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Assessment of Wetland Communities at Isle Royale National Park

Natural Resource Technical Report NPS/GLKN/NRTR—2009/162



ON THE COVER
Aquatic vegetation protected from moose browse by fallen cedars, Isle Royale. Photo by Jim Meeker.

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Jim Meeker
Northland College
1411 Ellis Avenue
Ashland, Wisconsin 54806

Al Harris
Northern Bioscience Ecological Consulting
363 Van Horne Street
Thunder Bay, Ontario, Canada P7A 3G3

Valena Hofman
Northland College
1411 Ellis Avenue
Ashland, Wisconsin 54806

Emmet Judziewicz
University of Wisconsin Stevens Point
301 Daniel O. Trainer Natural Resources Building
Stevens Point, Wisconsin 54481

and

Janet Marr
23180 Highway Loc. Rd.
Calumet, Michigan 49913

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Abstract

Isle Royale National Park (ISRO) contains numerous named and unnamed lakes, stretches of protected Lake Superior coves, open peatlands, and miles of stream – all with a variety of wetland habitats. Over the 2003-2006 field seasons, we assessed these diverse wetlands, guided by four main objectives.

We sought to: 1) describe and establish a monitoring benchmark for the aquatic and shoreline communities of all named lakes; 2) characterize the floristic composition in open peatlands; 3) give the island a "bill of health" relative to aggressive wetland invaders, especially cattails (*Typha* spp.) and common reed (*Phragmites australis*); and 4) expand the known flora of the island by locating plant taxa likely to be but not yet documented on the island.

Relative to goal 1, we described three aquatic plant assemblages; the aquatic assemblages of Lake Superior bays differed from those of lakes <20 ha in size, and these, in turn, were different from lakes >20 ha. For goal 2, we determined that peatland communities differed, as expected, along nutrient and water depth gradients, separating sedge meadow habitat from that of fens and bogs. For goal 3, we assessed 308 km of interior lake and Lake Superior bay shoreline and determined that 1.2% was occupied by aggressive taxa. Finally for goal 4, thirteen new taxa were added to the flora of ISRO, including the aquatic lake cress (*Armoracia lacustris*) and Farwell's water milfoil (*Myriophyllum farwellii*), both ranked as Threatened in Michigan.

We believe that this snapshot in time of the wetland plant communities will better enable the park to begin monitoring programs for these important wetland resources.

Acknowledgements

We appreciate the help of numerous individuals in this project. Joan Elias, Mike Jones, Kate Thompson, and Chris Tyrell assisted with the fieldwork; Tara King created all of the site maps. Jean Battle, Mark Romanski, and Alex Egan of Isle Royale National Park made the sometimes difficult logistics possible. Suzanne Sanders and Joan Elias of the Great Lakes Inventory and Monitoring Network provided helpful reviews.

Introduction

Background

Isle Royale National Park (ISRO) is known to be rich in aquatic resources, with 42 named lakes, 233 kilometers of perennial streams, and an estimated 7,000 hectares of wetlands (Lafrancois and Glase 2005). These wetlands support numerous wetland taxa, several of which are Endangered, Threatened, or of Special Concern in Michigan. Furthermore, it is believed that the aquatic plant communities of Isle Royale may have been considerably altered due to intense moose herbivory (Aho and Jordan 1979; Lafrancois and Glase 2005), suggesting the importance of establishing a baseline for monitoring these resources.

The importance of wetland and aquatic resources in general is now recognized as being greater than the mere proportion of these habitats in the landscape as a whole. In addition to providing areas for unique groups of plants, wetlands provide required food, habitat, and cover for fish, birds, mammals, and a host of invertebrates. Aquatic plants are also considered indicators of aquatic health; some wetland communities may be good candidates for long-term monitoring (Forst et al. 2004).

In 2002, the National Park Service (NPS) recognized a need for an inventory of wetland and aquatic habitat on ISRO (Route 2002). Previous inventories of wetland plants have been limited in scale (Toczydlowski et al. 1978) and not particularly designed to provide a summary of ISRO aquatic habitat (Lafrancois and Glase 2005).

Objectives

We developed several general objectives for this study with the understanding that the wetland plant resources that we address include shorelines, shallow water habitat (aquatic plants), and open peatland habitats, such as open bogs and fens.

First, we wanted to describe the floristic communities of peatlands, lakeshores, and aquatic beds over as much of the island as we could cover. Our goal for the aquatic and shoreline communities was to sample wetland vegetation in a majority of the 32 named lakes assessed by Kallemeyn (2000) and in sheltered Lake Superior waters that likely support wetland plants (i.e., bays, harbors, and coves). Secondly, we wanted to pilot the development of a long-term monitoring strategy to assess the level of invasion by aggressive aquatic taxa, while giving the island a bill of health relative to these taxa. Finally, we wanted to document the status and occurrence of aquatic and wetland plant species that may be expected to be present on ISRO by adding to the known wetland plant flora. (The Inventory and Monitoring Program of the NPS has a goal of documenting the occurrence of 90% or more of species expected to occur in a given park.)

We concentrated on open, non-treed wetlands that were not well-documented. These data will establish a baseline for monitoring vegetation changes. We did not address forested wetlands that have been adequately sampled in the USGS-NPS mapping project (The Nature Conservancy 1999).

Methods

Inland Lake and Lake Superior Bay Segment Sampling

Forty-seven inland lakes and Lake Superior bays and coves were assessed for wetland vegetation during the 2003-2006 field seasons (Figures 1 and 2). Sampling took place along transects parallel to shorelines, which we refer to as segments for this report. Most of this segment sampling took place between 20 July and 20 August, which is peak flowering time for the majority of wetland plant taxa. (Some peatland sampling, described below, was conducted in June to facilitate identification of early flowering taxa.)

Prior to sampling a given lake or bay, we looked at its general outline and identified all of its sheltered areas. These areas were chosen as primary locations to sample because they would most likely support macrophytes. In addition, on larger lakes, we often sampled along randomly selected portions of the sparsely vegetated shoreline that comprised the rest of the lake or bay shoreline. These sampling areas were of variable lengths. The length of the bay segments depended on the size of the bays; the sparsely vegetated segments were roughly estimated in the field to be between 150-250 m in length.

Two types of segments were sampled: **aquatic** and **shoreline**. Aquatic habitat was defined as the area from damp substrate or the water's edge *into* the water to a depth of about 2.5 m. A total of 168 aquatic segments were sampled at the 47 sites (37 lakes and 10 bays; Table 1). Shoreline segments were also assessed, parallel to the aquatic segments, and these were defined as the area *up from* the water's edge to the shrub-line or mean high water mark. Shorelines were sampled in only 72 of these 168 segments, due to the fact there was often an abrupt transition from aquatic to upland, allowing minimal shoreline habitat.

Even though the line between aquatic and shoreline is arbitrary, we sampled these habitats separately because we knew that elevation, and hence water depth, would be the strongest influencing factor in ordination analyses. We also analyzed aquatic and shoreline habitats separately in order to minimize these water depth differences and maximize the potential to detect differences among large lakes, small lakes, and Lake Superior bays. Some taxa occurred in both aquatic and shoreline segments; these taxa consisted primarily of emergent sedges and reeds that survive well out of water yet also grow in standing water.

We recorded sampling locations using GPS (Garmin 12XL), marking the beginnings and ends of all segments; coordinates are in UTM zone 16, NAD83 (Appendix A).

Plant Sampling in Aquatic Segments

We traversed each segment by wading, canoe, or swimming with a snorkel, and created a species list. Upon completion of the segment, we estimated each taxon's percent-cover class, where trace (tr) = <1% cover, 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = 51-75%, and 5 = 76-100%. To more accurately represent emergent, submergent, and floating species within each segment sampled, percent-cover was determined based on the following criteria: for those emergent taxa that were generally restricted to shallow water or shoreline (e.g., some reeds, grasses, and sedges), cover was estimated relative to the total area capable of supporting the above taxa (usually the area between mean high water and about 0.50 m in depth). Cover of the floating and submergent taxa

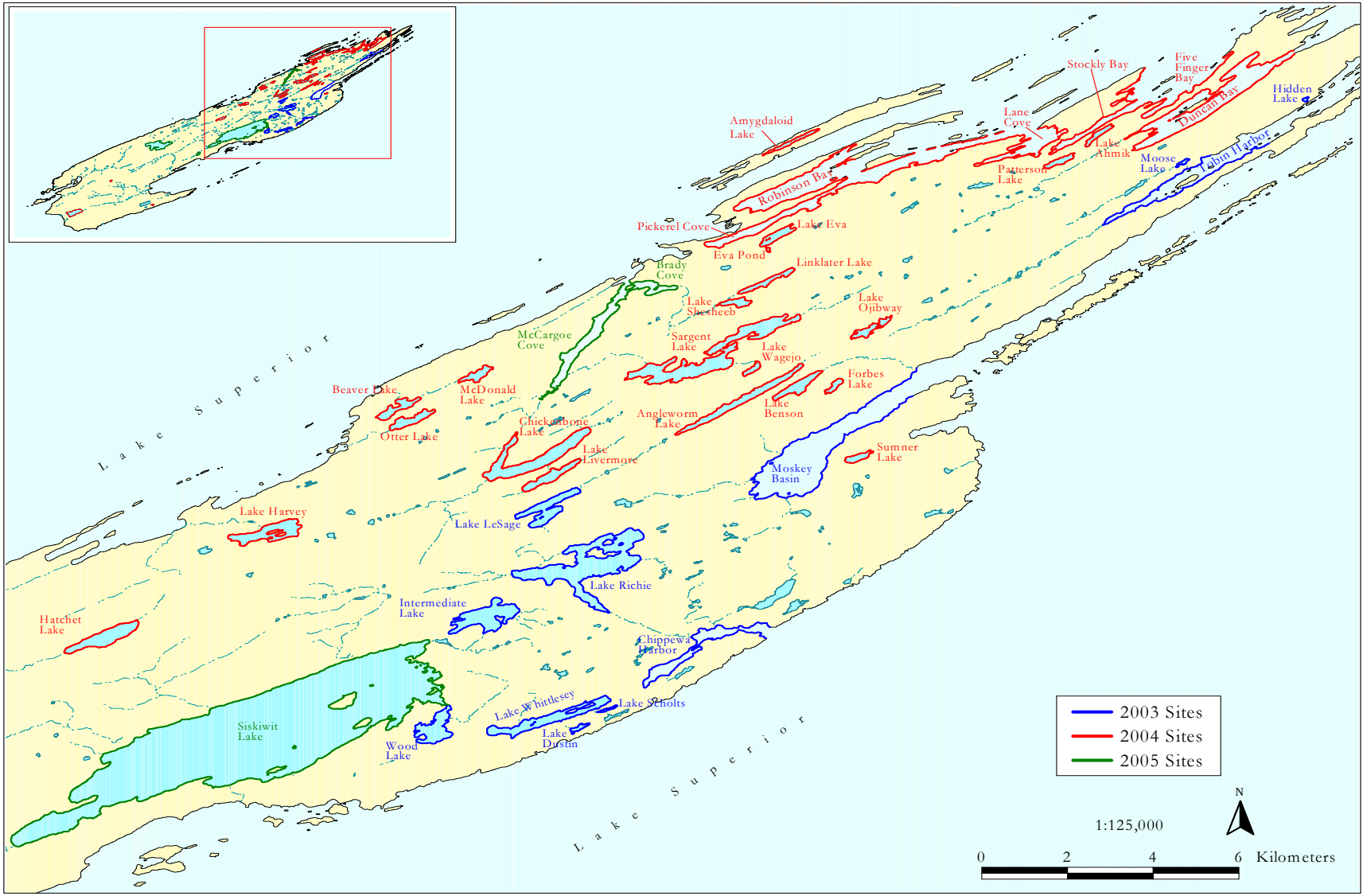


Figure 1. Interior lakes and Lake Superior bays sampled during 2003-2005 field seasons on northeast end of Isle Royale. The color of the outline indicates the year that the lake or bay was sampled for aquatic and/or shoreline plants as well as the perimeter of shoreline sampled for aggressive taxa (see text for list).

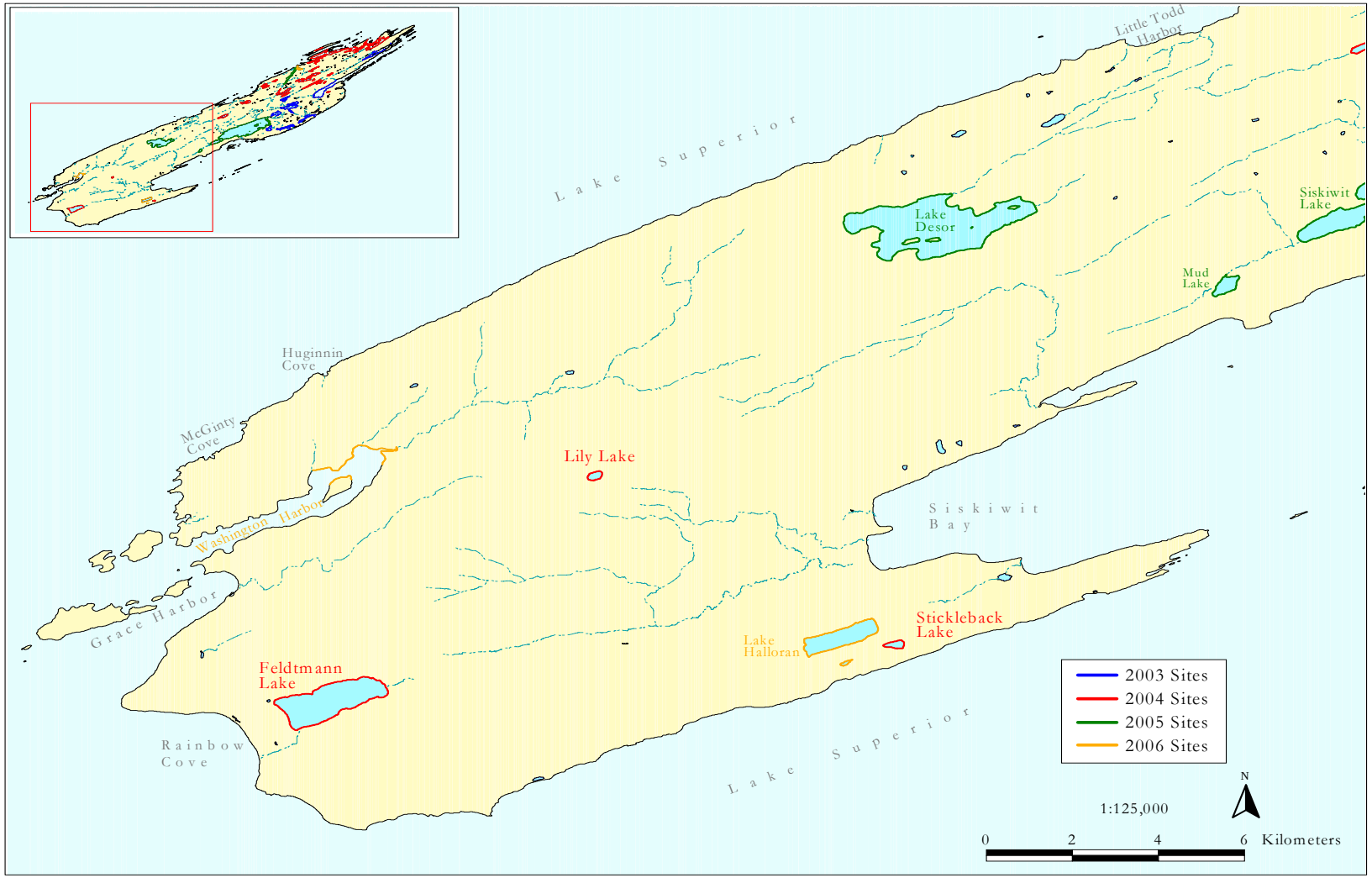


Figure 2. Interior lakes and Lake Superior bays sampled during 2003-2006 field seasons on southwest end of Isle Royale. The color of the outline indicates the year that the lake or bay was sampled for aquatic and/or shoreline plants as well as the perimeter of shoreline sampled for aggressive taxa (see text for list).

Table 1. Inland lakes and Lake Superior bays sampled for vegetation at Isle Royale 2003-2005. Columns indicate the number of aquatic and shoreline segments sampled in each basin.

Site	No. of Aquatic Segments	No. of Shoreline Segments	1=Lake Superior bay 2=Inland Lake	Year
Ahmik Lake	7	6	2	2004
Amygdaloid Lake	6	6	2	2004
Angleworm Lake	3	3	2	2004
Beaver Lake	2		2	2004
Benson Lake	4	4	2	2004
Chickenbone Lake	6		2	2004
Chippewa Harbor	4	3	1	2003
Desor Lake	6		2	2005
Duncan Bay	8	8	1	2004
Dustin Lake	1		2	2003
Eva Lake	6	6	2	2004
Eva Pond[1]	1	1	2	2004
Feldtmann Lake	3	2	2	2004
Five Finger Bay	2	2	1	2004
Forbes Lake	2	2	2	2004
Harvey Lake	5		2	2004
Hatchet Lake	4		2	2004
Hidden Lake[2]		1	2	2003
Intermediate Lake	9		2	2003
Lane Cove	5	5	1	2004
LeSage Lake	5		2	2003
Lily Lake[1]	1		2	2004
Linklater Lake	2		2	2004
Livermore Lake	3		2	2004
McCargoe/Brady coves	2		1	2005
McDonald Lake	1		2	2004
Moose Lake[2]	1	2	2	2003
Moskey Basin	1		1	2003
Mud Lake	2		2	2005
Ojibway Lake	2	1	2	2004
Otter Lake	2		2	2004
Patterson Lake	2	2	2	2004
Pickerel Cove	6	6	1	2004
Richie Lake	12		2	2003
Robinson Bay	7	7	1	2004
Sargent Lake	6		2	2004
Scholts Lake[1]	1	1	2	2003
Shesheeb Lake	1		2	2004
Siskiwit Lake	5		2	2005
Siskiwit Lake (NE)	1		2	2003
Stickleback[1]	1	1	2	2004

Table 1. Inland lakes and Lake Superior bays sampled for vegetation at Isle Royale 2003-2005. Columns indicate the number of aquatic and shoreline segments sampled in each basin (continued).

Site	No. of Aquatic Segments	No. of Shoreline Segments	1=Lake Superior bay 2=Inland Lake	Year
Stockly Bay	2	2	1	2004
Sumner Lake	1	1	2	2004
Tobin Harbor	3		1	2003
Wagejo Lake	2		2	2004
Whittlesey Lake	5		2	2003
Wood Lake	7		2	2003
TOTALS	**168**	**72**		

[1] entire lake as segment

[2] presence/absence data only at the shoreline segments

was estimated as the amount of aquatic habitat they covered relative to the total amount of habitat along the segment between 0.25 m and 2.5 m in depth.

In addition to listing taxa and estimating percent-cover within segments, as we traveled from segment to segment we noted any additional taxa we had not seen along the segments, adding to the species list for each lake. Uprooted fragments of aquatic taxa were included in the species list for inland lakes but not included in segments along the Lake Superior shoreline.

Plant Sampling in Shoreline Segments

Percent-cover of all taxa for the shoreline sampling was determined using the same percent-cover classes explained above for the aquatic sampling. In addition, while moving from segment to segment, any additional on-shore species not previously found were added to the species list.

Peatland Sampling

Peat-forming wetlands were also sampled. This was done to describe the floristics of open peatlands such as bogs (Community Number 70; The Nature Conservancy 1999), fens (Community Numbers 44, 67, 42, 37), remnant beaver meadows, and sedge meadows (Community Numbers 40, 41, 48) that are “wet” but are only temporarily flooded annually.

A pool of potential peatland plot locations was established by looking at aerial photography, assessing park vegetation maps, talking to NPS staff, and relying on our field experience on the island. From this general list we selected sites to visit and sampled them if they were generally open (non-treed) and large enough to accommodate a 10 m x 10 m habitat plot. Within this site, an initial point was chosen in a pseudo-random manner (an over the shoulder flag toss), and all taxa and estimates of their actual cover were taken in nested quadrats of increasing size. This process began at a chosen point with a 1 m x 1 m (1 m^2) quadrat, which then was expanded to a 5 m x 5 m (25 m^2) quadrat and then to a 10 m x 10 m (100 m^2) quadrat.

During the 2003-2005 field seasons, we sampled a total of 64 peatland plots at 23 general locations (Figures 3 and 4, Table 2). The centers of the 10 m x 10 m quadrats were geo-referenced using GPS (Garmin 12XL) (Appendix D).

Aggressive and Exotic Aquatic Species

All inland lakes and portions of Lake Superior bays sampled for aquatic and shoreline vegetation (described above) were also surveyed for aggressive taxa (locations are delineated in Figures 1 and 2).

We searched for the following aggressive taxa: wide-leaf cattail (*Typha latifolia* L.), narrow-leaf cattail (*Typha angustifolia* L.), common reed grass (*Phragmites australis* (Cav.) Trin.), reed canary grass (*Phalaris arundinacea* L.), curly-leaf pondweed (*Potamogeton crispus*), Eurasian milfoil (*Myriophyllum spicatum* L.), and purple loosestrife (*Lythrum salicaria* L.).

The locations of these aggressive taxa were mapped as either linear features or as points. If these features were greater than 5 m long, their endpoints were located and geo-referenced (Garmin 12XL). If an occurrence of aggressive aquatics was less than 5 m long, the center of the patch

Table 2. General locations of 10 m x 10 m peatland plots sampled at Isle Royale, 2003-2005.

Site Number	Site	No. of Plots	Year
1	Ahmik Lake	3	2004
2	Angleworm Lake	1	2004
3	Beaver Wetland	2	2004
4	Benson Lake	2	2004
5	Checker Point SE	1	2004
6	Daisy Farm Trail Boardwalk	3	2004
7	Eva Pond	2	2004
8	Forbes Lake	3	2004
9	Grace Creek	1	2004
10	Huginnin Cove Trail	2	2004
11	Lane Cove Trail	10	2003
12	Lily Lake	3	2004
13	McCargoe Cove	3	2005
14	Minong Ridge	8	2004
15	Mount Ojibway Trail	1	2004
16	Mud Lake	2	2005
17	Ojibway Lake	3	2004
18	Patterson Lake	2	2004
19	Siskiwit Fen	3	2004
20	Siskiwit Lake	2	2005
21	Stickleback Lake	2	2004
22	Sumner Lake	2	2004
23	Superior Shoreline Fens	3	2004

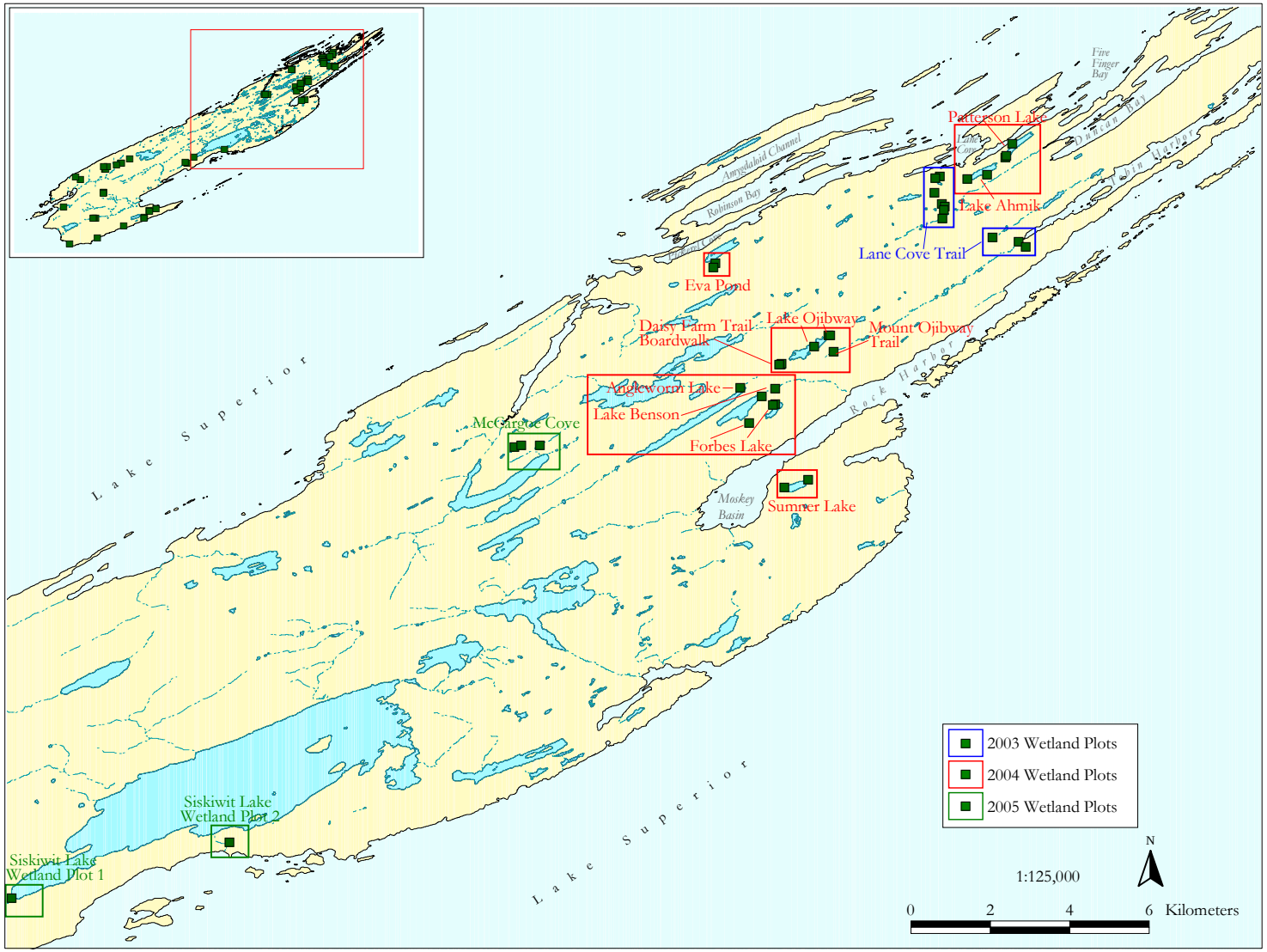


Figure 3. Location of 10 m x 10 m peatland plots sampled for wetland plants during the 2003–2005 field seasons on the northeast end of Isle Royale. The color of text label indicates the year that the peatland was sampled (see text for named list and GPS coordinates of plot centers).

