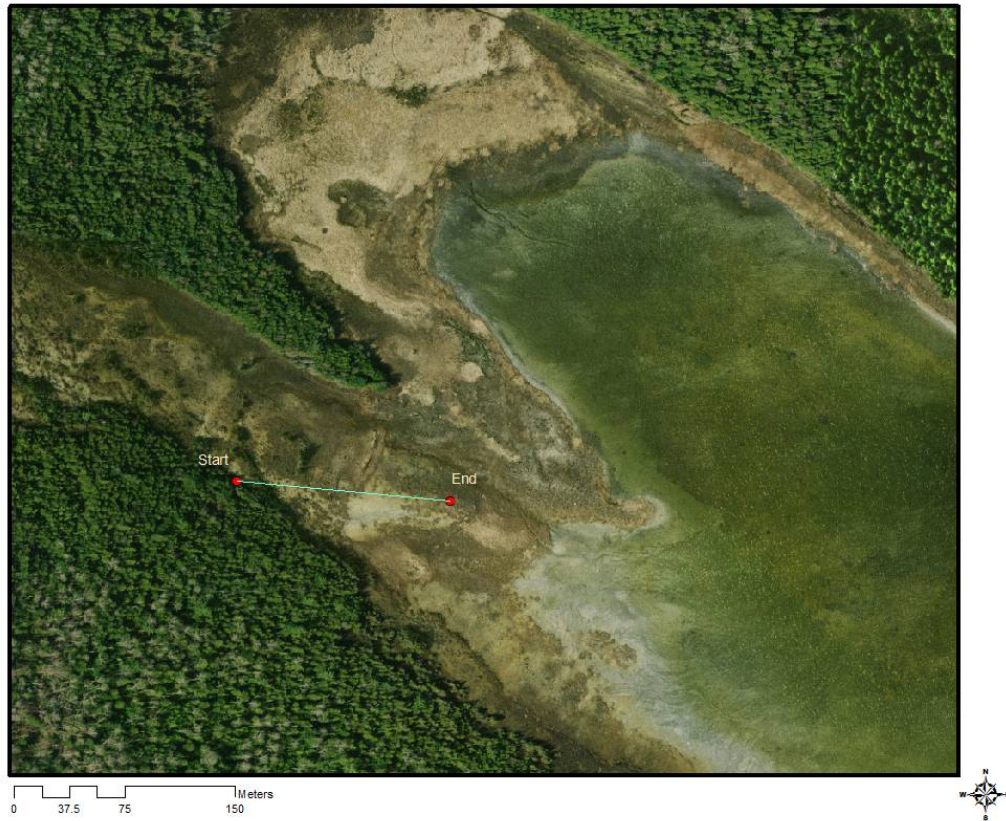


Figure 13. Peck Bay coastal fen and transect line.

Table 67. Ten most frequently encountered vascular plant species, Peck Bay.

Species	Common name	Frequency (%)
<i>Eleocharis rostellata</i>	beaked spike-rush	84.0
<i>Cladium mariscoides</i>	twig-rush	68.0
<i>Rhynchospora capillacea</i>	beak-rush	56.0
<i>Parnassia glauca</i>	grass-of-Parnassus	48.0
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	44.0
<i>Tofieldia glutinosa</i>	false asphodel	44.0
<i>Muhlenbergia glomerata</i>	marsh wild-timothy	44.0
<i>Utricularia cornuta</i>	horned bladderwort	40.0
<i>Solidago uliginosa</i>	bog goldenrod	32.0
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	28.0

Table 68. Ten vascular plant species with highest average cover, Peck Bay.

Species	Common name	Average cover (%) ± S.E.
<i>Eleocharis rostellata</i>	beaked spike-rush	25.3 ± 6.2
<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	1.4 ± 1.2
<i>Cladium mariscoides</i>	twig-rush	1.3 ± 0.4
<i>Triglochin maritimum</i> / <i>T. palustris</i> *	common bog arrow-grass/slender bog arrow-grass	1.3 ± 0.6
<i>Rhynchospora capillacea</i>	beak-rush	1.3 ± 0.5

Species	Common name	Average cover (%) ± S.E.
<i>Sarracenia purpurea</i>	pitcher-plant	1.0 ± 0.5
<i>Pinus strobus</i> 1 – 3m	white pine	0.6 ± 0.6
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	0.5 ± 0.3
<i>Juncus balticus</i>	Baltic rush	0.4 ± 0.3
<i>Solidago uliginosa</i>	bog goldenrod	0.4 ± 0.2

*Where basal leaves of *Triglochin maritimum* and *T. palustris* co-occurred, individuals were not identified to species.

Table 69. Ten most important vascular plant species, Peck Bay.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Eleocharis rostellata</i>	beaked spike-rush	67.5	9.1	38.3
<i>Cladium mariscoides</i>	twig-rush	3.5	7.3	5.4
<i>Rhynchospora capillacea</i>	beak-rush	3.4	6.0	4.7
<i>Cladium mariscoides</i>	twig-rush	7.4	7.0	7.2
<i>Triglochin maritimum</i> / <i>T. palustris</i> *	common bog arrow-grass/slender bog arrow-grass	3.4	3.9	3.7
<i>Sarracenia purpurea</i>	pitcher-plant	2.6	3.9	3.3
<i>Parnassia glauca</i>	grass-of-Parnassus	1.0	5.2	3.1
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	1.4	4.3	2.8
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	0.6	4.7	2.7
<i>Tofieldia glutinosa</i>	false asphodel	0.3	4.7	2.5

*Where basal leaves of *Triglochin maritimum* and *T. palustris* co-occurred, individuals were not identified to species.

Among environmental variables, Peck Bay was characterized by shallow standing water over most of the wetland surface (Table 70). Moss-covered hummocks and exposed marl were also encountered in several plots.

Table 70. Environmental variables, frequency and average value per plot, Peck Bay.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	44.0	19.9 ± 6.6
Unvegetated mineral soil	0	0
Unvegetated marl	32.0	0.4 ± 0.1
Unvegetated peat	0	0
Unvegetated cobble	4.0	0.0 ± 0.0
Unvegetated wood	0	0
Standing water	96.0	55.7 ± 7.4
Water depth (cm)	NA	1.2 ± 0.1
Crayfish burrows	0	0 burrows

Element Occurrences

The previously documented occurrences of coastal fen and Great Lakes marsh were observed in 2011 (Table 71). The coastal fen and Great Lakes marsh were remapped based on the field survey, although only the coastal fen was surveyed. Previously documented occurrences of dwarf lake iris and Houghton's goldenrod were not observed during the 2011 survey, although they likely remain present.

Table 71. Known and newly documented element occurrences, Peck Bay.

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Coastal fen		S2	1989	2011
Great Lakes marsh		S3	1989	2011
<i>Iris lacustris</i>	dwarf lake iris	T/LT; S3/G3	1999	1999
<i>Solidago houghtonii</i>	Houghton's goldenrod	T/LT; S3/G3	1993	1993
<i>Flexamia delongi</i>	leafhopper	SC; S1S2	2011	2011



Marl flats with interspersed peat hummocks characterize much of the coastal fen at Peck Bay.

MERIDIAN FEN

T41N R01W S24, 13; T41N R01E S18, 19

Mackinac County (Ecoregional Sub-subsection VIII.1.1)



Meridian Fen supports marl flats, peat islands, and shallow marl-bottomed pools in a small abandoned embayment on the south side of Marquette Island. The substrate is quite variable, ranging from moderately alkaline sand and gravel to marly clay, with moderately alkaline, loose sapric peat in hummocks. The fen was largely undisturbed, with local occurrences of mildly invasive plant species in the adjacent wooded areas and on the cobble beach. The north portion of the fen is protected from wind, wave, and ice action by a low forested beach ridge; the south portion of the fen likely experiences more frequent disturbance.

Vegetation and Environmental Data

A total of 39 vascular plant species were encountered in plots along the 200-meter belt transect (Figure 14), comprising 56% of the 70 species identified in a meander survey of the site (Appendix 5k). One species (3%) was encountered in 50% or more of the plots (Table 72). No species averaged greater than 10% cover; six species averaged 1% or greater cover (Table 73). Twig-rush (*Cladium mariscoides*) and spike-rush (*Eleocharis quinqueflora*) were the most important species (Table 74).



Figure 14. Meridian Fen coastal fen and transect line.

Table 72. Eleven most frequently encountered vascular plant species, Meridian Fen.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	82.4
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	47.1
<i>Triglochin maritimum</i>	common bog arrow grass	41.2
<i>Eleocharis rostellata</i>	beaked spike-rush	35.3
<i>Tofieldia glutinosa</i>	false asphodel	35.3
<i>Rhynchospora capillacea</i>	beak-rush	29.4
<i>Solidago uliginosa</i>	bog goldenrod	29.4
<i>Equisetum variegatum</i>	variegated scouring rush	29.4
<i>Triglochin maritimum</i> / <i>T. palustris</i> *	common bog arrow-grass/slender bog arrow-grass	29.4
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	29.4
<i>Parnassia glauca</i>	grass-of-Parnassus	29.4

*Where basal leaves of *Triglochin maritimum* and *T. palustris* co-occurred, individuals were not identified to species.

Table 73. Ten vascular plant species with highest average cover, Meridian Fen.

Species	Common name	Average cover (%) ± S.E.
<i>Cladium mariscoides</i>	twig-rush	3.7 ± 0.8
<i>Thuja occidentalis</i> 3 – 10m	northern white-cedar	3.6 ± 3.0
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	3.5 ± 2.6

Species	Common name	Average cover (%) ± S.E.
<i>Carex eburnea</i>	ebony sedge	2.9 ± 2.5
<i>Rhynchospora capillacea</i>	beak-rush	2.2 ± 1.7
<i>Schizachyrium scoparium</i>	little bluestem	1.6 ± 1.5
<i>Eleocharis rostellata</i>	beaked spike-rush	0.9 ± 0.8
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	0.6 ± 0.4
<i>Solidago uliginosa</i>	bog goldenrod	0.4 ± 0.2
<i>Iris lacustris</i>	dwarf lake iris	0.4 ± 0.3

Table 74. Ten most important vascular plant species, Meridian Fen.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Cladium mariscoides</i>	twig-rush	15.8	10.8	13.3
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	14.9	6.2	10.6
<i>Thuja occidentalis</i> 3 – 10m	northern white-cedar	15.3	1.5	8.4
<i>Carex eburnea</i>	ebony sedge	12.4	3.1	7.8
<i>Rhynchospora capillacea</i>	beak-rush	9.5	3.9	6.7
<i>Eleocharis rostellata</i>	beaked spike-rush	4.1	4.6	4.3
<i>Schizachyrium scoparium</i>	little bluestem	6.8	1.5	4.2
<i>Triglochin maritimum</i>	common bog arrow-grass	1.1	5.4	3.3
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	2.5	3.1	2.8
<i>Solidago uliginosa</i>	bog goldenrod	1.5	3.9	2.7

Among environmental variables, Meridian Fen was characterized by shallow standing water over most of the wetland surface (Table 75). Moss and unvegetated substrates were infrequently encountered.

Table 75. Environmental variables, frequency and average value per plot, Meridian Fen.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	23.5	2.6 ± 1.8
Unvegetated mineral soil	0	0
Unvegetated marl	23.5	0.9 ± 0.5
Unvegetated peat	0	0
Unvegetated cobble	35.3	1.0 ± 0.6
Unvegetated wood	0	0
Standing water	82.4	60.0 ± 11.8
Water depth (cm)	NA	3.4 ± 0.9
Crayfish burrows	0	0 burrows

Element Occurrences

The previously documented occurrences of coastal fen and dwarf lake iris were observed in 2011 (Table 76). The previously documented occurrence of Houghton's goldenrod was not observed during the 2011 survey, although the species likely remains present.

Table 76. Known and newly documented element occurrences, Meridian Fen.

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Coastal fen		S2	2002	2011
<i>Iris lacustris</i>	dwarf lake iris	T/LT; S3/G3	1989	2011
<i>Flexamia delongi</i>	leafhopper	SC; S1S2	2011	2011



The south portion of the coastal fen contains loose cobble and shallow marl-bottomed pools.

HORSESHOE BAY EAST

T41N R03W S4, 5

Mackinac County (Ecoregional Sub-subsection VIII.1.1)



Horseshoe Bay East supports several wetland openings protected or partially protected by gravel and sand beach ridges along the shore of Lake Huron. The wetlands lack evidence of groundwater seepage and occur on moderately alkaline cobble, gravel, and clay. The wetlands are protected within a federal wilderness area and appeared undisturbed. Non-native plants, including common reed (*Phragmites australis*) were noted locally in the adjacent Great Lakes marsh.

Vegetation and Environmental Data

A total of 24 vascular plant species were encountered in plots along the 90-meter belt transect (Figure 15), comprising 65% of the 37 species identified in a meander survey of the site (Appendix 51). Nine species (38%) were encountered in 50% or more of the plots (Table 77). Two species averaged greater than 10% cover; seven species averaged 1% or greater cover (Table 78). Little bluestem (*Schizachyrium scoparium*) and shrubby cinquefoil (*Potentilla fruticosa*) were the most important species (Table 79), followed by Ohio goldenrod (*Solidago ohioensis*) and northern white-cedar (*Thuja occidentalis*).

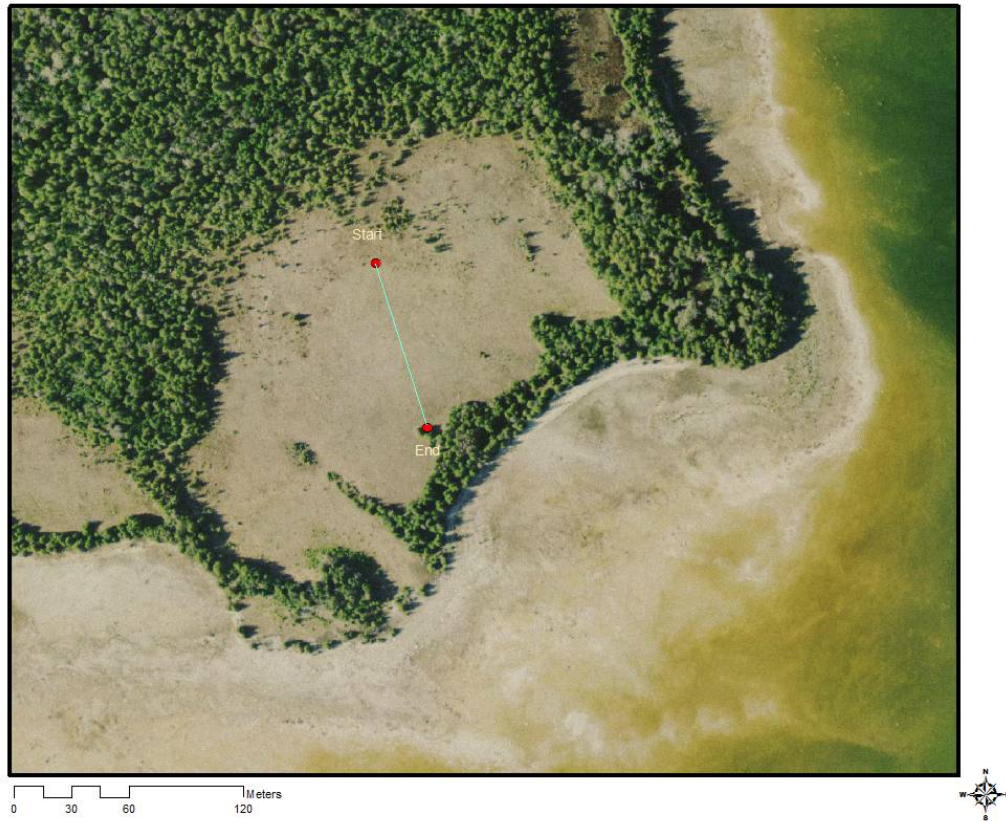


Figure 15. Horseshoe Bay East intertidal wetland and transect line.

Table 77. Twelve most frequently encountered vascular plant species, Horseshoe Bay East.

Species	Common name	Frequency (%)
<i>Schizachyrium scoparium</i>	little bluestem	100.0
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	100.0
<i>Calamintha arkansana</i>	low calamint	100.0
<i>Panicum lindheimeri</i>	panic grass	100.0
<i>Senecio pauperculus</i>	balsam ragwort	100.0
<i>Solidago ohioensis</i>	Ohio goldenrod	92.3
<i>Aster borealis</i>	rush aster	84.6
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	69.2
<i>Carex crawei</i>	Crawe's sedge	61.5
<i>Juncus balticus</i>	Baltic rush	30.8
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	30.8
<i>Parnassia glauca</i>	grass-of-Parnassus	30.8

Table 78. Ten vascular plant species with highest average cover, Horseshoe Bay East.

Species	Common name	Average cover (%) ± S.E.
<i>Schizachyrium scoparium</i>	little bluestem	18.8 ± 3.5
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	10.7 ± 2.6
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	6.2 ± 1.3
<i>Solidago ohioensis</i>	Ohio goldenrod	5.6 ± 1.4

Species	Common name	Average cover (%) ± S.E.
<i>Calamintha arkansana</i>	low calamint	3.0 ± 0.6
<i>Panicum lindheimeri</i>	panic grass	1.7 ± 0.4
<i>Senecio pauperculus</i>	balsam ragwort	1.1 ± 0.3
<i>Juncus balticus</i>	Baltic rush	0.9 ± 0.6
<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	0.8 ± 0.8
<i>Juniperus horizontalis</i>	creeping juniper	0.7 ± 0.7

Table 79. Ten most important vascular plant species, Horseshoe Bay East.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Schizachyrium scoparium</i>	little bluestem	36.8	9.4	23.1
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	21.0	9.4	15.2
<i>Solidago ohioensis</i>	Ohio goldenrod	10.9	8.6	9.8
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	12.1	6.5	9.3
<i>Calamintha arkansana</i>	low calamint	6.0	9.4	7.7
<i>Panicum lindheimeri</i>	panic grass	3.4	9.4	6.4
<i>Senecio pauperculus</i>	balsam ragwort	2.1	9.4	5.7
<i>Aster borealis</i>	rush aster	0.4	7.9	4.2
<i>Carex crawei</i>	Crawe's sedge	0.6	5.8	3.2
<i>Juncus balticus</i>	Baltic rush	1.8	2.9	2.4

Among environmental variables, Horseshoe Bay East lacked standing water and harbored a low water table (Table 80). Unvegetated areas of cobble occurred throughout the sample site.

Table 80. Environmental variables, frequency and average value per plot, Horseshoe Bay East.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	69.2	3.0 ± 1.5
Unvegetated mineral soil	23.1	0.5 ± 0.3
Unvegetated marl	0	0
Unvegetated peat	0	0
Unvegetated cobble	100.0	1.8 ± 0.4
Unvegetated wood	0	0
Standing water	0	0
Water depth (cm)	NA	0
Crayfish burrows	0	0 burrows

Element Occurrences

No element occurrences were previously documented in this area. The 2011 survey identified new occurrences of interdunal wetland and a rare leafhopper.

Table 81. Known and newly documented element occurrences, Horseshoe Bay East.

Community/species	Common name	State Status	Year First Observed	Year Last Observed
Interdunal wetland		S2	2011	2011
<i>Flexamia delongi</i>	leafhopper	SC;S1S2	2011	2011

HORSESHOE BAY WEST
T41N R03W S5
Mackinac County (Ecoregional Sub-subsection VIII.1.1)



Horseshoe Bay West supports a moderate-sized calcareous fen that grades into Great Lakes marsh and open water. The site is similar to inland occurrences of northern fen in the Straits region, characterized by large areas of marl flats with low sedge tussocks and clumps of dwarfed conifers on raised peat islands. Soils are generally moderately alkaline marl or gravelly marl; peat deposits occur under hummocks, many of which are colonized by sphagnum mosses. The fen is protected within a federal wilderness area and appeared undisturbed. Non-native plants, including common reed (*Phragmites australis*) were noted locally in the adjacent Great Lakes marsh.

Vegetation and Environmental Data

A total of 51 vascular plant species were encountered in plots along the 200-meter belt transect (Figure 16), comprising 61% of the 83 species identified in a meander survey of the site (Appendix 5m). Nine species (18%) were encountered in 50% or more of the plots (Table 82). One species averaged greater than 10% cover; nine species averaged 1% or greater cover (Table 83). Beaked spike-rush (*Eleocharis rostellata*) was the most important species, followed by beak-rush (*Rhynchospora capillacea*) and twig-rush (*Cladium mariscoides*) (Table 84).



Figure 16. Horseshoe Bay West coastal fen and transect line.

Table 82. Ten most frequently encountered vascular plant species, Horseshoe Bay West.

Species	Common name	Frequency (%)
<i>Cladium mariscoides</i>	twig-rush	94.7
<i>Eleocharis rostellata</i>	beaked spike-rush	84.2
<i>Rhynchospora capillacea</i>	beak-rush	73.7
<i>Triglochin maritimum</i>	common bog arrow-grass	73.7
<i>Tofieldia glutinosa</i>	false asphodel	68.4
<i>Sarracenia purpurea</i>	pitcher-plant	57.9
<i>Solidago ohioensis</i>	Ohio goldenrod	57.9
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	52.6
<i>Utricularia cornuta</i>	horned bladderwort	52.6
<i>Parnassia glauca</i>	grass-of-Parnassus	47.4

Table 83. Ten vascular plant species with highest average cover, Horseshoe Bay West.

Species	Common name	Average cover (%) ± S.E.
<i>Eleocharis rostellata</i>	beaked spike-rush	17.6 ± 7.1
<i>Rhynchospora capillacea</i>	beak-rush	6.5 ± 2.0
<i>Cladium mariscoides</i>	twig-rush	5.1 ± 1.5
<i>Juniperus horizontalis</i>	creeping juniper	4.8 ± 4.2
<i>Juncus balticus</i>	Baltic rush	2.1 ± 2.1
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	1.7 ± 0.9

Species	Common name	Average cover (%) ± S.E.
<i>Sarracenia purpurea</i>	pitcher-plant	1.7 ± 0.7
<i>Thuja occidentalis</i> 5 – 10m	northern white-cedar	1.6 ± 1.6
<i>Larix laricina</i> 0.5 – 1m	tamarack	1.5 ± 1.5
<i>Triglochin maritimum</i>	common bog arrow-grass	0.7 ± 0.2

Table 84. Ten most important vascular plant species, Horseshoe Bay West.

Species	Common name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Eleocharis rostellata</i>	beaked spike-rush	35.2	8.9	22.1
<i>Rhynchospora capillacea</i>	beak-rush	13.0	7.8	10.4
<i>Cladium mariscoides</i>	twig-rush	10.2	10.1	10.1
<i>Juniperus horizontalis</i>	creeping juniper	9.6	1.7	5.6
<i>Sarracenia purpurea</i>	pitcher-plant	3.3	6.2	4.7
<i>Triglochin maritimum</i>	common bog arrow-grass	1.5	7.8	4.6
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	3.4	5.6	4.5
<i>Tofieldia glutinosa</i>	false asphodel	0.4	7.3	3.8
<i>Solidago ohioensis</i>	Ohio goldenrod	1.4	6.2	3.8
<i>Utricularia cornuta</i>	horned bladderwort	0.7	5.6	3.1

Among environmental variables, Horseshoe Bay West was characterized by very shallow standing water over most of the wetland surface (Table 85). Moss-covered hummocks were scattered throughout the wetland.

Table 85. Environmental variables, frequency and average value per plot, Horseshoe Bay West.

Environmental variable	Frequency (%)	Average % cover ± S.E.
Moss cover	57.9	23.1 ± 8.1
Unvegetated mineral soil	23.1	0.5 ± 0.3
Unvegetated marl	0	0
Unvegetated peat	0	0
Unvegetated cobble	15.8	0.5 ± 0.5
Unvegetated wood	5.3	0.4 ± 0.4
Standing water	78.9	49.2 ± 8.4
Water depth (cm)	NA	0.9 ± 0.2
Crayfish burrows	10.5	2 burrows

Element Occurrences

No element occurrences were previously documented in this area. The 2011 survey identified new occurrences of coastal fen, interdunal wetland (Horseshoe Bay East), and butterwort.

Table 86. Known and newly documented element occurrences, Horseshoe Bay West.

Community/species	Common name	State Status	Year First Observed	Year Last Observed
Coastal fen		S2	2011	2011
<i>Pinguicula vulgaris</i>	butterwort	SC; S3	2011	2011
<i>Flexamia delongi</i>	leafhopper	SC; S1S2	2011	2011

ISAACSON LAKE
T41N R05E S15
Chippewa County (Ecoregional Sub-subsection VIII.1.1)



Isaacson Lake on Drummond Island supports a small lakebed marl fen isolated from Lake Huron. This site was surveyed due to its proximity to Lake Huron, but a site visit revealed the fen was discontinuous with the Great Lakes shoreline. The northern fen was dominated by beaked spike-rush (*Eleocharis rostellata*), associated with twig-rush (*Cladium mariscoides*) and a variety of other graminoids and forbs. Small islands of northern white-cedar (*Thuja occidentalis*), tamarack (*Larix laricina*), sweet gale (*Myrica gale*), and shrubby cinquefoil (*Potentilla fruticosa*) occur throughout the fen. The site was not sampled due to its isolation from the Great Lakes shoreline. However, Isaacson Lake qualifies as an element occurrence of northern fen and will be entered into the MNFI database (MNFI 2011). A significant portion of the fen was degraded by off-road vehicle activity, but native vegetation dominates even the disturbed areas.



Figure 17. Isaacson Lake northern fen.

Element Occurrences

Occurrences of northern fen and a rare leafhopper were newly documented at this site in 2011.

Table 87. Known and newly documented element occurrences, Isaacson Lake.

Community/species	Common name	State/Federal Status	Year First Observed	Year Last Observed
Northern fen		S3	2011	2011
<i>Flexamia delongi</i>	leafhopper	SC; S1S2	2011	2011

DISCUSSION

Vegetation and Environmental Sampling

Within each site, there was significant variation in number of vascular plant taxa per plot, indicative of heterogeneity both within vegetative zones and among zones. In general, those portions of the coastal fens least frequently and/or severely affected by wave and ice action appeared to exhibit the highest number of species per plot and the highest overall species richness. Plots were dominated by herbs and shrubs <0.5 m in height, although placement of the transect lines was biased towards characterizing open fen. The coastal fen at Dudley Bay West had the highest importance of shrubs >0.5 m in height; these shrubs were concentrated on shallow rises of peat- and silt-covered cobble within the wetland. Based on line intercept sampling, the highest percent woody cover >0.5m occurred at Dudley Bay East (17.5%), followed closely by Dudley Bay West (16.5%) (Appendix 3). In general, the plot-based method underestimated woody cover due to the clumped distribution of woody vegetation within the fens.

The most important plant species had the tendency to occur in all or most vegetative zones. Among these species, beak-rush (*Rhynchospora capillacea*) and twig-rush (*Cladium mariscoides*) were most important, due largely to their high relative cover and tendency to dominate zones within the coastal fens, particularly saturated to shallowly inundated alkaline sand flats exposed by summer recession of Great Lakes water levels. Beaked spike-rush (*Eleocharis rostellata*), the third most important species, exhibited high relative cover but low relative frequency; this species was concentrated on open marl and sand flats and did not occur at five of the 13 sample sites (Appendix 6). This pattern is demonstrated by several other less important species that occur at high densities in particular vegetative zones and at low densities in other zones. Shrubby cinquefoil (*Potentilla fruticosa*) was by far the most important shrub. It occurred in all coastal fen zones, although it was present almost exclusively as first-year seedlings in the sand flat zones. Ohio goldenrod (*Solidago ohioensis*) and northern white-cedar (*Thuja occidentalis*) were most important in the least frequently disturbed zones, but were also present as seedlings in the sand flat zones.

The Floristic Quality Assessments provide a baseline for the determination of floristic integrity of coastal fens. All of the survey sites exhibited significant floristic quality, as assessed through the mean *C* (coefficient of conservatism) and Floristic Quality Index (FQI) measures (Table 9, Herman et al. 2001). Coastal fens, due to their highly alkaline substrate, support a number of specialized plant species that occur predominantly in areas affected minimally by anthropogenic disturbance (Herman et al. 2001, Cohen et al. 2010). Native mean *C* values, which ranged from 6.0 to 7.3 in this study, are similar to those found in undisturbed northern Michigan peatlands and limestone habitats (MNFI, unpublished data).

Rare Element Surveys

The 2010 – 2011 surveys yielded four new occurrences of coastal fen and a fifth area of coastal fen that will be added to an existing occurrence (Table 10). Following the 2011 field season, MNFI has documented 22 coastal fens in Michigan (MNFI 2011). In addition, surveys documented one new occurrence each for limestone cobble shore and interdunal wetland and two new occurrences of northern fen that occur protected from the direct impacts of the Great Lakes behind forested beach ridges. These fens accumulate deeper deposits of peat and marl than the coastal fens, which are typically at least partially disturbed by wave and ice action (Cohen et al. 2010).

Eleven previously documented occurrences of rare plant species were observed in 2010 – 2011, including four occurrences of dwarf lake iris (*Iris lacustris*, state/federal threatened), three occurrences of butterwort (*Pinguicula vulgaris*, state special concern), three occurrences of Houghton’s goldenrod (*Solidago houghtonii*, state/federal threatened), and one occurrence of prairie Indian plantain (*Cacalia plantaginea*, state special concern). One new occurrence of a state-listed plant species, butterwort, was identified during surveys in 2011. Our findings suggest the Great Lakes shoreline in the vicinity of our sample sites has been well-surveyed for rare plant taxa.

The most significant results of the rare element surveys were several new element occurrence records for three state-listed insects. Over the course of this study, we documented eight new occurrences of the leafhopper *Flexamia delongi*. Prior to this study, this leafhopper was known from only 6 locations in Michigan. *F. delongi* is associated with little bluestem (*Schizachyrium scoparium*), and was previously known from prairie and savanna remnants and alvar before its discovery in coastal fens in 2010. Collections made from Alpena and Mackinac counties in 2010 represent new county records. Further intensive sampling at the other four sites which contained little bluestem (Appendix 6) may turn up additional records for this species.

The red-legged spittlebug (*Prosapia ignipectus*) was previously known to occur in alvar, pine barren, lakeplain prairie, and prairie fen communities (Cuthrell 1999), and the 2010 surveys revealed the species also occurs in at least one coastal fen (El Cajon Bay). Nymphs (sub-adult life stages) are believed to feed on the subterranean parts of little bluestem (*Schizachyrium scoparium*), a species that is concentrated in the drier zones of coastal fens. Further intensive sampling at the other eight sites which contained little bluestem (Appendix 6) may turn up additional records for this species, as nine of the 13 sites sampled contained the host plant.

The Kansan leafhopper (*Dorydiella kansana*) was first discovered in Michigan in 1994 at a lakeplain prairie site in St. Clair County (Comer et al. 1995). Since its initial discovery, Kansan leafhopper has been found in additional lakeplain prairies in Huron and Tuscola counties and from prairie fens in Washtenaw, Jackson, Hillsdale, and Kalamazoo counties. It has been reported to occur on spike-rushes (*Eleocharis* spp.), beak-rushes (*Rhynchospora* spp.), and nut-rush (*Scleria verticillata*) (Bess 2005). This species appears to be associated with nut-rush in Michigan, as this was one of the important plant species in the zone from which it was collected at El Cajon Bay. In addition, several coastal fen sites containing large stands of beak-rush (*Rhynchospora capillacea*) and spike-rushes (*Eleocharis* spp.) failed to produce this leafhopper after numerous sweeps. The only other coastal fens identified thus far by our study that contained nut-rush were Thompson’s Harbor and Cheboygan State Park North Fen (Appendix 6), and additional sampling may reveal the presence of Kansan leafhopper at those sites.

The state and federally listed Hine’s emerald dragonfly was not observed at any of the 16 coastal fen sample sites in 2010 – 2011. However, Hine’s emerald dragonfly was newly documented from a coastal fen on Garden Island in August 2011, and many of the sampled coastal fens support similar, presumably suitable habitat for the species. We suspect that future surveys of coastal fens during the peak flight for this species will yield additional occurrences for this rare dragonfly. In particular, the coastal fens associated with Great Lakes islands (including those on Marquette, Garden, and Hog Islands) and the fens in the Horseshoe Harbor area appear to support particularly appropriate habitat.

Management and Protection

As noted by Cohen et al. (2010) and Franks Taylor et al. (2010), coastal wetlands are threatened by hydrologic alteration, the construction of roads and trails, off-road vehicle use, and invasive plant species. Several of the coastal fens surveyed in 2010 – 2011 have experienced at least modest disturbance associated with recreational use of the Great Lakes shoreline, primarily in the form of off-road vehicle use. In particular, portions of the coastal fens at Squaw Bay, Waugoshance Point, and Dudley Bay East and the interdunal wetland at Albany Creek Mouth are affected by well-worn two-tracks that are used to access shoreline areas. Foot trails enter fen areas at Waugoshance Point and Thompson's Harbor, and locally alter surface water flow and species composition in these sites. However, damage to both sites appears minimal, and the foot trails provide people with the opportunity to explore and gain appreciation for these sensitive habitats. The coastal fen at Squaw Bay has been significantly disturbed by the construction of US-23, which bisects the wetland, and, in conjunction with the adjacent drainage ditch, has severely disrupted the hydrologic regime of the entire wetland.

Invasive species threaten even the least-disturbed coastal fens. Although all sites were dominated by native species, 14 non-native taxa were documented, including several species identified by Cohen et al. (2010) as particularly aggressive threats. Of particular concern is an infestation of glossy buckthorn (*Rhamnus frangula*) in the Alpena area. Glossy buckthorn was observed in all three Alpena County coastal fens, and was especially abundant in the disturbed Squaw Bay site, where it was concentrated around forested "islands" and in the best-developed fen areas at the margin of the inland forest. Despite invasive species removal efforts conducted by The Nature Conservancy at Squaw Bay, glossy buckthorn remains abundant and widespread, likely due to the presence of dense colonies on adjacent lands not being managed for conservation of biodiversity. Monitoring and removal efforts should focus on the less disturbed El Cajon Bay and Whitefish Bay sites to ensure glossy buckthorn does not attain population levels that require costly, time-consuming control efforts. Glossy buckthorn was not detected at Thompson's Harbor, Waugoshance Point, Cheboygan State Park, or in the Upper Peninsula sites.

The non-native variety of common reed (*Phragmites australis* ssp. *australis*) is another significant threat to coastal fen. Although only the native variety of common reed (*P. australis* var. *americanus*) was documented in 2010 coastal fen surveys, the non-native variety has been previously documented in El Cajon Bay and Squaw Bay (MNFI 2010), where the species is likely concentrated in the emergent marsh zones. The non-native variety of common reed was observed forming vigorous colonies in ditches and degraded wetlands near the City of Alpena in 2010, and the species appears to pose a particular threat to coastal wetlands in this region. In 2011, the non-native variety of common reed was documented along the northern shore of Lake Huron near the Horseshoe Bay West coastal fen in Mackinac County. Monitoring and removal of nascent populations of common reed is of critical importance to preserving the ecological integrity and biodiversity of coastal fens. In addition to common reed, native and non-native cat-tails (*Typha* spp.) are locally prevalent within several Great Lakes marsh communities associated with coastal fens, and their spread should be monitored and controlled.

Among the remaining non-native species observed in the coastal fen study sites, purple loosestrife (*Lythrum salicaria*) and dog mustard (*Erucastrum gallicum*) were locally important in shallow emergent and sand flat zones, respectively. Purple loosestrife populations were generally small and/or consisted of widely dispersed individuals, and may be controlled by hand-pulling and/or careful use of herbicides. Dog mustard colonizes bare substrates and may occur in large numbers, but its impacts on native species are unclear. Remaining non-native species observed in coastal

fen occurred in small numbers or in association with adjacent more suitable habitats (e.g., spotted knapweed [*Centaurea maculosa*] at the base of dune ridges).

Table 88 highlights management and protection strategies for each of the study sites. Sites are listed in order of element occurrence ranks assigned in 2010 or 2011. In general, C-ranked sites are affected by the most significant stressors and require more significant investment into habitat management and restoration. A- and AB-ranked sites are minimally disturbed and require periodic monitoring of habitat conditions.

Table 88. Summary of management and protection recommendations for coastal fens and associated natural communities surveyed in 2010 – 2011.

Site	Community Type	EO Rank (post-study*)	Management Recommendations
Thompson's Harbor	Coastal Fen	A	<ul style="list-style-type: none"> control and monitor invasive plant species in the adjacent marsh, especially narrow-leaved cat-tail restrict foot access to sensitive marl flats zone adjacent to trail periodic monitoring periodic monitoring
Horseshoe Bay East	Interdunal Wetland	A	<ul style="list-style-type: none"> periodic monitoring periodic monitoring
Horseshoe Bay West	Coastal Fen	A	<ul style="list-style-type: none"> control and monitor non-native common reed documented along shoreline periodic monitoring
Waugoshance Point	Coastal Fen/Great Lakes Marsh	AB	<ul style="list-style-type: none"> control and monitor invasive plant species in the adjacent marsh, especially narrow-leaved cat-tail periodic monitoring
El Cajon Bay	Coastal Fen	AB	<ul style="list-style-type: none"> control and monitor invasive plant species in the adjacent marsh, including common reed, narrow-leaved cat-tail, hybrid cat-tail, and purple loosestrife periodic monitoring
Meridian Fen	Coastal Fen	AB	<ul style="list-style-type: none"> periodic monitoring
Peck Bay	Coastal Fen	AB	<ul style="list-style-type: none"> periodic monitoring
St. Martin Point	Coastal Fen	AB	<ul style="list-style-type: none"> periodic monitoring
Cheboygan State Park North Fen	Coastal Fen	B	<ul style="list-style-type: none"> control and monitor invasive plant species in the adjacent marsh, including common reed, narrow-leaved cat-tail, and hybrid cat-tail periodic monitoring

Site	Community Type	EO Rank (post-study*)	Management Recommendations
Cheboygan State Park South Fen	Coastal Fen	B	<ul style="list-style-type: none"> control and monitor invasive plant species in the adjacent marsh, including common reed, narrow-leaved cat-tail, and hybrid cat-tail periodic monitoring
Dudley Bay East	Coastal Fen	B	<ul style="list-style-type: none"> periodic monitoring
Dudley Bay West	Coastal Fen	B	<ul style="list-style-type: none"> periodic monitoring
Whitefish Bay	Coastal Fen	BC	<ul style="list-style-type: none"> investigate and monitor water quality periodic monitoring
Squaw Bay	Coastal Fen/Great Lakes Marsh	C	<ul style="list-style-type: none"> continue treatment of glossy buckthorn, particularly new invasions outside the forested islands prevent further disruption of site hydrology investigate and monitor water quality, including salt contamination from US-23 periodic monitoring
Isaacson Lake	Northern Fen	C	<ul style="list-style-type: none"> restrict ORV activity through landowner education and surveillance of state land periodic monitoring
Albany Creek Mouth	Interdunal Wetland	C	<ul style="list-style-type: none"> restrict ORV activity through placement of more restrictive barriers along M-134 and surveillance periodic monitoring

*Pre-study EO ranks listed in Table 2.

Classification and Conservation Status

Prior to the beginning of this study, 17 coastal fens were documented in the MNFI database. Following completion of surveys on this study and other inventory projects, 22 coastal fens are now documented in the MNFI database (MNFI 2011). Some of these occurrences represent newly identified sites; some represent portions of previously documented Great Lakes marsh occurrences that were remapped and reclassified following surveys between 2009 and 2011. In addition to those coastal fens surveyed in 2010 – 2011 and previously documented coastal fens, we interpreted 2009 aerial photographs and identified and delineated an additional 44 sites that may support coastal fen. Some of these sites are additional Great Lakes marsh occurrences that support fen zones; most are sites not previously identified or surveyed. Potential coastal fens are concentrated in a few particular areas: Garden and Hog Islands in Charlevoix County; the Lake Huron shoreline from north of Presque Isle to south of Alpena; and several, generally small sites along the northern shore of Lake Huron from St. Ignace north and east to the Drummond Island shoreline. Coastal fen is apparently absent (or very local) along the northern mainland shore of Lake Michigan west of St. Ignace and on the eastern mainland shore south of Wilderness State

Park. Shapefiles and a stand-alone map of coastal fens tracked in the MNFI database and sites that potentially support additional occurrence are provided in conjunction with this research report.

Assessment of the conservation status of coastal fens is complicated by the synthetic nature of natural community classification. Coastal fens sampled in 2010 – 2011 exhibited significant variability in vegetative structure (Tables 4, 5), vegetative composition (Appendices 5a-m, 6), and environmental variables (see site descriptions). All of these factors are considered in the development of a classification system that attempts to synthesize individual biotic and abiotic characteristics to develop a framework for understanding repeating patterns in nature. At most sites, coastal fen graded into Great Lakes marsh, limestone bedrock lakeshore, limestone cobble shore, or sand and gravel beach. At several sites, particularly Waugoshance Point, substrate heterogeneity has led to the development of a patchwork of vegetative associations that shared characteristics of multiple natural communities as described by Kost et al. (2007).

An explicitly hierarchical classification system, such as the hydrogeomorphic classification for coastal wetlands developed by Albert et al. (2006), provides an alternative system for mapping and assessing the conservation status of coastal wetlands. The hydrogeomorphic approach classifies coastal wetlands based on hydrologic system (lacustrine, riverine, and barrier-protected), geomorphic type (e.g., swale complex, connecting channel), and modifiers (e.g., sand-spit swales, barrier beach lagoon) (Albert et al. 2006). In this classification scheme, coastal fens are encompassed within broader wetland systems that occupy open embayments or protected embayments (Albert et al. 2006). Although vegetative structure and composition of interdunal wetlands (e.g., Albany Creek Mouth) may be very similar to that of coastal fens, these wetlands exhibit different hydrologic and geomorphic characteristics due to their separation from Great Lakes surface waters by sandy beach ridges and occasionally gravel and cobble bars (e.g., Horseshoe Bay East) (Albert et al. 2006). Irrespective of the specific classification system used to name and describe coastal wetlands, the combination of biotic and abiotic characteristics that shape coastal fen are restricted to limited portions of the Great Lakes shoreline.

MNFI will process element occurrence data for coastal fens and associated rare species. These data are periodically shared with NatureServe, and can be used to revise classification and reevaluate the global conservation status of the two ecological associations that correspond to coastal fen, Great Lakes Sedge Rich Shore Fen and Shrubby-cinquefoil - Sweetgale Rich Shore Fen (NatureServe 2011). Both associations are considered critically imperiled at the global scale (G1G2; Appendix 1), based on documentation of approximately 11 sites rangewide (including 10 sites in Michigan) as of April 2000 (NatureServe 2011). Our current knowledge of 22 confirmed coastal fen occurrences in Michigan, in addition to the identification of several dozen potential sites, suggests coastal fen is more secure than currently ranked.

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Appendix 1. Global and state element ranking criteria.

GLOBAL RANKS

- G1** = critically imperiled: at very high risk of extinction due to extreme rarity (often 5 or fewer occurrences), very steep declines, or other factors.
- G2** = imperiled: at high risk of extinction due to very restricted range, very few occurrences (often 20 or fewer), steep declines, or other factors.
- G3** = vulnerable: at moderate risk of extinction due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors.
- G4** = apparently secure: uncommon but not rare; some cause for long-term concern due to declines or other factors.
- G5** = secure: common; widespread.
- GU** = currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
- GX** = eliminated: eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
- G?** = incomplete data.

STATE RANKS

- S1** = critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.
- S2** = imperiled in the state because of rarity due to very restricted range, very few occurrences (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.
- S3** = vulnerable in the state due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
- S4** = uncommon but not rare; some cause for long-term concern due to declines or other factors.
- S5** = common and widespread in the state.
- SX** = community is presumed to be extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
- S?** = incomplete data.

Appendix 2. For consistency, this report follows scientific nomenclature as presented in Kost et al. (2007), which follows Voss (1972, 1985, 1996) as summarized and modified by Herman et al. (2001). Recent taxonomic changes reflected in Reznicek et al. (2011) are presented in the right-hand column.

Scientific Name	Scientific Name (Reznicek et al. 2011)
<i>Acer rubrum</i> L.	
<i>Achillea millefolium</i> L.	
<i>Agalinis purpurea</i> (L.) Pennell	
<i>Agropyron trachycaulum</i> (Link) Malte	<i>Elymus trachycaulus</i> (Link) Gould
<i>Alnus rugosa</i> (Duroi) Sprengel	<i>Alnus incana</i> (L.) Moench
<i>Amelanchier</i> sp.	
<i>Andromeda glaucophylla</i> Link	
<i>Anemone canadensis</i> L.	
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	
<i>Aronia prunifolia</i> (Marshall) Rehder	
<i>Artemisia campestris</i> L.	
<i>Asclepias incarnata</i> L.	
<i>Aster borealis</i> (T. & G.) Prov.	<i>Symphotrichum boreale</i> (Torr. & A. Gray) Á. Löve & D. Löve
<i>Aster firmus</i> Nees	<i>Symphotrichum firmum</i> (Nees) G. L. Nesom
<i>Aster lanceolatus</i> Willd.	<i>Symphotrichum lanceolatum</i> (Willd.) G. L. Nesom
<i>Aster macrophyllus</i> L.	<i>Eurybia macrophylla</i> (L.) Cass.
<i>Aster puniceus</i> L.	<i>Symphotrichum puniceum</i> (L.) Á. Löve & D. Löve
<i>Aster</i> spp.	
<i>Aster umbellatus</i> Miller	<i>Doellingeria umbellata</i> (Mill.) Nees
<i>Betula alleghaniensis</i> Britton	
<i>Betula papyrifera</i> Marshall	
<i>Bromus ciliatus</i> L.	
<i>Cacalia plantaginea</i> (Raf.) Shinnars	<i>Arnoglossum plantagineum</i> Raf.

Scientific Name	Scientific Name (Reznicek et al. 2011)
<i>Calamagrostis canadensis</i> (Michx.) P. Beauv.	
<i>Calamagrostis inexpansa</i> Gray	<i>Calamagrostis stricta</i> (Timm) Koeler ssp. <i>inexpansa</i> (A. Gray) C.W. Greene
<i>Calamintha arkansana</i> (Nutt.) Shinnars	<i>Clinopodium arkansanum</i> (Nutt.) House
<i>Calopogon tuberosus</i> (L.) Britton, Sterns & Poggenb.	
<i>Calystegia sepium</i> (L.) R. Br.	
<i>Campanula aparinoides</i> Pursh	
<i>Campanula rotundifolia</i> L.	
<i>Carex aurea</i> Nutt.	
<i>Carex buxbaumii</i> Wahlenb.	
<i>Carex capillaris</i> L.	
<i>Carex crawei</i> Dewey	
<i>Carex eburnea</i> Boott	
<i>Carex flava</i> L.	
<i>Carex gynocrates</i> Drejer	
<i>Carex lasiocarpa</i> Ehrh.	
<i>Carex livida</i> (Wahlenb.) Willd.	
<i>Carex</i> spp.	
<i>Carex sterilis</i> Willd.	
<i>Carex stricta</i> Lam.	
<i>Carex viridula</i> Michx.	
<i>Castilleja coccinea</i> (L.) Spreng.	
<i>Centaurea maculosa</i> Lam.	<i>Centaurea stoebe</i> L.
<i>Chelone glabra</i> L.	
<i>Chrysanthemum leucanthemum</i> L.	<i>Leucanthemum vulgare</i> Lam.
<i>Cicuta bulbifera</i> L.	
<i>Cirsium muticum</i> Michx.	