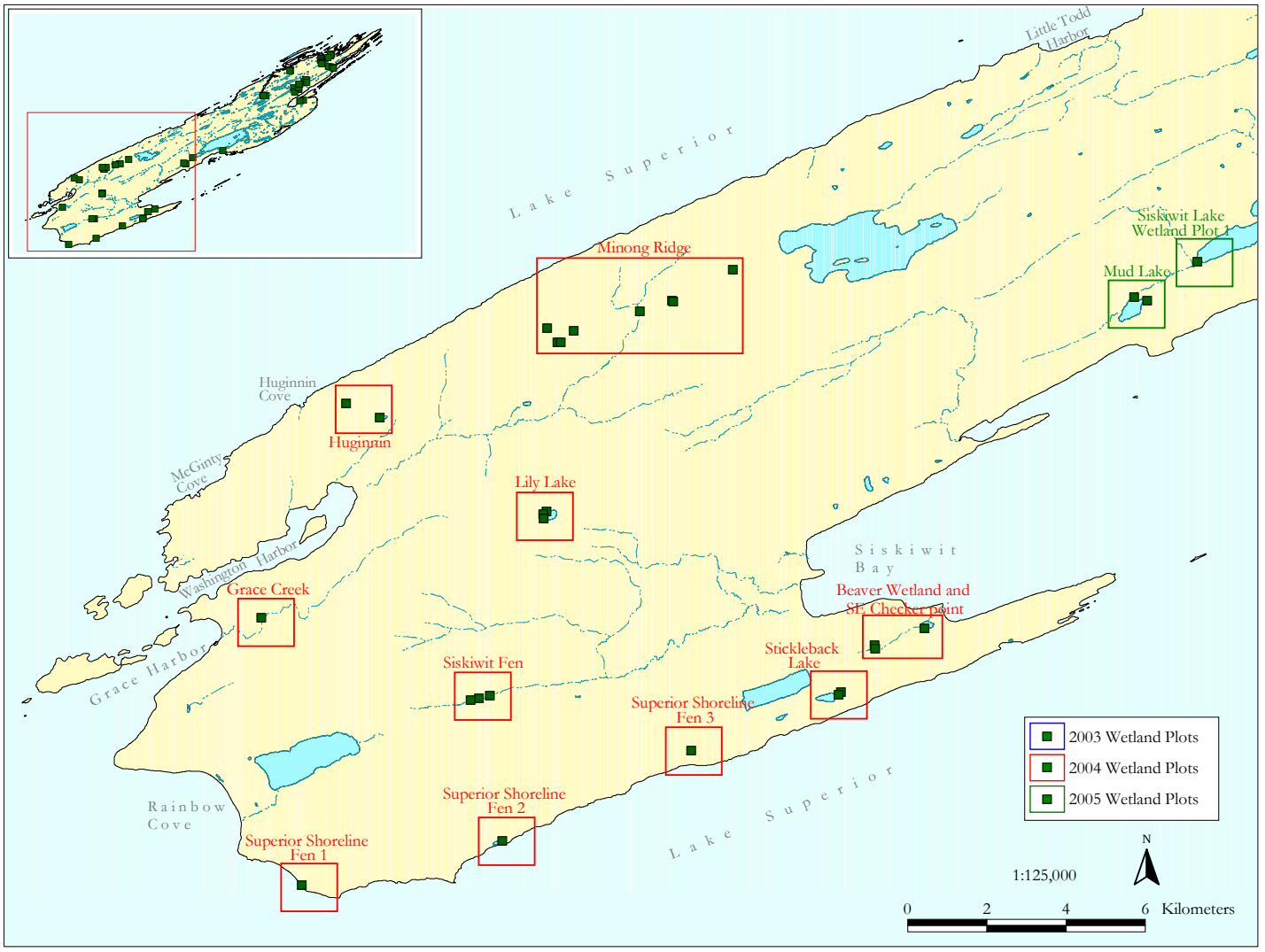


Figure 4. Location of 10 m x 10 m peatland plots sampled for wetland plants during the 2003–2005 field seasons on the southwest end of Isle Royale. The color of text label indicates the year that the peatland was sampled (see text for named list and GPS coordinates of plot centers).

was marked as a point. Linear features were also referred to as beds or patches and were considered continuous if there was less than 2 m between adjacent stems. Presence of reed canary grass was noted on inland lakes only, as the species was found fairly consistently scattered along the Lake Superior shorelines. In addition to referencing the location of these aggressive taxa, we estimated (in most cases) the number of stems constituting the point or beds.

New and Notable Species

As part of the goal to identify wetland taxa new to Isle Royale, we compiled a "hit" list (Table 3, modified from Judziewicz 1999, 2003) of the wetland plants that were likely to be found on the island but were not yet confirmed through collections (and hence not listed as part of the flora) (Slavick and Janke 1987, 1993). As we hiked and canoed to the aquatic, shoreline, and peatland sampling sites we looked for plants on this list. In the process, we also recorded and mapped occurrences of rare or notable plants, as well as larger beds of aquatic species present within lakes and bays but not recorded in the sampling segments. All new taxa were vouchered and have been placed in various regional herbaria.

Table 3. Isle Royale "target" wetland plants (those thought to possibly occur on ISRO, but not yet reported as of May 2003). List created by E.J.J. (as derived from Judziewicz 1999, 2003).

	Species	Family	Reported in this study
1	*Alisma subcordatum*	Alismataceae	
2	*Armoracia lacustris*	Brassicaceae	x
3	*Asclepias incarnate*	Asclepiadaceae	
4	*Caltha natans*	Ranunculaceae	
5	*Carex arcta*	Cyperaceae	
6	*Carex brachyglossa*	Cyperaceae	
7	*Carex bromoides*	Cyperaceae	
8	*Carex comosa*	Cyperaceae	
9	*Carex crawei*	Cyperaceae	
10	*Carex granularis*	Cyperaceae	
11	*Carex pellita*	Cyperaceae	
12	*Carex pseudo-cyperus*	Cyperaceae	
13	*Carex tribuloides*	Cyperaceae	
14	*Carex tuckermanii*	Cyperaceae	
15	*Carex vulpinoidea*	Cyperaceae	
16	*Ceratophyllum demersum*	Ceratophyllaceae	x
17	*Chrysosplenium americanum*	Saxifragaceae	
18	*Eleocharis elliptica*	Cyperaceae	
19	*Eleocharis erythropoda*	Cyperaceae	

Table 3. Isle Royale "target" wetland plants (those thought to possibly occur on ISRO, but not yet reported as of May 2003). List created by E.J.J. (as derived from Judziewicz 1999, 2003) (continued).

	Species	Family	Reported in this study
20	*Eleocharis mamillata*	Cyperaceae	
21	*Eleocharis obtuse*	Cyperaceae	
22	*Eleocharis quinqueflora*	Cyperaceae	
23	*Eleocharis robbinsii*	Cyperaceae	
24	*Elodea nuttallii*	Hydrocharitaceae	
25	*Epilobium strictum*	Onagraceae	
26	*Eriophorum chamissonis*	Cyperaceae	
27	*Eriophorum virginicum*	Cyperaceae	
28	*Galium labradoricum*	Rubiaceae	
29	*Glyceria grandis*	Poaceae	x
30	*Hypericum ellipticum*	Clusiaceae	
31	*Juncus articulatus*	Juncaceae	
32	*Juncus balticus var. littoralis*	Juncaceae	
33	*Juncus brachycephalus*	Juncaceae	
34	*Juncus bufonius*	Juncaceae	
35	*Juncus canadensis*	Juncaceae	
36	*Leersia oryzoides*	Poaceae	x
37	*Lemna turionifera*	Lemnaceae	
38	*Littorella uniflora*	Plantaginaceae	
39	*Lythrum salicaria*	Lythraceae	
40	*Myriophyllum farwellii*	Haloragaceae	x
41	*Myriophyllum heterophyllum*	Haloragaceae	x
42	*Potamogeton crispus*	Potamogetonaceae	
43	*Potamogeton friesii*	Potamogetonaceae	
44	*Potamogeton illinoensis*	Potamogetonaceae	
45	*Potamogeton nodosus*	Potamogetonaceae	
46	*Ranunculus gmelini*	Ranunculaceae	
47	*Sagittaria rigida*	Alismataceae	x
48	*Scirpus atrocinctus*	Cyperaceae	
49	*Scirpus (Schoenoplectus) pungens*	Cyperaceae	x
50	*Spirodela polyrhiza*	Lemnaceae	
51	*Tillaea aquatica*	Crassulaceae	
52	*Utricularia resupinata*	Lentibulariaceae	
53	*Zannichellia palustris*	Zannichelliaceae	
54	*Zizania palustris*	Poaceae	
55	*Zosterella (Heteranthera) dubia*	Pontederiaceae	x

Results

Products

Map Creation

All locations of aquatic, shoreline, and peatland sampling, as well as locations of aggressive taxa, were mapped and are included in Appendix B. An example of the mapping results after sampling Angleworm, Benson, and Forbes Lakes is shown in Figure 5. Angleworm Lake was sampled for shoreline and/or aquatics along three segments (S1-S3), and the entire shoreline was sampled for aggressive taxa, resulting in two beds of *Phragmites* and one point of *Typha latifolia* consisting of two stems. In addition, one peatland plot was established on the northeast end of the lake (PP1). Note that Benson Lake had its own segments and plot numbering system (with 4 segments and two peatland plots). All maps were created in Arcview, projected in UTM zone 16, NAD 83. A compact disk containing all GIS data is included in this report.

Data Entry

All raw data from the wetland sampling were entered in Microsoft Excel spreadsheets, error checked twice, and are included in a separate Data Supplement. There is one worksheet per lake, bay, or trail, in the following order: aquatic segments (A), shoreline segments (S), and peatland plots (P). These data sheets include all taxa found at the particular site, identified to the best of our abilities in the field. In a few cases, for more difficult taxa, we collected specimens for identification at a later date. Occasionally, small sprigs of plant material were found and we were only able to identify the taxon to genus (e.g., *Potamogeton* sp.) or to family (e.g., Poaceae sp.). These taxa were recorded even at this broad level of classification because they represent additional richness at the sites, information we wanted to retain. All nomenclature throughout this report is according to Gleason and Cronquist (1991). We encountered 402 taxa over the 2003-2005 field seasons, including those listed during sampling and those new taxa noted between sampling sites (Appendix C).

Aquatic Segments at Inland Lakes and Lake Superior Bays

In addition to a list of species and their cover classes for each of the 168 aquatic segments, the richness of each segment is also reported in the Data Supplement. A summary of these richness data indicated that segment richness varied from as few as two taxa to as many as 41, with a mean of 16.9 taxa per segment (SE $\pm$0.47). Ninety-five percent of all segment richness values ranged from 4-26 taxa per segment.

The aquatic data were combined into one spreadsheet, resulting in a matrix of 108 taxa by 168 segments. Prior to summarizing the data, all cover class determinations were modified to represent a cover percent. Tr (trace) was replaced by a value of 0.1% cover. Cover class 1 became 3%, cover class 2 became 15%, cover class 3 became 38%, cover class 4 became 63%, and cover class 5 became 88%. These changes represent the midpoint of each cover class (e.g., 3 = the midpoint of the range 26-50% or 38%).

Twelve taxa occurred with greater than 2.0 % mean cover over the 168 segments (Table 4). The three most abundant taxa by cover included an emergent reed (*Eleocharis palustris*) at 9.86%, an

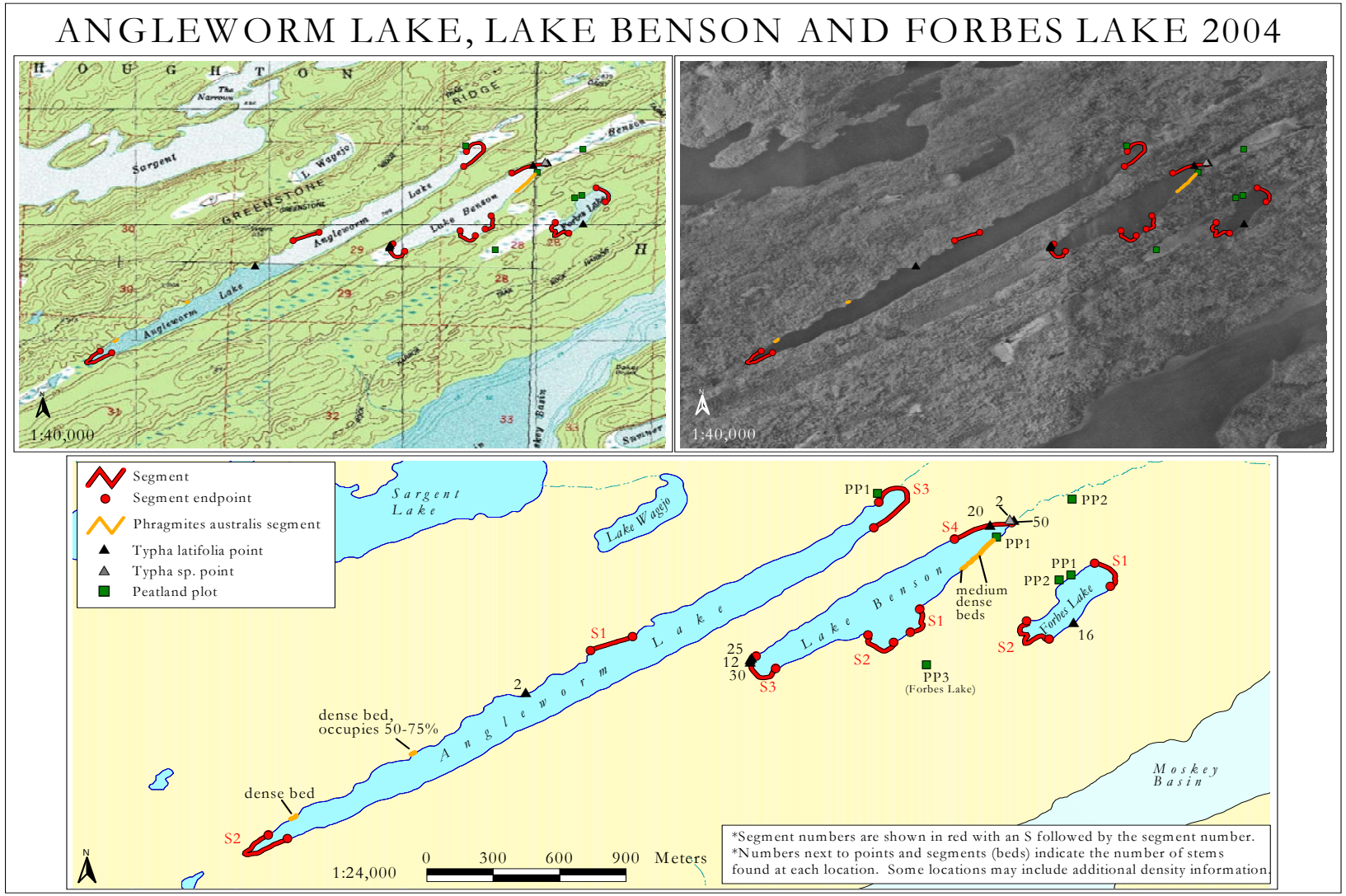


Figure 5. Locations of sampling segments, peatland plots, and aggressive taxa occurrences at Angleworm Lake, Lake Benson, and Forbes Lake, Isle Royale, 2004. GPS coordinates of all indicated features are listed in Appendix A (aquatic and shoreline segments), Appendix D (Peatland plots), and Appendix E (aggressive taxa).

Table 4. Twelve most abundant plant taxa in aquatic segments by cover. All taxa with greater than 2.0% cover per segment are listed.

	Species	Growth Form	Total % Cover	Frequency of Occurrence (n=168 segments)	Mean % Cover per Segment
1	*Eleocharis palustris*	Emergent	1,280.7	98	9.86
2	*Potamogeton gramineus*	Floating	1,116.9	141	8.60
3	*Carex lasiocarpa*	Emergent	1,088.8	62	8.39
4	*Equisetum fluviatile*	Emergent	900.0	122	6.93
5	*Najas flexilis*	Submerged	848.4	80	6.53
6	*Sparganium fluctuans*	Floating	809.4	54	6.23
7	*Isoetes* spp.	Submerged	569.2	126	4.38
8	*Chara* spp.	Submerged	552.8	90	4.26
9	*Potamogeton amplifolius*	Submerged	473.2	80	3.64
10	*Potamogeton richardsonii*	Submerged	398.1	91	3.07
11	*Scirpus subterminalis*	Submerged	397.5	33	3.06
12	*Potamogeton foliosus*	Submerged	365.8	33	2.82

emergent sedge (*Carex lasiocarpa*) at 8.39%, and a floating leaf pondweed (*Potamogeton gramineus*) at 8.60%. Most of the remaining abundant taxa by cover were submergents.

We used non-metric multidimensional scaling (NMS) ordination techniques included in PCORD software (McCune and Mefford 1999) to investigate the differences in aquatic macrophyte communities among segments found in large lakes (>20 ha), small lakes (<20 ha), and Lake Superior coves and bays. Since we were interested in general patterns within this data set, we eliminated the rare taxa found in <3 segments. In addition, preliminary analyses indicated that three segments (Lily Lake 1, Siskiwit Lake 1, and Siskiwit Lake 4) were outliers primarily due to low taxa diversity per segment (5, 2, and 2 taxa respectively) and these were eliminated from the NMS ordination analysis, resulting in a matrix of 165 aquatic segments by 78 taxa.

The NMS ordination of this matrix indicates that Lake Superior segments (Figure 6, solid squares, n=40) plot somewhat higher on axis 2, apart from the inland lakes. In addition there is a hint of a separation between the two inland lake groups, with the segments on larger lakes (Figure 6, open triangles, n=82) generally plotting lower on axis 1.

Taxa that may contribute to these differences among aquatic segment categories are indicated in Table 5. Here we list the 22 taxa that occur with >50% frequency in any one of the three categories. *Bidens beckii*, *Najas flexilis*, and *Sparganium fluctuans*, for example, are very infrequent in Lake Superior bays, while occurring much more frequently on inland lakes. Conversely, *Carex aquatilis*, *Myriophyllum verticillatum*, and *Ranunculus longirostris* are better represented on Lake Superior bay segments. Taxa that appear to favor small lakes include *Utricularia vulgaris*, *Nuphar variegata*, and *Dulichium arundinaceum*, whereas *Najas flexilis* is more likely in segments of larger lakes. It is likely that these axes represent a combination of

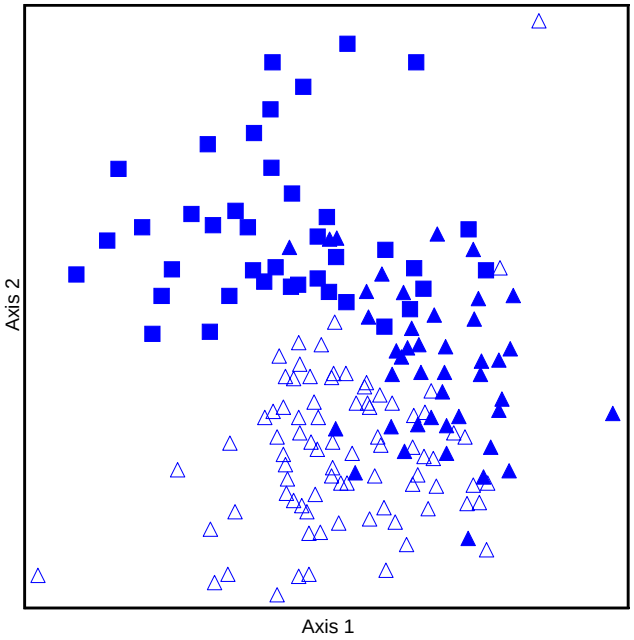


Figure 6. Non-metric multidimensional scaling (NMS) ordination of 165 aquatic segments, using the 78 taxa that occurred in more than 2 segments. Solid square symbols indicate Lake Superior bays and coves, solid triangles indicated segments on small (<20 ha) lakes, and open triangles indicate segments on larger lakes (>20 ha).

wave energy, water temperature, substrate, and nutrient availability, but we have no measures of these variables and may only infer. For example, some of the taxa better represented in small lakes (*Bidens beckii, Utricularia vulgaris*, and *Nuphar variegata*) are known to flourish in more sheltered locations, conditions more likely in small lakes (J. Meeker, personal observation). In addition, aquatic vegetation cover is often greater where fallen logs have created small exclosures, limiting access by moose (Figure 7).

Shoreline Segments on Inland Lakes and Lake Superior Bays

Data from all shoreline segments (Data Supplement) were combined in one spreadsheet, resulting in a matrix of 128 taxa by 72 segments. The segments in this analysis were divided into only two categories (inland lakes and Lake Superior bays) because of the limited number of segments overall (72 vs. 168 in the above aquatic segment analysis). Species cover values were transformed to presence and absence data (power transformation in PCORD, where p = 0.0), as the Lake Superior shoreline segments were generally low in cover compared to the inland lakes, and we wanted the ordination to maximize floristic differences. In addition, one inland lake segment (Amygdaloid Lake # 1) was eliminated from the analysis as an outlier with only two taxa.

The NMS ordination indicated floristic differences between the inland lakes and Lake Superior bays, as the bulk of the Lake Superior segments plotted higher on axis 1 and lower on axis 2

Table 5. Twenty-two taxa found in greater than 50% of the aquatic segments in at least one of the segment categories: Inland lakes >20 ha, inland lakes <20 ha, and Lake Superior bays and coves.

		Inland Lakes >20 ha		Inland Lakes <20 ha		Lake Superior Bays and Coves	
		Frequency of occurrence (84 segments)	% Frequency	Frequency of occurrence (44 segments)	% Frequency	Frequency of occurrence (40 segments)	% Frequency
1	*Bidens beckii*	28	33.3	27	61.4	2	5.0
2	*Carex aquatilis*	1	1.2	5	11.4	24	60.0
3	*Carex lasiocarpa*	26	31.0	28	63.6	8	20.0
4	*Chara* spp.	61	72.6	22	50.0	7	17.5
5	*Dulichium arundinaceum*	11	13.1	28	63.6	5	12.5
6	*Eleocharis acicularis*	34	40.5	22	50.0	33	82.5
7	*Eleocharis palustris*	53	63.1	26	59.1	19	47.5
8	*Equisetum fluviatile*	67	79.8	36	81.8	19	47.5
9	*Glyceria borealis*	26	31.0	24	54.5	17	42.5
10	*Isoetes* spp.	66	78.6	26	59.1	34	85.0
11	*Juncus brevicaudatus*	2	2.4	12	27.3	20	50.0
12	*Myriophyllum verticillatum*	26	31.0	12	27.3	26	65.0
13	*Najas flexilis*	64	76.2	16	36.4	0	0.0
14	*Nuphar variegate*	46	54.8	43	97.7	10	25.0
15	*Potamogeton amplifolius*	48	57.1	29	65.9	3	7.5
16	*Potamogeton gramineus*	80	95.2	40	90.9	21	52.5
17	*Potamogeton richardsonii*	59	70.2	6	13.6	26	65.0
18	*Ranunculus longirostris*	27	32.1	18	40.9	30	75.0
19	*Sagittaria latifolia*	36	42.9	28	63.6	16	40.0
20	*Sium suave*	8	9.5	25	56.8	16	40.0
21	*Sparganium fluctuans*	25	29.8	26	59.1	3	7.5
22	*Utricularia vulgaris*	18	21.4	34	77.3	9	22.5

(closed squares in Figure 8). Twenty-one taxa occurred with a frequency of 50% or greater in at least one of the two shoreline categories, and some of these taxa showed an obvious preference for one habitat over the other (Table 6). For example, *Carex hystericina*, *Epilobium* spp., and *Phalaris arundinacea* had frequencies >50% on Lake Superior segments while having frequencies <10% in the inland segments (Table 6). The distribution of *Phalaris* in the above mentioned NMS ordination can be seen in Figure 9, showing this species at 27 of the 31 Lake Superior sites and in only one of the inland lake sites. *Triadenum fraseri*, *Dulichium arundinaceum*, and *Carex lasiocarpa* are examples of taxa more frequently found in the inland lake segments (Table 6).



Figure 7. Aquatic vegetation protected from moose browse by fallen cedars, Isle Royale 2004. Yellow water lily (*Nuphar variegata*) (above), assorted emergents (below).

Peatland Sampling

Mean plant richness per peatland plot increased with plot size, with means of 10.4, 19.0, and 25.2 taxa respectively for the 1 m x 1 m, 5 m x 5 m, and 10 m x 10 m plots (Table 7). Richness was beginning to level off in the largest plots, but we did not attempt to calculate richness values for larger plot sizes as the maximum patch size often appeared to be close to the 10 m x 10 m plot size.

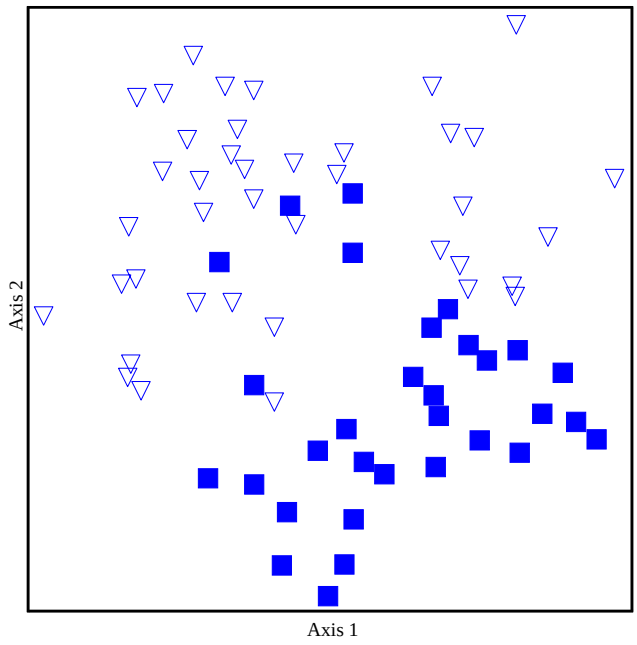


Figure 8. Non-metric multidimensional scaling (NMS) ordination of 71 shoreline segments and 128 taxa. Closed squares indicate shoreline segments along Lake Superior bays and coves, and open triangles indicate segments along inland lakes. One inland lake segment (Amygdaloid Lake segment # 4), having only two taxa, was eliminated from the ordination as an outlier.

As in the aquatic segments, each taxon's cover class determined in the field (tr and 1-5) was transformed to the mid-point of the range where tr = 0.1, 1 = 3%, 2 = 15%, 3 = 38%, 4 = 63% and 5 = 88%. Using these transformed values, twenty-seven peatland taxa had mean per plot cover values of 2.0% and greater, which contributed almost 76% of the total relative cover for all taxa (Table 8). *Carex lasiocarpa* had the greatest cover, averaging 30% per plot, followed by *Sphagnum* species (16.8%) and two shrub taxa, *Myrica gale* and *Chamaedaphne calyculata*. The most frequency encountered taxa over all 64 plots were *Iris versicolor* and *Calamagrostis canadensis* (with frequencies of 47 and 42, respectively).

Table 6. Frequencies (%) of twenty-one taxa occurring in 50% or more of the segments in either the Lake Superior bays and coves or the inland lakes along all shoreline segments (72 segments). A comparison of mean percent cover between the two habitat groups is also indicated. **Bold** taxa indicate those occurring at a frequency greater than 50% in both habitat types.

	Species	Bays and Coves (31 segments)	Inland Lakes (41 segments)
1	*Agrostis hyemalis*	80.6	31.7
2	*Aster puniceus*	61.3	14.6
3	***Calamagrostis canadensis***	51.6	92.7
4	*Campanula aparinoides*	45.2	53.7
5	*Carex aquatilis*	54.8	17.1
6	*Carex hystericina*	51.6	7.3
7	*Carex lasiocarpa*	19.4	73.2
8	*Dulichium arundinaceum*	16.1	73.2
9	*Epilobium* spp.	61.3	4.9
10	***Eupatorium maculatum***	83.9	61.0
11	*Impatiens capensis*	64.5	12.2
12	*Juncus brevicaudatus*	64.5	39.0
13	*Iris versicolor*	48.4	70.7
14	***Lycopus americanus***	51.6	56.1
15	*Lysimachia terrestris*	35.5	58.5
16	*Mentha arvensis*	51.6	36.6
17	*Myrica gale*	35.5	63.4
18	*Phalaris arundinacea*	87.1	2.4
19	*Thalictrum dasycarpum*	51.6	19.5
20	*Sium suave*	45.2	51.2
21	*Triadenum fraseri*	12.9	51.2
	Mean percent-cover per segment (all taxa)	16.31	34.83

In order to investigate differences among these plots, data from all 10 m x 10 m peatland plots (Data Supplement) were combined in a matrix with 268 taxa. This matrix was reduced by eliminating those taxa occurring in <3 plots, resulting in a matrix of 154 taxa by 64 plots.

A NMS ordination of the peatland data resulted in a two dimensional representation of habitat presumably along a nutrient gradient (axis 1) and an elevational or moisture gradient (axis 2).

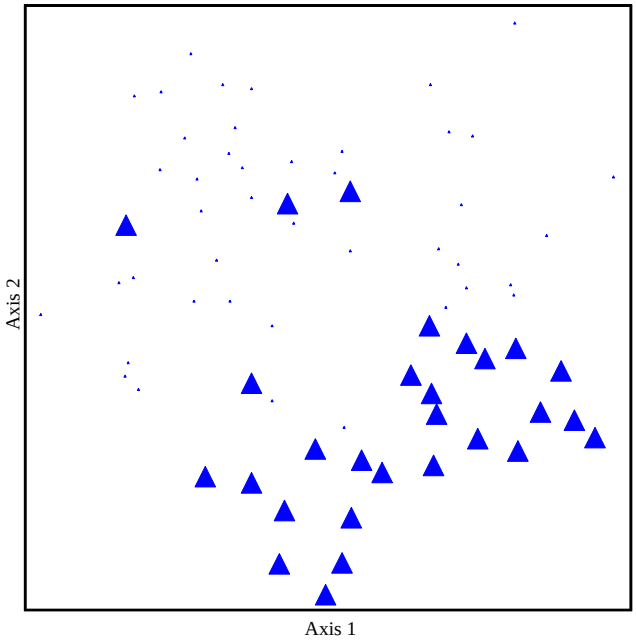


Figure 9. Non-metric multidimensional scaling (NMS) ordination of 71 shoreline segments and 128 taxa. Larger triangles indicate the presence of reed canary grass, *Phalaris arundinacea*, consistently more frequent along the segments in Lake Superior bays and coves, compare to Figure 8, showing Lake Superior bays.

Table 7. Mean plant richness assessed at 64 peatland sites, each with progressively increasing plot size: 1 m x 1 m, 5 m x 5 m, and 10 m x 10 m. The richness range including 95% of the plots disregards the two highest and two lowest values.

Plot Size	Mean Richness per plot	Richness Range (all plots)	Richness Range (95% of plots)	Standard Error
1 m x 1 m	10.4	3-24	4-18	0.53
5 m x 5 m	19.0	5-41	10-35	0.92
10 m x 10 m	25.2	9-54	13-44	1.14

One small group of plots had generally higher axis 1 and lower axis 2 scores, separated from two other groups (Figure 10). These plots tend to have greater cover values for *Carex stricta* and a combination of grass taxa (primarily *Calamagrostis canadensis* and *Agrostis hymenalis*), as indicated by those plots with larger symbols in Figure 11. The other plots with higher axis 2 scores formed two groups that grade into each other across axis 1, with one group dominated by *Sphagnum* taxa (Figure 12) and the other by *Carex lasiocarpa* (Figure 13). In summary, Figures 11-13 represent three habitat groups that we refer to as: 1) sedge meadows (dominated by *Carex*

Table 8. All taxa in peatland plots with >2.0% cover per 10 m x 10 m plot. Columns indicate total cover per taxa over all 64 plots, mean cover per plot, % cover relative to all taxa, cumulative relative cover for these 27 taxa, and frequency of occurrence.

Taxa	Total cover over all 64 plots	Mean cover per plot	Relative cover	Cumulative relative cover	Frequency of occurrence (n=64)
Carex lasiocarpa	1,941.20	30.33	12.84	12.84	40
Sphagnum spp.	1,074.00	16.78	7.10	19.94	21
Myrica gale	988.10	15.44	6.53	26.47	28
Chamaedaphne calyculata	872.50	13.63	5.77	32.24	32
Menyanthes trifoliata	791.30	12.36	5.23	37.48	27
Calamagrostis canadensis	787.50	12.30	5.21	42.69	42
Sarracenia purpurea	426.70	6.67	2.82	45.51	19
Equisetum fluviatile	376.00	5.88	2.49	47.99	37
Carex stricta	368.50	5.76	2.44	50.43	17
Iris versicolor	301.20	4.71	1.99	52.42	47
Vaccinium oxycoccos	291.30	4.55	1.93	54.35	18
Potentilla palustris	275.80	4.31	1.82	56.17	31
Alnus incana	269.10	4.2	1.78	57.95	28
Carex livida	241.50	3.77	1.60	59.55	14
Andromeda glaucophylla	238.60	3.73	1.58	61.13	23
Scirpus hudsonianus	238.20	3.72	1.58	62.70	10
Scutellaria galericulata	229.30	3.58	1.52	64.22	19
Carex exilis	194.00	3.03	1.28	65.50	5
Kalmia polifolia	193.30	3.02	1.28	66.78	12
Campanula aparinoides	190.70	2.98	1.26	68.04	33
Utricularia intermedia	188.30	2.94	1.25	69.29	28
Thalictrum dasycarpum	173.60	2.71	1.15	70.43	12
Symplocarpus foetidus	171.70	2.68	1.14	71.57	16
Aster umbellatus	157.70	2.46	1.04	72.61	16
Drosera anglica	156.10	2.44	1.03	73.65	5
Carex limosa	139.60	2.18	0.92	74.57	12
Dulichium arundinaceum	138.10	2.16	0.91	75.48	25

stricta, grasses, and *Aster* spp.), 2) *Sphagnum* bogs dominated by Sphagnum and Ericaceous shrubs, and 3) fens dominated by thin leaf sedges (particularly *Carex lasiocarpa*).

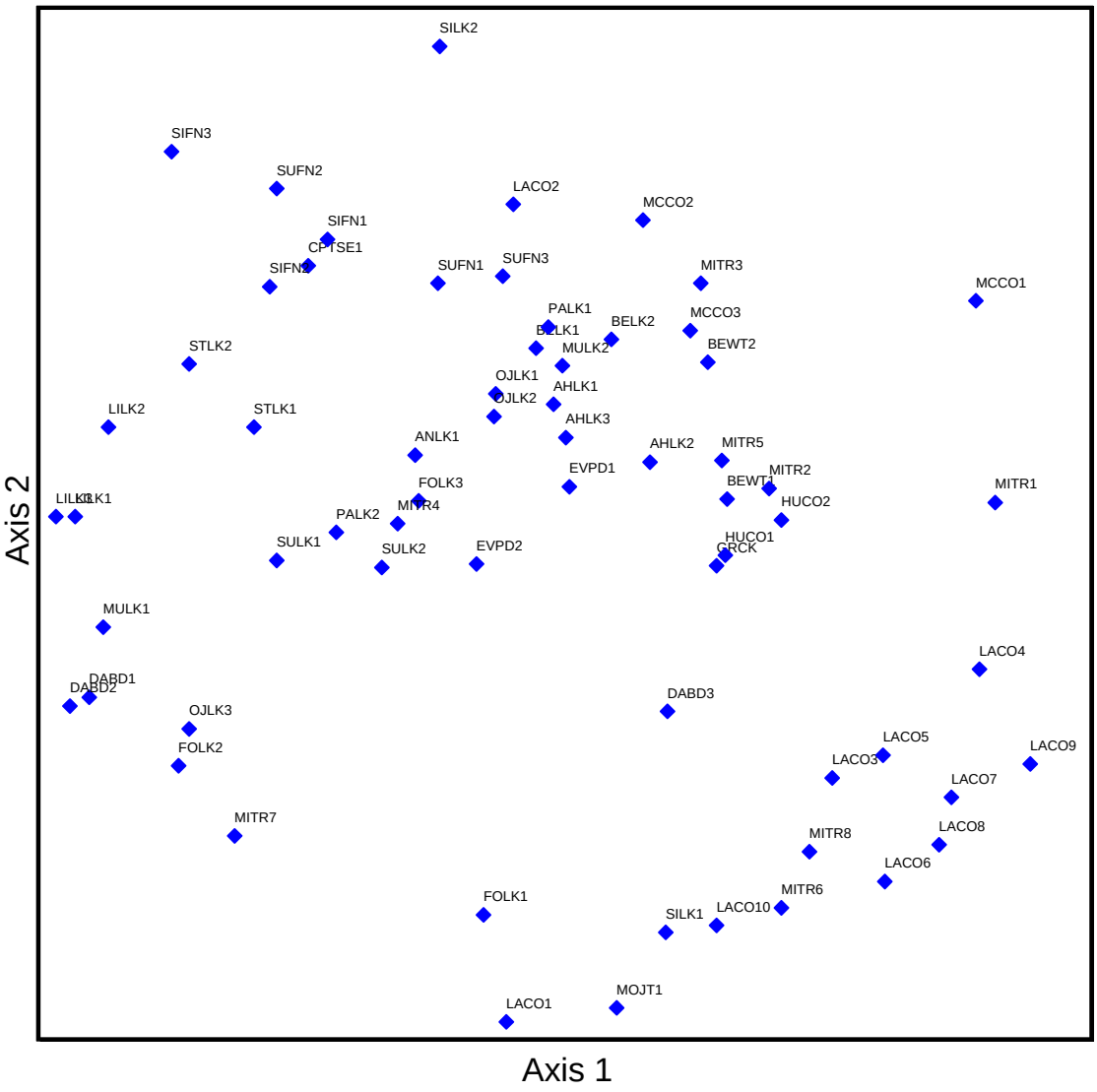


Figure 10. Non-metric multidimensional scaling (NMS) ordination of 64 10-m x 10-m peatland plots using the 154 taxa that occurred in >2 plots. See Appendix D for explanation of site codes.

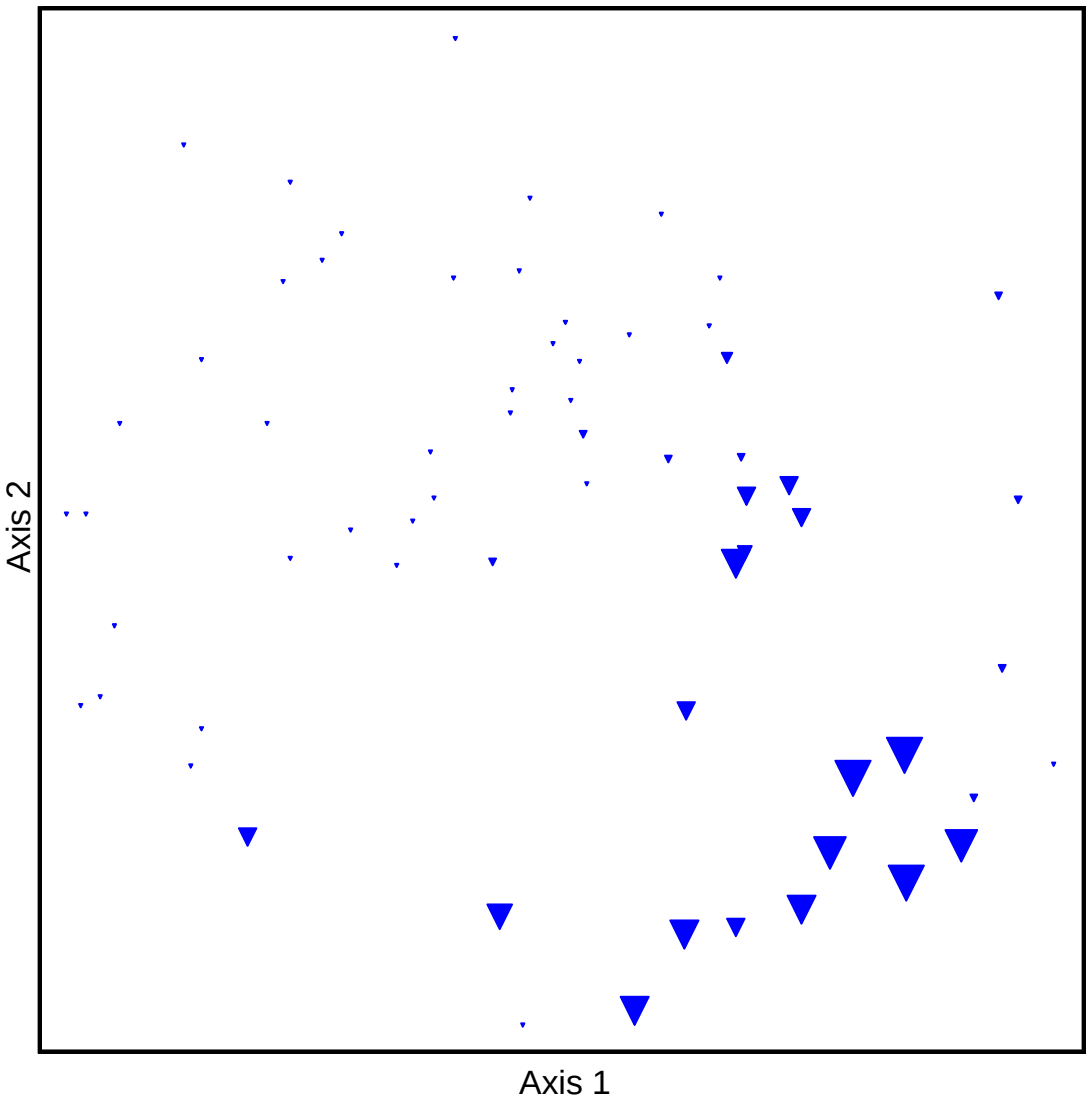


Figure 11. Non-metric multidimensional scaling (NMS) ordination of 64 10-m x 10-m peatland plots using the 154 taxa that occurred in >2 plots. Plots with larger symbols indicate greater coverage of *Carex stricta* combined with grass taxa, abundant in sedge meadows.

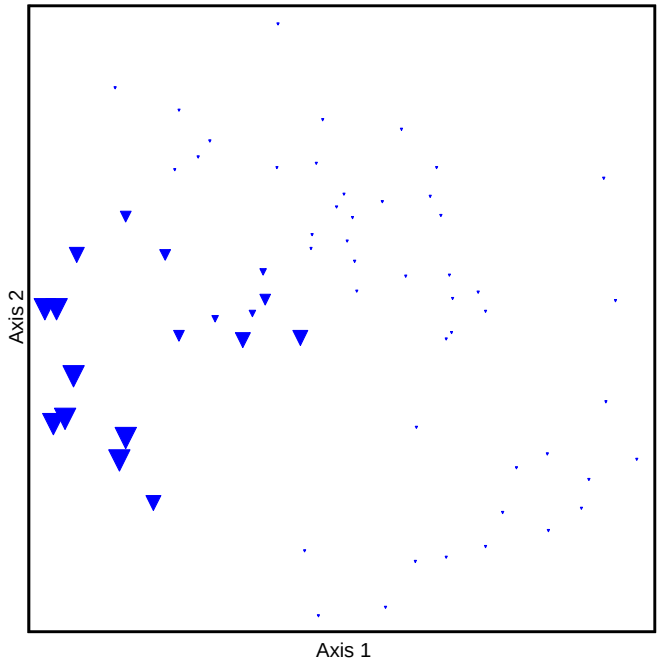


Figure 12. Non-metric multidimensional scaling (NMS) ordination of 64 10-m x 10-m peatland plots using the 154 taxa that occurred in >2 plots. Plots with larger symbols indicate greater coverage of *Sphagnum* taxa, indicating more acidic bog conditions.

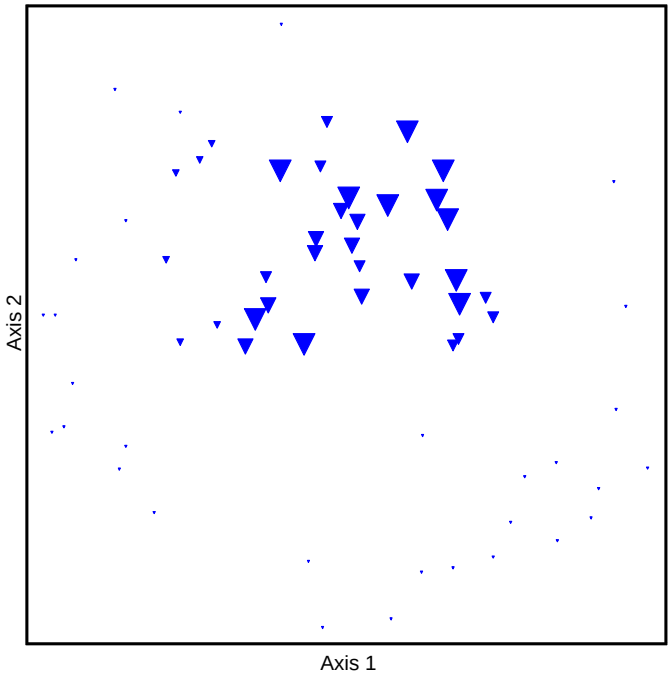


Figure 13. Non-metric multidimensional scaling (NMS) ordination of 64 10-m x 10-m peatland plots using the 154 taxa that occurred in >2 plots. Plots with larger symbols indicate greater coverage of *Carex lasiocarpa*, indicating more pH neutral, fen-like plots.

Aggressive and Exotic Aquatic Species

A summary of occurrences of *Typha* spp. and *Phragmites australis* across all inland lakes and Lake Superior bays indicates a total of 265 *Typha latifolia*, seven *T. angustifolia*, and 31 *Phragmites* locations (Table 9). Although exact determination of *Typha* species can be difficult or impossible in the field with sterile individuals, we assume that most of the sterile occurrences were *T. latifolia* due to leaf width, general color, and the scarcity of *T. angustifolia* or the hybrid (*T.* x *glauca*). It is notable that the only two general locations for either *T. angustifolia* or *T.* x *glauca* are at Sargent Lake (one point) and McCargoe/Brady coves (2 large potentially troublesome beds) (see Appendix B for detailed maps). We did not find any curly-leaf pondweed (*Potamogeton crispus*), Eurasian milfoil (*Myriophyllum spicatum* L.), or purple loosestrife (*Lythrum salicaria* L.) on the island in any of our segments, plots, or travels.

Table 9. Summary of occurrences of *Typha* spp. and *Phragmites australis* on inland lakes and Lake Superior bays, Isle Royale, 2003-2005.

		Typha latifolia[1]			*Typha* x *glauca* or *T. angustifolia*			*Phragmites australis*		
	Location	Points	Beds	All	Points	Beds	All	Points	Beds	All
1	Ahmik Lake	2	1	3						
2	Amygdaloid Lake									
3	Angleworm Lake	1		1					2	2
4	Beaver Lake	5		5						
5	Benson Lake	6		6					2	2
6	Chickenbone Lake								1	1
7	Chippewa Harbor	2		2						
8	Desor Lake	26	3	29					1	1
9	Duncan Bay	8		8					2	2
10	Dustin Lake	1		1						
11	Eva Lake	2		2						
12	Eva Pond	5		5						
13	Feldtmann Lake									
14	Five Finger Bay	1		1						
15	Forbes Lake	1		1						
16	Harvey Lake	3		3						
17	Hatchet Lake	2		2					3	3
18	Hidden Lake									
19	Intermediate Lake	3	1	4				2		2
20	Lane Cove	8	1	9						
21	LeSage Lake	2	2	4				1	1	2
22	Lily Lake									
23	Linklater Lake	5	3	8						

Table 9. Summary of occurrences of *Typha* spp. and *Phragmites australis* on inland lakes and Lake Superior bays, Isle Royale, 2003-2005 (continued).