Scientific Name	Scientific Name (Reznicek et al. 2011)
<i>Cirsium palustre</i> (L.) Scop.	
<i>Cirsium vulgare</i> (Savi) Ten.	
<i>Cladium mariscoides</i> (Muhl.) Torr.	
<i>Comandra umbellata</i> (L.) Nutt.	
<i>Coreopsis lanceolata</i> L.	
<i>Cornus canadensis</i> L.	
<i>Cornus stolonifera</i> Michx.	<i>Cornus sericea</i> L.
<i>Cypripedium calceolus</i> L. var. <i>pubescens</i> (Willd.) Correll	<i>Cypripedium parviflorum</i> Salisb. var. <i>pubescens</i> (Willd.) O. W. Knight
<i>Danthonia spicata</i> (L.) Roem. & Schult.	
<i>Deschampsia cespitosa</i> (L.) P. Beauv.	
<i>Drosera linearis</i> Goldie	
<i>Drosera rotundifolia</i> L.	
<i>Eleocharis elliptica</i> Kunth	
<i>Eleocharis quinqueflora</i> (Hartmann) O. Schwarz	
<i>Eleocharis rostellata</i> Torr.	
<i>Eleocharis smallii</i> Britton	<i>Eleocharis palustris</i> (L.) Roem. & Schult.
<i>Epigaea repens</i> L.	
<i>Equisetum fluviatile</i> L.	
<i>Equisetum variegatum</i> Schleich.	
<i>Eriophorum viridi-carinatum</i> (Engelm.) Fernald	
<i>Erucastrum gallicum</i> (Willd.) Schulz	
<i>Eupatorium maculatum</i> L.	<i>Eutrochium maculatum</i> (L.) E. E. Lamont
<i>Eupatorium perfoliatum</i> L.	
<i>Euthamia graminifolia</i> (L.) Nutt.	
<i>Fragaria virginiana</i> Mill.	
<i>Fraxinus pennsylvanica</i> Marshall	

Scientific Name	Scientific Name (Reznicek et al. 2011)
<i>Gaultheria hispidula</i> (L.) Muhl.	
<i>Gaultheria procumbens</i> L.	
<i>Gaylussacia baccata</i> (Wangenh.) K. Koch	
<i>Gentianopsis procera</i> (Holm) Ma	<i>Gentianopsis virgata</i> (Raf.) Holub
<i>Hieracium caespitosum</i> Dumort.	
<i>Hieracium</i> sp.	
<i>Hypericum kalmianum</i> L.	
<i>Iris lacustris</i> Nutt.	
<i>Iris versicolor</i> L.	
<i>Juncus balticus</i> Willd.	
<i>Juncus brachycephalus</i> (Engelm.) Buchenau	
<i>Juncus brevicaudatus</i> (Engelm.) Fernald	
<i>Juncus nodosus</i> L.	
<i>Juniperus communis</i> L.	
<i>Juniperus horizontalis</i> Moench	
<i>Larix laricina</i> (Du Roi) K. Koch	
<i>Lathyrus palustris</i> L.	
<i>Ledum groenlandicum</i> Oeder	<i>Rhododendron groenlandicum</i> (Oeder) Kron & Judd
<i>Lilium philadelphicum</i> L.	
<i>Linnaea borealis</i> L.	
<i>Liparis loeselii</i> (L.) Rich.	
<i>Lobelia kalmii</i> L.	
<i>Lobelia spicata</i> Lam.	
<i>Lonicera oblongifolia</i> (Goldie) Hook.	
<i>Lycopus americanus</i> Muhl.	
<i>Lycopus uniflorus</i> Michx.	

Scientific Name	Scientific Name (Reznicek et al. 2011)
<i>Lysimachia quadriflora</i> Sims	
<i>Lysimachia terrestris</i> (L.) Britton, Sterns & Poggenb.	
<i>Lythrum salicaria</i> L.	
<i>Melampyrum lineare</i> Desr.	
<i>Mentha arvensis</i> L.	<i>Mentha canadensis</i> L.
<i>Mentha xpiperita</i> L.	
<i>Muhlenbergia glomerata</i> (Willd.) Trin.	
<i>Myrica gale</i> L.	
<i>Onoclea sensibilis</i> L.	
<i>Osmunda regalis</i> L.	
<i>Panicum lindheimeri</i> Nash	<i>Dichanthelium lindheimeri</i> (Nash) Gould
<i>Parnassia glauca</i> Raf.	
<i>Phalaris arundinacea</i> L.	
<i>Phragmites australis</i> (Cav.) Steudel	<i>Phragmites australis</i> ssp. <i>americanus</i> Saltonst., P. M. Peterson & Soreng
<i>Picea mariana</i> (Mill.) Britton, Sterns & Poggenb.	
<i>Pinguicula vulgaris</i> L.	
<i>Pinus strobus</i> L.	
<i>Platanthera hyperborea</i> (L.) Lindl.	<i>Platanthera huronensis</i> (Nutt.) Lindl.
<i>Poa compressa</i> L.	
<i>Pogonia ophioglossoides</i> (L.) Ker Gawl.	
<i>Polygala paucifolia</i> Willd.	
<i>Polygonum amphibium</i> L.	<i>Persicaria amphibia</i> (L.) A. Gray
<i>Polygonum</i> sp.	
<i>Populus balsamifera</i> L.	
<i>Populus tremuloides</i> Michx.	
<i>Potentilla anserina</i> L.	

Scientific Name	Scientific Name (Reznicek et al. 2011)
<i>Potentilla fruticosa</i> L.	<i>Dasiphora fruticosa</i> (L.) Rydb.
<i>Prenanthes racemosa</i> Michx.	
<i>Primula mistassinica</i> Michx.	
<i>Proserpinaca palustris</i> L.	
<i>Prunella vulgaris</i> L.	
<i>Quercus rubra</i> L.	
<i>Rhamnus alnifolia</i> L'Her.	
<i>Rhamnus frangula</i> L.	<i>Frangula alnus</i> Mill.
<i>Rhynchospora alba</i> (L.) Vahl	
<i>Rhynchospora capillacea</i> Torr.	
<i>Rudbeckia hirta</i> L.	
<i>Salix candida</i> Willd.	
<i>Salix petiolaris</i> Sm.	
<i>Salix</i> spp.	
<i>Sarracenia purpurea</i> L.	
<i>Schizachyrium scoparium</i> Michx.	
<i>Schoenoplectus acutus</i> (Bigelow) Á. Löve & D. Löve	
<i>Schoenoplectus pungens</i> (Vahl) Palla	
<i>Scleria verticillata</i> Willd.	
<i>Selaginella eclipes</i> W. R. Buck.	
<i>Senecio aureus</i> L.	<i>Packera aurea</i> (L.) Á. Löve & D. Löve
<i>Senecio pauperculus</i> Michx.	<i>Packera paupercula</i> Michx.
<i>Shepherdia canadensis</i> (L.) Nutt.	
<i>Smilacina stellata</i> (L.) Desf.	<i>Maianthemum stellatum</i> (L.) Link
<i>Solidago altissima</i> L.	
<i>Solidago canadensis</i> L.	

Scientific Name	Scientific Name (Reznicek et al. 2011)
<i>Solidago houghtonii</i> Torr. & A. Gray	
<i>Solidago ohioensis</i> Riddell	
<i>Solidago ptarmicoides</i> (Torr. & A. Gray) B. Boivin	
<i>Solidago rugosa</i> Mill.	
<i>Solidago uliginosa</i> Nutt.	
<i>Sonchus</i> sp.	
<i>Spiraea alba</i> Du Roi	
<i>Spiranthes cernua</i> (L.) Rich.	
<i>Spiranthes romanzoffiana</i> Cham.	
<i>Stachys</i> sp.	
<i>Thelypteris palustris</i> Schott	
<i>Thuja occidentalis</i> L.	
<i>Tofieldia glutinosa</i> (Michx.) Pers.	<i>Triantha glutinosa</i> (Michx.) Baker
<i>Triadenum fraseri</i> (Spach) Gleason	
<i>Trichophorum alpinum</i> (L.) Pers.	
<i>Trichophorum cespitosum</i> (L.) Hartm.	
<i>Trientalis borealis</i> Raf.	
<i>Triglochin maritimum</i> L.	<i>Triglochin maritima</i> L.
<i>Triglochin palustris</i> L.	
<i>Utricularia cornuta</i> Michx.	
<i>Utricularia intermedia</i> Hayne	
<i>Vaccinium angustifolium</i> Aiton	
<i>Vaccinium myrtilloides</i> Michx.	
<i>Vaccinium oxycoccos</i> L.	
<i>Viola nephrophylla</i> Greene	
<i>Viola</i> spp.	

Scientific Name	Scientific Name (Reznicek et al. 2011)
<i>Vitis riparia</i> Michx.	
<i>Zigadenus glaucus</i> (Nutt.) Nutt.	<i>Anticlea elegans</i> (Pursh) Rydb.

Appendix 3. Woody cover by taxon by site, based on line intercept samples.

Site	Species	Common Name	Percent Cover
Dudley Bay East	<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	7.1
	<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	5.1
	<i>Alnus rugosa</i> 1 – 3m	tag alder	3.2
	<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	1.0
	<i>Thuja occidentalis</i> 3 – 10m	northern white-cedar	0.5
	<i>Betula papyrifera</i> 1 – 3m	paper birch	0.3
	<i>Alnus rugosa</i> 0.5 – 1m	tag alder	0.2
	<i>Myrica gale</i> 0.5 – 1m	sweet gale	0.2
	TOTAL		17.5
	Dudley Bay West	<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil
<i>Myrica gale</i> 0.5 – 1m		sweet gale	3.7
<i>Thuja occidentalis</i> 1 – 3m		northern white-cedar	2.1
<i>Thuja occidentalis</i> 0.5 – 1m		northern white-cedar	1.9
<i>Alnus rugosa</i> 0.5 – 1m		tag alder	0.6
<i>Larix laricina</i> 1 – 3m		tamarack	0.6
<i>Alnus rugosa</i> 1 – 3m		tag alder	0.5
TOTAL			16.5
Whitefish Bay	<i>Larix laricina</i> 3 – 10m	tamarack	2.7
	<i>Thuja occidentalis</i> 3 – 10m	northern white-cedar	2.6
	<i>Thuja occidentalis</i> 3 – 10m	northern white-cedar	1.2
	<i>Larix laricina</i> 1 – 3m	tamarack	0.8
	<i>Juniperus communis</i> 1 – 3m	common juniper	0.7
	<i>Larix laricina</i> 0.5 – 1m	tamarack	0.3
	<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	0.1
	<i>Picea mariana</i> 0.5 – 1m	black spruce	0.1
	TOTAL		8.5
	St. Martin Point	<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil
<i>Myrica gale</i> 0.5 – 1m		sweet gale	1.6
<i>Picea mariana</i> 1 – 3m		black spruce	0.4
TOTAL			7.9

Site	Species	Common Name	Percent Cover
Meridian Fen	<i>Thuja occidentalis</i> 3 – 10m	northern white-cedar	2.3
	<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	1.9
	<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	1.3
	<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	0.3
	TOTAL		5.8
Thompson's Harbor	<i>Hypericum kalmianum</i> 0.5 – 1m	Kalm's St. John's-wort	2.1
	<i>Salix</i> sp. 1 – 3m	willow	1.2
	<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	0.4
	<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	0.3
	<i>Populus balsamifera</i> 1 – 3m	balsam poplar	0.2
	<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	0.2
	TOTAL		4.3
Albany Creek Mouth	<i>Myrica gale</i> 0.5 – 1m	sweet gale	2.5
	<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	1.6
	TOTAL		4.2
Peck Bay	<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	1.4
	<i>Picea mariana</i> 1 – 3m	black spruce	0.7
	<i>Larix laricina</i> 1 – 3m	tamarack	0.5
	<i>Picea mariana</i> 3 – 10m	black spruce	0.5
	<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	0.2
	<i>Larix laricina</i> 0.5 – 1m	tamarack	0.0
TOTAL		3.3	
Cheboygan State Park South Fen	<i>Myrica gale</i> 0.5 – 1m	sweet gale	2.6
	<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	0.3
	TOTAL		2.9
Horseshoe Bay East	<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	1.1
	<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	0.2
	TOTAL		1.3
Squaw Bay	<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	1.1
	<i>Alnus rugosa</i> 1 – 3m	tag alder	0.2

Site	Species	Common Name	Percent Cover
	<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	0.0
	TOTAL		1.3
Horseshoe Bay West	<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	0.5
	<i>Larix laricina</i> 0.5 – 1m	tamarack	0.4
	<i>Betula papyrifera</i> 0.5 – 1m	paper birch	0.1
	<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	0.1
	TOTAL		1.1
Waugoshance Point	<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	0.5
	TOTAL		0.5
El Cajon Bay	<i>Thuja occidentalis</i> 1 – 3m	northern white-cedar	0.4
	<i>Thuja occidentalis</i> 0.5 – 1m	northern white-cedar	0.0
	TOTAL		0.4
Cheboygan State Park North Fen	TOTAL		0.0

Appendix 4. Summary list of vascular plant species documented in coastal fen sample plots, ranked by importance value. CAPITALIZED names indicate non-native species.

Species	Common Name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Rhynchospora capillacea</i>	beak-rush	18.61%	5.07%	11.84%
<i>Cladium mariscoides</i>	twig-rush	15.35%	7.12%	11.24%
<i>Eleocharis rostellata</i>	beaked spike-rush	15.07%	3.34%	9.20%
<i>Potentilla fruticosa</i> <0.5m	shrubby cinquefoil	8.96%	5.39%	7.17%
<i>Solidago ohioensis</i>	Ohio goldenrod	3.85%	5.20%	4.53%
<i>Juncus balticus</i>	Baltic rush	4.93%	2.60%	3.77%
<i>Thuja occidentalis</i> <0.5m	northern white-cedar	1.73%	3.66%	2.69%
<i>Sarracenia purpurea</i>	pitcher-plant	2.07%	2.44%	2.25%
<i>Hypericum kalmianum</i> <0.5m	Kalm's St. John's-wort	0.33%	3.63%	1.98%
<i>Schizachyrium scoparium</i>	little bluestem	2.83%	0.99%	1.91%
<i>Parnassia glauca</i>	grass-of-Parnassus	0.45%	3.31%	1.88%
<i>Myrica gale</i> <0.5m	sweet gale	2.27%	1.09%	1.68%
<i>Panicum lindheimeri</i>	panic grass	0.42%	2.76%	1.59%
<i>Calamagrostis canadensis</i>	bluejoint grass	2.07%	1.09%	1.58%
<i>Tofieldia glutinosa</i>	false asphodel	0.11%	2.95%	1.53%
<i>Schoenoplectus pungens</i>	three-square	0.74%	2.02%	1.38%
<i>Calamintha arkansana</i>	low calamint	0.66%	2.05%	1.36%
<i>Utricularia cornuta</i>	horned bladderwort	0.27%	2.37%	1.32%
<i>Muhlenbergia glomerata</i>	marsh wild timothy	0.11%	2.41%	1.26%
<i>Thuja occidentalis</i> 1 – 3m	northern white cedar	2.08%	0.35%	1.22%
<i>Equisetum variegatum</i>	variegated scouring rush	0.10%	2.15%	1.12%
<i>Lobelia kalmii</i>	Kalm's lobelia dwarf Canadian	0.02%	2.18%	1.10%
<i>Primula mistassinica</i>	primrose	0.27%	1.86%	1.07%
<i>Senecio pauperculus</i>	balsam ragwort	0.22%	1.89%	1.06%
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	0.90%	0.99%	0.95%
<i>Potentilla fruticosa</i> 0.5 – 1m	shrubby cinquefoil	1.48%	0.35%	0.91%
<i>Lycopus uniflorus</i>	northern bugleweed common bog arrow-	0.07%	1.70%	0.89%
<i>Triglochin maritimum</i>	grass	0.19%	1.51%	0.85%
<i>Juncus brachycephalus</i>	rush	0.19%	1.32%	0.75%
<i>Carex stricta</i>	tussock sedge	0.85%	0.64%	0.75%
<i>Rhynchospora alba</i>	white beak-rush	0.58%	0.90%	0.74%
<i>Solidago uliginosa</i>	bog goldenrod	0.44%	0.93%	0.68%
<i>Juniperus horizontalis</i>	creeping juniper	0.99%	0.32%	0.65%
<i>Trichophorum cespitosum</i>	tufted bulrush	0.71%	0.58%	0.65%
<i>Selaginella eclipses</i>	selaginella	0.05%	1.16%	0.60%
<i>Danthonia spicata</i>	poverty grass	0.52%	0.64%	0.58%
<i>Carex livida</i>	livid sedge	0.39%	0.77%	0.58%
<i>Carex flava</i>	yellow sedge	0.33%	0.80%	0.56%
<i>Carex eburnea</i>	ebony sedge	0.63%	0.42%	0.52%
<i>Deschampsia cespitosa</i>	tufted hair grass	0.11%	0.80%	0.46%
<i>Thuja occidentalis</i> 3 – 10m	northern white cedar	0.78%	0.13%	0.45%
<i>Gentianopsis procera</i>	small-fringed gentian	0.02%	0.87%	0.44%

Species	Common Name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Carex sterilis</i>	dioecious sedge	0.26%	0.61%	0.43%
<i>Aster borealis</i>	northern bog aster	0.04%	0.77%	0.41%
<i>Thuja occidentalis</i> 0.5 – 1m	northern white cedar	0.40%	0.32%	0.36%
<i>Drosera rotundifolia</i>	round-leaved sundew	0.08%	0.61%	0.35%
<i>Myrica gale</i> 0.5 – 1m	sweet gale	0.46%	0.22%	0.34%
<i>Viola</i> sp.	violet	0.03%	0.61%	0.32%
<i>Triglochin palustris</i>	slender bog arrow-grass	0.30%	0.32%	0.31%
<i>Larix laricina</i> 1 – 3m	tamarack	0.54%	0.06%	0.30%
<i>Scleria verticillata</i>	nut-rush	0.24%	0.32%	0.28%
<i>Juncus brevicaudatus</i>	rush	0.17%	0.39%	0.28%
<i>Potentilla anserina</i>	silverweed	0.16%	0.32%	0.24%
<i>Hypericum kalmianum</i> 0.5 – 1m	Kalm's St. John's-wort	0.38%	0.10%	0.24%
<i>Alnus rugosa</i> 1 – 3m	tag alder	0.37%	0.10%	0.24%
unknown forb		0.00%	0.45%	0.23%
<i>Larix laricina</i> <0.5m	tamarack	0.03%	0.42%	0.23%
<i>Solidago ohioensis</i> / <i>S. uliginosa</i>	Ohio goldenrod/bog goldenrod	0.32%	0.13%	0.23%
<i>Triglochin maritimum</i> / <i>T. palustris</i>	grass/slender bog arrow-grass	0.00%	0.45%	0.22%
<i>Comandra umbellata</i>	bastard toadflax	0.06%	0.39%	0.22%
<i>Carex crawei</i>	Crawe's sedge	0.05%	0.39%	0.22%
<i>Pogonia ophioglossoides</i>	rose pogonia	0.01%	0.42%	0.22%
<i>Solidago altissima</i>	tall goldenrod	0.19%	0.22%	0.21%
<i>Proserpinaca palustris</i>	mermaid-weed	0.02%	0.39%	0.20%
<i>Carex buxbaumii</i>	Buxbaum's sedge	0.22%	0.16%	0.19%
<i>Aster umbellatus</i>	tall flat-top white aster	0.09%	0.29%	0.19%
<i>Euthamia graminifolia</i>	grass-leaved goldenrod	0.05%	0.32%	0.19%
<i>Eleocharis elliptica</i>	golden-seeded spike-rush	0.20%	0.16%	0.18%
<i>Calamagrostis inexpansa</i>	bog reedgrass	0.07%	0.26%	0.16%
<i>Acer rubrum</i> <0.5m	red maple	0.00%	0.32%	0.16%
<i>Eupatorium perfoliatum</i>	common boneset	0.03%	0.29%	0.16%
<i>Larix laricina</i> 0.5 – 1m	tamarack	0.24%	0.06%	0.15%
<i>Solidago houghtonii</i>	Houghton's goldenrod	0.11%	0.19%	0.15%
<i>Vaccinium oxycoccos</i>	small cranberry	0.06%	0.22%	0.14%
<i>Schoenoplectus acutus</i>	hardstem bulrush	0.01%	0.26%	0.14%
<i>Solidago canadensis</i>	Canada goldenrod	0.11%	0.16%	0.13%
<i>Polygala paucifolia</i>	gay wings	0.01%	0.26%	0.13%
<i>Aster lanceolatus</i>	eastern lined aster	0.01%	0.26%	0.13%
<i>Ledum groenlandicum</i> <0.5m	Labrador tea	0.13%	0.13%	0.13%
<i>Alnus rugosa</i> 3 – 10m	tag alder	0.19%	0.06%	0.13%
CIRSIUM PALUSTRE	MARSH THISTLE	0.09%	0.16%	0.12%
<i>Carex viridula</i>	little green sedge	0.05%	0.19%	0.12%
<i>Picea mariana</i> <0.5m	black spruce	0.12%	0.13%	0.12%
<i>Lysimachia quadriflora</i>	whorled loosestrife	0.02%	0.19%	0.11%
<i>Spiranthes cernua</i>	nodding ladies' tresses	0.00%	0.19%	0.10%