		Typha latifolia[1]			*Typha* x *glauca* or *T. angustifolia*			*Phragmites australis*		
	Location	Points	Beds	All	Points	Beds	All	Points	Beds	All
24	Livermore Lake	6		6						
25	McCargoe/Brady coves	14	1	15	2	2	4		2	2
26	McDonald Lake	3	2	5						
27	Moose Lake	1		1						
28	Moskey Basin	2		2						
29	Mud Lake									
30	Ojibway Lake	5	2	7						
31	Otter Lake	1	2	3						
32	Patterson Lake	2	1	3						
33	Pickerel Cove	2		2						
34	Richie Lake	5	3	8					1	1
35	Robinson Bay									
36	Sargent Lake	40	4	44	1		1	1	1	2
37	Scholts Lake	1		1						
38	Shesheeb Lake		1	1						
39	Siskiwit Lake	19	2	21						
40	Stickleback Lake									
41	Stockly Bay	4		4						
42	Sumner Lake	1		1						
43	Tobin Harbor									
44	Wagejo Lake							1	7	8
45	Whittlesey Lake	1		1				1		1
46	Wood Lake	1	4	5						
	Totals	**191**	**33**	**224**	**3**	**2**	**5**	**6**	**23**	**29**

[1] Includes occurrences of sterile individuals presumed to be *T. latifolia*

A detailed list of all the aggressive taxa beds and points is presented in Appendix E along with their general location (lake or bay), length in meters (if a bed), stem count, GPS coordinates (start and end points if a bed), and added notes. From these data we estimated the total length and percent of each lake or bay's shoreline occupied by either *Typha latifolia*, *T. angustifolia*, and/or *Phragmites.* For this analysis we assume all points to be 2.5 meters in length (half of the maximum length possible by our definition of points), but this is likely a slight over-estimate, as many of the points were merely 1-5 stems occupying about a meter in length). The largest percent of shoreline occupied by any of the aggressives was about 15% by *T. latifolia* on Linklater Lake and 11% by *Phragmites* on Wagejo Lake (Table 10). Overall *Typha latifolia*, *T.*

Table 10. Length (m) and percent of lake and bay shorelines occupied by *Typha* spp. and *Phragmites australis*, Isle Royale, 2003-2006.

Location	Lake Perimeter (km)	Total length (m)			% of Shoreline		
		Typha latifolia[1]	*Typha angustifolia*[2]	*Phragmites australis*	*Typha latifolia*[1]	*Typha angustifolia*[2]	*Phragmites australis*
Ahmik Lake	2.01	42.98			2.13		
Amygdaloid Lake	3.09						
Angleworm Lake	7.43	2.50		50.08	0.03		0.67
Beaver Lake	3.11	12.50			0.40		
Benson Lake	3.13	15.00		190.59	0.48		6.09
Brady Cove	4.78	57.70	227.60	81.98	1.21	4.76	1.71
Chickenbone Lake	8.21			37.61			0.46
Chippewa Harbor	8.95	5.00			0.06		
Desor Lake	15.54	159.08		100.14	1.02		0.64
Duncan Bay	16.01	20.00		125.49	0.12		0.78
Dustin Lake	1.40	2.50			0.18		
Eva Lake	2.61	5.00			0.19		
Eva Pond	0.47	12.50			2.64		
Feldtmann Lake	6.69						
Five Finger Bay	8.64	2.50			0.03		
Forbes Lake	1.38	2.50			0.18		
Halloran Lake	4.47	255.60			5.72		
Halloran Bog Pond	0.70						
Harvey Lake	5.99	7.50			0.13		
Hatchet Lake	4.15	5.00		135.90	0.12		3.27
Hidden Lake	0.44						
Intermediate Lake	6.62	36.62		5.00	0.55		0.08
Lane Cove	7.80	36.01			0.46		
LeSage Lake	5.90	101.61		47.73	1.72		0.81
Lily Lake	0.97						
Linklater Lake	3.27	506.40			15.49		
Livermore Lake	3.52	15.00			0.43		
McCargoe Cove	9.61	39.40	5.00		0.41	0.05	

Table 10. Length (m) and percent of lake and bay shorelines occupied by *Typha* spp. and *Phragmites australis*, Isle Royale, 2003-2006 (continued).

Location	Lake Perimeter (km)	Total length (m)			% of Shoreline		
		Typha latifolia[1]	*Typha angustifolia*[2]	*Phragmites australis*	*Typha latifolia*[1]	*Typha angustifolia*[2]	*Phragmites australis*
McDonald Lake	2.28	53.99			2.37		
Moose Lake	0.92	2.50			0.27		
Moskey Basin	12.38	5.00			0.04		
Mud Lake	2.09						
Ojibway Lake	3.50	38.25			1.09		
Otter Lake	2.86	30.97			1.08		
Patterson Lake	1.87	18.62			1.00		
Pickerel Cove	8.54	5.00			0.06		
Richie Lake	16.14	84.72		11.53	0.53		0.07
Robinson Bay	16.28						
Sargent Lake	16.10	260.53	2.50	94.61	1.62	0.02	0.59
Scholts Lake	1.08	2.50			0.23		
Shesheeb Lake	1.97	74.63			3.80		
Siskiwit Lake	38.87	148.94			0.38		
Stickleback Lake	1.19						
Stockly Bay	5.59	10.00			0.18		
Sumner Lake	1.71	2.50			0.15		
Tobin Harbor	8.45						
Wagejo Lake	1.32			148.57			11.23
Whittlesey Lake	8.84	2.50		2.50	0.03		0.03
Wood Lake	4.98	135.92			2.73		
Washington Harbor	4.16	67.10			1.61		
Totals	308.03	2,286.57	235.10	1,031.73	0.72	0.08	0.34
Overall length (m), all taxa			3553.40				
Overall % occurrence, all taxa						1.15	

angustifolia, and *Phragmites* were found on 39, 3, and 13 of the 50 sampled locations, respectively.

In total, 1.2% of the 308 km of interior lake and Lake Superior bay shoreline surveyed was occupied by *Typha* or *Phragmites*. Although precise data are unavailable, Isle Royale probably has less invaded lake shoreline than most other parks in the northeastern U.S., although we only have comparable data from Voyageurs National Park. There, percent invasion varied from as low as 4% to almost 90% in select bays of Namakan Lake, and was as much as 45% in some parts of Rainy Lake (Meeker et al. 2005). However, *Typha angustifolia* (or *T.* x *Glauca*) is probably at an early stage of invading Isle Royale, given that the species has been spreading quickly across the northeastern U.S. and Canada (Galatowitsch et al. 1999) and was not observed in the park until 2004. We predict that *Typha* may continue to spread in the park, but may not reach the extreme abundance observed in areas with greater nutrients and manipulated water levels.

New and Notable Species

We found thirteen species during 2003-2005 fieldwork that were not previously documented from Isle Royale National Park (Appendix F, and noted immediately below). Nine were predicted to occur (Table 3). We also found new populations of seventeen species that are rare in Michigan but had been previously documented in the park. Comments on the status of these plants around Lake Superior are derived from Voss (1972, 1985, 1996), Soper et al. (1989), Ownbey and Morley (1991), and Reznicek et al. (2004).

The species newly reported to Isle Royale include:

***Armoracia lacustris* (A. Gray) Al-Shehbaz & V. Bates**
Collected at several locations at the east end of Lake Richie. Elsewhere around Lake Superior known from the Wisconsin mainland and recently discovered on Lake Superior tributaries at the Nipigon River mouth, Ontario (Harris, pers. obs.), and in the AuTrain River in the Upper Peninsula of Michigan. Apparently declining across most of its range.

***Ceratophyllum demersum* L.**
Submergent in west end of Patterson Lake. Common south and west of Lake Superior, but rare on the north shore.

***Glyceria grandis* S. Wats.**
Stream floodplain along portage between Moskey Basin and Lake Richie. Common on the mainland around Lake Superior.

***Leersia oryzoides* (L.) Swartz**
Stream floodplain between Siskiwit Lake and Intermediate Lake. Uncommon and local on the north shore of Lake Superior.

***Malva moschata* L.**
Single plant growing along portage between Moskey Basin and Lake Richie. A European exotic.

***Myriophyllum farwellii* Morong**
Discovered at several lakes on the northeast side of Isle Royale including Lake Ahmik, Lake Shesheeb, Linklater Lake, and Patterson Lake. This submergent species is known from scattered locations around Lake Superior.

***Myriophyllum heterophyllum* Michx.**
Submergent in north inlet at west end of Duncan Bay. Not known from the north shore of Lake Superior in Minnesota or Ontario.

***Ophioglossum vulgatum* L. var. *pseudopodum* (S.F. Blake) Farw.; =*O. pusillum* Raf.**
Wetland along Minong Ridge. Uncommon and scattered in the Lake Superior basin.

***Sagittaria rigida* Pursh**
West end of Linklater Lake. Uncommon near Lake Superior.

***Scirpus pungens* Vahl; =*Schoenoplectus pungens* (Vahl) Palla**
Beach on south side of Sargent Lake. Uncommon on the mainland around Lake Superior.

***Typha angustifolia* L.**
Northeast end of Sargent Lake. Several vegetative populations of cattail may have been this species or its hybrid with *Typha latifolia* (=*Typha X glauca*). Invasive and spreading in central North America.

***Xyris montana* H. Ries**
Fen at Lily Lake. Near Lake Superior, it is confined to a few rich fens.

***Zosterella dubia* (Jacq.) Small; = *Heteranthera dubia* (Jacq.) MacMill.**
Submergent in the east end of Lake Richie. Uncommon around Lake Superior, but recently discovered at several locations on the north shore in Ontario.

Species Rare in Michigan

The following nineteen species noted during fieldwork in 2003-2005 are ranked as Endangered, Threatened, or Special Concern in Michigan (Michigan Natural Features Inventory 2005); seventeen of these were noted previously.

***Armoracia lacustris* (A. Gray) Al-Shehbaz & V. Bates** **Threatened (S2/G4)**
Also new to ISRO, collected at several locations at the east end of Lake Richie. Elsewhere around Lake Superior, known from the Wisconsin mainland and recently discovered on Lake Superior tributaries at the Nipigon River mouth, Ontario (Harris, pers. obs.), and in the AuTrain River in the Upper Peninsula of Michigan. Apparently declining across most of its range.

***Beckmannia syzigachne* (Steud.) Fern.** **Threatened (S2/G5)**
Lake Superior shoreline at southwest end of Stockly Bay. A western species sporadically distributed around Lake Superior.

***Callitriche hermaphroditica* L.** **Special Concern (S2/G5)**
Submergent in Pickerel Cove and Five Finger Bay. A northern species, fairly common north of Lake Superior.

***Carex atratiformis* Britton** **Threatened (S2/G5)**
Lake Superior shoreline at Five Finger Bay. An arctic-alpine disjunct species (Given and Soper 1981), known in Michigan from Isle Royale (Voss 1972) and mainland Keweenaw and Marquette counties. Also scattered locations on the Ontario side of Lake Superior.

***Carex norvegica* Retz. (*C. media*)** **Threatened (S2S3/G5T5)**
Lake Superior shoreline at Stockly Bay. A northern species relatively common on the north shore of Lake Superior and northward, but rare and local in Michigan.

***Castilleja septentrionalis* Lindl.** **Threatened (S2S3/G5)**
Lake Superior shorelines at Stockly Bay, Five Finger Bay, and Pickerel Cove. An arctic-alpine disjunct species (Given and Soper 1981), known from scattered locations around the lake.

***Drosera anglica* Hudson** **Special Concern (S3/G5)**
Lake Superior shoreline fen and Siskiwit Fen. Its Michigan range includes the Upper Peninsula and northern Lower Peninsula (Penskar and Higman 1999b). Also widespread along the north shore of Lake Superior in Ontario in rich fens and edges of Lake Superior rock pools.

***Juncus stygius* L.** **Threatened (S1S2/G5)**
Fen at Stickleback Lake. Previously collected only once (1901) on Isle Royale (location unknown) and in three other counties in Michigan's Upper Peninsula. Relatively common in fens on the Ontario side of Lake Superior.

***Lycopodium selago* L.;** **Special Concern (S3/G5)**
= *Huperzia selago* (L.) Bernhardi ex Schrank & Martius
Between Lake Whittlesey and Lake Dustin. A northern species typically found on north-facing cliffs near Lake Superior.

***Myriophyllum alterniflorum* DC.** **Special Concern (S2S3/G5)**
Submergent species discovered at Feldtmann Lake and Stockly Bay. A northern species fairly common on the north shore of Lake Superior.

***Myriophyllum farwellii* Morong** **Threatened (S2/G5)**
Also new to ISRO, discovered at several lakes on the northeast side of Isle Royale including Lake Ahmik, Lake Shesheeb, Linklater Lake, and Patterson Lake. This submergent species is known from scattered locations around Lake Superior.

***Nymphaea tetragona* Georgi; = *N. leibergii* Morong** **Endangered (S1/G5)**
Hatchet Lake and Duncan Bay at edge of stream channel. A northern species at the southern limit of its range.

***Orchis rotundifolia* Banks; =*Amerorchis rotundifolia* (Banks ex Pursh) Hultén** **Endangered (S1/G5)**

Rich fen habitat at Siskiwit Fen. Widespread in boreal North America, but rare and local in the east (Penskar and Higman 1999a). Common in suitable habitat on the Sibley Peninsula, Ontario, approximately 30 km north of Isle Royale.

***Parnassia palustris* L.** **Threatened (S2/G5)**

Rich fen habitat at Sumner Lake, Siskiwit Fen, and Dustin Lake. Common on the north shore of Lake Superior.

***Pinguicula vulgaris* L.** **Special Concern (S3/G5)**

Shorelines at Lane Cove, Siskiwit Lake, and Five Finger Bay. A northern species, locally common on the north shore of Lake Superior.

***Poa alpina* L.** **Threatened (S1S2/G5)**

Hidden Lake. An arctic-alpine disjunct species, rare and local on Lake Superior (Given and Soper 1981).

***Ranunculus macounii* Britton** **Threatened (S1/G5)**

Shoreline at Robinson Bay. Known in Michigan only from Isle Royale (Voss 1985), but relatively common on the Ontario side of Lake Superior.

***Subularia aquatica* L.** **Endangered (S1/G5)**

Submergent in Lake Richie, Lake LeSage, and five Lake Superior bays on the east end of the island. Previously reported on Isle Royale from only one location (Moskey Basin) in 1930. A northern species, generally rare around Lake Superior and easily overlooked when sterile.

***Trisetum spicatum* (L.) K. Richter** **Special Concern (S2S3/G5)**

Observed on Lake Superior shorelines at Robinson Bay and Stockly Bay. A northern species, relatively common on the north shore of Lake Superior.

Discussion and Recommendations

Isle Royale is an exciting location to conduct biological studies. For the same reason that islands everywhere offer allure for students of natural history, this rugged insular park offers researchers the opportunity of witnessing native ecological communities and their interactions in as close to pristine conditions as one can experience in the upper Midwest. Highlighted, of course, are the ongoing moose-wolf research (Peterson and Vucetich 2004) and loon studies (Egan and Oelfke 2000), but there are numerous other examples touting the ecological integrity of the park. Brood stocks of coastal brook trout have been developed from ISRO for use in restoration efforts elsewhere around Lake Superior. Elements of the island's flora include rare, relictual plants with distinctive arctic-alpine affinity, and western disjuncts not common elsewhere (Judziewicz 2004). In addition, many of the wetland communities we describe in this report are intact, especially in their low level of exotic plant invasion. We believe that, due to its insular nature, ISRO presents one of the best opportunities in the Midwest to maintain examples of intact native wetland communities into the distant future. In order to achieve this goal, these resources will have to be monitored for change, including a continuation of the types of aggressive plant surveys that we piloted in this report. As we are all well aware, weeds are best dealt with at very early stages of their invasions.

In addition to presenting ideas for ongoing shoreline plant monitoring, we were also able to characterize some general differences among wetland types. For example, we have determined that prior to the monitoring of peat-forming wetlands, it may be appropriate to stratify types into newly formed communities (what we have referred to above as sedge meadows), thus distinguishing them from those peatlands described as fens or bogs. Future studies that follow the development of peat-forming wetlands throughout the cycle of beaver ponding and abandonment would be very helpful in better understanding the successional processes that occur on the island. This type of work may answer questions about the time it takes to move from one state to the next, and, very importantly, how to separate these natural cyclic changes from those brought about by the invasions of aggressive taxa (Meeker 2003).

Insularity, however, is a double-edged sword. The same insular nature that protects this island archipelago from exotic invasion permits or even enhances irruptive ecological behavior. Beginning with the arrival of moose introduction in the early 1900s, observers have noted the effects of herbivory on aquatic plants (Koelz 1929; Murie 1934; both as reported in Lafrancois and Glase 2005). Photographs depicting two views of the wetland shoreline of Sumner Lake in 1905 (Adams 1908) and near the same locations in 2005 (J.E.M photos) shows the almost complete eradication of floating vegetation, most likely yellow water lilies (*Nuphar variegata*) (Figures 14 and 15).

Almost every aquatic bed that we surveyed by snorkel showed signs of herbivory, either in the form of remnant stems with the leafy tissue removed or moose prints revealed in the sedimentary/organic substrate. If moose numbers decline, important questions include: 1) are there enough relict patches remaining in the lakes to offer real recovery without transplanting?, and 2) how quickly could remnant or refugial patches of aquatics (as the water lilies depicted in figure 7, protected by woody debris) respond to a release of herbivory? Do their abundances track changes in herbivore pressure? The first question can be partially addressed by looking at



Figure 14. Two views of the northeast end of Sumner Lake. The top photograph was taken in 1905 as reprinted in an *Ecological Survey of Isle Royale, Lake Superior* (Adams 1908), while the bottom digital image was taken in August 2004 (Jim Meeker photo).

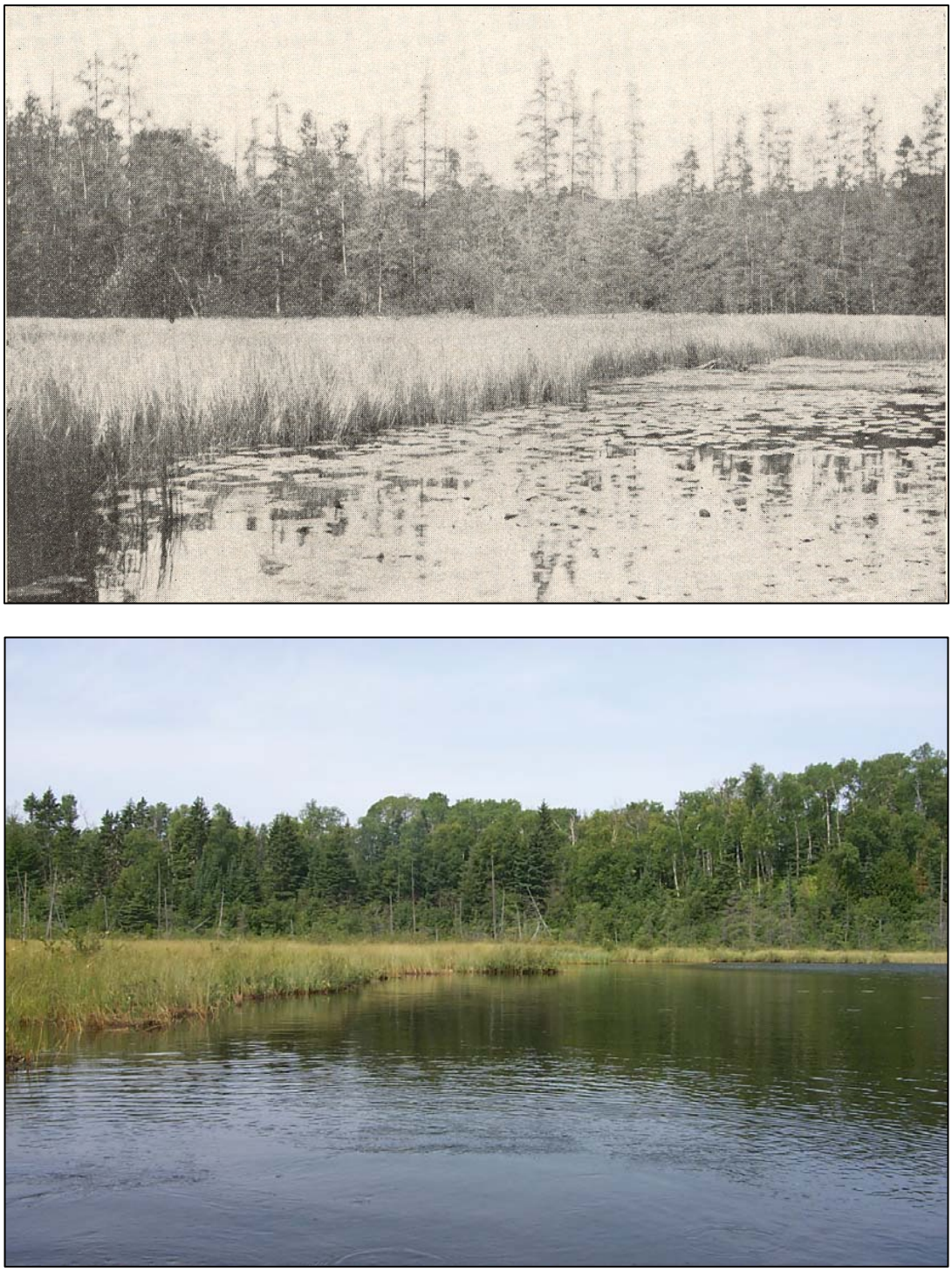


Figure 15. Two views of the southwestern end of Sumner Lake. The top photograph was taken in 1905 as reprinted in an *Ecological Survey of Isle Royale, Lake Superior* (Adams 1908), while the bottom digital image was taken in August 2004 (Jim Meeker photo).

the raw data for the aquatic segments. These data indicate that all of the lakes surveyed have at least one small patch of *Nuphar*, although most of the abundance estimates are recorded as trace, representing less than 1% cover. Tracking lily response to herbivory would need to include monitoring of existing patches (their size changes) and more extensive surveys designed to detect any new colonies that may appear. This sampling would require more precise global positioning equipment and repeated sampling.

During the duration of this study thirteen new taxa were added to the flora of ISRO, including the aquatic lake cress (*Armoracia lacustris*) and Farwell's water milfoil (*Myriophyllum farwellii*), both ranked as Threatened in Michigan. In total, we have verified nine of the taxa listed on the May 2003 target list (Table 3). After the first summer of our field work, a review of the ISRO flora was reported to contain 731 species (Judziewicz 2003), including our 2003 new species reports. In 2004, we located an additional eight species suggesting the flora should now amount to at least 739 species.

No doubt the flora will increase as weedy taxa arrive, yet some species not thought of as "weeds" are fairly common on the Wisconsin and Michigan mainland and are yet to be recorded for ISRO. These include some taxa that would not appear to be restricted in their dispersal such as swamp milkweed (*Asclepias incarnata*) and star duckweed (*Lemna trisulca*). How many of these we will continue to find is anyone's guess; they may be over the next ridge.

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Appendix A. Wetland community sampling locations at Isle Royale National Park, including UTM coordinates and length of each segment sampled.

Coordinates are in UTM Zone 16, NAD 83.

Location	Segment Number	Year Sampled	Start		End		Length (m)
			Easting	Northing	Easting	Northing	
Ahmik Lake	1	2004	385728.738	5334265.683	385851.101	5334249.645	177.7
Ahmik Lake	2	2004	385208.456	5333733.014	385371.998	5333851.028	297.0
Ahmik Lake	3	2004	385217.442	5333845.637	385318.083	5333922.316	168.5
Ahmik Lake	4	2004	385376.192	5333987.613	385404.947	5334058.901	153.5
Ahmik Lake	5	2004	385519.650	5334139.161	385681.218	5334236.577	188.9
Ahmik Lake	6	2004	385551.320	5334072.002	385693.056	5334207.992	196.4
Ahmik Lake	7	2004	385500.642	5333975.217	385659.240	5334104.115	204.7
Amygdaloid Lake	1	2004	378482.904	5333876.877	378662.374	5333961.377	203.4
Amygdaloid Lake	2	2004	378228.655	5333725.075	378313.903	5333767.699	104.1
Amygdaloid Lake	3	2004	377673.046	5333479.052	377756.051	5333515.693	131.3
Amygdaloid Lake	4	2004	378221.177	5333814.810	378402.890	5333903.049	203.0
Amygdaloid Lake	5	2004	378390.926	5333903.797	378568.152	5333998.767	202.7
Amygdaloid Lake	6	2004	378939.805	5334176.741	378992.898	5334179.732	113.5
Angleworm Lake	1	2004	377187.871	5327067.951	377374.767	5327140.178	201.3
Angleworm Lake	2	2004	375625.199	5326012.223	375820.141	5326089.953	366.7
Angleworm Lake	3	2004	378465.952	5327706.818	378569.155	5327911.312	414.2
Beaver Lake	1	2004	369536.371	5326952.262	369694.286	5326978.745	198.7
Beaver Lake	2	2004	369072.755	5326572.628	369192.506	5326675.799	162.8
Benson Lake	1	2004	378630.732	5327163.329	378672.487	5327280.563	153.9
Benson Lake	2	2004	378434.004	5327115.151	378555.253	5327104.712	189.4
Benson Lake	3	2004	377906.221	5326990.690	378020.185	5326972.997	230.9
Benson Lake	4	2004	378829.124	5327645.733	379082.915	5327728.291	271.8
Brady Cove	1	2005	374770.490	5329923.030	374860.280	5329927.230	115.7
Chickenbone Lake	1	2004	373348.587	5326117.083	373501.319	5326189.909	179.3
Chickenbone Lake	2	2004	373647.982	5326079.658	373580.214	5326217.218	238.3
Chickenbone Lake	3	2004	372210.929	5325018.458	372387.215	5325094.009	193.1
Chickenbone Lake	4	2004	371731.099	5324860.999	371885.851	5324900.334	162.1
Chickenbone Lake	5	2004	371164.897	5324894.798	371280.613	5324803.189	160.8
Chickenbone Lake	6	2004	371548.287	5325458.721	371634.223	5325607.522	176.7
Chippewa Harbor	1	2003	376261.804	5320292.945	376333.563	5320246.093	86.8
Chippewa Harbor	2	2003	376140.228	5320315.481	376249.350	5320332.086	159.6
Chippewa Harbor	3	2003	375566.745	5320677.243	375986.034	5320609.635	636.3
Chippewa Harbor	4	2003	375994.040	5320605.401	376044.054	5320583.047	105.5
Lake Desor	1	2005	351371.730	5314524.500	351278.000	5314724.250	254.8
Lake Desor	2	2005	350584.560	5314504.020	350357.820	5314642.950	278.8
Lake Desor	3	2005	350293.170	5314872.500	350324.290	5315011.330	250.6
Lake Desor	4	2005	349758.180	5315234.760	349624.650	5315353.910	181.8
Lake Desor	5	2005	352176.700	5316006.010	352241.780	5315976.330	102.0
Lake Desor	6	2005	353109.720	5315996.160	353209.010	5316084.840	218.6
Duncan Bay	1	2004	385784.162	5333712.812	386599.501	5334144.379	969.4

Appendix A. Wetland community sampling locations at Isle Royale National Park, including UTM coordinates and length of each segment sampled (continued).

Location	Segment Number	Year Sampled	Start		End		Length (m)
			Easting	Northing	Easting	Northing	
Duncan Bay	2	2004	386481.066	5334156.660	386703.001	5334327.813	284.7
Duncan Bay	3	2004	387893.003	5335165.081	388129.175	5335183.365	348.2
Duncan Bay	4	2004	388347.825	5335509.435	388435.437	5335498.007	177.3
Duncan Bay	5	2004	389036.533	5336140.243	389259.754	5336173.002	324.2
Duncan Bay	6	2004	386294.263	5333610.481	386454.972	5333635.289	251.8
Duncan Bay	7	2004	386357.899	5333678.432	386339.563	5333719.418	49.6
Duncan Bay	8	2004	386692.259	5334014.949	386695.495	5334048.385	57.7
Dustin Lake	1	2003	373204.105	5318156.954	373532.775	5318278.996	440.8
Eva Lake	1	2004	378310.721	5331577.680	378388.079	5331643.016	172.1
Eva Lake	2	2004	378319.607	5331524.888	378453.415	5331519.661	261.8
Eva Lake	3	2004	377898.843	5331147.246	378056.172	5331266.942	200.4
Eva Lake	4	2004	377629.659	5331040.095	377618.160	5331113.794	109.0
Eva Lake	5	2004	377636.454	5331151.428	377681.928	5331183.834	106.7
Eva Lake	6	2004	377977.246	5331432.111	378140.847	5331533.513	205.5
Eva Pond	1	2004	377806.670	5330893.695	377749.469	5331038.105	473.6
Feldtmann Lake	1	2004	336567.513	5302591.640	336697.482	5302620.987	137.2
Feldtmann Lake	2	2004	338732.743	5302614.143	338886.907	5302611.314	176.5
Feldtmann Lake	3	2004	337315.820	5301859.496	337504.770	5301955.537	217.0
Five Finger Bay	1	2004	386595.586	5334753.816	386792.704	5334849.414	346.3
Five Finger Bay	2	2004	386577.603	5334472.123	386756.403	5334559.687	202.1
Forbes Lake	1	2004	379530.781	5327401.086	379462.329	5327521.316	177.6
Forbes Lake	2	2004	379119.430	5327168.076	379255.108	5327127.475	297.7
Harvey Lake	1	2004	366827.894	5323496.023	366883.541	5323607.317	182.5
Harvey Lake	2	2004	366813.687	5323297.115	366825.527	5323493.655	221.6
Harvey Lake	3	2004	365544.622	5323033.522	365699.111	5323160.593	206.4
Harvey Lake	4	2004	365231.716	5323234.710	365270.688	5323338.634	187.0
Harvey Lake	5	2004	365690.861	5323378.956	365868.894	5323421.990	185.4
Hatchet Lake	1	2004	362390.778	5320388.583	362550.552	5320484.448	191.7
Hatchet Lake	2	2004	362195.074	5320340.546	362378.567	5320378.567	193.4
Hatchet Lake	3	2004	361385.670	5320261.286	361529.945	5320363.172	192.0
Hatchet Lake	4	2004	362105.374	5320682.833	362281.116	5320777.126	225.5
Hidden Lake	1	2003	390275.031	5334963.000	390417.656	5335027.500	240.7
Intermediate Lake	1	2003	370339.861	5320728.631	370420.819	5320698.271	172.4
Intermediate Lake	2	2003	370389.999	5320929.645	370530.756	5320937.005	375.8
Intermediate Lake	3	2003	370451.638	5321091.561	370593.314	5321102.141	297.5
Intermediate Lake	4	2003	370904.726	5321314.655	371079.292	5321366.404	184.1
Intermediate Lake	5	2003	371352.984	5321591.338	371593.788	5321563.049	411.8
Intermediate Lake	6	2003	371669.686	5321484.851	371839.422	5321483.471	179.1
Intermediate Lake	7	2003	371732.245	5321081.441	371987.078	5321288.436	376.2
Intermediate Lake	8	2003	371560.669	5320910.326	371454.412	5321073.622	237.1
Intermediate Lake	9	2003	371174.739	5320818.788	371070.782	5320962.765	194.4
Lane Cove	1	2004	383995.701	5333472.180	384157.633	5333521.790	343.9
Lane Cove	2	2004	383847.831	5333494.906	383928.807	5333524.690	89.7

Appendix A. Wetland community sampling locations at Isle Royale National Park, including UTM coordinates and length of each segment sampled (continued).

Location	Segment Number	Year Sampled	Start		End		Length (m)
			Easting	Northing	Easting	Northing	
Lane Cove	3	2004	383523.927	5333421.376	383617.003	5333463.260	103.3
Lane Cove	4	2004	382607.129	5333214.747	382685.313	5333197.993	152.3
Lane Cove	5	2004	382678.797	5333295.723	382716.028	5333274.316	82.6
LeSage Lake	1	2003	372845.715	5324099.441	373001.094	5324033.000	335.9
LeSage Lake	2	2003	372393.640	5323753.516	372402.172	5323859.067	184.8
LeSage Lake	3	2003	372365.037	5323944.354	372518.528	5323983.746	163.3
LeSage Lake	4	2003	371918.406	5323763.500	371975.275	5323910.681	302.5
LeSage Lake	5	2003	372848.036	5324377.193	373060.934	5324481.366	241.2
Lily Lake	1	2004	343609.531	5308600.500	343953.406	5308690.500	968.9
Linklater Lake	1	2204	378329.024	5330462.077	378425.846	5330433.031	130.5
Linklater Lake	2	2004	378160.500	5330256.744	378321.358	5330322.012	229.4
Livermore Lake	1	2004	373295.673	5325186.004	373404.383	5325290.657	158.8
Livermore Lake	2	2004	372997.533	5324959.661	373149.645	5325080.134	195.5
Livermore Lake	3	2004	373121.405	5325225.445	373291.002	5325325.359	198.9
McCargoe Cove	1	2005	372829.310	5327254.230	372884.190	5327283.330	111.9
McDonald Lake	1	2004	370608.463	5327427.881	370795.124	5327481.213	201.4
Moose Lake	1	2003	387411.944	5333229.500	387598.240	5333338.048	276.9
Moose Lake	2	2003	387415.906	5333225.538	387602.202	5333334.086	270.8
Moskey Basin	1	2003	377464.267	5324730.747	377448.818	5324864.334	359.0
Mud Lake	1	2005	358708.530	5313895.070	358669.130	5313720.060	184.4
Mud Lake	2	2005	358763.190	5314008.200	358712.550	5313917.360	106.0
Ojibway Lake	1	2004	380162.795	5328918.512	380316.226	5328977.207	239.4
Ojibway Lake	2	2004	380660.011	5329098.995	380677.512	5329200.303	159.5
Otter Lake	1	2004	368977.090	5326163.813	369060.545	5326294.475	188.0
Otter Lake	2	2004	369580.288	5326545.238	369664.105	5326590.139	119.2
Patterson Lake	1	2004	384909.971	5333391.181	384933.257	5333540.532	283.3
Patterson Lake	2	2004	384187.304	5333118.173	384376.000	5333139.853	204.8
Pickerel Cove	1	2004	376393.343	5331028.138	376356.560	5331158.296	223.2
Pickerel Cove	2	2004	376593.936	5331026.004	376764.662	5331075.948	218.3
Pickerel Cove	3	2004	378726.228	5331989.205	378672.717	5332061.063	181.1
Pickerel Cove	4	2004	379001.561	5332118.380	379019.251	5332192.678	131.0
Pickerel Cove	5	2004	379282.505	5332434.656	379333.325	5332440.050	79.1
Pickerel Cove	6	2004	379356.889	5332459.923	379418.497	5332507.052	135.3
Richie Lake	1	2003	373974.998	5323052.541	374090.440	5323075.637	121.0
Richie Lake	2	2003	373011.406	5322867.500	373196.954	5322870.008	343.4
Richie Lake	3	2003	372975.169	5322556.100	373058.500	5322504.000	161.6
Richie Lake	4	2003	372229.293	5322427.512	372431.788	5322457.024	218.3
Richie Lake	5	2003	371980.054	5322190.085	371927.188	5322387.000	474.3
Richie Lake	6	2003	372253.461	5322145.500	372571.828	5322141.448	353.6
Richie Lake	7	2003	373732.313	5321372.000	373842.195	5321327.394	187.9
Richie Lake	8	2003	374089.522	5321281.305	373882.617	5321500.699	306.4
Richie Lake	9	2003	373504.947	5322169.583	373732.313	5322267.000	321.0
Richie Lake	10	2003	374133.432	5322299.106	374347.469	5322346.500	343.8
Richie Lake	11	2003	374389.750	5322416.500	374512.947	5322421.673	223.1

Appendix A. Wetland community sampling locations at Isle Royale National Park, including UTM coordinates and length of each segment sampled (continued).

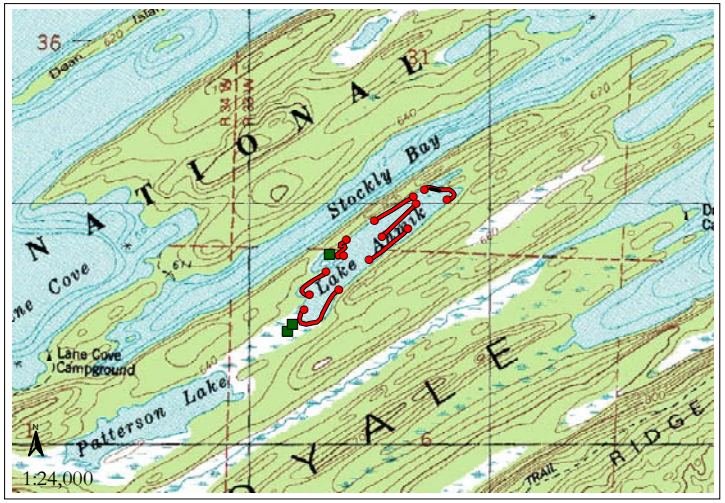
Location	Segment Number	Year Sampled	Start		End		Length (m)
			Easting	Northing	Easting	Northing	
Richie Lake	12	2003	374900.131	5323275.909	374797.275	5323451.781	214.7
Robinson Bay	1	2004	379059.316	5332591.876	379228.863	5332718.215	213.7
Robinson Bay	2	2004	377660.225	5332015.069	377762.788	5332030.535	135.7
Robinson Bay	3	2004	377377.831	5331939.336	377663.503	5332024.727	324.2
Robinson Bay	4	2004	377076.875	5331999.559	377224.159	5332264.440	491.1
Robinson Bay	5	2004	378564.552	5332931.211	378740.378	5333030.542	210.7
Robinson Bay	6	2004	379230.549	5333438.435	379326.428	5333508.770	214.1
Robinson Bay	7	2004	379711.929	5333709.084	379866.746	5333775.507	284.4
Sargent Lake	1	2004	376304.279	5328189.620	376408.304	5328273.113	175.8
Sargent Lake	2	2004	377223.917	5328915.923	377418.054	5328963.810	201.3
Sargent Lake	3	2004	377412.877	5328968.987	377597.308	5329024.640	193.8
Sargent Lake	4	2004	377794.680	5329105.530	377987.523	5329152.123	208.1
Sargent Lake	5	2004	378379.679	5329139.181	378514.928	5329216.188	173.6
Sargent Lake	6	2004	376967.612	5327949.698	376946.643	5328067.841	212.9
Scholts Lake	1	2003	373798.468	5318627.690	374056.289	5318703.591	295.6
Shesheeb Lake	1	2004	377128.371	5329663.461	377258.619	5329657.672	199.9
Siskiwit Lake NE	1	2003	368875.844	5318164.000	369263.906	5318422.360	933.8
Siskiwit Lake	1	2005	363156.800	5316222.080	363079.560	5316312.000	168.7
Siskiwit Lake	2	2005	362205.310	5315928.500	362206.410	5315865.000	81.8
Siskiwit Lake	3	2005	360302.570	5315007.540	360163.560	5315086.500	166.0
Siskiwit Lake	4	2005	361609.530	5316202.000	361487.290	5316292.690	181.7
Siskiwit Lake	5	2005	362347.280	5317240.000	362229.500	5317388.000	263.7
Stickleback Lake	1	2004	350492.170	5304001.369	350975.898	5304066.792	1188.1
Stockly Bay	1	2004	384347.011	5333523.943	384444.058	5333520.947	152.5
Stockly Bay	2	2004	384423.690	5333626.381	384433.874	5333683.292	103.5
Sumner Lake	1	2004	379719.371	5325264.035	379612.839	5325417.442	241.4
Tobin Harbor	1	2003	387325.583	5332439.790	387641.832	5332654.189	427.5
Tobin Harbor	2	2003	385752.986	5331680.661	385902.557	5331780.216	181.8
Tobin Harbor	3	2003	386225.003	5332151.253	386366.417	5332206.058	157.3
Wagejo Lake	1	2004	377229.050	5327700.157	377389.398	5327796.591	196.7
Wagejo Lake	2	2004	377606.934	5327787.620	377550.868	5327960.303	235.1
Whittlesey Lake	1	2003	372248.140	5318423.437	372475.963	5318455.023	255.6
Whittlesey Lake	2	2003	371802.505	5318157.647	372248.140	5318423.437	593.6
Whittlesey Lake	3	2003	371253.570	5318173.538	371802.505	5318157.647	609.3
Whittlesey Lake	4	2003	371237.469	5318146.500	371742.808	5318012.570	682.2
Whittlesey Lake	5	2003	371742.808	5318012.570	372273.369	5318145.328	701.3
Wood Lake	1	2003	370279.373	5318308.816	370352.813	5318442.807	207.3
Wood Lake	2	2003	370282.046	5318127.608	370252.082	5318280.217	199.0
Wood Lake	3	2003	370309.215	5317910.068	370314.447	5318083.556	330.6
Wood Lake	4	2003	369984.064	5317761.500	370237.068	5317894.612	314.8
Wood Lake	5	2003	369588.188	5317843.000	369729.147	5317766.917	325.9
Wood Lake	6	2003	369545.231	5317964.352	369566.901	5318189.572	272.3
Wood Lake	7	2003	369714.055	5318252.478	369917.654	5318262.991	265.9

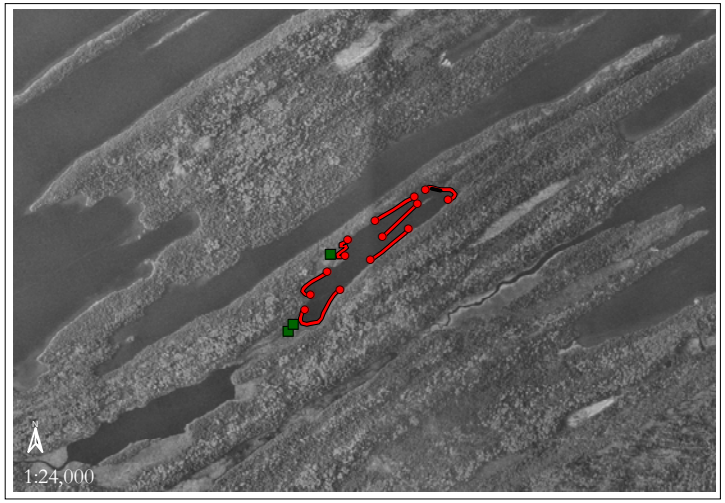
Appendix B. Wetland sampling site maps.

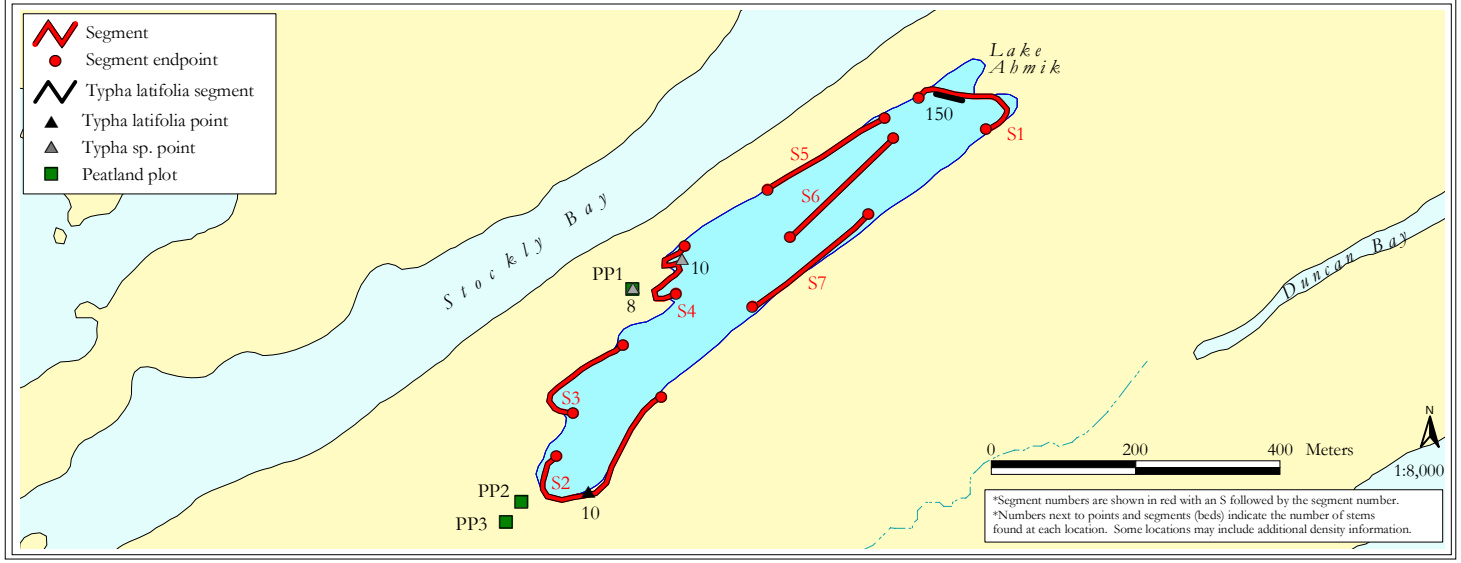
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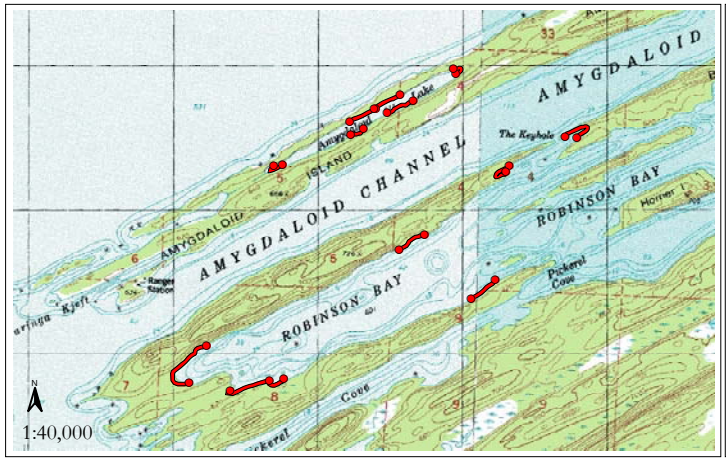
LAKE AHMIK 2004