Species	Common Name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Castilleja coccinea</i>	Indian paintbrush	0.00%	0.19%	0.10%
<i>Utricularia</i> sp.	bladderwort	0.00%	0.19%	0.10%
<i>Iris lacustris</i>	dwarf lake iris	0.05%	0.13%	0.09%
<i>Solidago rugosa</i>	rough goldenrod	0.12%	0.06%	0.09%
<i>Juncus nodosus</i>	rush	0.03%	0.13%	0.08%
<i>Trientalis borealis</i>	starflower	0.03%	0.13%	0.08%
<i>Pinus strobus</i> 1 – 3m	white pine	0.12%	0.03%	0.08%
<i>Juniperus communis</i>	common juniper	0.09%	0.06%	0.08%
<i>Agalinis purpurea</i>	purple gerardii	0.02%	0.13%	0.08%
<i>Carex capillaris</i>	hair-like sedge	0.02%	0.13%	0.07%
RHAMNUS FRANGULA	GLOSSY			
<0.5m	BUCKTHORN	0.02%	0.13%	0.07%
<i>Pinguicula vulgaris</i>	butterwort	0.01%	0.13%	0.07%
<i>Drosera linearis</i>	linear-leaved sundew	0.00%	0.13%	0.07%
<i>Aronia prunifolia</i>	black chokeberry	0.00%	0.13%	0.06%
<i>Lobelia spicata</i>	pale spiked lobelia	0.00%	0.13%	0.06%
<i>Thelypteris palustris</i>	marsh fern	0.03%	0.10%	0.06%
<i>Aster</i> indet. 1	aster	0.06%	0.06%	0.06%
ERUCASTRUM GALLICUM	DOG MUSTARD	0.02%	0.10%	0.06%
<i>Arctostaphylos uva-ursi</i>	bearberry	0.05%	0.06%	0.06%
PRUNELLA VULGARIS	LAWN PRUNELLA	0.02%	0.10%	0.06%
<i>Aster puniceus</i>	swamp aster	0.05%	0.06%	0.05%
<i>Lathyrus palustris</i>	marsh pea	0.07%	0.03%	0.05%
<i>Triadenum fraseri</i>	marsh St. John's-wort	0.00%	0.10%	0.05%
<i>Campanula aparinoides</i>	marsh bellflower	0.00%	0.10%	0.05%
<i>Larix laricina</i> 3 – 10m	tamarack	0.03%	0.06%	0.05%
<i>Fragaria virginiana</i>	wild strawberry	0.02%	0.06%	0.04%
<i>Cornus sericea</i> <0.5m	red-osier dogwood	0.05%	0.03%	0.04%
<i>Aster firmus</i>	smooth swamp aster	0.02%	0.06%	0.04%
<i>Rudbeckia hirta</i>	black-eyed Susan	0.02%	0.06%	0.04%
<i>Coreopsis lanceolata</i>	sand coreopsis	0.01%	0.06%	0.04%
<i>Solidago ptarmicoides</i>	upland white goldenrod	0.01%	0.06%	0.04%
<i>Cornus sericea</i> 0.5 – 1m	red-osier dogwood	0.04%	0.03%	0.04%
<i>Carex</i> indet. 4	sedge	0.01%	0.06%	0.04%
<i>Vaccinium angustifolium</i>	low sweet blueberry	0.00%	0.06%	0.03%
<i>Alnus rugosa</i> 0.5 – 1m	tag alder	0.03%	0.03%	0.03%
<i>Anemone canadensis</i>	Canada anemone	0.03%	0.03%	0.03%
<i>Populus balsamifera</i> 0.5 – 1m	balsam poplar	0.03%	0.03%	0.03%
<i>Populus tremuloides</i> <0.5m	quaking aspen	0.00%	0.06%	0.03%
<i>Stachys</i> sp.	hedge nettle	0.00%	0.06%	0.03%
<i>Viola nephrophylla</i>	bog violet	0.00%	0.06%	0.03%
<i>Fraxinus pennsylvanicus</i>	green ash			
<0.5m		0.00%	0.06%	0.03%
<i>Lycopus americanus</i>	horehound	0.00%	0.06%	0.03%
unknown graminoid		0.00%	0.06%	0.03%
unknown woody seedling		0.00%	0.06%	0.03%
<i>Cirsium muticum</i>	swamp thistle	0.02%	0.03%	0.03%
<i>Lysimachia terrestris</i>	swamp candles	0.02%	0.03%	0.02%

Species	Common Name	Relative Cover (%)	Relative Frequency (%)	Importance Value
<i>Asclepias incarnata</i>	swamp milkweed	0.01%	0.03%	0.02%
<i>Betula papyrifera</i>	paper birch	0.01%	0.03%	0.02%
<i>Calystegia sepium</i>	hedge bindweed	0.01%	0.03%	0.02%
<i>Carex</i> indet. 1	sedge	0.01%	0.03%	0.02%
<i>Carex lasiocarpa</i>	wiregrass sedge	0.01%	0.03%	0.02%
<i>Gaylussacia baccata</i> <0.5m	huckleberry	0.01%	0.03%	0.02%
<i>Hieracium caespitosum</i>	king devil	0.01%	0.03%	0.02%
<i>Iris versicolor</i>	wild blue flag	0.01%	0.03%	0.02%
<i>Salix petiolaris</i> 1 – 3m	slender willow	0.01%	0.03%	0.02%
<i>Alnus rugosa</i> <0.5m	tag alder	0.00%	0.03%	0.02%
<i>Bromus ciliatus</i>	fringed brome	0.00%	0.03%	0.02%
<i>Eleocharis smallii</i>	spike-rush	0.00%	0.03%	0.02%
<i>Mentha spicata</i>	wild mint	0.00%	0.03%	0.02%
<i>Prenanthes racemosa</i>	glaucous white lettuce	0.00%	0.03%	0.02%
<i>Salix candida</i> 0.5 – 1m	sage willow	0.00%	0.03%	0.02%
<i>Sonchus</i> sp.	sow thistle	0.00%	0.03%	0.02%
<i>Vaccinium myrtilloides</i>	Canada blueberry	0.00%	0.03%	0.02%
<i>Zigadenus glaucus</i>	white camas	0.00%	0.03%	0.02%
<i>Campanula rotundifolia</i>	harebell	0.00%	0.03%	0.02%
<i>Carex</i> indet. 3	sedge	0.00%	0.03%	0.02%
<i>Cypripedium parviflorum</i> var. <i>pubescens</i>	large yellow lady's-slipper	0.00%	0.03%	0.02%
<i>Lilium philadelphicum</i>	wood lily	0.00%	0.03%	0.02%
<i>Osmunda regalis</i>	royal fern	0.00%	0.03%	0.02%
<i>Polygonum</i> sp.	smartweed	0.00%	0.03%	0.02%
<i>Rhamnus alnifolia</i> <0.5m	alder-leaved buckthorn	0.00%	0.03%	0.02%
<i>Salix candida</i> <0.5m	sage willow	0.00%	0.03%	0.02%
<i>Salix</i> indet. 2	willow	0.00%	0.03%	0.02%
<i>Salix</i> indet. 3	willow	0.00%	0.03%	0.02%
<i>Senecio aureus</i>	golden ragwort	0.00%	0.03%	0.02%
<i>Aster</i> sp.	aster	0.00%	0.03%	0.02%
<i>Carex</i> indet. 2	sedge	0.00%	0.03%	0.02%
<i>Eupatorium maculatum</i>	joe-pye-weed	0.00%	0.03%	0.02%
<i>Liparis loeselii</i>	Loesel's twayblade	0.00%	0.03%	0.02%
<i>Poa compressa</i>	Canada bluegrass	0.00%	0.03%	0.02%
<i>Salix</i> indet. 1.	sedge	0.00%	0.03%	0.02%
unknown conifer seedling		0.00%	0.03%	0.02%
unknown deciduous seedling		0.00%	0.03%	0.02%
unknown sterile graminoid		0.00%	0.03%	0.02%
<i>Aster</i> indet. 2	aster	0.00%	0.03%	0.02%

Appendix 5a. Floristic Quality Assessment of El Cajon Bay.

Site: El Cajon Bay Coastal Fen EO-57-1936
 Locale: Alpena Co., MI
 Date: August 9, 10, 2010 - hours
 By: Brad Slaughter, Dave Cuthrell
 File: c:\Active Projects\Coastal fen CZM grant\FQA\El Cajon Bay Coastal Fen EO-57-1936.inv
 Notes: Also: Viola sp., Carex sp. (**78 spp. total**)

FLORISTIC QUALITY DATA		Native		Adventive			
73	NATIVE SPECIES	Tree	5	6.6%	Tree	0	0.0%
76	Total Species	Shrub	8	10.5%	Shrub	1	1.3%
6.5	NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0	0.0%
6.3	W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
55.9	NATIVE FQI	P-Forb	30	39.5%	P-Forb	1	1.3%
54.8	W/Adventives	B-Forb	1	1.3%	B-Forb	1	1.3%
-3.2	NATIVE MEAN W	A-Forb	3	3.9%	A-Forb	0	0.0%
-3.1	W/Adventives	P-Grass	7	9.2%	P-Grass	0	0.0%
AVG:	Fac. Wetland	A-Grass	0	0.0%	A-Grass	0	0.0%
		P-Sedge	15	19.7%	P-Sedge	0	0.0%
		A-Sedge	1	1.3%	A-Sedge	0	0.0%
		Fern	3	3.9%			

ACRONYM	C	SCIENTIFIC NAME	W	WETNESS	PHYSIOGNOMY	COMMON NAME
ACERUB	1	Acer rubrum	0	FAC	Nt Tree	RED MAPLE
ALNRUG	5	Alnus rugosa	-5	OBL	Nt Shrub	TAG ALDER
ANDSCO	5	Andropogon scoparius	3	FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ARCUVA	8	Arctostaphylos uva-ursi	5	UPL	Nt Shrub	BEARBERRY
ASTBOR	9	Aster borealis	-5	OBL	Nt P-Forb	NORTHERN BOG ASTER
CALCAN	3	Calamagrostis canadensis	-5	OBL	Nt P-Grass	BLUE JOINT GRASS
CALARK	10	Calamintha arkansana	-3	FACW	Nt P-Forb	LOW CALAMINT
CXBUXB	10	Carex buxbaumii	-5	OBL	Nt P-Sedge	SEDGE
CXEUBUR	7	Carex eburnea	4	FACU-	Nt P-Sedge	SEDGE
CXFLAV	4	Carex flava	-5	OBL	Nt P-Sedge	SEDGE
CXLIVI	10	Carex livida	-5	OBL	Nt P-Sedge	SEDGE
CXSTER	10	Carex sterilis	-5	OBL	Nt P-Sedge	SEDGE
CXSTRI	4	Carex stricta	-5	OBL	Nt P-Sedge	SEDGE

CXVIRI	4	Carex viridula	-5	OBL	Nt	P-Sedge	SEDGE
CASCOC	8	Castilleja coccinea	0	FAC	Nt	A-Forb	INDIAN PAINTBRUSH
CICBUL	5	Cicuta bulbifera	-5	OBL	Nt	P-Forb	WATER HEMLOCK
CIRMUT	6	Cirsium muticum	-5	OBL	Nt	B-Forb	SWAMP THISTLE
CIRVUL	0	CIRSIUM VULGARE	4	FACU-	Ad	B-Forb	BULL THISTLE
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
CORSTO	2	Cornus stolonifera	-3	FACW	Nt	Shrub	RED OSIER DOGWOOD
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
DROLIN	10	Drosera linearis	-5	OBL	Nt	P-Forb	LINEAR LEAVED SUNDEW
ELEQUI	10	Eleocharis quinqueflora	-5	OBL	Nt	P-Sedge	SPIKE RUSH
ELEROS	10	Eleocharis rostellata	-5	OBL	Nt	P-Sedge	SPIKE RUSH
ELESMA	5	Eleocharis smallii	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
FRAPEN	2	Fraxinus pennsylvanica	-3	FACW	Nt	Tree	RED ASH
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
IRILAC	9	Iris lacustris	0	FAC	Nt	P-Forb	DWARF LAKE IRIS
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRP	7	Juncus brachycephalus	-5	OBL	Nt	P-Forb	RUSH
JUNBRE	8	Juncus brevicaudatus	-5	OBL	Nt	P-Forb	RUSH
JUNHOR	10	Juniperus horizontalis	1	FAC-	Nt	Shrub	CREEPING JUNIPER
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LONOBL	8	Lonicera oblongifolia	-5	OBL	Nt	Shrub	SWAMP FLY HONEYSUCKLE
LYCAME	2	Lycopus americanus	-5	OBL	Nt	P-Forb	COMMON WATER HOREHOUND
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
LYTSAL	0	LYTHRUM SALICARIA	-5	OBL	Ad	P-Forb	PURPLE LOOSESTRIFE
MUHGL0	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PHRAUS	0	Phragmites australis	-4	FACW+	Nt	P-Grass	REED
PICMAR	6	Picea mariana	-3	FACW	Nt	Tree	BLACK SPRUCE
POGOPH	10	Pogonia ophioglossoides	-5	OBL	Nt	P-Forb	ROSE POGONIA
POTANS	5	Potentilla anserina	-4	FACW+	Nt	P-Forb	SILVERWEED
POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL

PRIMIS	10	Primula mistassinica	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHAFRA	0	RHAMNUS FRANGULA	-1	FAC+	Ad	Shrub	GLOSSY BUCKTHORN
RHYALB	6	Rhynchospora alba	-5	OBL	Nt	P-Sedge	BEAK RUSH
RHYCAL	10	Rhynchospora capillacea	-5	OBL	Nt	P-Sedge	BEAK RUSH
RUDHIR	1	Rudbeckia hirta	3	FACU	Nt	P-Forb	BLACK EYED SUSAN
SALCAN	9	Salix candida	-5	OBL	Nt	Shrub	HOARY WILLOW
SARPUP	10	Sarracenia purpurea	-5	OBL	Nt	P-Forb	PITCHER PLANT
SCHPUN	5	Schoenoplectus pungens	-5	OBL	Nt	P-Sedge	THREE SQUARE
SCLVER	10	Scleria verticillata	-5	OBL	Nt	A-Sedge	NUT RUSH
SELECL	5	Selaginella eclipses	-4	FACW+	Nt	F...Ally	SELAGINELLA
SENPAU	3	Senecio pauperculus	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SOLALT	1	Solidago altissima	3	FACU	Nt	P-Forb	TALL GOLDENROD
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLPTA	6	Solidago ptarmicoides	5	UPL	Nt	P-Forb	UPLAND WHITE GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
SPICER	4	Spiranthes cernua	-2	FACW-	Nt	P-Forb	NODDING LADIES' TRESSES
THEPAL	2	Thelypteris palustris	-4	FACW+	Nt	Fern	MARSH FERN
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRIFRA	6	Triadenum fraseri	-5	OBL	Nt	P-Forb	MARSH ST. JOHN'S WORT
TRICES	10	Trichophorum cespitosum	-5	OBL	Nt	P-Sedge	BULRUSH
TRIMAR	8	Triglochin maritimum	-5	OBL	Nt	P-Forb	COMMON BOG ARROW GRASS
TRIPAL	8	Triglochin palustris	-5	OBL	Nt	P-Forb	SLENDER BOG ARROW GRASS
UTRCOR	10	Utricularia cornuta	-5	OBL	Nt	A-Forb	HORNED BLADDERWORT

Appendix 5b. Floristic Quality Assessment for Whitefish Bay.

Site: Whitefish Bay Coastal Fen EO-56-24
 Locale: Alpena Co., MI
 Date: August 11, 2010 - hours
 By: Brad Slaughter, Dave Cuthrell
 File: c:\FQA\studies\Whitefish Bay.inv
 Notes: Also: Carex sp., Viola sp., Salix sp., Platanthera hyperborea = P. huronensis. (77 total spp.)

FLORISTIC QUALITY DATA		Native		Adventive	
70	NATIVE SPECIES	Tree	4 5.4%	Tree	0 0.0%
74	Total Species	Shrub	9 12.2%	Shrub	1 1.4%
6.9	NATIVE MEAN C	W-Vine	1 1.4%	W-Vine	0 0.0%
6.5	W/Adventives	H-Vine	0 0.0%	H-Vine	0 0.0%
57.8	NATIVE FQI	P-Forb	33 44.6%	P-Forb	2 2.7%
56.3	W/Adventives	B-Forb	0 0.0%	B-Forb	1 1.4%
-2.9	NATIVE MEAN W	A-Forb	3 4.1%	A-Forb	0 0.0%
-2.6	W/Adventives	P-Grass	7 9.5%	P-Grass	0 0.0%
AVG: Fac. Wetland		A-Grass	0 0.0%	A-Grass	0 0.0%
		P-Sedge	12 16.2%	P-Sedge	0 0.0%
		A-Sedge	0 0.0%	A-Sedge	0 0.0%
		Fern	1 1.4%		

ACRONYM	C	SCIENTIFIC NAME	W	WETNESS	PHYSIOGNOMY	COMMON NAME
ANDGLA	10	Andromeda glaucophylla	-5	OBL	Nt Shrub	BOG ROSEMARY
ANDSCO	5	Andropogon scoparius	3	FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ARCUVA	8	Arctostaphylos uva-ursi	5	UPL	Nt Shrub	BEARBERRY
ASCINC	6	Asclepias incarnata	-5	OBL	Nt P-Forb	SWAMP MILKWEED
ASTBOR	9	Aster borealis	-5	OBL	Nt P-Forb	NORTHERN BOG ASTER
BETALL	7	Betula alleghaniensis	0	FAC	Nt Tree	YELLOW BIRCH
CALCAN	3	Calamagrostis canadensis	-5	OBL	Nt P-Grass	BLUE JOINT GRASS
CALARK	10	Calamintha arkansana	-3	FACW	Nt P-Forb	LOW CALAMINT
CALTUB	9	Calopogon tuberosus	-5	OBL	Nt P-Forb	GRASS PINK
CXCAPI	9	Carex capillaris	-3	FACW	Nt P-Sedge	SEDGE
CXE BUR	7	Carex eburnea	4	FACU-	Nt P-Sedge	SEDGE
CXFLAV	4	Carex flava	-5	OBL	Nt P-Sedge	SEDGE
CXSTER	10	Carex sterilis	-5	OBL	Nt P-Sedge	SEDGE

CXSTRI	4	Carex stricta	-5	OBL	Nt	P-Sedge	SEDGE
CASCOC	8	Castilleja coccinea	0	FAC	Nt	A-Forb	INDIAN PAINTBRUSH
CENMAU	0	CENTAUREA MACULOSA	5	UPL	Ad	B-Forb	SPOTTED BLUET
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
DROLIN	10	Drosera linearis	-5	OBL	Nt	P-Forb	LINEAR LEAVED SUNDEW
DROROT	6	Drosera rotundifolia	-5	OBL	Nt	P-Forb	ROUND LEAVED SUNDEW
ELEROS	10	Eleocharis rostellata	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HIECAE	0	HIERACIUM CAESPITOSUM	5	UPL	Ad	P-Forb	KING DEVIL
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
IRILAC	9	Iris lacustris	0	FAC	Nt	P-Forb	DWARF LAKE IRIS
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNCOI	4	Juniperus communis	3	FACU	Nt	Shrub	COMMON or GROUND JUNIPER
JUNHOR	10	Juniperus horizontalis	1	FAC-	Nt	Shrub	CREEPING JUNIPER
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LILPHI	10	Lilium philadelphicum	1	FAC-	Nt	P-Forb	WOOD LILY
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LOBSPI	4	Lobelia spicata	0	FAC	Nt	P-Forb	PALE SPIKED LOBELIA
LONOBL	8	Lonicera oblongifolia	-5	OBL	Nt	Shrub	SWAMP FLY HONEYSUCKLE
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
LYTSAL	0	LYTHRUM SALICARIA	-5	OBL	Ad	P-Forb	PURPLE LOOSESTRIFE
MUHGLO	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PEDLAN	8	Pedicularis lanceolata	-4	FACW+	Nt	P-Forb	SWAMP BETONY
PHRAUS	0	Phragmites australis	-4	FACW+	Nt	P-Grass	REED
PICMAR	6	Picea mariana	-3	FACW	Nt	Tree	BLACK SPRUCE
PLAHYP	5	Platanthera hyperborea	-4	FACW+	Nt	P-Forb	TALL NORTHERN BOG ORCHID
POGOPH	10	Pogonia ophioglossoides	-5	OBL	Nt	P-Forb	ROSE POGONIA
POTANS	5	Potentilla anserina	-4	FACW+	Nt	P-Forb	SILVERWEED
POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRIMIS	10	Primula mistassinica	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE

PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHAFRA	0	RHAMNUS FRANGULA	-1	FAC+	Ad	Shrub	GLOSSY BUCKTHORN
RHYALB	6	Rhynchospora alba	-5	OBL	Nt	P-Sedge	BEAK RUSH
RHYCAL	10	Rhynchospora capillacea	-5	OBL	Nt	P-Sedge	BEAK RUSH
RUDHIR	1	Rudbeckia hirta	3	FACU	Nt	P-Forb	BLACK EYED SUSAN
SARPUP	10	Sarracenia purpurea	-5	OBL	Nt	P-Forb	PITCHER PLANT
SCHACU	5	Schoenoplectus acutus	-5	OBL	Nt	P-Sedge	HARDSTEM BULRUSH
SCHPUN	5	Schoenoplectus pungens	-5	OBL	Nt	P-Sedge	THREE SQUARE
SENPAU	3	Senecio pauperculus	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SHECAN	7	Shepherdia canadensis	5	UPL	Nt	Shrub	SOAPBERRY
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLRUG	3	Solidago rugosa	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
SPICER	4	Spiranthes cernua	-2	FACW-	Nt	P-Forb	NODDING LADIES' TRESSES
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRICES	10	Trichophorum cespitosum	-5	OBL	Nt	P-Sedge	BULRUSH
TRIMAR	8	Triglochin maritimum	-5	OBL	Nt	P-Forb	COMMON BOG ARROW GRASS
TRIPAL	8	Triglochin palustris	-5	OBL	Nt	P-Forb	SLENDER BOG ARROW GRASS
UTRCOR	10	Utricularia cornuta	-5	OBL	Nt	A-Forb	HORNED BLADDERWORT
UTRINT	10	Utricularia intermedia	-5	OBL	Nt	P-Forb	FLAT LEAVED BLADDERWORT
VITRIP	3	Vitis riparia	-2	FACW-	Nt	W-Vine	RIVERBANK GRAPE
ZIGGLA	10	Zigadenus glaucus	-3	FACW	Nt	P-Forb	WHITE CAMAS

Appendix 5c. Floristic Quality Assessment of Thunder Bay/Squaw Bay.

Site: Thunder Bay/Squaw Bay EO-25-13250
 Locale: Alpena Co.
 Date: August 12, 2010 - hours
 By: Brad Slaughter, Dave Cuthrell
 File: c:\Active Projects\Coastal fen CZM grant\FQA\Thunder Bay, Squaw Bay EO-25-13250.inv
 Notes: Also: Polygonum sp., Aster ?lanceolatus, Viola sp. (65 total spp.)