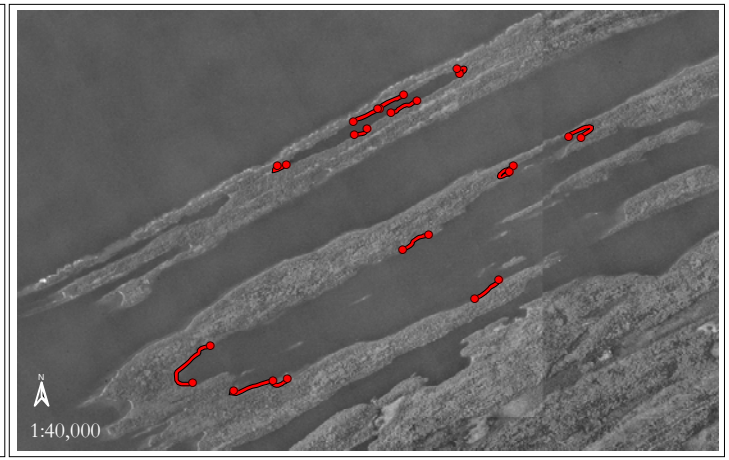


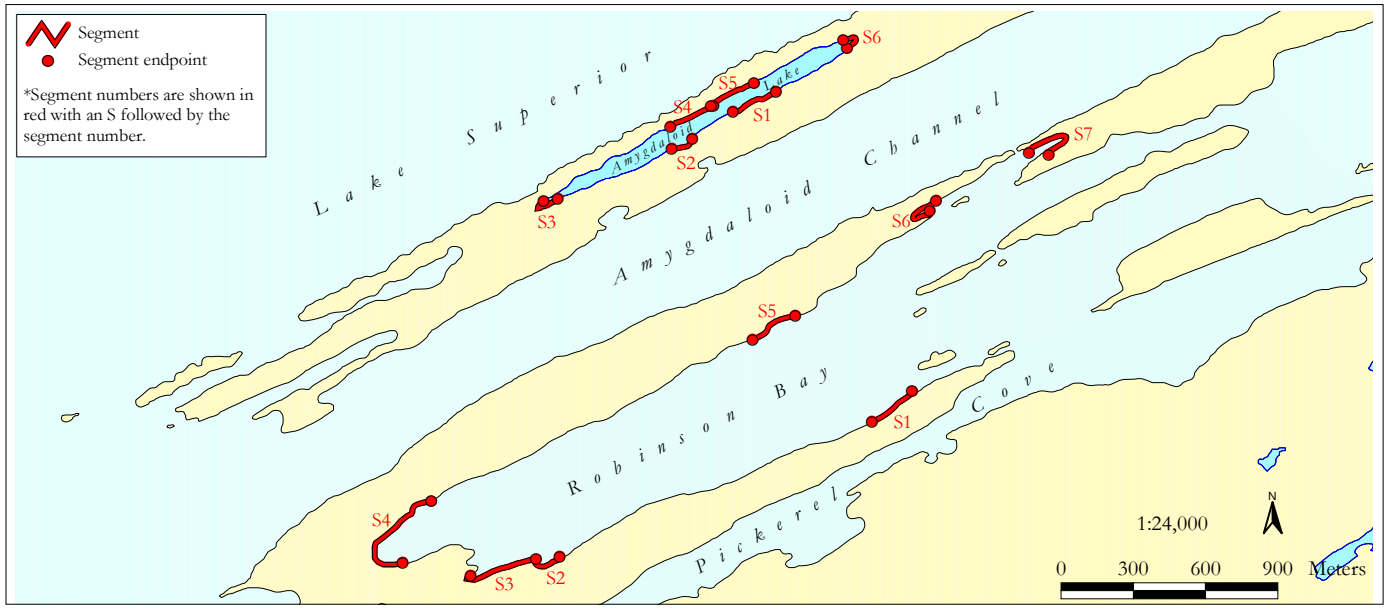




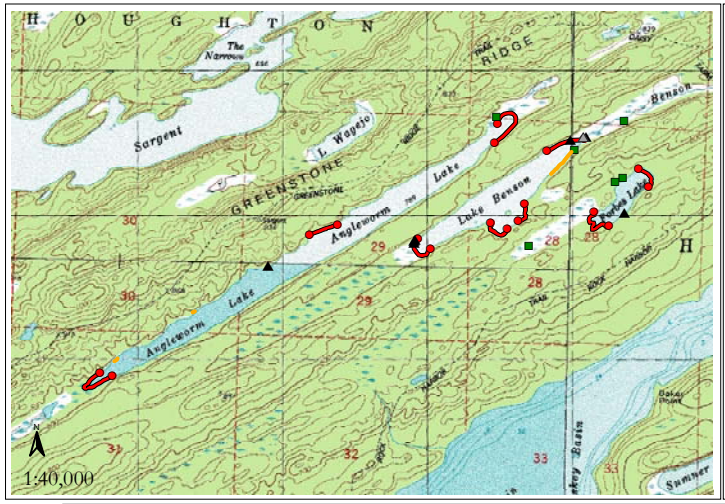
AMYGDALOID LAKE AND ROBINSON BAY 2004

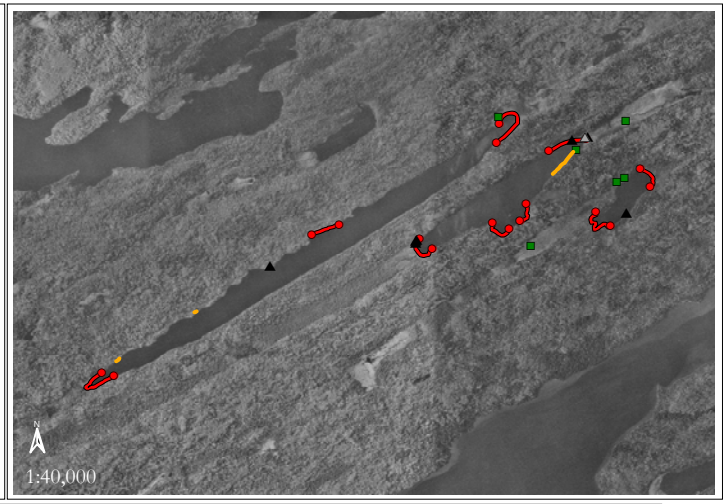


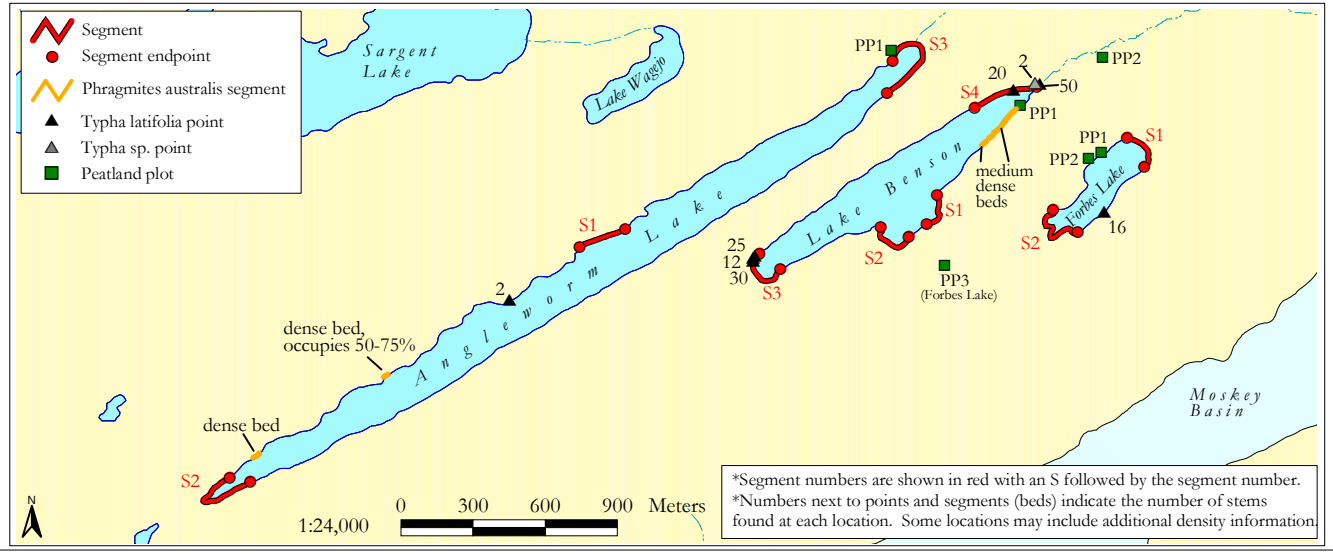




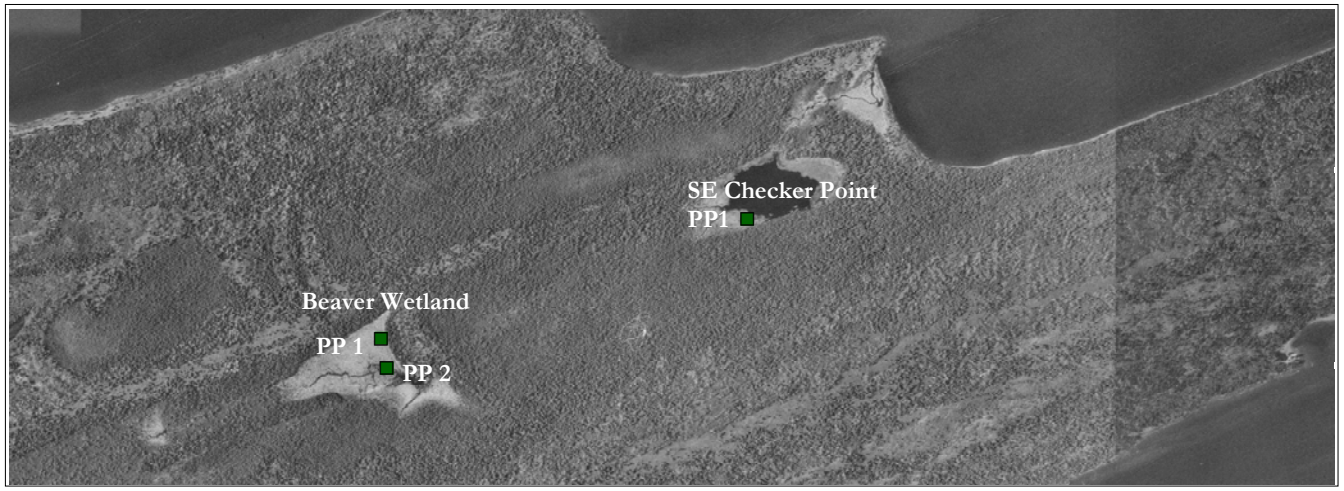
ANGLEWORM LAKE, LAKE BENSON AND FORBES LAKE 2004

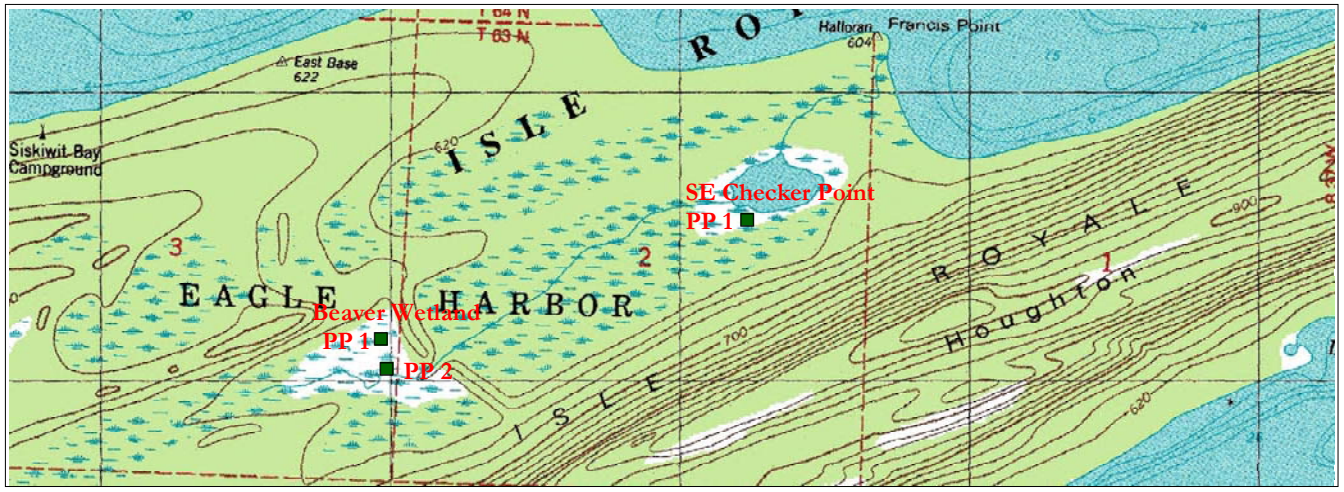




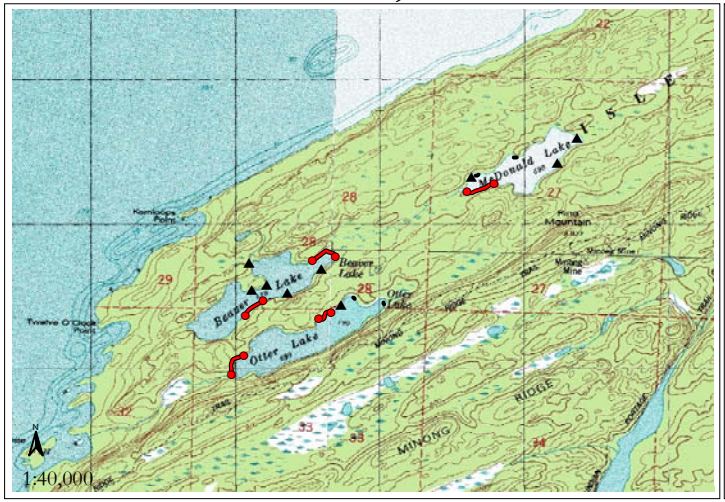


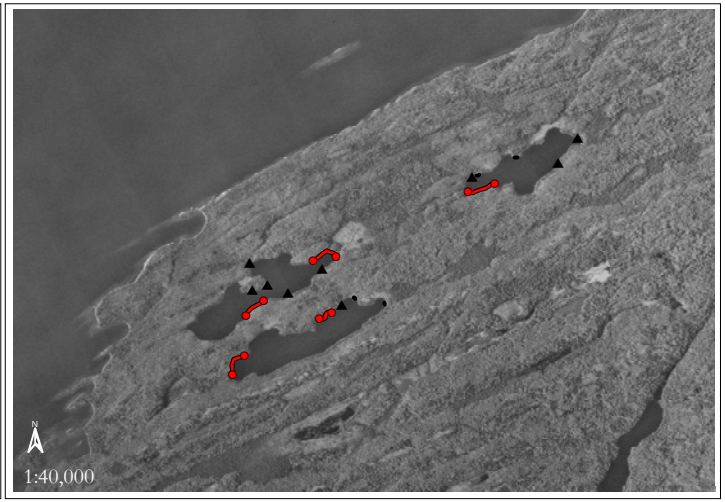
BEAVER WETLAND AND SE CHECKER POINT PEATLAND PLOTS 2004

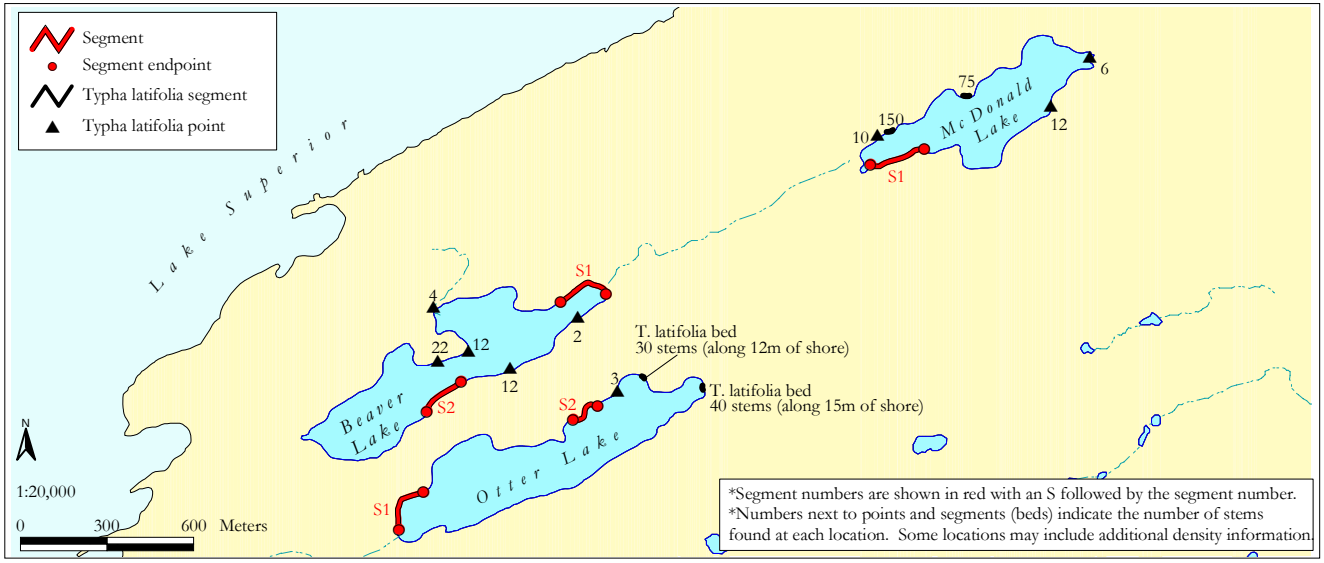




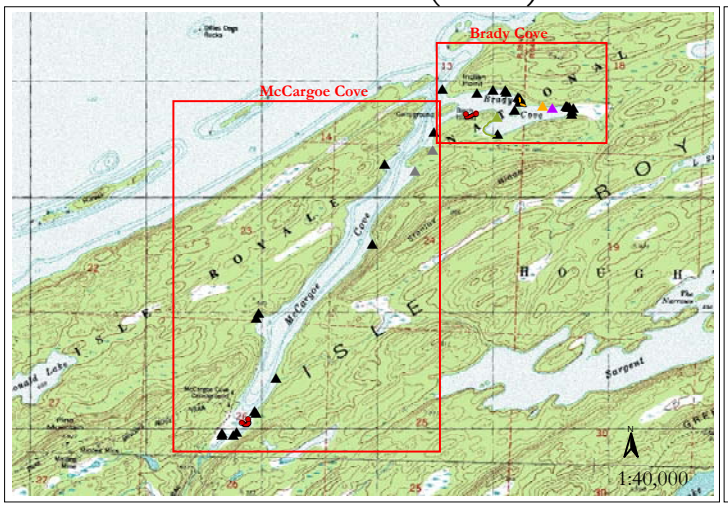
BEAVER, MCDONALD AND OTTER LAKES 2004

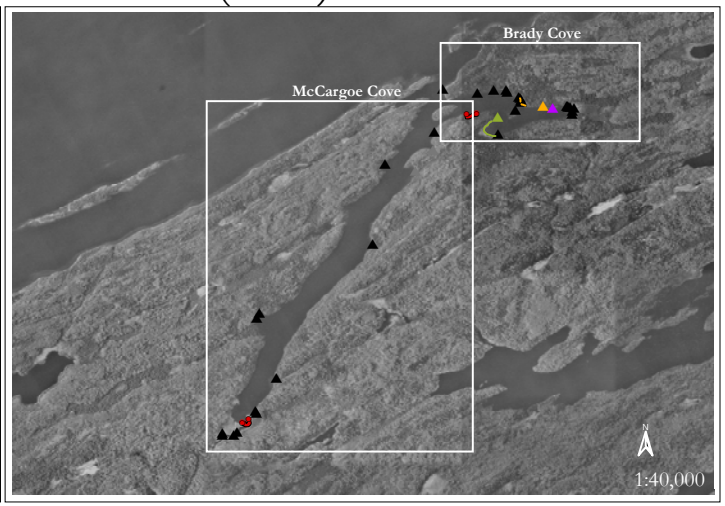






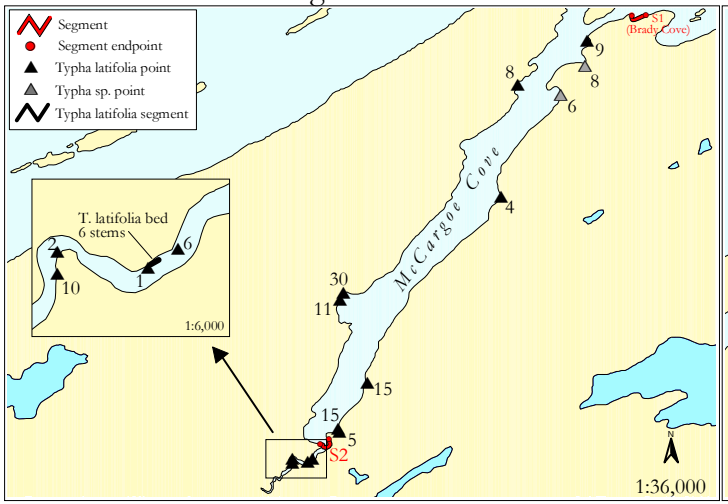
BRADY (2006) AND McCARGOE (2005) COVES

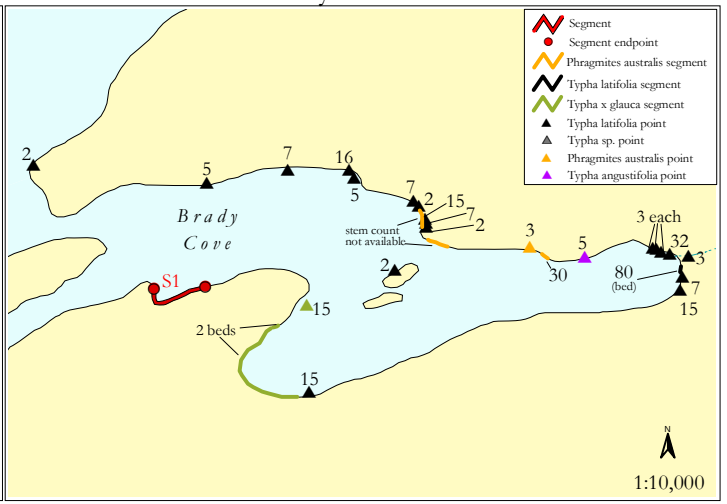




McCargoe Cove 2005

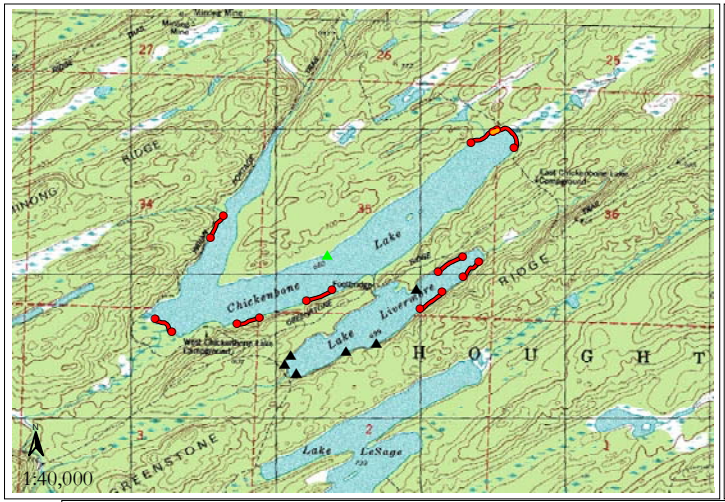
Brady Cove 2006

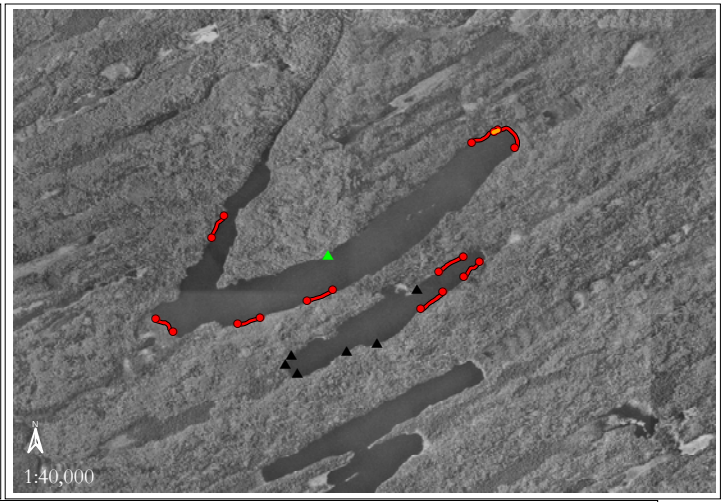


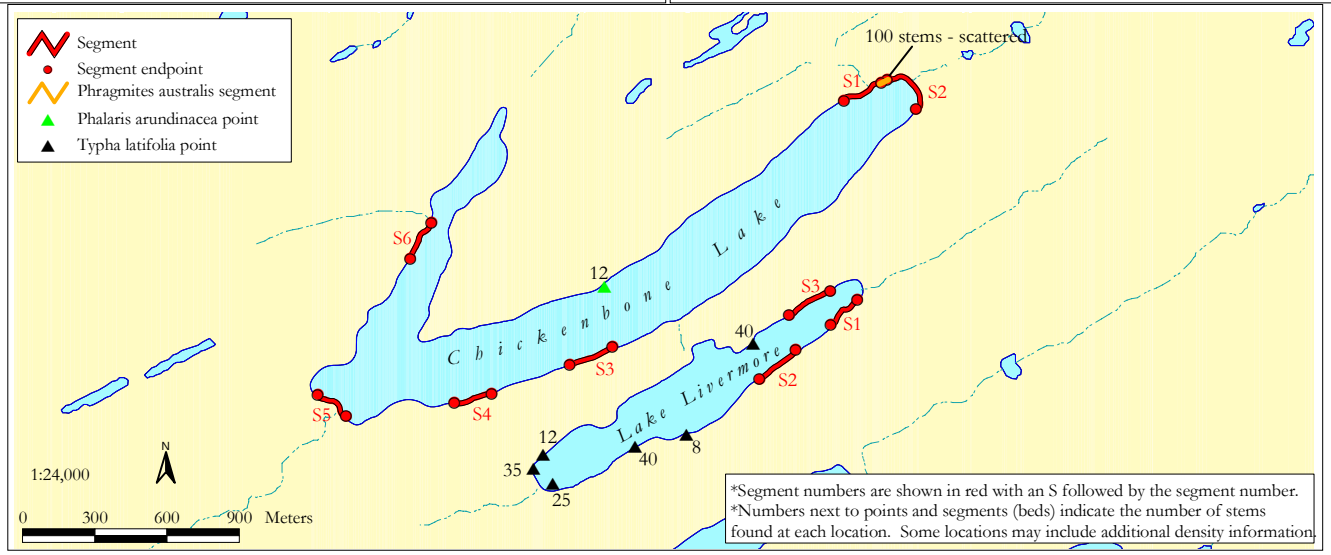


*Segment numbers are shown in red with an S followed by the segment number. *Numbers next to points and segments (beds) indicate the number of stems found at each location.