FLORISTIC QUALITY DATA		Native		Adventive			
61	NATIVE SPECIES	Tree	6	9.7%	Tree	0	0.0%
62	Total Species	Shrub	8	12.9%	Shrub	1	1.6%
6.2	NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0	0.0%
6.1	W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
48.8	NATIVE FQI	P-Forb	24	38.7%	P-Forb	0	0.0%
48.4	W/Adventives	B-Forb	0	0.0%	B-Forb	0	0.0%
-3.5	NATIVE MEAN W	A-Forb	2	3.2%	A-Forb	0	0.0%
-3.5	W/Adventives	P-Grass	6	9.7%	P-Grass	0	0.0%
AVG:	Fac. Wetland (+)	A-Grass	0	0.0%	A-Grass	0	0.0%
		P-Sedge	12	19.4%	P-Sedge	0	0.0%
		A-Sedge	0	0.0%	A-Sedge	0	0.0%
		Fern	3	4.8%			

ACRONYM	C	SCIENTIFIC NAME	W	WETNESS	PHYSIOGNOMY	COMMON NAME
ACERUB	1	Acer rubrum	0	FAC	Nt Tree	RED MAPLE
ALNRUG	5	Alnus rugosa	-5	OBL	Nt Shrub	TAG ALDER
AROPRU	5	Aronia prunifolia	-3	FACW	Nt Shrub	BLACK CHOKEBERRY
ASCINC	6	Asclepias incarnata	-5	OBL	Nt P-Forb	SWAMP MILKWEED
ASTUMB	5	Aster umbellatus	-3	FACW	Nt P-Forb	TALL FLAT TOP WHITE ASTER
CALCAN	3	Calamagrostis canadensis	-5	OBL	Nt P-Grass	BLUE JOINT GRASS
CALINE	8	Calamagrostis inexpansa	-4	FACW+	Nt P-Grass	BOG REEDGRASS
CXEBUR	7	Carex eburnea	4	FACU-	Nt P-Sedge	SEDGE
CXFLAV	4	Carex flava	-5	OBL	Nt P-Sedge	SEDGE
CXLIVI	10	Carex livida	-5	OBL	Nt P-Sedge	SEDGE
CXSTER	10	Carex sterilis	-5	OBL	Nt P-Sedge	SEDGE
CXSTRI	4	Carex stricta	-5	OBL	Nt P-Sedge	SEDGE
CXVIRI	4	Carex viridula	-5	OBL	Nt P-Sedge	SEDGE

CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
CYCAPU	5	Cypripedium calceolus var. pubescens	-1	FAC+	Nt	P-Forb	LARGE YELLOW LADY'S SLIPPER
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
DROROT	6	Drosera rotundifolia	-5	OBL	Nt	P-Forb	ROUND LEAVED SUNDEW
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
ERIVID	8	Eriophorum viridi-carinatum	-5	OBL	Nt	P-Sedge	GREEN KEELED COTTON GRASS
EUTGRA	3	Euthamia graminifolia	-2	FACW-	Nt	P-Forb	GRASS LEAVED GOLDENROD
FRAVIR	2	Fragaria virginiana	1	FAC-	Nt	P-Forb	WILD STRAWBERRY
FRAPEN	2	Fraxinus pennsylvanica	-3	FACW	Nt	Tree	RED ASH
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRP	7	Juncus brachycephalus	-5	OBL	Nt	P-Forb	RUSH
JUNBRE	8	Juncus brevicaudatus	-5	OBL	Nt	P-Forb	RUSH
JUNCOI	4	Juniperus communis	3	FACU	Nt	Shrub	COMMON or GROUND JUNIPER
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
MUHGL	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
OSMREG	5	Osmunda regalis	-5	OBL	Nt	Fern	ROYAL FERN
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PHRAUS	0	Phragmites australis	-4	FACW+	Nt	P-Grass	REED
PINSTR	3	Pinus strobus	3	FACU	Nt	Tree	WHITE PINE
POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRIMIS	10	Primula mistassinica	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PROPAL	6	Proserpinaca palustris	-5	OBL	Nt	P-Forb	MERMAID WEED
QUERUB	5	Quercus rubra	3	FACU	Nt	Tree	RED OAK
RHAFRA	0	RHAMNUS FRANGULA	-1	FAC+	Ad	Shrub	GLOSSY BUCKTHORN
RHYALB	6	Rhynchospora alba	-5	OBL	Nt	P-Sedge	BEAK RUSH
RHYCAL	10	Rhynchospora capillacea	-5	OBL	Nt	P-Sedge	BEAK RUSH
SARPUP	10	Sarracenia purpurea	-5	OBL	Nt	P-Forb	PITCHER PLANT
SCHPUN	5	Schoenoplectus pungens	-5	OBL	Nt	P-Sedge	THREE SQUARE
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLRUG	3	Solidago rugosa	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
SPICER	4	Spiranthes cernua	-2	FACW-	Nt	P-Forb	NODDING LADIES' TRESSES
THEPAL	2	Thelypteris palustris	-4	FACW+	Nt	Fern	MARSH FERN

THUOCC	4	<i>Thuja occidentalis</i>	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	<i>Tofieldia glutinosa</i>	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRIFRA	6	<i>Triadenum fraseri</i>	-5	OBL	Nt	P-Forb	MARSH ST. JOHN'S WORT
TRIALP	10	<i>Trichophorum alpinum</i>	-5	OBL	Nt	P-Sedge	BULRUSH
TRIBOR	5	<i>Trientalis borealis</i>	-1	FAC+	Nt	P-Forb	STARFLOWER
TRIMAR	8	<i>Triglochin maritimum</i>	-5	OBL	Nt	P-Forb	COMMON BOG ARROW GRASS
TRIPAL	8	<i>Triglochin palustris</i>	-5	OBL	Nt	P-Forb	SLENDER BOG ARROW GRASS
UTRCOR	10	<i>Utricularia cornuta</i>	-5	OBL	Nt	A-Forb	HORNED BLADDERWORT
UTRINT	10	<i>Utricularia intermedia</i>	-5	OBL	Nt	P-Forb	FLAT LEAVED BLADDERWORT
VACMYR	4	<i>Vaccinium myrtilloides</i>	-2	FACW-	Nt	Shrub	CANADA BLUEBERRY
VACOXY	8	<i>Vaccinium oxycoccos</i>	-5	OBL	Nt	Shrub	SMALL CRANBERRY

Appendix 5d. Floristic Quality Assessment for Thompson's Harbor Coastal Fen.

Site: Thompson's Harbor State Park
 Locale: Presque Isle Co., MI
 Date: August 13, 2010 - hours
 By: Brad Slaughter, Dave Cuthrell
 File: c:\Active Projects\Coastal fen CZM grant\FQA\Thompson's Harbor Coastal Fen EO-3-11086.inv
 Notes: Also: indet. Salix spp. (2), Polygonum sp., Stachys sp., Aster sp., Sonchus sp., Viola sp. (110 total spp.)

FLORISTIC QUALITY DATA		Native		Adventive		
99 NATIVE SPECIES	Tree	8	7.8%	Tree	0	0.0%
103 Total Species	Shrub	12	11.7%	Shrub	0	0.0%
6.3 NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0	0.0%
6.1 W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
62.8 NATIVE FQI	P-Forb	45	43.7%	P-Forb	3	2.9%
61.6 W/Adventives	B-Forb	1	1.0%	B-Forb	0	0.0%
-2.9 NATIVE MEAN W	A-Forb	4	3.9%	A-Forb	0	0.0%
-2.8 W/Adventives	P-Grass	8	7.8%	P-Grass	1	1.0%
AVG: Fac. Wetland	A-Grass	0	0.0%	A-Grass	0	0.0%
	P-Sedge	16	15.5%	P-Sedge	0	0.0%
	A-Sedge	1	1.0%	A-Sedge	0	0.0%
	Fern	4	3.9%			

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ACERUB	1 Acer rubrum	0 FAC	Nt Tree	RED MAPLE
AGAPUR	7 Agalinis purpurea	-3 FACW	Nt A-Forb	PURPLE GERARDIA
ANDSCO	5 Andropogon scoparius	3 FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ARCUVA	8 Arctostaphylos uva-ursi	5 UPL	Nt Shrub	BEARBERRY
ASTBOR	9 Aster borealis	-5 OBL	Nt P-Forb	NORTHERN BOG ASTER
ASTFIR	4 Aster firmus	-5 OBL	Nt P-Forb	SMOOTH SWAMP ASTER
ASTLAN	2 Aster lanceolatus	-3 FACW	Nt P-Forb	EASTERN LINED ASTER
ASTMAC	4 Aster macrophyllus	5 UPL	Nt P-Forb	BIG LEAVED ASTER
ASTPUN	5 Aster puniceus	-5 OBL	Nt P-Forb	SWAMP ASTER
ASTUMB	5 Aster umbellatus	-3 FACW	Nt P-Forb	TALL FLAT TOP WHITE ASTER
BETPAP	2 Betula papyrifera	2 FACU+	Nt Tree	PAPER BIRCH
CACPLA	10 Cacalia plantaginea	0 FAC	Nt P-Forb	TUBEROUS INDIAN PLANTAIN

CALCAN	3	Calamagrostis canadensis	-5	OBL	Nt	P-Grass	BLUE JOINT GRASS
CALINE	8	Calamagrostis inexpansa	-4	FACW+	Nt	P-Grass	BOG REEDGRASS
CALARK	10	Calamintha arkansana	-3	FACW	Nt	P-Forb	LOW CALAMINT
CALTUB	9	Calopogon tuberosus	-5	OBL	Nt	P-Forb	GRASS PINK
CXBUXB	10	Carex buxbaumii	-5	OBL	Nt	P-Sedge	SEDGE
CXCAPI	9	Carex capillaris	-3	FACW	Nt	P-Sedge	SEDGE
CXCRAE	10	Carex crawei	-3	FACW	Nt	P-Sedge	SEDGE
CXFLAV	4	Carex flava	-5	OBL	Nt	P-Sedge	SEDGE
CXLASI	8	Carex lasiocarpa	-5	OBL	Nt	P-Sedge	SEDGE
CXSTER	10	Carex sterilis	-5	OBL	Nt	P-Sedge	SEDGE
CXSTRI	4	Carex stricta	-5	OBL	Nt	P-Sedge	SEDGE
CXVIRI	4	Carex viridula	-5	OBL	Nt	P-Sedge	SEDGE
CASCOC	8	Castilleja coccinea	0	FAC	Nt	A-Forb	INDIAN PAINTBRUSH
CIRMUT	6	Cirsium muticum	-5	OBL	Nt	B-Forb	SWAMP THISTLE
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
CORSTO	2	Cornus stolonifera	-3	FACW	Nt	Shrub	RED OSIER DOGWOOD
CYCAPU	5	Cypripedium calceolus var. pubescens	-1	FAC+	Nt	P-Forb	LARGE YELLOW LADY'S SLIPPER
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
DROLIN	10	Drosera linearis	-5	OBL	Nt	P-Forb	LINEAR LEAVED SUNDEW
DROROT	6	Drosera rotundifolia	-5	OBL	Nt	P-Forb	ROUND LEAVED SUNDEW
ELEROS	10	Eleocharis rostellata	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EQUFLU	7	Equisetum fluviatile	-5	OBL	Nt	F...Ally	WATER HORSETAIL
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
ERIVID	8	Eriophorum viridi-carinatum	-5	OBL	Nt	P-Sedge	GREEN KEELED COTTON GRASS
EUPMAM	4	Eupatorium maculatum	-5	OBL	Nt	P-Forb	JOE PYE WEED
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
EUTGRA	3	Euthamia graminifolia	-2	FACW-	Nt	P-Forb	GRASS LEAVED GOLDENROD
FRAPEN	2	Fraxinus pennsylvanica	-3	FACW	Nt	Tree	RED ASH
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HIECAE	0	HIERACIUM CAESPITOSUM	5	UPL	Ad	P-Forb	KING DEVIL
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
IRILAC	9	Iris lacustris	0	FAC	Nt	P-Forb	DWARF LAKE IRIS
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRP	7	Juncus brachycephalus	-5	OBL	Nt	P-Forb	RUSH
JUNCOI	4	Juniperus communis	3	FACU	Nt	Shrub	COMMON or GROUND JUNIPER
JUNHOR	10	Juniperus horizontalis	1	FAC-	Nt	Shrub	CREEPING JUNIPER

LARLAR	5	<i>Larix laricina</i>	-3	FACW	Nt	Tree	TAMARACK
LATPAL	7	<i>Lathyrus palustris</i>	-3	FACW	Nt	P-Forb	MARSH PEA
LEDGRO	8	<i>Ledum groenlandicum</i>	-5	OBL	Nt	Shrub	LABRADOR TEA
LIPLOE	5	<i>Liparis loeselii</i>	-4	FACW+	Nt	P-Forb	LOESEL'S TWAYBLADE
LOBKAL	10	<i>Lobelia kalmii</i>	-5	OBL	Nt	P-Forb	BOG LOBELIA
LONOBL	8	<i>Lonicera oblongifolia</i>	-5	OBL	Nt	Shrub	SWAMP FLY HONEYSUCKLE
LYCUNI	2	<i>Lycopus uniflorus</i>	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
LYSQUR	10	<i>Lysimachia quadriflora</i>	-5	OBL	Nt	P-Forb	WHORLED LOOSESTRIFE
MENPIP	0	MENTHA PIPERITA	-5	OBL	Ad	P-Forb	PEPPERMINT
MUHGLO	10	<i>Muhlenbergia glomerata</i>	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
ONOSEN	2	<i>Onoclea sensibilis</i>	-3	FACW	Nt	Fern	SENSITIVE FERN
PANLID	8	<i>Panicum lindheimeri</i>	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	<i>Parnassia glauca</i>	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PHRAUS	0	<i>Phragmites australis</i>	-4	FACW+	Nt	P-Grass	REED
PICMAR	6	<i>Picea mariana</i>	-3	FACW	Nt	Tree	BLACK SPRUCE
PINVUL	10	<i>Pinguicula vulgaris</i>	-5	OBL	Nt	P-Forb	BUTTERWORT
PLAHYP	5	<i>Platanthera hyperborea</i>	-4	FACW+	Nt	P-Forb	TALL NORTHERN BOG ORCHID
POACOM	0	POA COMPRESSA	2	FACU+	Ad	P-Grass	CANADA BLUEGRASS
POPBAL	2	<i>Populus balsamifera</i>	-3	FACW	Nt	Tree	BALSAM POPLAR
POPTRE	1	<i>Populus tremuloides</i>	0	FAC	Nt	Tree	QUAKING ASPEN
POTANS	5	<i>Potentilla anserina</i>	-4	FACW+	Nt	P-Forb	SILVERWEED
POTFRU	10	<i>Potentilla fruticosa</i>	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRIMIS	10	<i>Primula mistassinica</i>	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHAALN	8	<i>Rhamnus alnifolia</i>	-5	OBL	Nt	Shrub	ALDER LEAVED BUCKTHORN
RHYALB	6	<i>Rhynchospora alba</i>	-5	OBL	Nt	P-Sedge	BEAK RUSH
RHYCAL	10	<i>Rhynchospora capillacea</i>	-5	OBL	Nt	P-Sedge	BEAK RUSH
RUDHIR	1	<i>Rudbeckia hirta</i>	3	FACU	Nt	P-Forb	BLACK EYED SUSAN
SALCAN	9	<i>Salix candida</i>	-5	OBL	Nt	Shrub	HOARY WILLOW
SARPUP	10	<i>Sarracenia purpurea</i>	-5	OBL	Nt	P-Forb	PITCHER PLANT
SCHACU	5	<i>Schoenoplectus acutus</i>	-5	OBL	Nt	P-Sedge	HARDSTEM BULRUSH
SCHPUN	5	<i>Schoenoplectus pungens</i>	-5	OBL	Nt	P-Sedge	THREE SQUARE
SCLVER	10	<i>Scleria verticillata</i>	-5	OBL	Nt	A-Sedge	NUT RUSH
SELECL	5	<i>Selaginella eclipses</i>	-4	FACW+	Nt	F...Ally	SELAGINELLA
SENAUR	5	<i>Senecio aureus</i>	-3	FACW	Nt	P-Forb	GOLDEN RAGWORT
SENPAU	3	<i>Senecio pauperculus</i>	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SHECAN	7	<i>Shepherdia canadensis</i>	5	UPL	Nt	Shrub	SOAPBERRY
SMISTE	5	<i>Smilacina stellata</i>	1	FAC-	Nt	P-Forb	STARRY FALSE SOLOMON SEAL

SOLCAN	1	Solidago canadensis	3	FACU	Nt	P-Forb	CANADA GOLDENROD
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLPTA	6	Solidago ptarmicoides	5	UPL	Nt	P-Forb	UPLAND WHITE GOLDENROD
SOLRUG	3	Solidago rugosa	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
SPICER	4	Spiranthes cernua	-2	FACW-	Nt	P-Forb	NODDING LADIES' TRESSES
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRIFRA	6	Triadenum fraseri	-5	OBL	Nt	P-Forb	MARSH ST. JOHN'S WORT
TRICES	10	Trichophorum cespitosum	-5	OBL	Nt	P-Sedge	BULRUSH
TRIMAR	8	Triglochin maritimum	-5	OBL	Nt	P-Forb	COMMON BOG ARROW GRASS
TRIPAL	8	Triglochin palustris	-5	OBL	Nt	P-Forb	SLENDER BOG ARROW GRASS
TYPANG	0	TYPHA ANGUSTIFOLIA	-5	OBL	Ad	P-Forb	NARROW LEAVED CATTAIL
UTRCOR	10	Utricularia cornuta	-5	OBL	Nt	A-Forb	HORNED BLADDERWORT
VACOXY	8	Vaccinium oxycoccos	-5	OBL	Nt	Shrub	SMALL CRANBERRY

Appendix 5e. Floristic Quality Assessment for Waugoshance Point.

Site: Waugoshance Point Coastal Fen EO-1-17336
 Locale: Emmet Co., MI
 Date: August 14, 2010 - hours
 By: Brad Slaughter, Dave Cuthrell
 File: c:\Active Projects\Coastal fen CZM grant\FQA\Waugoshance Point Coastal Fen EO-1-17336.inv
 Notes: Also: Salix sp., Aster lanceolatus/borealis, Potamogeton sp., Carex sp. (58 total spp.)

FLORISTIC QUALITY DATA						
	Native			Adventive		
54 NATIVE SPECIES	Tree	3	5.6%	Tree	0	0.0%
54 Total Species	Shrub	4	7.4%	Shrub	0	0.0%
6.4 NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0	0.0%
6.4 W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
47.2 NATIVE FQI	P-Forb	25	46.3%	P-Forb	0	0.0%
47.2 W/Adventives	B-Forb	1	1.9%	B-Forb	0	0.0%
-3.7 NATIVE MEAN W	A-Forb	4	7.4%	A-Forb	0	0.0%
-3.7 W/Adventives	P-Grass	8	14.8%	P-Grass	0	0.0%
AVG: Fac. Wetland (+)	A-Grass	0	0.0%	A-Grass	0	0.0%
	P-Sedge	7	13.0%	P-Sedge	0	0.0%
	A-Sedge	0	0.0%	A-Sedge	0	0.0%
	Fern	2	3.7%			

ACRONYM	C	SCIENTIFIC NAME	W	WETNESS	PHYSIOGNOMY	COMMON NAME
AGAPUR	7	Agalinis purpurea	-3	FACW	Nt A-Forb	PURPLE GERARDIA
ANDSCO	5	Andropogon scoparius	3	FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ARTCAM	5	Artemisia campestris	0	FAC	Nt B-Forb	WORMWOOD
ASCINC	6	Asclepias incarnata	-5	OBL	Nt P-Forb	SWAMP MILKWEED
CALCAN	3	Calamagrostis canadensis	-5	OBL	Nt P-Grass	BLUE JOINT GRASS
CALINE	8	Calamagrostis inexpansa	-4	FACW+	Nt P-Grass	BOG REEDGRASS
CALARK	10	Calamintha arkansana	-3	FACW	Nt P-Forb	LOW CALAMINT
CAMAPR	7	Campanula aparinoides	-5	OBL	Nt P-Forb	MARSH BELLFLOWER
CXLASI	8	Carex lasiocarpa	-5	OBL	Nt P-Sedge	SEDGE
CXVIRI	4	Carex viridula	-5	OBL	Nt P-Sedge	SEDGE
CASCOC	8	Castilleja coccinea	0	FAC	Nt A-Forb	INDIAN PAINTBRUSH
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt P-Sedge	TWIG RUSH
DANSPI	4	Danthonia spicata	5	UPL	Nt P-Grass	POVERTY GRASS; OATGRASS

DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
ELEQUI	10	Eleocharis quinqueflora	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
EUPMAM	4	Eupatorium maculatum	-5	OBL	Nt	P-Forb	JOE PYE WEED
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
EUTGRA	3	Euthamia graminifolia	-2	FACW-	Nt	P-Forb	GRASS LEAVED GOLDENROD
FRAPEN	2	Fraxinus pennsylvanica	-3	FACW	Nt	Tree	RED ASH
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
IRIVER	5	Iris versicolor	-5	OBL	Nt	P-Forb	WILD BLUE FLAG
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRP	7	Juncus brachycephalus	-5	OBL	Nt	P-Forb	RUSH
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LYCAME	2	Lycopus americanus	-5	OBL	Nt	P-Forb	COMMON WATER HOREHOUND
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
MUHGLO	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PHRAUS	0	Phragmites australis	-4	FACW+	Nt	P-Grass	REED
PINVUL	10	Pinguicula vulgaris	-5	OBL	Nt	P-Forb	BUTTERWORT
POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRIMIS	10	Primula mistassinica	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PROPAL	6	Proserpinaca palustris	-5	OBL	Nt	P-Forb	MERMAID WEED
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHYCAL	10	Rhynchospora capillacea	-5	OBL	Nt	P-Sedge	BEAK RUSH
SALCAN	9	Salix candida	-5	OBL	Nt	Shrub	HOARY WILLOW
SCHACU	5	Schoenoplectus acutus	-5	OBL	Nt	P-Sedge	HARDSTEM BULRUSH
SCHPUN	5	Schoenoplectus pungens	-5	OBL	Nt	P-Sedge	THREE SQUARE
SELECL	5	Selaginella eclipses	-4	FACW+	Nt	F...Ally	SELAGINELLA
SENPAU	3	Senecio pauperculus	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SOLHOU	10	Solidago houghtonii	-5	OBL	Nt	P-Forb	HOUGHTON'S GOLDENROD
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
SPICER	4	Spiranthes cernua	-2	FACW-	Nt	P-Forb	NODDING LADIES' TRESSES
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL

TRIFRA 6 Triadenum fraseri
TRIMAR 8 Triglochin maritimum
UTRCOR 10 Utricularia cornuta

-5 OBL Nt P-Forb MARSH ST. JOHN'S WORT
-5 OBL Nt P-Forb COMMON BOG ARROW GRASS
-5 OBL Nt A-Forb HORNED BLADDERWORT

Appendix 5f. Floristic Quality Assessment for Dudley Bay (West and East).