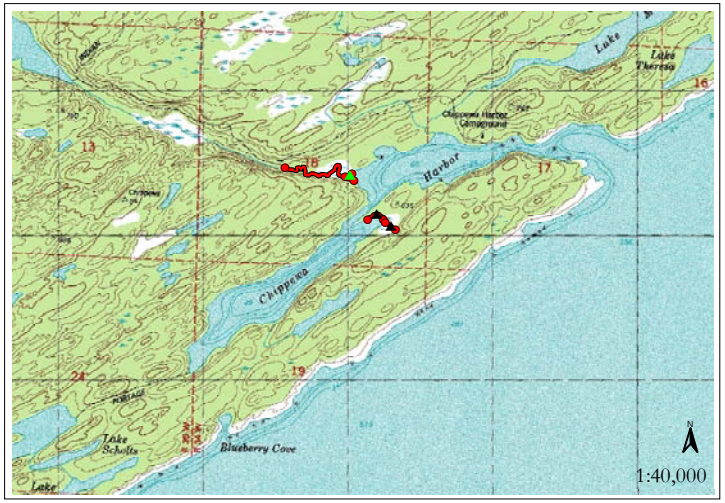
CHICKENBONE LAKE AND LAKE LIVERMORE 2004

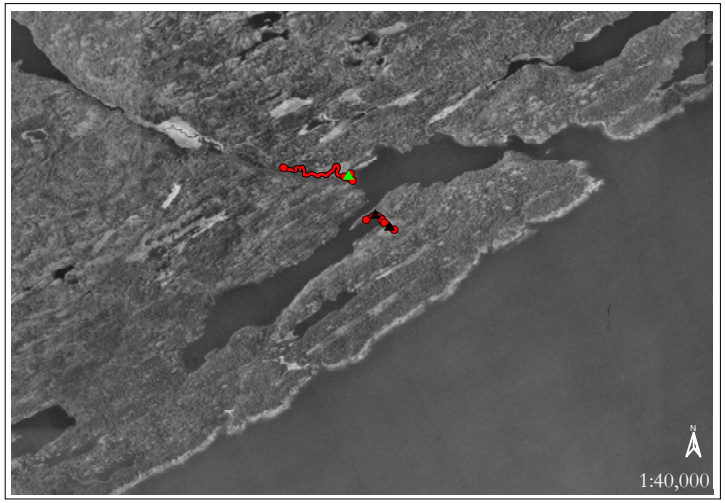


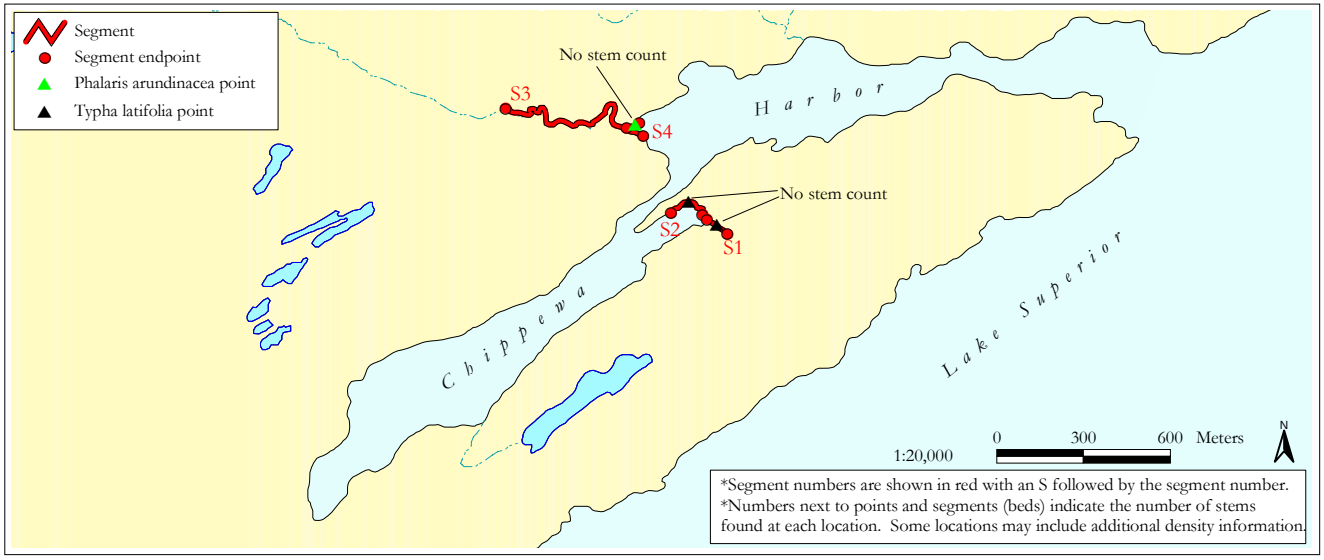




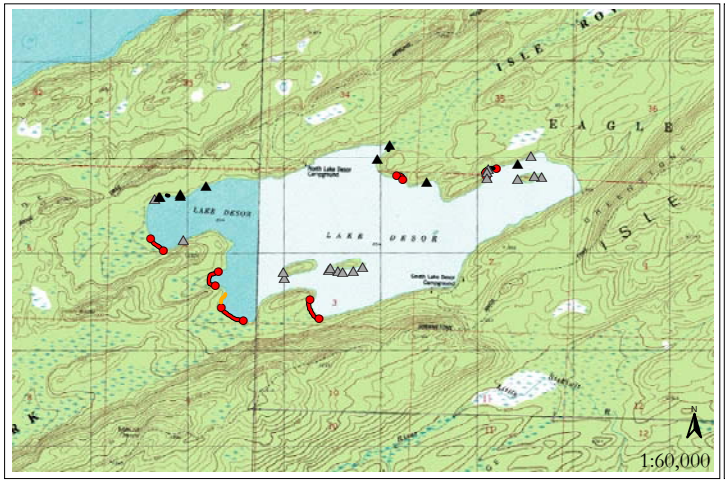
CHIPPEWA HARBOR 2003

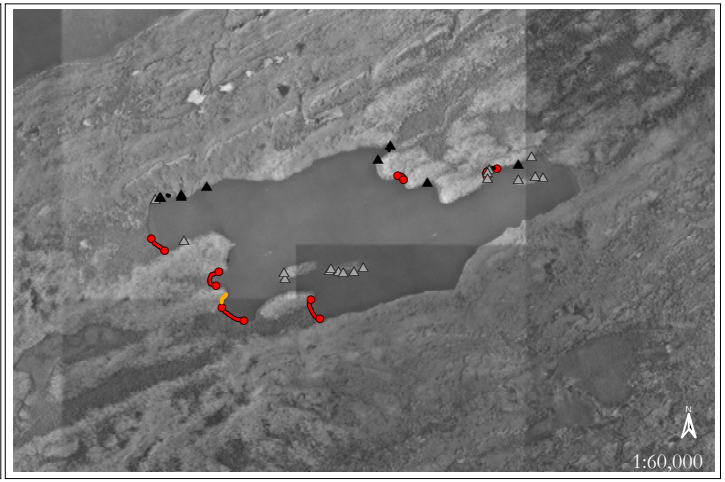


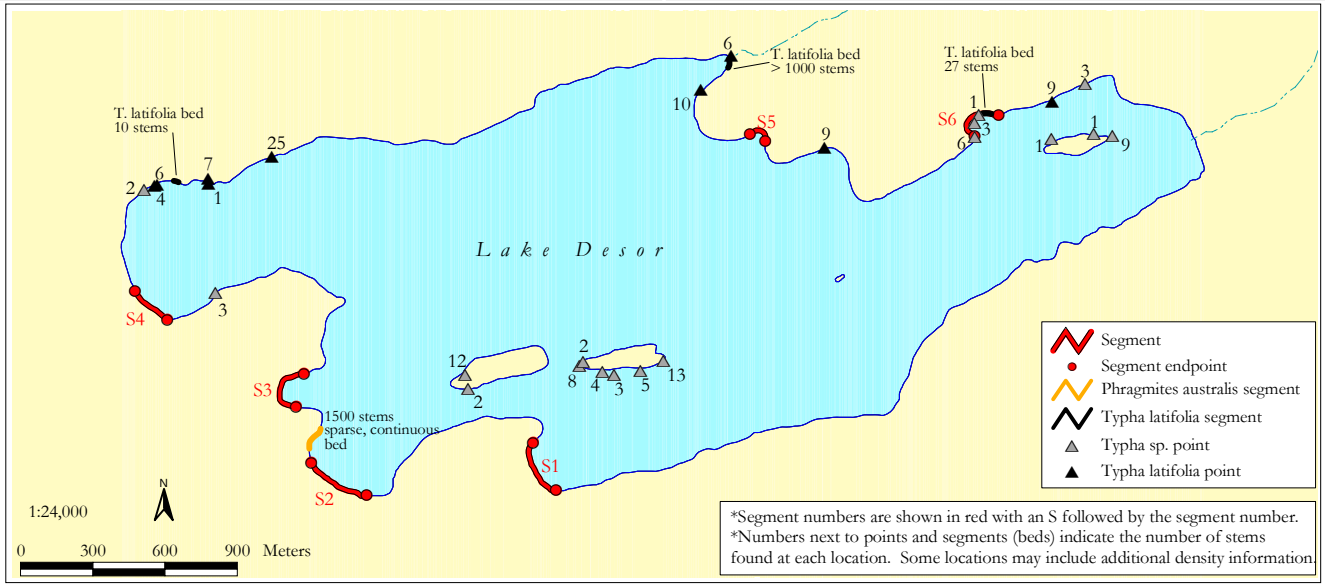




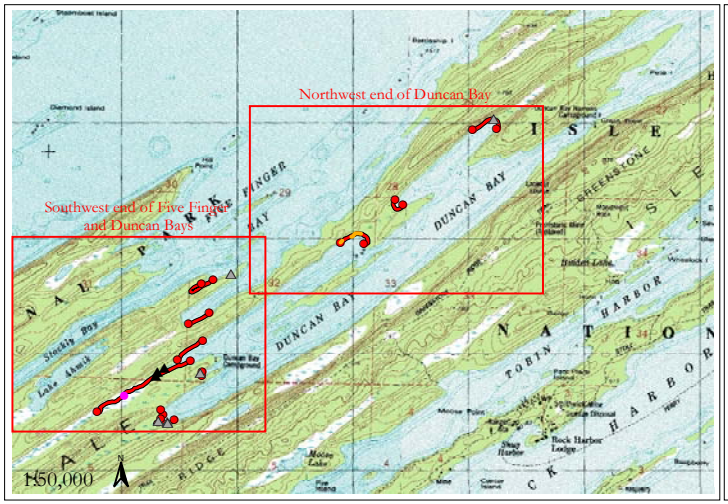
LAKE DESOR 2005

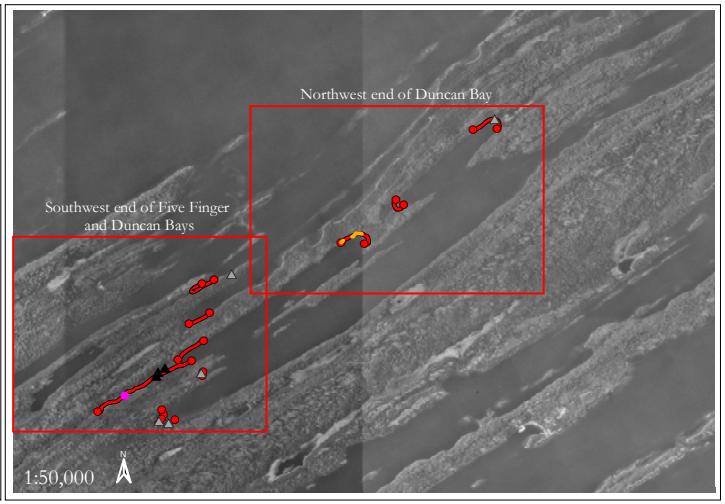




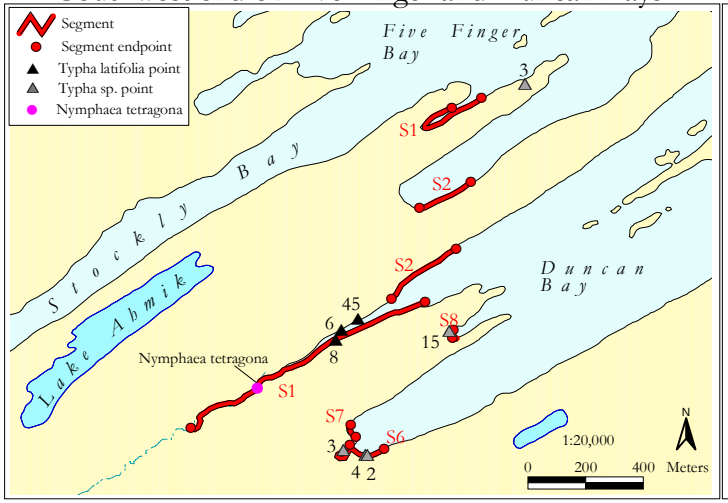


DUNCAN BAY AND FIVE FINGER BAY 2004

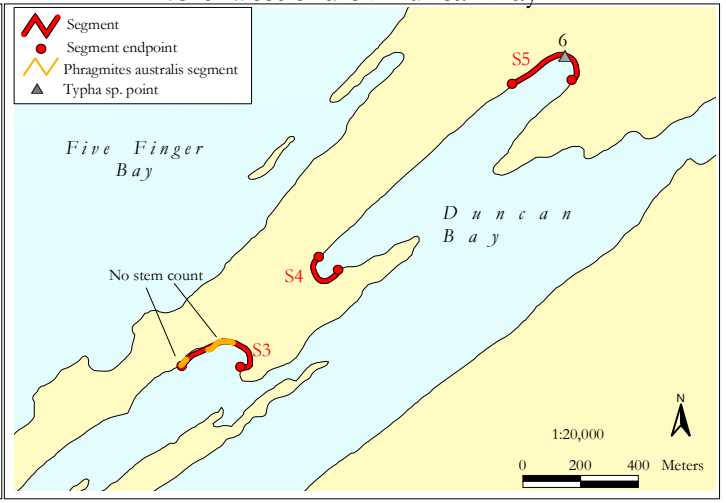




Southwest end of Five Finger and Duncan Bays

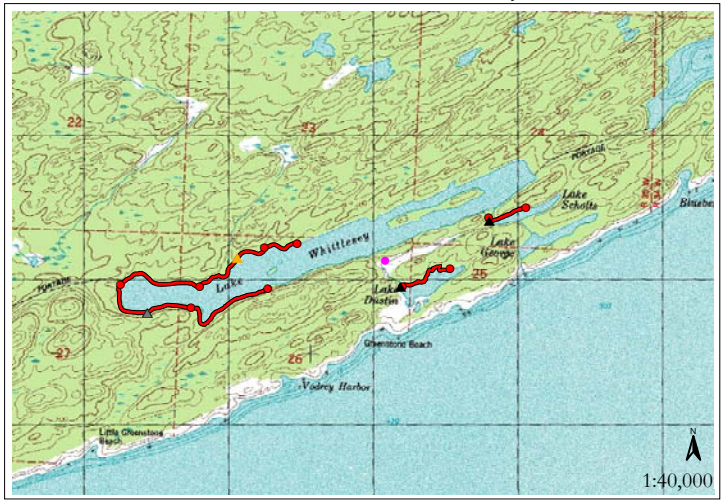


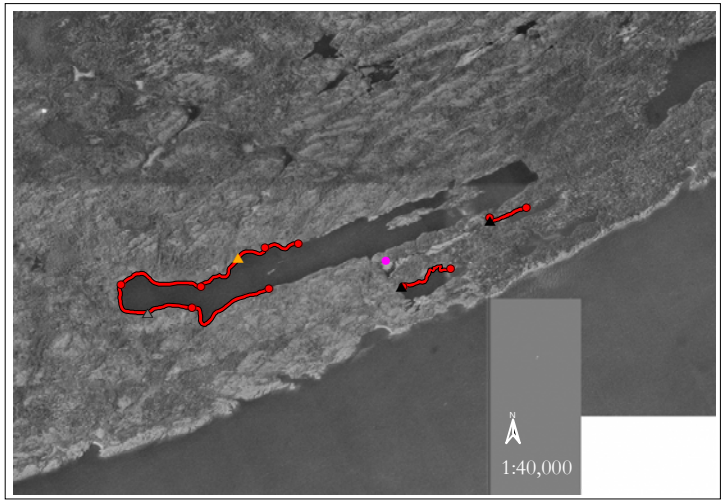
Northwest end of Duncan Bay

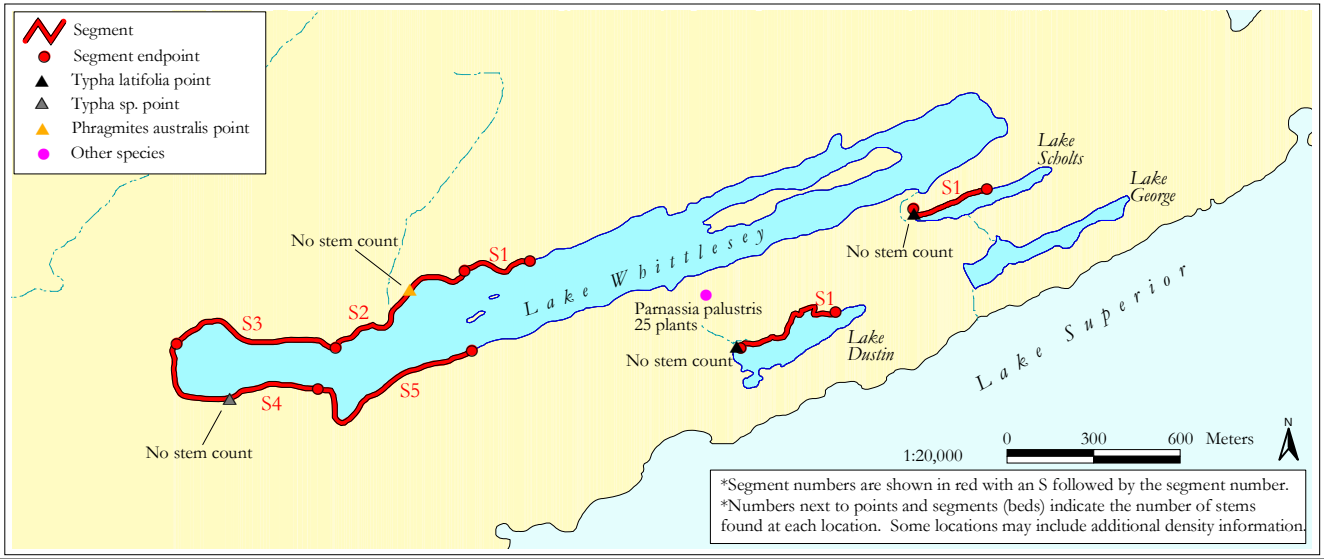


*Segment numbers are shown in red with an S followed by the segment number. *Numbers next to points and segments (beds) indicate the number of stems found at each location.

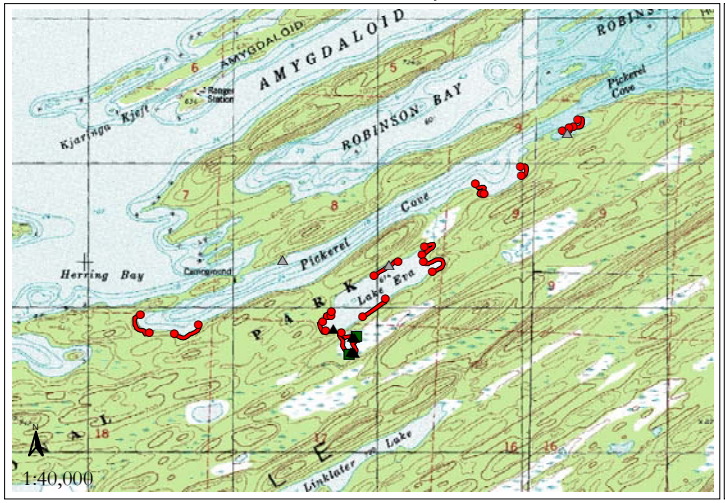
LAKES DUSTIN, SCHOLTS AND WHITTLESEY 2003

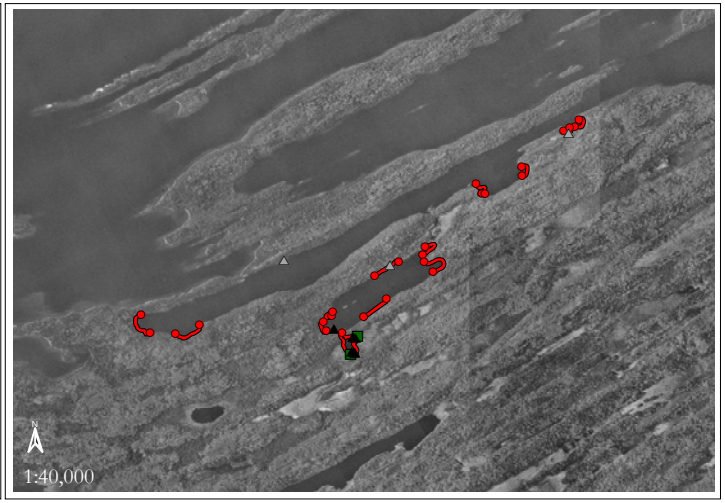


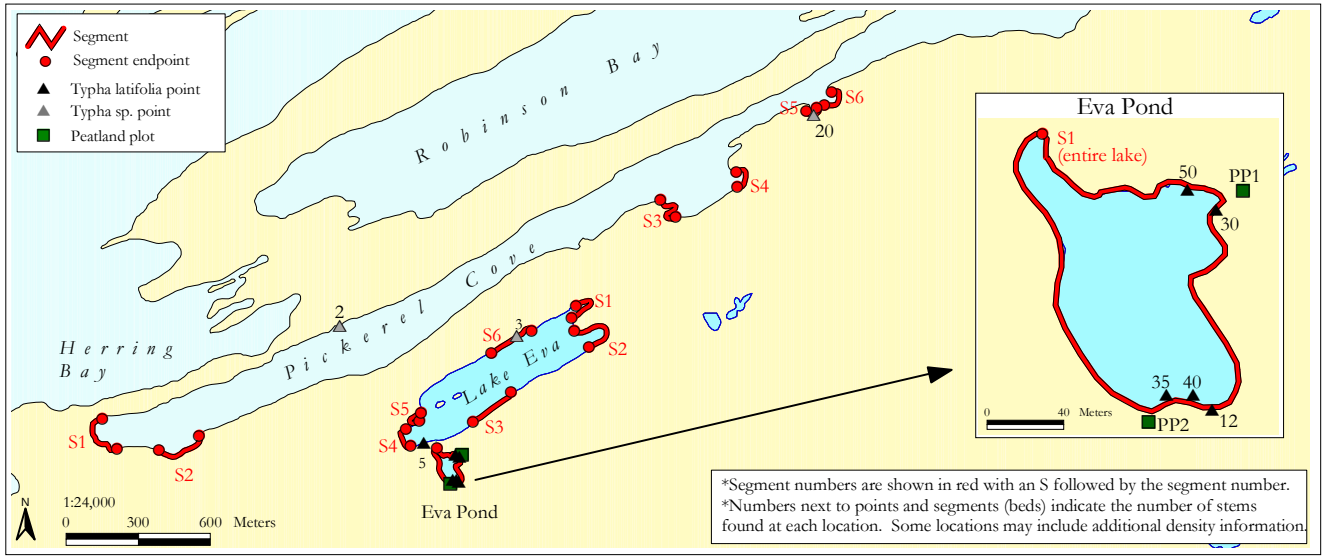




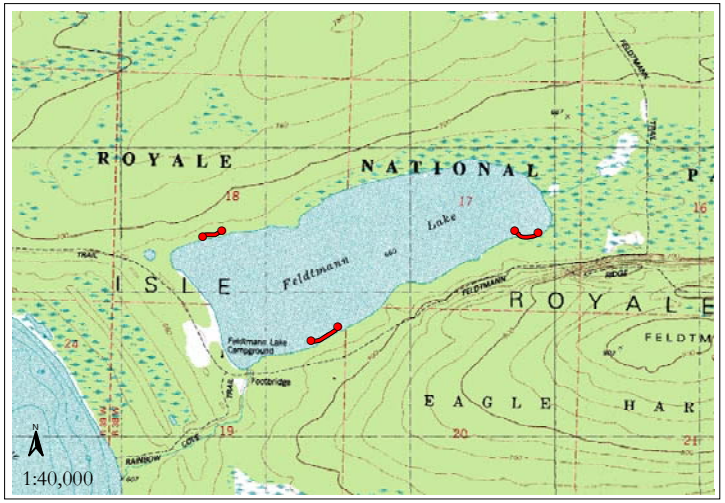
EVA POND, LAKE EVA AND PICKEREL COVE 2004