Site: Dudley Bay Coastal Fen
 Locale: Mackinac Co., MI
 Date: August 15, 2010 - hours
 By: Brad Slaughter, Dave Cuthrell
 File: c:\Active Projects\Coastal fen CZM grant\FQA\Dudley Bay Coastal Fen EO-26-13470.inv
 Notes: Also: Salix sp. with red petioles, Rubus sp., Aster sp., Viola sp. **(83 total spp.)**

FLORISTIC QUALITY DATA		Native		Adventive			
77	NATIVE SPECIES	Tree	7	8.9%	Tree	0	0.0%
79	Total Species	Shrub	8	10.1%	Shrub	0	0.0%
6.0	NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0	0.0%
5.8	W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
52.3	NATIVE FQI	P-Forb	37	46.8%	P-Forb	0	0.0%
51.6	W/Adventives	B-Forb	0	0.0%	B-Forb	1	1.3%
-2.9	NATIVE MEAN W	A-Forb	3	3.8%	A-Forb	1	1.3%
-2.8	W/Adventives	P-Grass	8	10.1%	P-Grass	0	0.0%
AVG:	Fac. Wetland	A-Grass	0	0.0%	A-Grass	0	0.0%
		P-Sedge	12	15.2%	P-Sedge	0	0.0%
		A-Sedge	0	0.0%	A-Sedge	0	0.0%
		Fern	2	2.5%			

ACRONYM	C	SCIENTIFIC NAME	W	WETNESS	PHYSIOGNOMY	COMMON NAME
AGAPUR	7	Agalinis purpurea	-3	FACW	Nt A-Forb	PURPLE GERARDIA
AGRTRA	8	Agropyron trachycaulum	0	FAC	Nt P-Grass	SLENDER WHEAT GRASS
ALNRUG	5	Alnus rugosa	-5	OBL	Nt Shrub	TAG ALDER
ANECAN	4	Anemone canadensis	-3	FACW	Nt P-Forb	CANADA ANEMONE
ASTLAN	2	Aster lanceolatus	-3	FACW	Nt P-Forb	EASTERN LINED ASTER
ASTPUN	5	Aster puniceus	-5	OBL	Nt P-Forb	SWAMP ASTER
ASTUMB	5	Aster umbellatus	-3	FACW	Nt P-Forb	TALL FLAT TOP WHITE ASTER
BETPAP	2	Betula papyrifera	2	FACU+	Nt Tree	PAPER BIRCH
BROCIL	6	Bromus ciliatus	-3	FACW	Nt P-Grass	FRINGED BROME
CALCAN	3	Calamagrostis canadensis	-5	OBL	Nt P-Grass	BLUE JOINT GRASS
CALARK	10	Calamintha arkansana	-3	FACW	Nt P-Forb	LOW CALAMINT
CAMAPR	7	Campanula aparinoides	-5	OBL	Nt P-Forb	MARSH BELLFLOWER
CXCAPI	9	Carex capillaris	-3	FACW	Nt P-Sedge	SEDGE

CXEBUR	7	Carex eburnea	4	FACU-	Nt	P-Sedge	SEDGE
CXFLAV	4	Carex flava	-5	OBL	Nt	P-Sedge	SEDGE
CXSTRI	4	Carex stricta	-5	OBL	Nt	P-Sedge	SEDGE
CIRPAL	0	CIRSIUM PALUSTRE	-4	FACW+	Ad	B-Forb	MARSH THISTLE
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
CYCAPU	5	Cypripedium calceolus var. pubescens	-1	FAC+	Nt	P-Forb	LARGE YELLOW LADY'S SLIPPER
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
ELEELL	6	Eleocharis elliptica	-3	FACW	Nt	P-Sedge	GOLDEN SEEDED SPIKE RUSH
ELEQUI	10	Eleocharis quinqueflora	-5	OBL	Nt	P-Sedge	SPIKE RUSH
ELESMA	5	Eleocharis smallii	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
ERUGAL	0	ERUCASTRUM GALLICUM	5	UPL	Ad	A-Forb	DOG MUSTARD
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
EUTGRA	3	Euthamia graminifolia	-2	FACW-	Nt	P-Forb	GRASS LEAVED GOLDENROD
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
IRILAC	9	Iris lacustris	0	FAC	Nt	P-Forb	DWARF LAKE IRIS
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRP	7	Juncus brachycephalus	-5	OBL	Nt	P-Forb	RUSH
JUNNOD	5	Juncus nodosus	-5	OBL	Nt	P-Forb	JOINT RUSH
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
LYSTER	6	Lysimachia terrestris	-5	OBL	Nt	P-Forb	SWAMP CANDLES
MENARV	3	Mentha arvensis	-3	FACW	Nt	P-Forb	WILD MINT
MUHGLO	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PHAARU	0	Phalaris arundinacea	-4	FACW+	Nt	P-Grass	REED CANARY GRASS
PICMAR	6	Picea mariana	-3	FACW	Nt	Tree	BLACK SPRUCE
PINSTR	3	Pinus strobus	3	FACU	Nt	Tree	WHITE PINE
POLPAU	7	Polygala paucifolia	3	FACU	Nt	P-Forb	GAY WINGS
POPBAL	2	Populus balsamifera	-3	FACW	Nt	Tree	BALSAM POPLAR
POPTRE	1	Populus tremuloides	0	FAC	Nt	Tree	QUAKING ASPEN
POTANS	5	Potentilla anserina	-4	FACW+	Nt	P-Forb	SILVERWEED

POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRERAC	8	Prenanthes racemosa	-3	FACW	Nt	P-Forb	GLAUCOUS WHITE LETTUCE
PRIMIS	10	Primula mistassinica	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHAALN	8	Rhamnus alnifolia	-5	OBL	Nt	Shrub	ALDER LEAVED BUCKTHORN
RHYCAL	10	Rhynchospora capillacea	-5	OBL	Nt	P-Sedge	BEAK RUSH
SALCAN	9	Salix candida	-5	OBL	Nt	Shrub	HOARY WILLOW
SALPET	1	Salix petiolaris	-4	FACW+	Nt	Shrub	SLENDER WILLOW
SARPUP	10	Sarracenia purpurea	-5	OBL	Nt	P-Forb	PITCHER PLANT
SCHACU	5	Schoenoplectus acutus	-5	OBL	Nt	P-Sedge	HARDSTEM BULRUSH
SCHPUN	5	Schoenoplectus pungens	-5	OBL	Nt	P-Sedge	THREE SQUARE
SELECL	5	Selaginella eclipses	-4	FACW+	Nt	F...Ally	SELAGINELLA
SENPAU	3	Senecio pauperculus	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SHECAN	7	Shepherdia canadensis	5	UPL	Nt	Shrub	SOAPBERRY
SOLALT	1	Solidago altissima	3	FACU	Nt	P-Forb	TALL GOLDENROD
SOLCAN	1	Solidago canadensis	3	FACU	Nt	P-Forb	CANADA GOLDENROD
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLRUG	3	Solidago rugosa	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
SPICER	4	Spiranthes cernua	-2	FACW-	Nt	P-Forb	NODDING LADIES' TRESSES
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRICES	10	Trichophorum cespitosum	-5	OBL	Nt	P-Sedge	BULRUSH
TRIBOR	5	Trientalis borealis	-1	FAC+	Nt	P-Forb	STARFLOWER
TRIMAR	8	Triglochin maritimum	-5	OBL	Nt	P-Forb	COMMON BOG ARROW GRASS
TRIPAL	8	Triglochin palustris	-5	OBL	Nt	P-Forb	SLENDER BOG ARROW GRASS
UTRCOR	10	Utricularia cornuta	-5	OBL	Nt	A-Forb	HORNED BLADDERWORT
ZIGGLA	10	Zigadenus glaucus	-3	FACW	Nt	P-Forb	WHITE CAMAS

Appendix 5g. Floristic Quality Assessment for St. Martin Point.

Site: St. Martin Point coastal fen
 Locale: Mackinac Co., MI
 Date: August 16, 2010 - hours
 By: Brad Slaughter, Dave Cuthrell
 File: c:\FQA\studies\St. Martin Point.inv
 Notes: Also: Salix spp., Rubus sp., Ribes sp., Viola sp., Carex sp. (81 total spp.)

FLORISTIC QUALITY DATA		Native		Adventive	
75	NATIVE SPECIES	Tree	4 5.3%	Tree	0 0.0%
76	Total Species	Shrub	12 15.8%	Shrub	0 0.0%
6.1	NATIVE MEAN C	W-Vine	0 0.0%	W-Vine	0 0.0%
6.1	W/Adventives	H-Vine	0 0.0%	H-Vine	0 0.0%
53.2	NATIVE FQI	P-Forb	35 46.1%	P-Forb	0 0.0%
52.9	W/Adventives	B-Forb	0 0.0%	B-Forb	1 1.3%
-2.9	NATIVE MEAN W	A-Forb	3 3.9%	A-Forb	0 0.0%
-3.0	W/Adventives	P-Grass	10 13.2%	P-Grass	0 0.0%
AVG:	Fac. Wetland	A-Grass	0 0.0%	A-Grass	0 0.0%
		P-Sedge	9 11.8%	P-Sedge	0 0.0%
		A-Sedge	0 0.0%	A-Sedge	0 0.0%
		Fern	2 2.6%		

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ACHMIL	1 Achillea millefolium	3 FACU	Nt P-Forb	YARROW
AGAPUR	7 Agalinis purpurea	-3 FACW	Nt A-Forb	PURPLE GERARDIA
AGRTRA	8 Agropyron trachycaulum	0 FAC	Nt P-Grass	SLENDER WHEAT GRASS
ALNRUG	5 Alnus rugosa	-5 OBL	Nt Shrub	TAG ALDER
ANDSCO	5 Andropogon scoparius	3 FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ARCUVA	8 Arctostaphylos uva-ursi	5 UPL	Nt Shrub	BEARBERRY
ASTBOR	9 Aster borealis	-5 OBL	Nt P-Forb	NORTHERN BOG ASTER
ASTLAN	2 Aster lanceolatus	-3 FACW	Nt P-Forb	EASTERN LINED ASTER
ASTPUN	5 Aster puniceus	-5 OBL	Nt P-Forb	SWAMP ASTER
BROCIL	6 Bromus ciliatus	-3 FACW	Nt P-Grass	FRINGED BROME
CALCAN	3 Calamagrostis canadensis	-5 OBL	Nt P-Grass	BLUE JOINT GRASS
CALINE	8 Calamagrostis inexpansa	-4 FACW+	Nt P-Grass	BOG REEDGRASS
CALARK	10 Calamintha arkansana	-3 FACW	Nt P-Forb	LOW CALAMINT

CXCAPI	9	Carex capillaris	-3	FACW	Nt	P-Sedge	SEDGE
CXFLAV	4	Carex flava	-5	OBL	Nt	P-Sedge	SEDGE
CXLASI	8	Carex lasiocarpa	-5	OBL	Nt	P-Sedge	SEDGE
CASCOC	8	Castilleja coccinea	0	FAC	Nt	A-Forb	INDIAN PAINTBRUSH
CHEGLB	7	Chelone glabra	-5	OBL	Nt	P-Forb	TURTLEHEAD
CIRPAL	0	CIRSIUM PALUSTRE	-4	FACW+	Ad	B-Forb	MARSH THISTLE
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
CORSTO	2	Cornus stolonifera	-3	FACW	Nt	Shrub	RED OSIER DOGWOOD
CYCAPU	5	Cypripedium calceolus var. pubescens	-1	FAC+	Nt	P-Forb	LARGE YELLOW LADY'S SLIPPER
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
ELEELL	6	Eleocharis elliptica	-3	FACW	Nt	P-Sedge	GOLDEN SEEDED SPIKE RUSH
ELEROS	10	Eleocharis rostellata	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
EUTGRA	3	Euthamia graminifolia	-2	FACW-	Nt	P-Forb	GRASS LEAVED GOLDENROD
FRAVIR	2	Fragaria virginiana	1	FAC-	Nt	P-Forb	WILD STRAWBERRY
FRAPEN	2	Fraxinus pennsylvanica	-3	FACW	Nt	Tree	RED ASH
GAUHIS	8	Gaultheria hispidula	-3	FACW	Nt	Shrub	CREEPING SNOWBERRY
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
IRIVER	5	Iris versicolor	-5	OBL	Nt	P-Forb	WILD BLUE FLAG
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRP	7	Juncus brachycephalus	-5	OBL	Nt	P-Forb	RUSH
JUNNOD	5	Juncus nodosus	-5	OBL	Nt	P-Forb	JOINT RUSH
JUNHOR	10	Juniperus horizontalis	1	FAC-	Nt	Shrub	CREEPING JUNIPER
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LYCAME	2	Lycopus americanus	-5	OBL	Nt	P-Forb	COMMON WATER HOREHOUND
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
MUHGL0	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PHAARU	0	Phalaris arundinacea	-4	FACW+	Nt	P-Grass	REED CANARY GRASS
PICMAR	6	Picea mariana	-3	FACW	Nt	Tree	BLACK SPRUCE
POLAMP	6	Polygonum amphibium	-5	OBL	Nt	P-Forb	WATER SMARTWEED

POTANS	5	Potentilla anserina	-4	FACW+	Nt	P-Forb	SILVERWEED
POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRERAC	8	Prenanthes racemosa	-3	FACW	Nt	P-Forb	GLAUCOUS WHITE LETTUCE
PRIMIS	10	Primula mistassinica	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PROPAL	6	Proserpinaca palustris	-5	OBL	Nt	P-Forb	MERMAID WEED
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHAALN	8	Rhamnus alnifolia	-5	OBL	Nt	Shrub	ALDER LEAVED BUCKTHORN
RHYCAL	10	Rhynchospora capillacea	-5	OBL	Nt	P-Sedge	BEAK RUSH
SALCAN	9	Salix candida	-5	OBL	Nt	Shrub	HOARY WILLOW
SARPUP	10	Sarracenia purpurea	-5	OBL	Nt	P-Forb	PITCHER PLANT
SCHACU	5	Schoenoplectus acutus	-5	OBL	Nt	P-Sedge	HARDSTEM BULRUSH
SELECL	5	Selaginella eclipses	-4	FACW+	Nt	F...Ally	SELAGINELLA
SENPAU	3	Senecio pauperculus	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SMISTE	5	Smilacina stellata	1	FAC-	Nt	P-Forb	STARRY FALSE SOLOMON SEAL
SOLALT	1	Solidago altissima	3	FACU	Nt	P-Forb	TALL GOLDENROD
SOLHOU	10	Solidago houghtonii	-5	OBL	Nt	P-Forb	HOUGHTON'S GOLDENROD
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
SPIALB	4	Spiraea alba	-4	FACW+	Nt	Shrub	MEADOWSWEET
SPICER	4	Spiranthes cernua	-2	FACW-	Nt	P-Forb	NODDING LADIES' TRESSES
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRICES	10	Trichophorum cespitosum	-5	OBL	Nt	P-Sedge	BULRUSH
TRIBOR	5	Trientalis borealis	-1	FAC+	Nt	P-Forb	STARFLOWER
VACANG	4	Vaccinium angustifolium	3	FACU	Nt	Shrub	BLUEBERRY

Appendix 5h. Floristic Quality Assessment for Cheboygan State Park (including north and south fens).

Site: Cheboygan State Park Coastal Fen EO-2-17529
 Locale: Cheboygan Co., MI
 Date: July 19, 2011 - hours
 July 18, 2011 - hours
 September 22, 2010 - hours
 By: Brad Slaughter (22 Sep 10); Brad Slaughter and Dave Cuthrell (18 and 19 July 2011)
 File: n:\Community_EOs\Coastal Fen\Cheboygan State Park EO-2-17529\Species Lists\Cheboygan State Park Coastal Fen EO-2-17529_bss_071911.inv
 Notes: Also: Viola sp., Carex spp., brown mosses, unknown forb seedling, Aster sp.

FLORISTIC QUALITY DATA							
	Native	63	100.0%	Adventive	0	0.0%	
63	NATIVE SPECIES	Tree	3	4.8%	Tree	0	0.0%
63	Total Species	Shrub	6	9.5%	Shrub	0	0.0%
6.9	NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0	0.0%
6.9	W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
55.1	NATIVE FQI	P-Forb	26	41.3%	P-Forb	0	0.0%
55.1	W/Adventives	B-Forb	0	0.0%	B-Forb	0	0.0%
-3.5	NATIVE MEAN W	A-Forb	3	4.8%	A-Forb	0	0.0%
-3.5	W/Adventives	P-Grass	7	11.1%	P-Grass	0	0.0%
AVG: Fac. Wetland		A-Grass	0	0.0%	A-Grass	0	0.0%
		P-Sedge	13	20.6%	P-Sedge	0	0.0%
		A-Sedge	1	1.6%	A-Sedge	0	0.0%
		Fern	4	6.3%			

ACRONYM	C	SCIENTIFIC NAME	W	WETNESS	PHYSIOGNOMY	COMMON NAME
ALNRUG	5	<i>Alnus rugosa</i>	-5	OBL	Nt Shrub	TAG ALDER
ANDSCO	5	<i>Andropogon scoparius</i>	3	FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ASTBOR	9	<i>Aster borealis</i>	-5	OBL	Nt P-Forb	NORTHERN BOG ASTER
CALCAN	3	<i>Calamagrostis canadensis</i>	-5	OBL	Nt P-Grass	BLUE JOINT GRASS
CALINE	8	<i>Calamagrostis inexpansa</i>	-4	FACW+	Nt P-Grass	BOG REEDGRASS
CALARK	10	<i>Calamintha arkansana</i>	-3	FACW	Nt P-Forb	LOW CALAMINT
CALSEP	2	<i>Calystegia sepium</i>	0	FAC	Nt P-Forb	HEDGE BINDWEED
CAMAPR	7	<i>Campanula aparinoides</i>	-5	OBL	Nt P-Forb	MARSH BELLFLOWER
CXBUXB	10	<i>Carex buxbaumii</i>	-5	OBL	Nt P-Sedge	SEDGE
CXCAPI	9	<i>Carex capillaris</i>	-3	FACW	Nt P-Sedge	SEDGE

CXEBUR	7	Carex eburnea	4	FACU-	Nt	P-Sedge	SEDGE
CXFLAV	4	Carex flava	-5	OBL	Nt	P-Sedge	SEDGE
CXLASI	8	Carex lasiocarpa	-5	OBL	Nt	P-Sedge	SEDGE
CXLIVI	10	Carex livida	-5	OBL	Nt	P-Sedge	SEDGE
CXSTRI	4	Carex stricta	-5	OBL	Nt	P-Sedge	SEDGE
CASCOC	8	Castilleja coccinea	0	FAC	Nt	A-Forb	INDIAN PAINTBRUSH
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
ELEQUI	10	Eleocharis quinqueflora	-5	OBL	Nt	P-Sedge	SPIKE RUSH
ELEROS	10	Eleocharis rostellata	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
FRAVIR	2	Fragaria virginiana	1	FAC-	Nt	P-Forb	WILD STRAWBERRY
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
IRIVER	5	Iris versicolor	-5	OBL	Nt	P-Forb	WILD BLUE FLAG
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRE	8	Juncus brevicaudatus	-5	OBL	Nt	P-Forb	RUSH
JUNHOR	10	Juniperus horizontalis	1	FAC-	Nt	Shrub	CREEPING JUNIPER
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
MUHGLO	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
OSMREG	5	Osmunda regalis	-5	OBL	Nt	Fern	ROYAL FERN
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PINSTR	3	Pinus strobus	3	FACU	Nt	Tree	WHITE PINE
POGOPH	10	Pogonia ophioglossoides	-5	OBL	Nt	P-Forb	ROSE POGONIA
POTANS	5	Potentilla anserina	-4	FACW+	Nt	P-Forb	SILVERWEED
POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRIMIS	10	Primula mistassinica	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PROPAL	6	Proserpinaca palustris	-5	OBL	Nt	P-Forb	MERMAID WEED
RHYALB	6	Rhynchospora alba	-5	OBL	Nt	P-Sedge	BEAK RUSH
RHYCAL	10	Rhynchospora capillacea	-5	OBL	Nt	P-Sedge	BEAK RUSH
SALCAN	9	Salix candida	-5	OBL	Nt	Shrub	HOARY WILLOW

SARPUP	10	Sarracenia purpurea	-5	OBL	Nt	P-Forb	PITCHER PLANT
SCHPUN	5	Schoenoplectus pungens	-5	OBL	Nt	P-Sedge	THREE SQUARE
SCLVER	10	Scleria verticillata	-5	OBL	Nt	A-Sedge	NUT RUSH
SELECL	5	Selaginella eclipes	-4	FACW+	Nt	F...Ally	SELAGINELLA
SENPAU	3	Senecio pauperculus	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLRUG	3	Solidago rugosa	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
THEPAL	2	Thelypteris palustris	-4	FACW+	Nt	Fern	MARSH FERN
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRIFRA	6	Triadenum fraseri	-5	OBL	Nt	P-Forb	MARSH ST. JOHN'S WORT
TRIMAR	8	Triglochin maritimum	-5	OBL	Nt	P-Forb	COMMON BOG ARROW GRASS
UTRCOR	10	Utricularia cornuta	-5	OBL	Nt	A-Forb	HORNED BLADDERWORT
UTRINT	10	Utricularia intermedia	-5	OBL	Nt	P-Forb	FLAT LEAVED BLADDERWORT

Appendix 5i. Floristic Quality Assessment of Albany Creek Mouth.

Site: Albany Creek Mouth Interdunal Wetland EO-19-12342
 Locale: Mackinac Co., MI
 Date: July 21, 2011 - hours
 By: Brad Slaughter, Dave Cuthrell
 File: c:\MNFI Active Projects\Coastal fen CZM grant\FY11\report\site summaries\Albany Creek Mouth Interdunal Wetland EO-19-12342_bss_072111.inv
 Notes: Also: unknown forb seedling, Hieracium sp.

FLORISTIC QUALITY DATA		Native		Adventive	
52 NATIVE SPECIES	Tree	3	5.8%	Tree	0 0.0%
52 Total Species	Shrub	6	11.5%	Shrub	0 0.0%
7.3 NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0 0.0%
7.3 W/Adventives	H-Vine	0	0.0%	H-Vine	0 0.0%
52.3 NATIVE FQI	P-Forb	23	44.2%	P-Forb	0 0.0%
52.3 W/Adventives	B-Forb	0	0.0%	B-Forb	0 0.0%
-2.9 NATIVE MEAN W	A-Forb	3	5.8%	A-Forb	0 0.0%
-2.9 W/Adventives	P-Grass	4	7.7%	P-Grass	0 0.0%
AVG: Fac. Wetland	A-Grass	0	0.0%	A-Grass	0 0.0%
	P-Sedge	11	21.2%	P-Sedge	0 0.0%
	A-Sedge	0	0.0%	A-Sedge	0 0.0%
	Fern	2	3.8%		

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ALNRUG	5 Alnus rugosa	-5 OBL	Nt Shrub	TAG ALDER
CALINE	8 Calamagrostis inexpansa	-4 FACW+	Nt P-Grass	BOG REEDGRASS
CALARK	10 Calamintha arkansana	-3 FACW	Nt P-Forb	LOW CALAMINT
CAMROT	6 Campanula rotundifolia	1 FAC-	Nt P-Forb	HAREBELL
CXCRAE	10 Carex crawei	-3 FACW	Nt P-Sedge	SEDGE
CXEBUR	7 Carex eburnea	4 FACU-	Nt P-Sedge	SEDGE
CXSTER	10 Carex sterilis	-5 OBL	Nt P-Sedge	SEDGE
CXVIRI	4 Carex viridula	-5 OBL	Nt P-Sedge	SEDGE
CASCOC	8 Castilleja coccinea	0 FAC	Nt A-Forb	INDIAN PAINTBRUSH
CLAMAR	10 Cladium mariscoides	-5 OBL	Nt P-Sedge	TWIG RUSH
COMUMB	5 Comandra umbellata	3 FACU	Nt P-Forb	BASTARD TOADFLAX
CORLAN	8 Coreopsis lanceolata	3 FACU	Nt P-Forb	SAND COREOPSIS

CYCAPU	5	Cypripedium calceolus var. pubescens	-1 FAC+	Nt	P-Forb	LARGE YELLOW LADY'S SLIPPER
DANSPI	4	Danthonia spicata	5 UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DROLIN	10	Drosera linearis	-5 OBL	Nt	P-Forb	LINEAR LEAVED SUNDEW
DROROT	6	Drosera rotundifolia	-5 OBL	Nt	P-Forb	ROUND LEAVED SUNDEW
ELEELL	6	Eleocharis elliptica	-3 FACW	Nt	P-Sedge	GOLDEN SEEDED SPIKE RUSH
ELEQUI	10	Eleocharis quinqueflora	-5 OBL	Nt	P-Sedge	SPIKE RUSH
EQUVAR	8	Equisetum variegatum	-3 FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
FRAVIR	2	Fragaria virginiana	1 FAC-	Nt	P-Forb	WILD STRAWBERRY
HYPKAL	10	Hypericum kalmianum	-2 FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
JUNBAL	4	Juncus balticus	-5 OBL	Nt	P-Forb	RUSH
JUNBRE	8	Juncus brevicaudatus	-5 OBL	Nt	P-Forb	RUSH
JUNCOI	4	Juniperus communis	3 FACU	Nt	Shrub	COMMON or GROUND JUNIPER
LARLAR	5	Larix laricina	-3 FACW	Nt	Tree	TAMARACK
LINBOR	6	Linnaea borealis	0 FAC	Nt	P-Forb	TWINFLOWER
LOBKAL	10	Lobelia kalmii	-5 OBL	Nt	P-Forb	BOG LOBELIA
LONOBL	8	Lonicera oblongifolia	-5 OBL	Nt	Shrub	SWAMP FLY HONEYSUCKLE
LYCUNI	2	Lycopus uniflorus	-5 OBL	Nt	P-Forb	NORTHERN BUGLE WEED
MELLIN	6	Melampyrum lineare	1 FAC-	Nt	A-Forb	COW WHEAT
MUHGL	10	Muhlenbergia glomerata	-4 FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5 OBL	Nt	Shrub	SWEET GALE
OSMREG	5	Osmunda regalis	-5 OBL	Nt	Fern	ROYAL FERN
PANLID	8	Panicum lindheimeri	-5 OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5 OBL	Nt	P-Forb	GRASS OF PARNASSUS
PINVUL	10	Pinguicula vulgaris	-5 OBL	Nt	P-Forb	BUTTERWORT
PINSTR	3	Pinus strobus	3 FACU	Nt	Tree	WHITE PINE
POGOPH	10	Pogonia ophioglossoides	-5 OBL	Nt	P-Forb	ROSE POGONIA
POTFRU	10	Potentilla fruticosa	-3 FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRIMIS	10	Primula mistassinica	-3 FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
RHYALB	6	Rhynchospora alba	-5 OBL	Nt	P-Sedge	BEAK RUSH
RHYCAL	10	Rhynchospora capillacea	-5 OBL	Nt	P-Sedge	BEAK RUSH
SARPUP	10	Sarracenia purpurea	-5 OBL	Nt	P-Forb	PITCHER PLANT
SCHPUN	5	Schoenoplectus pungens	-5 OBL	Nt	P-Sedge	THREE SQUARE
SENPAU	3	Senecio pauperculus	-1 FAC+	Nt	P-Forb	BALSAM RAGWORT
SOLOHI	8	Solidago ohioensis	-5 OBL	Nt	P-Forb	OHIO GOLDENROD
THUOCC	4	Thuja occidentalis	-3 FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5 OBL	Nt	P-Forb	FALSE ASPHODEL
TRICES	10	Trichophorum cespitosum	-5 OBL	Nt	P-Sedge	BULRUSH
TRIMAR	8	Triglochin maritimum	-5 OBL	Nt	P-Forb	COMMON BOG ARROW GRASS

UTRCOR 10 Utricularia cornuta
VIONEP 8 Viola nephrophylla

-5 OBL Nt A-Forb HORNED BLADDERWORT
-4 FACW+ Nt P-Forb NORTHERN BOG VIOLET

Appendix 5j. Floristic Quality Assessment for Peck Bay.

Site: Peck Bay Coastal Fen EO-31-13746
 Locale: Mackinac Co., MI
 Date: July 24, 2011 - hours
 By: Brad Slaughter, Dave Cuthrell, Pete Badra
 File: c:\MNFI Active Projects\Coastal fen CZM grant\FY11\report\site summaries\Peck Bay Coastal Fen EO-31-13746_bss_072411.inv
 Notes: Also: Salix sp., Viola sp., Carex sp., unknown sterile forb, unknown sterile graminoid

FLORISTIC QUALITY DATA		Native		Adventive	
66 NATIVE SPECIES	Tree	5	7.6%	Tree	0 0.0%
66 Total Species	Shrub	11	16.7%	Shrub	0 0.0%
6.9 NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0 0.0%
6.9 W/Adventives	H-Vine	0	0.0%	H-Vine	0 0.0%
56.1 NATIVE FQI	P-Forb	23	34.8%	P-Forb	0 0.0%
56.1 W/Adventives	B-Forb	0	0.0%	B-Forb	0 0.0%
-3.2 NATIVE MEAN W	A-Forb	2	3.0%	A-Forb	0 0.0%
-3.2 W/Adventives	P-Grass	6	9.1%	P-Grass	0 0.0%
AVG: Fac. Wetland	A-Grass	0	0.0%	A-Grass	0 0.0%
	P-Sedge	17	25.8%	P-Sedge	0 0.0%
	A-Sedge	0	0.0%	A-Sedge	0 0.0%
	Fern	2	3.0%		

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
BETPAP	2 Betula papyrifera	2 FACU+	Nt Tree	PAPER BIRCH
CALCAN	3 Calamagrostis canadensis	-5 OBL	Nt P-Grass	BLUE JOINT GRASS
CALINE	8 Calamagrostis inexpansa	-4 FACW+	Nt P-Grass	BOG REEDGRASS
CALARK	10 Calamintha arkansana	-3 FACW	Nt P-Forb	LOW CALAMINT
CXAURE	3 Carex aurea	-4 FACW+	Nt P-Sedge	SEDGE
CXBUXB	10 Carex buxbaumii	-5 OBL	Nt P-Sedge	SEDGE
CXCAPI	9 Carex capillaris	-3 FACW	Nt P-Sedge	SEDGE
CXE BUR	7 Carex eburnea	4 FACU-	Nt P-Sedge	SEDGE
CXFLAV	4 Carex flava	-5 OBL	Nt P-Sedge	SEDGE
CXSTER	10 Carex sterilis	-5 OBL	Nt P-Sedge	SEDGE
CXSTRI	4 Carex stricta	-5 OBL	Nt P-Sedge	SEDGE
CXVIRI	4 Carex viridula	-5 OBL	Nt P-Sedge	SEDGE

CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
DROLIN	10	Drosera linearis	-5	OBL	Nt	P-Forb	LINEAR LEAVED SUNDEW
DROROT	6	Drosera rotundifolia	-5	OBL	Nt	P-Forb	ROUND LEAVED SUNDEW
ELEQUI	10	Eleocharis quinqueflora	-5	OBL	Nt	P-Sedge	SPIKE RUSH
ELEROS	10	Eleocharis rostellata	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
ERIVID	8	Eriophorum viridi-carinatum	-5	OBL	Nt	P-Sedge	GREEN KEELED COTTON GRASS
EUPMAM	4	Eupatorium maculatum	-5	OBL	Nt	P-Forb	JOE PYE WEED
EUTGRA	3	Euthamia graminifolia	-2	FACW-	Nt	P-Forb	GRASS LEAVED GOLDENROD
GAUHIS	8	Gaultheria hispidula	-3	FACW	Nt	Shrub	CREEPING SNOWBERRY
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRE	8	Juncus brevicaudatus	-5	OBL	Nt	P-Forb	RUSH
JUNHOR	10	Juniperus horizontalis	1	FAC-	Nt	Shrub	CREEPING JUNIPER
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LEDGRO	8	Ledum groenlandicum	-5	OBL	Nt	Shrub	LABRADOR TEA
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
MUHGLA	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PICMAR	6	Picea mariana	-3	FACW	Nt	Tree	BLACK SPRUCE
PINSTR	3	Pinus strobus	3	FACU	Nt	Tree	WHITE PINE
POLPAU	7	Polygala paucifolia	3	FACU	Nt	P-Forb	GAY WINGS
POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRIMIS	10	Primula mistassinica	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHAALN	8	Rhamnus alnifolia	-5	OBL	Nt	Shrub	ALDER LEAVED BUCKTHORN
RHYCAL	10	Rhynchospora capillacea	-5	OBL	Nt	P-Sedge	BEAK RUSH
SARPUP	10	Sarracenia purpurea	-5	OBL	Nt	P-Forb	PITCHER PLANT
SCHACU	5	Schoenoplectus acutus	-5	OBL	Nt	P-Sedge	HARDSTEM BULRUSH
SCHPUN	5	Schoenoplectus pungens	-5	OBL	Nt	P-Sedge	THREE SQUARE
SELECL	5	Selaginella eclipses	-4	FACW+	Nt	F...Ally	SELAGINELLA

SENPAU	3	Senecio pauperculus	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SHECAN	7	Shepherdia canadensis	5	UPL	Nt	Shrub	SOAPBERRY
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRIALP	10	Trichophorum alpinum	-5	OBL	Nt	P-Sedge	BULRUSH
TRICES	10	Trichophorum cespitosum	-5	OBL	Nt	P-Sedge	BULRUSH
TRIBOR	5	Trientalis borealis	-1	FAC+	Nt	P-Forb	STARFLOWER
TRIMAR	8	Triglochin maritimum	-5	OBL	Nt	P-Forb	COMMON BOG ARROW GRASS
TRIPAL	8	Triglochin palustris	-5	OBL	Nt	P-Forb	SLENDER BOG ARROW GRASS
UTRCOR	10	Utricularia cornuta	-5	OBL	Nt	A-Forb	HORNED BLADDERWORT
VACANG	4	Vaccinium angustifolium	3	FACU	Nt	Shrub	BLUEBERRY
VACMYR	4	Vaccinium myrtilloides	-2	FACW-	Nt	Shrub	CANADA BLUEBERRY
VACOXY	8	Vaccinium oxycoccos	-5	OBL	Nt	Shrub	SMALL CRANBERRY
VIONEP	8	Viola nephrophylla	-4	FACW+	Nt	P-Forb	NORTHERN BOG VIOLET

Appendix 5k. Floristic Quality Assessment of Meridian Fen.

Site: Meridian Fen Coastal Fen EO-23-1093
 Locale: Mackinac Co., MI
 Date: July 25, 2011 - hours
 By: Brad Slaughter, Dave Cuthrell, Pete Badra
 File: c:\MNFI Active Projects\Coastal fen CZM grant\FY11\report\site summaries\Meridian Fen Coastal Fen EO-23-1093_bss_072511.inv
 Notes: Also: Amelanchier sp., Hieracium sp., unknown forb

FLORISTIC QUALITY DATA		Native		Adventive	
67 NATIVE SPECIES	Tree	5	7.5%	Tree	0 0.0%
67 Total Species	Shrub	12	17.9%	Shrub	0 0.0%
7.1 NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0 0.0%
7.1 W/Adventives	H-Vine	0	0.0%	H-Vine	0 0.0%
57.8 NATIVE FQI	P-Forb	25	37.3%	P-Forb	0 0.0%
57.8 W/Adventives	B-Forb	0	0.0%	B-Forb	0 0.0%
-2.6 NATIVE MEAN W	A-Forb	2	3.0%	A-Forb	0 0.0%
-2.6 W/Adventives	P-Grass	8	11.9%	P-Grass	0 0.0%
AVG: Fac. Wetland	A-Grass	0	0.0%	A-Grass	0 0.0%
	P-Sedge	13	19.4%	P-Sedge	0 0.0%
	A-Sedge	0	0.0%	A-Sedge	0 0.0%
	Fern	2	3.0%		

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
AGRTRA	8 Agropyron trachycaulum	0 FAC	Nt P-Grass	SLENDER WHEAT GRASS
ALNRUG	5 Alnus rugosa	-5 OBL	Nt Shrub	TAG ALDER
ANDSCO	5 Andropogon scoparius	3 FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ARCUVA	8 Arctostaphylos uva-ursi	5 UPL	Nt Shrub	BEARBERRY
BETPAP	2 Betula papyrifera	2 FACU+	Nt Tree	PAPER BIRCH
CALCAN	3 Calamagrostis canadensis	-5 OBL	Nt P-Grass	BLUE JOINT GRASS
CALINE	8 Calamagrostis inexpansa	-4 FACW+	Nt P-Grass	BOG REEDGRASS
CALARK	10 Calamintha arkansana	-3 FACW	Nt P-Forb	LOW CALAMINT
CAMROT	6 Campanula rotundifolia	1 FAC-	Nt P-Forb	HAREBELL
CXBUXB	10 Carex buxbaumii	-5 OBL	Nt P-Sedge	SEDGE
CXCAP	9 Carex capillaris	-3 FACW	Nt P-Sedge	SEDGE
CXCRAE	10 Carex crawei	-3 FACW	Nt P-Sedge	SEDGE

CXEBUR	7	Carex eburnea	4	FACU-	Nt	P-Sedge	SEDGE
CXFLAV	4	Carex flava	-5	OBL	Nt	P-Sedge	SEDGE
CXGYNO	10	Carex gynocrates	-5	OBL	Nt	P-Sedge	SEDGE
CXSTRI	4	Carex stricta	-5	OBL	Nt	P-Sedge	SEDGE
CASCOC	8	Castilleja coccinea	0	FAC	Nt	A-Forb	INDIAN PAINTBRUSH
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
CYCAPU	5	Cypripedium calceolus var. pubescens	-1	FAC+	Nt	P-Forb	LARGE YELLOW LADY'S SLIPPER
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
ELEQUI	10	Eleocharis quinqueflora	-5	OBL	Nt	P-Sedge	SPIKE RUSH
ELEROS	10	Eleocharis rostellata	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
GAUHIS	8	Gaultheria hispidula	-3	FACW	Nt	Shrub	CREEPING SNOWBERRY
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
IRILAC	9	Iris lacustris	0	FAC	Nt	P-Forb	DWARF LAKE IRIS
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRE	8	Juncus brevicaudatus	-5	OBL	Nt	P-Forb	RUSH
JUNNOD	5	Juncus nodosus	-5	OBL	Nt	P-Forb	JOINT RUSH
JUNHOR	10	Juniperus horizontalis	1	FAC-	Nt	Shrub	CREEPING JUNIPER
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LEDGRO	8	Ledum groenlandicum	-5	OBL	Nt	Shrub	LABRADOR TEA
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
MUHGLO	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PICMAR	6	Picea mariana	-3	FACW	Nt	Tree	BLACK SPRUCE
PINSTR	3	Pinus strobus	3	FACU	Nt	Tree	WHITE PINE
POLPAU	7	Polygala paucifolia	3	FACU	Nt	P-Forb	GAY WINGS
POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRIMIS	10	Primula mistassinica	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHAALN	8	Rhamnus alnifolia	-5	OBL	Nt	Shrub	ALDER LEAVED BUCKTHORN
RHYCAL	10	Rhynchospora capillacea	-5	OBL	Nt	P-Sedge	BEAK RUSH
SARPUP	10	Sarracenia purpurea	-5	OBL	Nt	P-Forb	PITCHER PLANT
SCHACU	5	Schoenoplectus acutus	-5	OBL	Nt	P-Sedge	HARDSTEM BULRUSH

SELECL	5	Selaginella eclipses	-4	FACW+	Nt	F...Ally	SELAGINELLA
SENPAU	3	Senecio pauperculus	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLPTA	6	Solidago ptarmicoides	5	UPL	Nt	P-Forb	UPLAND WHITE GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRICES	10	Trichophorum cespitosum	-5	OBL	Nt	P-Sedge	BULRUSH
TRIBOR	5	Trientalis borealis	-1	FAC+	Nt	P-Forb	STARFLOWER
TRIMAR	8	Triglochin maritimum	-5	OBL	Nt	P-Forb	COMMON BOG ARROW GRASS
TRIPAL	8	Triglochin palustris	-5	OBL	Nt	P-Forb	SLENDER BOG ARROW GRASS
UTRCOR	10	Utricularia cornuta	-5	OBL	Nt	A-Forb	HORNED BLADDERWORT
VACANG	4	Vaccinium angustifolium	3	FACU	Nt	Shrub	BLUEBERRY
VACMYR	4	Vaccinium myrtilloides	-2	FACW-	Nt	Shrub	CANADA BLUEBERRY
VACOXY	8	Vaccinium oxycoccos	-5	OBL	Nt	Shrub	SMALL CRANBERRY
VIONEP	8	Viola nephrophylla	-4	FACW+	Nt	P-Forb	NORTHERN BOG VIOLET
ZIGGLA	10	Zigadenus glaucus	-3	FACW	Nt	P-Forb	WHITE CAMAS

Appendix 5I. Floristic Quality Assessment for Horseshoe Bay East.

Site: Horseshoe Bay Interdunal Wetland EO-28-18583
 Locale: Mackinac Co., MI
 Date: July 26, 2011 - hours
 By: Brad Slaughter, Dave Cuthrell, Pete Badra
 File: c:\MNFI Active Projects\Coastal fen CZM grant\FY11\report\site summaries\Horseshoe Bay Interdunal Wetland EO-28-18583_bss_072611.inv
 Notes: Also: Amelanchier sp., unknown conifer seedling, unknown deciduous seedling

FLORISTIC QUALITY DATA		Native		Adventive	
36 NATIVE SPECIES	Tree	2	5.4%	Tree	0 0.0%
37 Total Species	Shrub	4	10.8%	Shrub	0 0.0%
6.7 NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0 0.0%
6.5 W/Adventives	H-Vine	0	0.0%	H-Vine	0 0.0%
40.2 NATIVE FQI	P-Forb	17	45.9%	P-Forb	1 2.7%
39.6 W/Adventives	B-Forb	0	0.0%	B-Forb	0 0.0%
-2.1 NATIVE MEAN W	A-Forb	1	2.7%	A-Forb	0 0.0%
-1.9 W/Adventives	P-Grass	6	16.2%	P-Grass	0 0.0%
AVG: Fac. Wetland (-)	A-Grass	0	0.0%	A-Grass	0 0.0%
	P-Sedge	6	16.2%	P-Sedge	0 0.0%
	A-Sedge	0	0.0%	A-Sedge	0 0.0%
	Fern	0	0.0%		

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ANDSCO	5 Andropogon scoparius	3 FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ASTBOR	9 Aster borealis	-5 OBL	Nt P-Forb	NORTHERN BOG ASTER
CALCAN	3 Calamagrostis canadensis	-5 OBL	Nt P-Grass	BLUE JOINT GRASS
CALINE	8 Calamagrostis inexpansa	-4 FACW+	Nt P-Grass	BOG REEDGRASS
CALARK	10 Calamintha arkansana	-3 FACW	Nt P-Forb	LOW CALAMINT
CXCAPI	9 Carex capillaris	-3 FACW	Nt P-Sedge	SEDGE
CXCRAE	10 Carex crawei	-3 FACW	Nt P-Sedge	SEDGE
CXE BUR	7 Carex eburnea	4 FACU-	Nt P-Sedge	SEDGE
CXFLAV	4 Carex flava	-5 OBL	Nt P-Sedge	SEDGE
CXSTRI	4 Carex stricta	-5 OBL	Nt P-Sedge	SEDGE
CASCOC	8 Castilleja coccinea	0 FAC	Nt A-Forb	INDIAN PAINTBRUSH
CHRLEU	0 CHRYSANTHEMUM LEUCANTHEMUM	5 UPL	Ad P-Forb	OX EYE DAISY

CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
CORLAN	8	Coreopsis lanceolata	3	FACU	Nt	P-Forb	SAND COREOPSIS
CYCAPU	5	Cypripedium calceolus var. pubescens	-1	FAC+	Nt	P-Forb	LARGE YELLOW LADY'S SLIPPER
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNHOR	10	Juniperus horizontalis	1	FAC-	Nt	Shrub	CREEPING JUNIPER
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LINBOR	6	Linnaea borealis	0	FAC	Nt	P-Forb	TWINFLOWER
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LOBSPI	4	Lobelia spicata	0	FAC	Nt	P-Forb	PALE SPIKED LOBELIA
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS
PARGLA	8	Parnassia glauca	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
POTFRU	10	Potentilla fruticosa	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHAALN	8	Rhamnus alnifolia	-5	OBL	Nt	Shrub	ALDER LEAVED BUCKTHORN
RUDHIR	1	Rudbeckia hirta	3	FACU	Nt	P-Forb	BLACK EYED SUSAN
SENPAU	3	Senecio pauperculus	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SOLOHI	8	Solidago ohioensis	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLULI	4	Solidago uliginosa	-5	OBL	Nt	P-Forb	BOG GOLDENROD
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	Tofieldia glutinosa	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
ZIGGLA	10	Zigadenus glaucus	-3	FACW	Nt	P-Forb	WHITE CAMAS

Appendix 5m. Floristic Quality Assessment of Horseshoe Bay West.

Site: Horseshoe Bay Coastal Fen EO-5-18584
 Locale: Mackinac Co., MI
 Date: July 27, 2011 - hours
 July 26, 2011 - hours
 By: Brad Slaughter, Dave Cuthrell, Pete Badra
 File: c:\MNFI Active Projects\Coastal fen CZM grant\FY11\report\site summaries\Horseshoe Bay Coastal Fen
 EO-5-18584_bss_072711.inv
 Notes: Also: unknown forb seedling, unknown graminoid seedling, Salix spp.

FLORISTIC QUALITY DATA		Native		Adventive		
82 NATIVE SPECIES	Tree	5	6.0%	Tree	0	0.0%
83 Total Species	Shrub	20	24.1%	Shrub	0	0.0%
6.7 NATIVE MEAN C	W-Vine	0	0.0%	W-Vine	0	0.0%
6.7 W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
61.0 NATIVE FQI	P-Forb	31	37.3%	P-Forb	0	0.0%
60.6 W/Adventives	B-Forb	0	0.0%	B-Forb	1	1.2%
-2.6 NATIVE MEAN W	A-Forb	3	3.6%	A-Forb	0	0.0%
-2.7 W/Adventives	P-Grass	8	9.6%	P-Grass	0	0.0%
AVG: Fac. Wetland	A-Grass	0	0.0%	A-Grass	0	0.0%
	P-Sedge	13	15.7%	P-Sedge	0	0.0%
	A-Sedge	0	0.0%	A-Sedge	0	0.0%
	Fern	2	2.4%			

ACRONYM	C	SCIENTIFIC NAME	W	WETNESS	PHYSIOGNOMY	COMMON NAME
ALNRUG	5	<i>Alnus rugosa</i>	-5	OBL	Nt Shrub	TAG ALDER
ANDGLA	10	<i>Andromeda glaucophylla</i>	-5	OBL	Nt Shrub	BOG ROSEMARY
ANDSCO	5	<i>Andropogon scoparius</i>	3	FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ARCUVA	8	<i>Arctostaphylos uva-ursi</i>	5	UPL	Nt Shrub	BEARBERRY
ASCINC	6	<i>Asclepias incarnata</i>	-5	OBL	Nt P-Forb	SWAMP MILKWEED
ASTBOR	9	<i>Aster borealis</i>	-5	OBL	Nt P-Forb	NORTHERN BOG ASTER
BETPAP	2	<i>Betula papyrifera</i>	2	FACU+	Nt Tree	PAPER BIRCH
CALCAN	3	<i>Calamagrostis canadensis</i>	-5	OBL	Nt P-Grass	BLUE JOINT GRASS
CALINE	8	<i>Calamagrostis inexpansa</i>	-4	FACW+	Nt P-Grass	BOG REEDGRASS
CALARK	10	<i>Calamintha arkansana</i>	-3	FACW	Nt P-Forb	LOW CALAMINT

CXBUXB	10	Carex buxbaumii	-5	OBL	Nt	P-Sedge	SEDGE
CXCAPI	9	Carex capillaris	-3	FACW	Nt	P-Sedge	SEDGE
CXCRAE	10	Carex crawei	-3	FACW	Nt	P-Sedge	SEDGE
CXE BUR	7	Carex eburnea	4	FACU-	Nt	P-Sedge	SEDGE
CXFLAV	4	Carex flava	-5	OBL	Nt	P-Sedge	SEDGE
CXSTER	10	Carex sterilis	-5	OBL	Nt	P-Sedge	SEDGE
CXSTRI	4	Carex stricta	-5	OBL	Nt	P-Sedge	SEDGE
CXVIRI	4	Carex viridula	-5	OBL	Nt	P-Sedge	SEDGE
CASCOC	8	Castilleja coccinea	0	FAC	Nt	A-Forb	INDIAN PAINTBRUSH
CIRPAL	0	CIRSIUM PALUSTRE	-4	FACW+	Ad	B-Forb	MARSH THISTLE
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
COMUMB	5	Comandra umbellata	3	FACU	Nt	P-Forb	BASTARD TOADFLAX
CORCAA	6	Cornus canadensis	0	FAC	Nt	Shrub	BUNCHBERRY
CORSTO	2	Cornus stolonifera	-3	FACW	Nt	Shrub	RED OSIER DOGWOOD
CYCAPU	5	Cypripedium calceolus var. pubescens	-1	FAC+	Nt	P-Forb	LARGE YELLOW LADY'S SLIPPER
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DESCES	9	Deschampsia cespitosa	-4	FACW+	Nt	P-Grass	HAIR GRASS
DROROT	6	Drosera rotundifolia	-5	OBL	Nt	P-Forb	ROUND LEAVED SUNDEW
ELEROS	10	Eleocharis rostellata	-5	OBL	Nt	P-Sedge	SPIKE RUSH
EPIREP	7	Epigaea repens	5	UPL	Nt	Shrub	TRAILING ARBUTUS
EQUVAR	8	Equisetum variegatum	-3	FACW	Nt	F...Ally	VARIEGATED SCOURING RUSH
EUPMAM	4	Eupatorium maculatum	-5	OBL	Nt	P-Forb	JOE PYE WEED
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
GAUHIS	8	Gaultheria hispidula	-3	FACW	Nt	Shrub	CREEPING SNOWBERRY
GAUPRO	5	Gaultheria procumbens	3	FACU	Nt	Shrub	WINTERGREEN
GAYBAC	7	Gaylussacia baccata	3	FACU	Nt	Shrub	HUCKLEBERRY
GENPRO	8	Gentianopsis procera	-5	OBL	Nt	A-Forb	SMALL FRINGED GENTIAN
HYPKAL	10	Hypericum kalmianum	-2	FACW-	Nt	Shrub	KALM'S ST. JOHN'S WORT
JUNBAL	4	Juncus balticus	-5	OBL	Nt	P-Forb	RUSH
JUNBRE	8	Juncus brevicaudatus	-5	OBL	Nt	P-Forb	RUSH
JUNHOR	10	Juniperus horizontalis	1	FAC-	Nt	Shrub	CREEPING JUNIPER
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LEDGRO	8	Ledum groenlandicum	-5	OBL	Nt	Shrub	LABRADOR TEA
LOBKAL	10	Lobelia kalmii	-5	OBL	Nt	P-Forb	BOG LOBELIA
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
MUHGLO	10	Muhlenbergia glomerata	-4	FACW+	Nt	P-Grass	MARSH WILD TIMOTHY
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
PANLID	8	Panicum lindheimeri	-5	OBL	Nt	P-Grass	PANIC GRASS

PARGLA	8	<i>Parnassia glauca</i>	-5	OBL	Nt	P-Forb	GRASS OF PARNASSUS
PHRAUS	0	<i>Phragmites australis</i>	-4	FACW+	Nt	P-Grass	REED
PICMAR	6	<i>Picea mariana</i>	-3	FACW	Nt	Tree	BLACK SPRUCE
PINVUL	10	<i>Pinguicula vulgaris</i>	-5	OBL	Nt	P-Forb	BUTTERWORT
PLAHYP	5	<i>Platanthera hyperborea</i>	-4	FACW+	Nt	P-Forb	TALL NORTHERN BOG ORCHID
POLPAU	7	<i>Polygala paucifolia</i>	3	FACU	Nt	P-Forb	GAY WINGS
POPTRE	1	<i>Populus tremuloides</i>	0	FAC	Nt	Tree	QUAKING ASPEN
POTANS	5	<i>Potentilla anserina</i>	-4	FACW+	Nt	P-Forb	SILVERWEED
POTFRU	10	<i>Potentilla fruticosa</i>	-3	FACW	Nt	Shrub	SHRUBBY CINQUEFOIL
PRIMIS	10	<i>Primula mistassinica</i>	-3	FACW	Nt	P-Forb	DWARF CANADIAN PRIMROSE
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
RHAALN	8	<i>Rhamnus alnifolia</i>	-5	OBL	Nt	Shrub	ALDER LEAVED BUCKTHORN
RHYCAL	10	<i>Rhynchospora capillacea</i>	-5	OBL	Nt	P-Sedge	BEAK RUSH
SALCAN	9	<i>Salix candida</i>	-5	OBL	Nt	Shrub	HOARY WILLOW
SARPUP	10	<i>Sarracenia purpurea</i>	-5	OBL	Nt	P-Forb	PITCHER PLANT
SELECL	5	<i>Selaginella eclipes</i>	-4	FACW+	Nt	F...Ally	SELAGINELLA
SENPAU	3	<i>Senecio pauperculus</i>	-1	FAC+	Nt	P-Forb	BALSAM RAGWORT
SHECAN	7	<i>Shepherdia canadensis</i>	5	UPL	Nt	Shrub	SOAPBERRY
SOLALT	1	<i>Solidago altissima</i>	3	FACU	Nt	P-Forb	TALL GOLDENROD
SOLOHI	8	<i>Solidago ohioensis</i>	-5	OBL	Nt	P-Forb	OHIO GOLDENROD
SOLRUG	3	<i>Solidago rugosa</i>	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD
SOLULI	4	<i>Solidago uliginosa</i>	-5	OBL	Nt	P-Forb	BOG GOLDENROD
SPIROM	10	<i>Spiranthes romanzoffiana</i>	-4	FACW+	Nt	P-Forb	HOODED LADIES' TRESSES
THUOCC	4	<i>Thuja occidentalis</i>	-3	FACW	Nt	Tree	ARBOR VITAE
TOFGLU	10	<i>Tofieldia glutinosa</i>	-5	OBL	Nt	P-Forb	FALSE ASPHODEL
TRIALP	10	<i>Trichophorum alpinum</i>	-5	OBL	Nt	P-Sedge	BULRUSH
TRICES	10	<i>Trichophorum cespitosum</i>	-5	OBL	Nt	P-Sedge	BULRUSH
TRIBOR	5	<i>Trientalis borealis</i>	-1	FAC+	Nt	P-Forb	STARFLOWER
TRIMAR	8	<i>Triglochin maritimum</i>	-5	OBL	Nt	P-Forb	COMMON BOG ARROW GRASS
TRIPAL	8	<i>Triglochin palustris</i>	-5	OBL	Nt	P-Forb	SLENDER BOG ARROW GRASS
UTRCOR	10	<i>Utricularia cornuta</i>	-5	OBL	Nt	A-Forb	HORNED BLADDERWORT
VACANG	4	<i>Vaccinium angustifolium</i>	3	FACU	Nt	Shrub	BLUEBERRY
VACMYR	4	<i>Vaccinium myrtilloides</i>	-2	FACW-	Nt	Shrub	CANADA BLUEBERRY
VACOXY	8	<i>Vaccinium oxycoccos</i>	-5	OBL	Nt	Shrub	SMALL CRANBERRY
ZIGGLA	10	<i>Zigadenus glaucus</i>	-3	FACW	Nt	P-Forb	WHITE CAMAS

Appendix 6. Summary list of vascular plants documented in coastal fen sample sites. CAPITALIZED scientific names indicate non-native species. A solid box represents a taxon that occurred within sample plots; "x" represents a taxon documented from the site but not encountered in sample plots.

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Acer rubrum</i>	red maple	■		■	■									
<i>Achillea millefolium</i>	yarrow							x						
<i>Agalinis purpurea</i>	purple gerardia				■	■	x	x						
<i>Agropyron trachycaulum</i>	slender wheat grass							x					x	
<i>Alnus rugosa</i>	tag alder	x		■			■	x	x	■		x	x	
<i>Amelanchier</i> sp.	serviceberry										x			
<i>Andromeda glaucophylla</i>	bog rosemary		x									x		
<i>Anemone canadensis</i>	Canada anemone						■				■			
<i>Arctostaphylos uva-ursi</i>	bearberry	x	■		x			x			x		■	
<i>Aronia prunifolia</i>	black chokeberry			■										
<i>Artemisia campestris</i>	wormwood					x								
<i>Asclepias incarnata</i>	swamp milkweed		x	x		x						■		
<i>Aster borealis</i>	northern bog aster	■	■		■			■		■	■	■		
<i>Aster firmus</i>	smooth swamp aster				■									

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Aster lanceolatus</i>	eastern lined aster													
<i>Aster macrophyllus</i>	big leaved aster				X									
<i>Aster puniceus</i>	swamp aster							X						
<i>Aster</i> spp.	aster spp.													
<i>Aster umbellatus</i>	tall flat-top white aster			X										
<i>Betula alleghaniensis</i>	yellow birch		X											
<i>Betula papyrifera</i>	paper birch						X					X	X	X
<i>Bromus ciliatus</i>	fringed brome													
<i>Cacalia plantaginea</i>	prairie Indian-plantain				X									
<i>Calamagrostis canadensis</i>	bluejoint grass									X	X	X	X	X
<i>Calamagrostis inexpansa</i>	bog reedgrass				X				X		X	X	X	X
<i>Calamintha arkansana</i>	low calamint													X
<i>Calopogon tuberosus</i>	grass pink		X		X									
<i>Calystegia sepium</i>	hedge bindweed													
<i>Campanula aparinoides</i>	marsh bellflower					X								
<i>Campanula rotundifolia</i>	harebell								X					
<i>Carex aurea</i>	sedge													X

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Carex buxbaumii</i>	Buxbaum's sedge	x			x							x	x	x
<i>Carex capillaris</i>	hair-like sedge						x			x	x	x		x
<i>Carex crawei</i>	Crawe's sedge											x		
<i>Carex eburnea</i>	ebony sedge	x		x			x		x	x				
<i>Carex flava</i>	yellow sedge						x			x	x	x	x	x
<i>Carex gynocrates</i>	sedge												x	
<i>Carex lasiocarpa</i>	wiregrass sedge				x	x				x				
<i>Carex livida</i>	livid sedge													
<i>Carex</i> spp.	sedges									x				x
<i>Carex sterilis</i>	dioecious sedge													
<i>Carex stricta</i>	tussock sedge	x		x							x	x		x
<i>Carex viridula</i>	little green sedge				x	x			x					
<i>Castilleja coccinea</i>	Indian paintbrush	x	x			x		x	x			x	x	
<i>CENTAUREA MACULOSA</i>	SPOTTED BLUET		x											
<i>Chelone glabra</i>	turtlehead							x						
<i>CHRYSANTHEMUM LEUCANTHEMUM</i>	OX EYE DAISY										x			
<i>Cicuta bulbifera</i>	water hemlock	x												

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Cirsium muticum</i>	swamp thistle	x												
<i>CIRSIUM PALUSTRE</i>	MARSH THISTLE							x						
<i>CIRSIUM VULGARE</i>	BULL THISTLE	x												
<i>Cladium mariscoides</i>	twig-rush													
<i>Comandra umbellata</i>	bastard toadflax	x					x					x	x	
<i>Coreopsis lanceolata</i>									x					
<i>Cornus canadensis</i>	bunchberry											x		
<i>Cornus stolonifera</i>	red-osier dogwood				x			x				x		
<i>Cypripedium calceolus</i> var. <i>pubescens</i>	large yellow lady's-slipper			x	x		x	x	x		x		x	
<i>Danthonia spicata</i>	poverty grass	x				x						x		x
<i>Deschampsia cespitosa</i>	hair grass			x								x		
<i>Drosera linearis</i>	linear-leaved sundew	x												x
<i>Drosera rotundifolia</i>	round-leaved sundew			x										
<i>Eleocharis elliptica</i>	golden-seeded spike-rush													
<i>Eleocharis quinqueflora</i>	few-flower spike-rush	x												
<i>Eleocharis rostellata</i>	beaked spike-rush													

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Eleocharis smallii</i>	spike-rush	x												
<i>Epigaea repens</i>	trailing arbutus											x		
<i>Equisetum fluviatile</i>	water horsetail				x									
<i>Equisetum variegatum</i>	variegated scouring rush													
<i>Eriophorum viridi-carinatum</i>	green-keeled cotton-grass			x	x									x
<i>ERUCASTRUM GALLICUM</i>	DOG MUSTARD													
<i>Eupatorium maculatum</i>	joe-pye-weed				x	x								x
<i>Eupatorium perfoliatum</i>	common boneset	x										x		
<i>Euthamia graminifolia</i>	grass-leaved goldenrod			x										
<i>Fragaria virginiana</i>	wild strawberry			x					x					
<i>Fraxinus pennsylvanica</i>	green ash			x	x	x		x						
<i>Gaultheria hispidula</i>	creeping snowberry							x				x	x	x
<i>Gaultheria procumbens</i>	wintergreen											x		
<i>Gaylussacia baccata</i>	huckleberry													
<i>Gentianopsis procera</i>	small-fringed gentian									x				
<i>HIERACIUM CAESPITOSUM</i>	KING DEVIL		x											
<i>HIERACIUM SP.</i>	HAWKWEED								x				x	

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Hypericum kalmianum</i>	Kalm's St. John's-wort													
<i>Iris lacustris</i>	dwarf lake iris	x			x									
<i>Iris versicolor</i>	wild blue flag					x		x						
<i>Juncus balticus</i>	Baltic rush			x										
<i>Juncus brachycephalus</i>	rush													
<i>Juncus brevicaudatus</i>	rush													
<i>Juncus nodosus</i>	rush													
<i>Juniperus communis</i>	common juniper			x					x					
<i>Juniperus horizontalis</i>	creeping juniper	x								x			x	
<i>Larix laricina</i>	tamarack	x		x	x	x			x	x	x		x	
<i>Lathyrus palustris</i>	marsh pea													
<i>Ledum groenlandicum</i>	Labrador tea				x								x	
<i>Lilium philadelphicum</i>	wood lily													
<i>Linnaea borealis</i>	twinflower								x		x			
<i>Liparis loeselii</i>	Loesel's twayblade													
<i>Lobelia kalmii</i>	Kalm's lobelia										x			
<i>Lobelia spicata</i>	pale spiked lobelia													

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Lonicera oblongifolia</i>	swamp fly honeysuckle	x	x		x				x					
<i>Lycopus americanus</i>	common water horehound							x						
<i>Lycopus uniflorus</i>	northern bugleweed					x						x	x	
<i>Lysimachia quadriflora</i>	whorled loosestrife													
<i>Lysimachia terrestris</i>	swamp candles													
<i>LYTHRUM SALICARIA</i>	PURPLE LOOSESTRIFE	x	x											
<i>Melampyrum lineare</i>	cow-wheat								x					
<i>Mentha arvensis</i>	wild mint													
<i>MENTHA PIPERITA</i>	peppermint				x									
<i>Muhlenbergia glomerata</i>	marsh wild timothy					x								
<i>Myrica gale</i>	sweet gale		x			x							x	
<i>Onoclea sensibilis</i>	sensitive fern				x									
<i>Osmunda regalis</i>	royal fern			x					x					
<i>Panicum lindheimeri</i>	panic grass													
<i>Parnassia glauca</i>	grass-of-Parnassus					x								

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>PHALARIS ARUNDINACEA</i>	REED CANARY GRASS						x	x						
<i>Phragmites australis</i>	common reed	x	x	x	x	x						x		
<i>Picea mariana</i>	black spruce		x		x			x					x	
<i>Pinguicula vulgaris</i>	butterwort				x	x								
<i>Pinus strobus</i>	white pine			x			x		x	x			x	
<i>Platanthera hyperborea</i>	tall northern bog orchid		x		x							x		
<i>POA COMPRESSA</i>	CANADA BLUEGRASS													
<i>Pogonia ophioglossoides</i>	rose pogonia													
<i>Polygala paucifolia</i>	gay wings													
<i>Polygonum amphibium</i>	water smartweed							x						
<i>Polygonum sp.</i>	smartweed													
<i>Populus balsamifera</i>	balsam poplar						x							
<i>Populus tremuloides</i>	quaking aspen											x		
<i>Potentilla anserina</i>	silverweed							x						
<i>Potentilla fruticosa</i>	shrubby cinquefoil													
<i>Prenanthes racemosa</i>	glaucous white lettuce							x						

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Primula mistassinica</i>	dwarf Canadian primrose													
<i>Proserpinaca palustris</i>	mermaid-weed			x										
<i>PRUNELLA VULGARIS</i>	LAWN PRUNELLA	x				x	x				x	x	x	x
<i>Quercus rubra</i>	red oak			x										
<i>Rhamnus alnifolia</i>	alder-leaved buckthorn				x		x	x			x	x	x	
<i>RHAMNUS FRANGULA</i>	GLOSSY BUCKTHORN		x											
<i>Rhynchospora alba</i>	white beak-rush	x												
<i>Rhynchospora capillacea</i>	beak-rush													
<i>Rudbeckia hirta</i>	black-eyed Susan	x			x						x			
<i>Salix candida</i>	sage willow	x				x	x	x				x		
<i>Salix petiolaris</i>	slender willow													
<i>Salix</i> spp.	willows					x	x					x		x
<i>Sarracenia purpurea</i>	pitcher-plant						x	x					x	
<i>Schizachyrium scoparium</i>	little bluestem	x				x								
<i>Schoenoplectus acutus</i>	hardstem bulrush					x		x					x	
<i>Schoenoplectus pungens</i>	three-square													x
<i>Scleria verticillata</i>	nut-rush									x				

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Selaginella eclipes</i>	selaginella												x	
<i>Senecio aureus</i>	golden ragwort													
<i>Senecio pauperculus</i>	balsam ragwort													
<i>Shepherdia canadensis</i>	soapberry		x		x		x					x		x
<i>Smilacina stellata</i>	starry false Solomon's seal				x		x							
<i>Solidago altissima</i>	tall goldenrod											x		
<i>Solidago canadensis</i>	Canada goldenrod													
<i>Solidago houghtonii</i>	Houghton's goldenrod													
<i>Solidago ohioensis</i>	Ohio goldenrod												x	
<i>Solidago ptarmicoides</i>	upland white goldenrod	x			x									
<i>Solidago rugosa</i>	rough goldenrod		x	x						x		x		
<i>Solidago uliginosa</i>	bog goldenrod			x	x	x					x			
SONCHUS SP.	SOW THISTLE													
<i>Spiraea alba</i>	meadowsweet							x						
<i>Spiranthes cernua</i>	nodding ladies' tresses	x	x	x		x	x							
<i>Spiranthes romanzoffiana</i>	hooded ladies' tresses											x		

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Stachys</i> sp.	hedge nettle													
<i>Thelypteris palustris</i>	marsh fern	x		x										
<i>Thuja occidentalis</i>	northern white-cedar													
<i>Tofieldia glutinosa</i>	false asphodel					x								
<i>Triadenum fraseri</i>	marsh St. John's-wort	x		x	x	x								
<i>Trichophorum alpinum</i>	Alpine bulrush			x								x		x
<i>Trichophorum cespitosum</i>	tufted bulrush	x					x						x	
<i>Trientalis borealis</i>	starflower			x				x						
<i>Triglochin maritimum</i>	common bog arrow-grass													
<i>Triglochin palustris</i>	slender bog arrow-grass		x											
<i>Utricularia cornuta</i>	horned bladderwort				x									
<i>Utricularia intermedia</i>	flat-leaved bladderwort		x	x						x				
<i>Vaccinium angustifolium</i>	low sweet blueberry							x					x	
<i>Vaccinium myrtilloides</i>	Canada blueberry			x									x	x
<i>Vaccinium oxycoccos</i>	small cranberry			x	x								x	
<i>Viola nephrophylla</i>	bog violet								x					x
<i>Viola</i> spp.	violets									x				x

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
<i>Vitis riparia</i>	riverbank grape		x											
<i>Zigadenus glaucus</i>	white camas		x				x				x	x		

*Taxon occurred in at least one of the two sample sites associated with this E.O. (i.e., Dudley Bay East/Dudley Bay West or Cheboygan State Park South/Cheboygan State Park North).

Appendix 7. Summary list of animals documented in coastal fen sample sites, 2010 – 2011.

Scientific Name	Common Name	El Cajon Bay	Whitefish Bay	Squaw Bay	Thompson's Harbor	Waugoshance Point	Dudley Bay West and East*	St. Martin Point	Albany Creek Mouth	Cheboygan State Park*	Horseshoe Bay East	Horseshoe Bay West	Meridian Fen	Peck Bay
Dragonflies (9)														
<i>Libellula pulchella</i>	Twelve-Spotted Skimmer	x	x	x	x	x	x	x		x		x	x	x
<i>Libellula quadrimaculata</i>	Four-Spotted Skimmer	x	x		x									
<i>Sympetrum spp.</i>	Meadowhawk	x	x	x	x	x	x	x	x	x	x	x	x	x
<i>Celithemis elisa</i>	Calico Pennant	x	x		x							x	x	
<i>Celithemis eponina</i>	Halloween Pennant					x						x		
<i>Aeshna canadensis</i>	Canada Darner	x	x	x	x	x	x			x		x	x	x
<i>Aeshna verticalis</i>	Green-Striped Darner	x												
<i>Anax junius</i>	Common Green Darner			x		x	x	x	x	x			x	x
<i>Somatochlora walshii</i>	Brush-Tipped Emerald				x									
Butterflies (20)														
<i>Pieris rapae</i>	Cabbage White			x										
<i>Colias eurytheme</i>	Orange Sulphur			x	x									
<i>Colias interior</i>	Pink-edged Sulphur	x		x	x									
<i>Cercyonis pegala nephele</i>	Wood Nymph	x			x	x	x	x					x	
<i>Beloria bellona</i>	Meadow Fritillary	x		x	x									
<i>Boloria selene myrina</i>	Silver-bordered Fritillary					x	x	x						

<i>Speyeria cybele cybele</i>	Great-spangled Fritillary						x	x								
<i>Speyeria atlantis</i>	Atlantis Fritillary									x						
<i>Euptoieta claudia</i>	Variegated Fritillary	x														
<i>Phyciodes selenis</i>	Northern Pearl Crescent		x		x	x	x	x								
<i>Euphydryas phaeton</i>	Baltimore	x														
<i>Vanessa cardui</i>	Painted Lady							x								
<i>Junonia coenia</i>	Buckeye						x			x					x	
<i>Limenitis archippus</i>	Viceroy	x		x	x	x	x	x		x					x	
<i>Limenitis arthemis astyanax</i>	Red-spotted Purple						x	x								
<i>Limenitis arthemis arthemis</i>	White Admiral							x		x					x	
<i>Lycaena dorcus</i>	Dorcas Copper										x				x	
<i>Danaus plexippus</i>	Monarch	x					x			x					x	
<i>Hesperia comma laurentina</i>	Common Branded Skipper	x						x								
<i>Wallengrenia egeremet</i>	Northern Broken Dash										x					
Other State-Listed Insects (3)																
<i>Flexamia delongi</i>	A leafhopper		x							x		x	x	x	x	x
<i>Dorydiella kansana</i>	Kansan Leafhopper	x														
<i>Prosapia ignipectus</i>	Red-legged Spittlebug	x														
Birds (15)																
<i>Ardea alba</i>	Great Egret		x													
<i>Ardea herodias</i>	Great Blue Heron			x	x			x			x			x		x
<i>Cygnus olor</i>	Mute Swan	x														
<i>Cathartes aura</i>	Turkey vulture	x														
<i>Haliaeetus leucocephalus</i>	Bald Eagle		x				x					x	x			
<i>Pandion haliaetus</i>	Osprey														x	
<i>Accipiter cooperii</i>	Cooper's Hawk	x		x			x									
<i>Buteo lineatus</i>	Red-shouldered Hawk	x						x								

<i>Buteo jamaciensis</i>	Red-tailed Hawk			x		x								
<i>Falco columbarius</i>	Merlin					x	x					x		
<i>Tringa melanoleuca</i>	Greater Yellowlegs	x	x											
<i>Larus delawarensis</i>	Ring-billed Gull	x			x						x	x	x	x
<i>Sterna hirundo</i>	Common Tern			x										
<i>Zenaida macroura</i>	Mourning Dove	x							x			x	x	
<i>Tyrannus tyrannus</i>	Eastern Kingbird	x												
Reptiles and Amphibians (3)														
<i>Thamnophis sirtalis sirtalis</i>	Eastern Garter Snake		x											
<i>Bufo americanus americanus</i>	Eastern American Toad		x											
<i>Rana pipiens</i>	Northern Leopard Frog	x	x	x	x	x		x		x	x	x		x