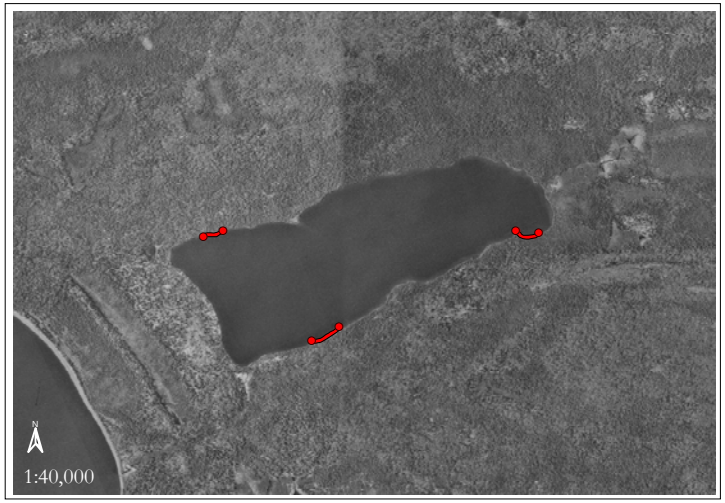


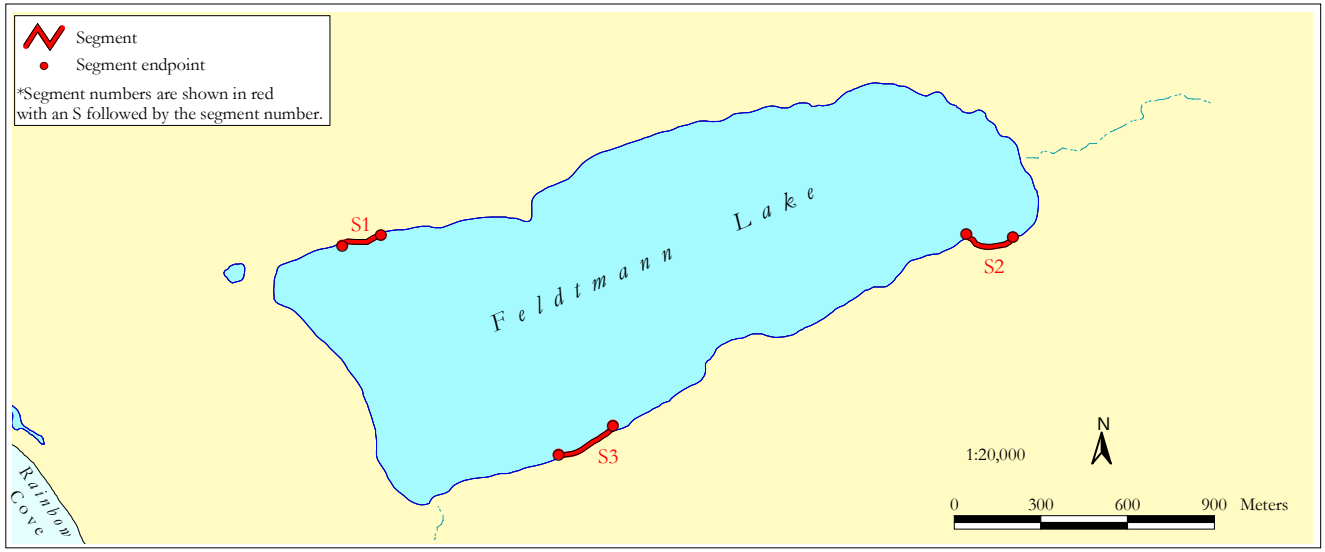




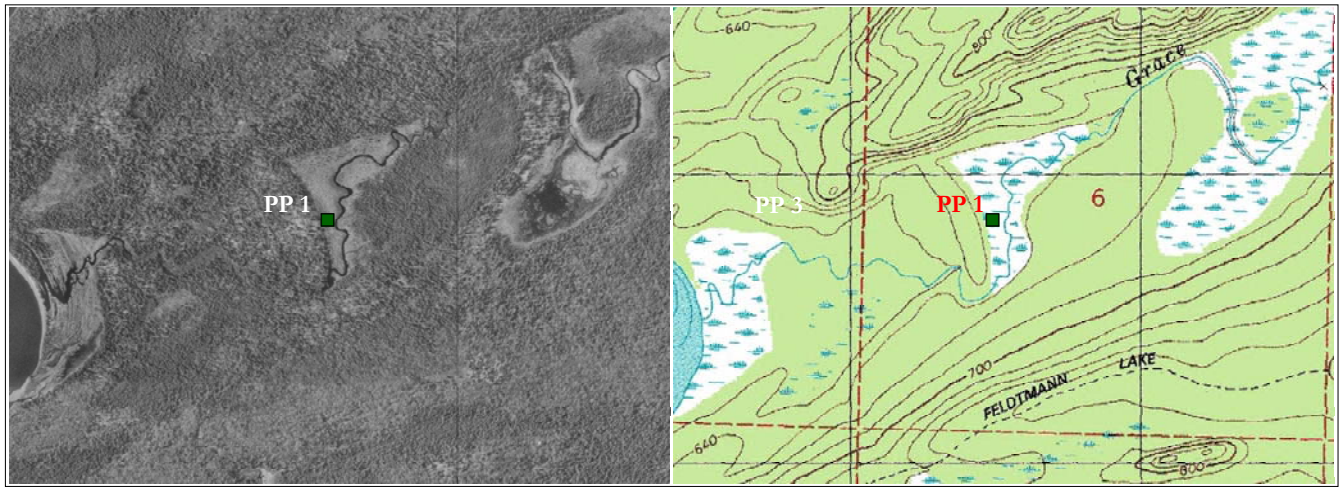
FELDTMANN LAKE 2004



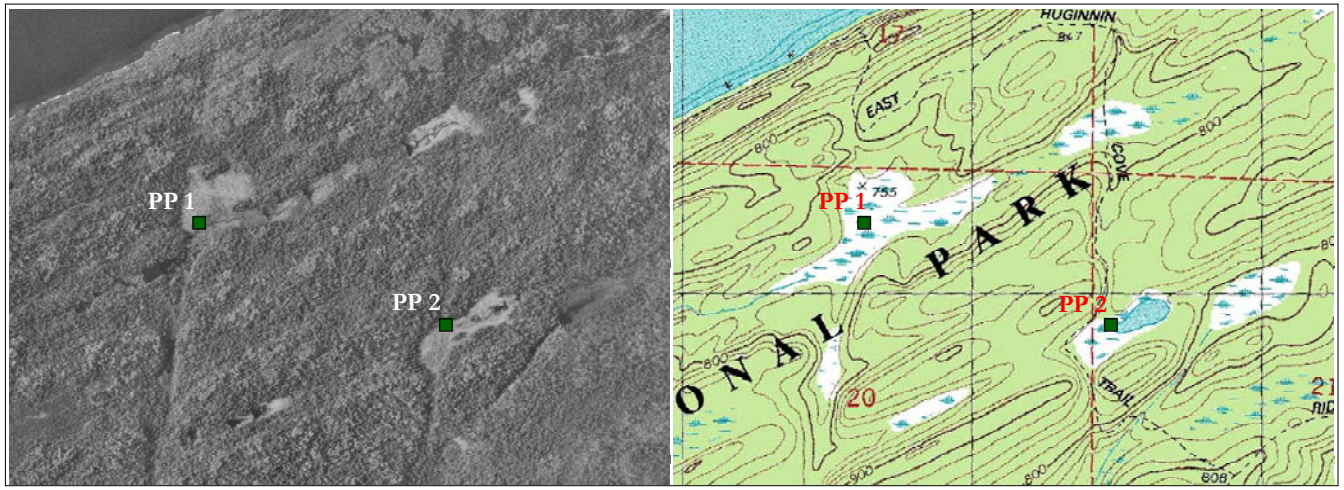




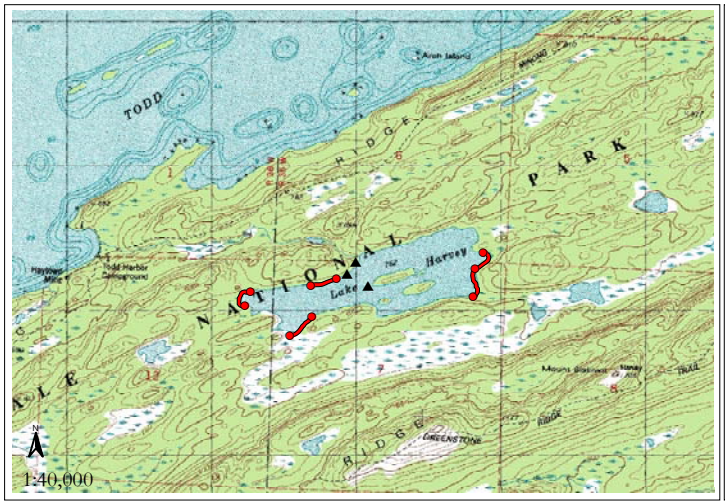
GRACE CREEK PEATLAND PLOTS 2004

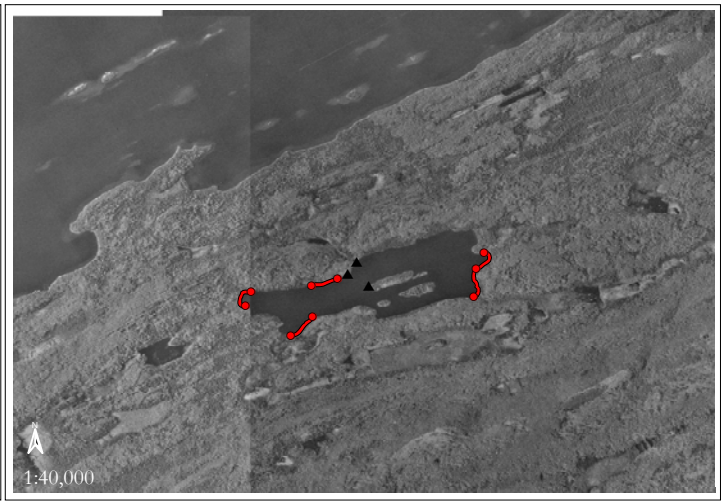


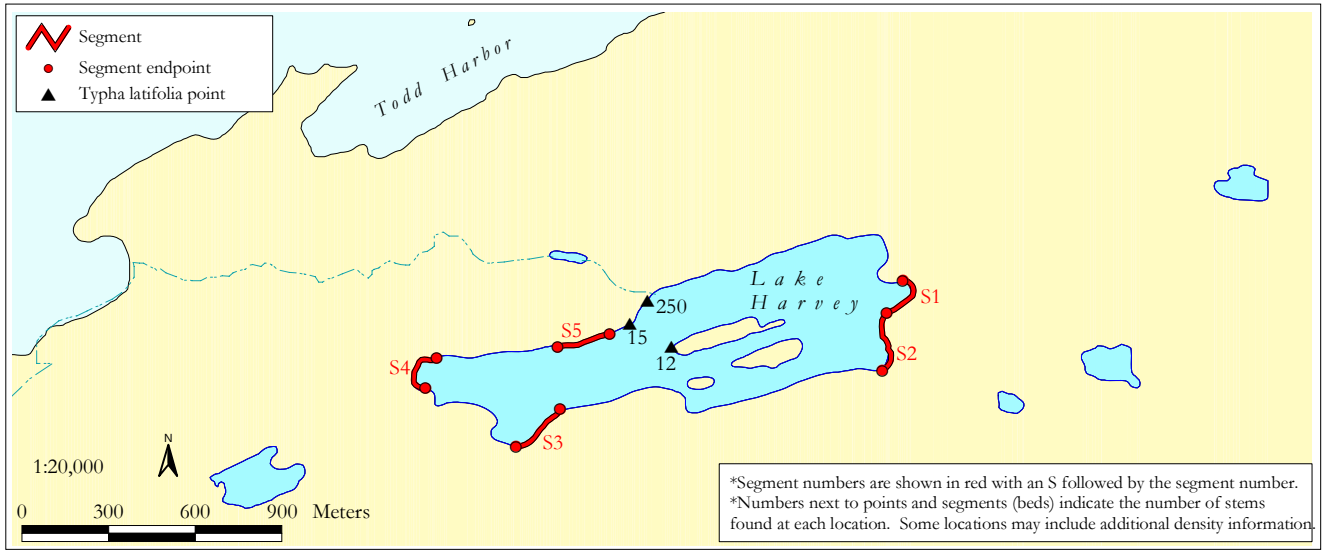
HUGINNIN COVE PEATLAND PLOTS 2004



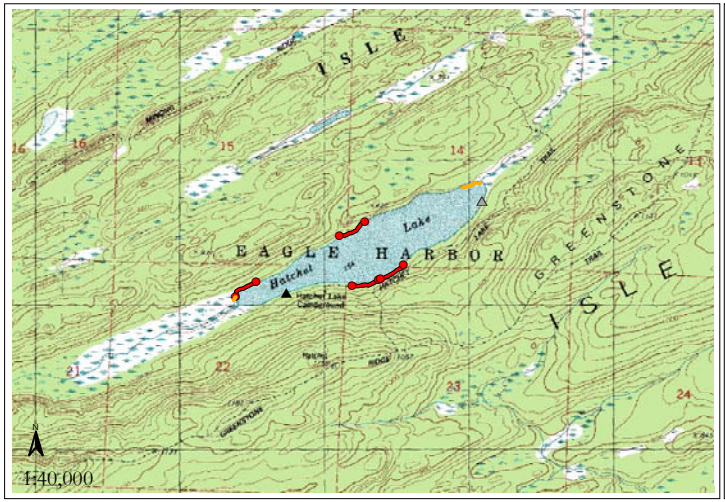
LAKE HARVEY 2004

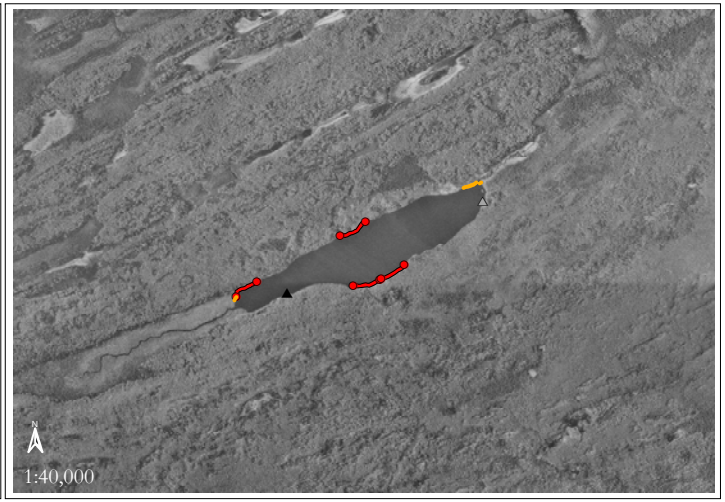


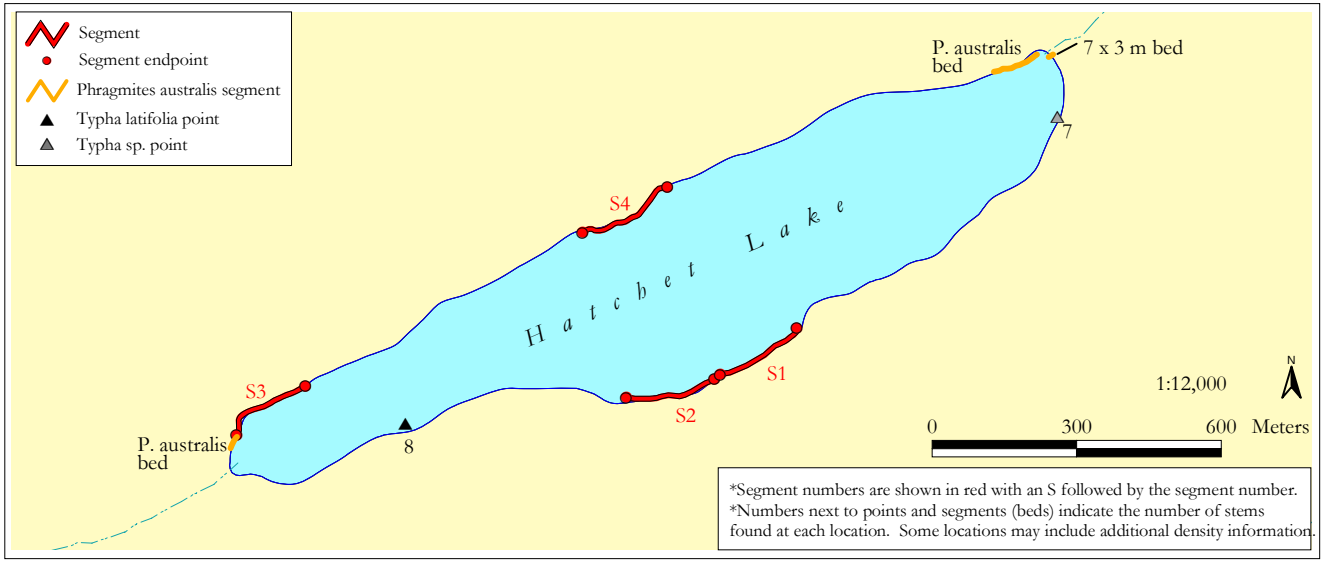




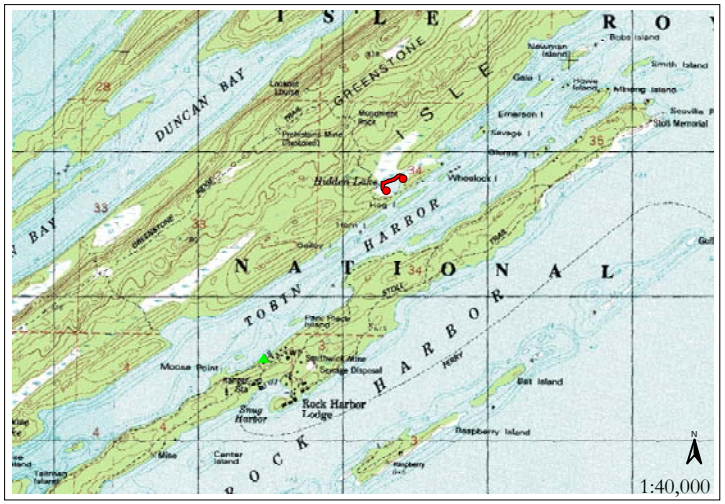
HATCHET LAKE 2004

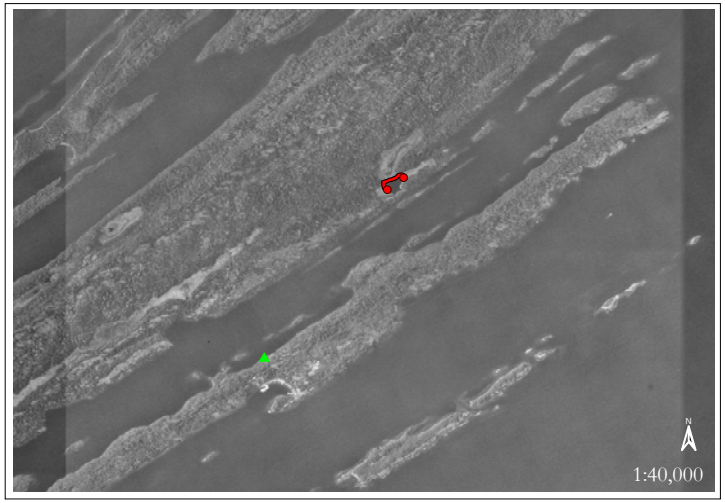


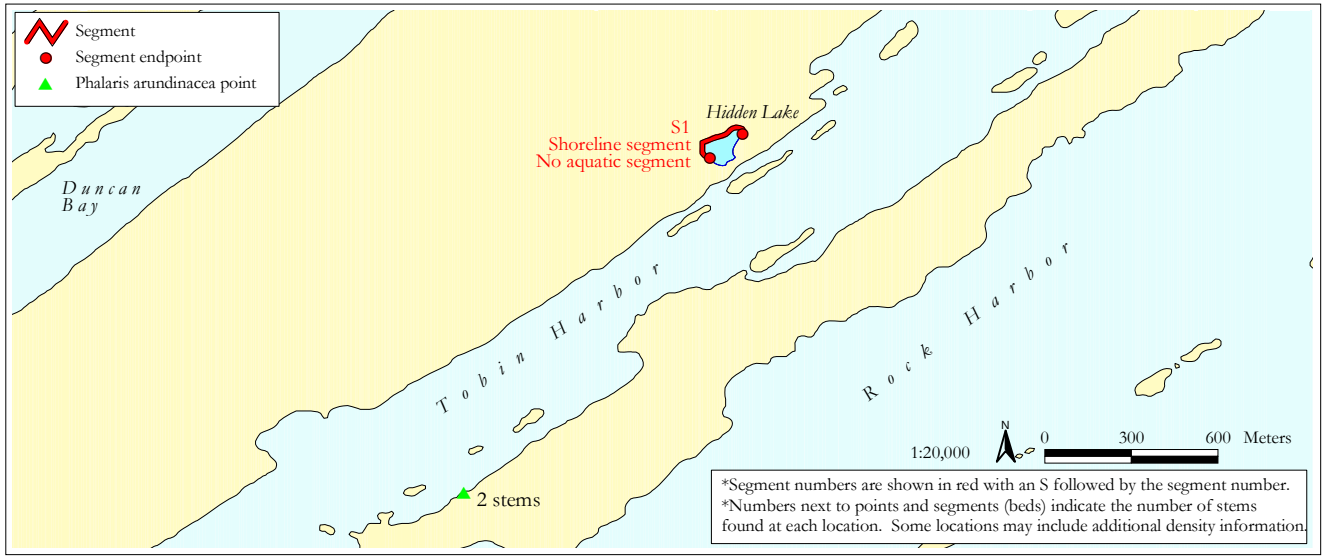




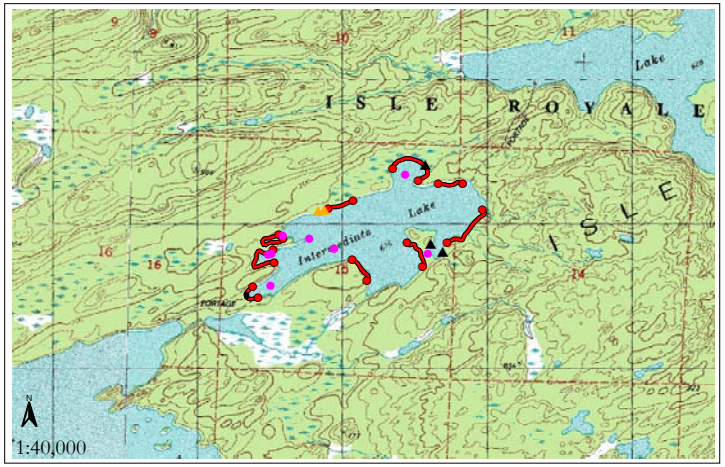
HIDDEN LAKE 2003

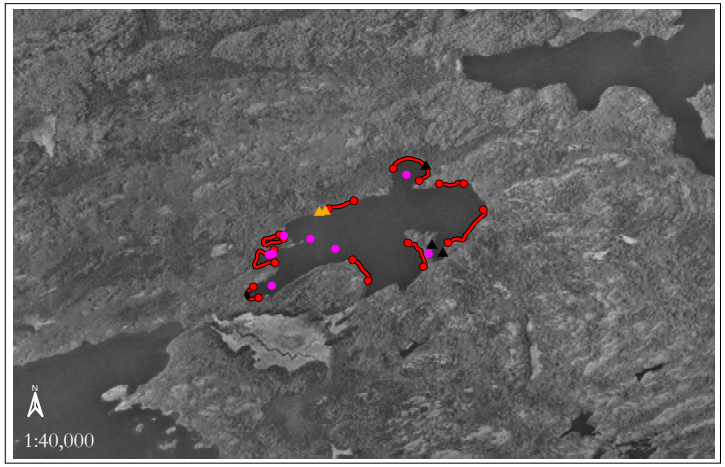


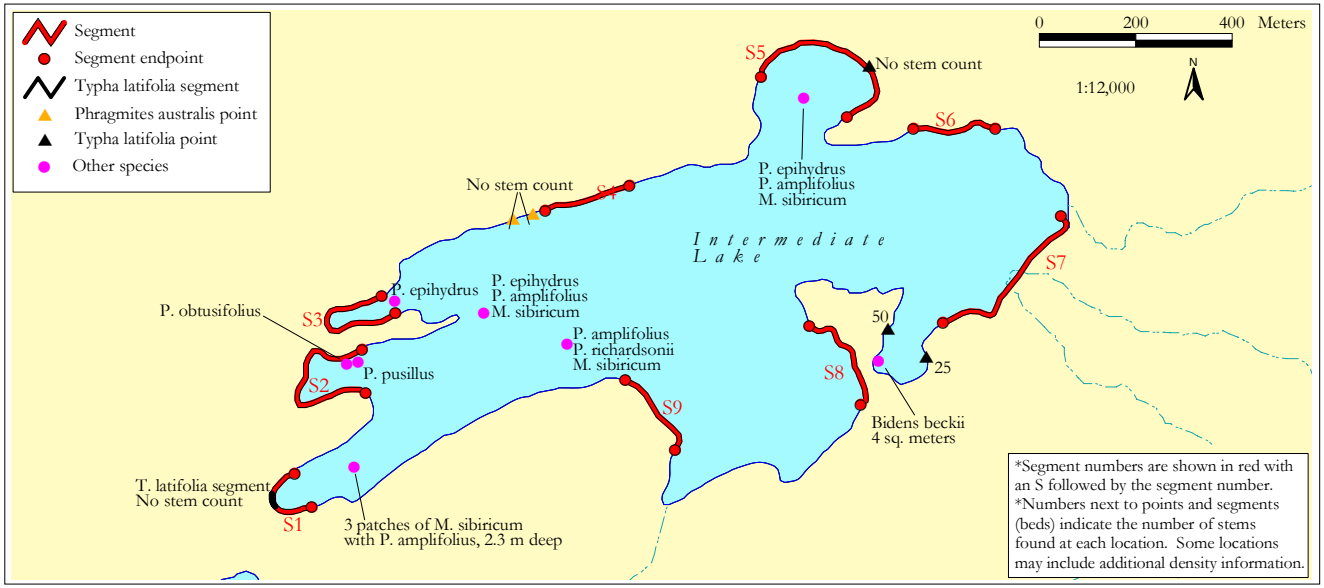




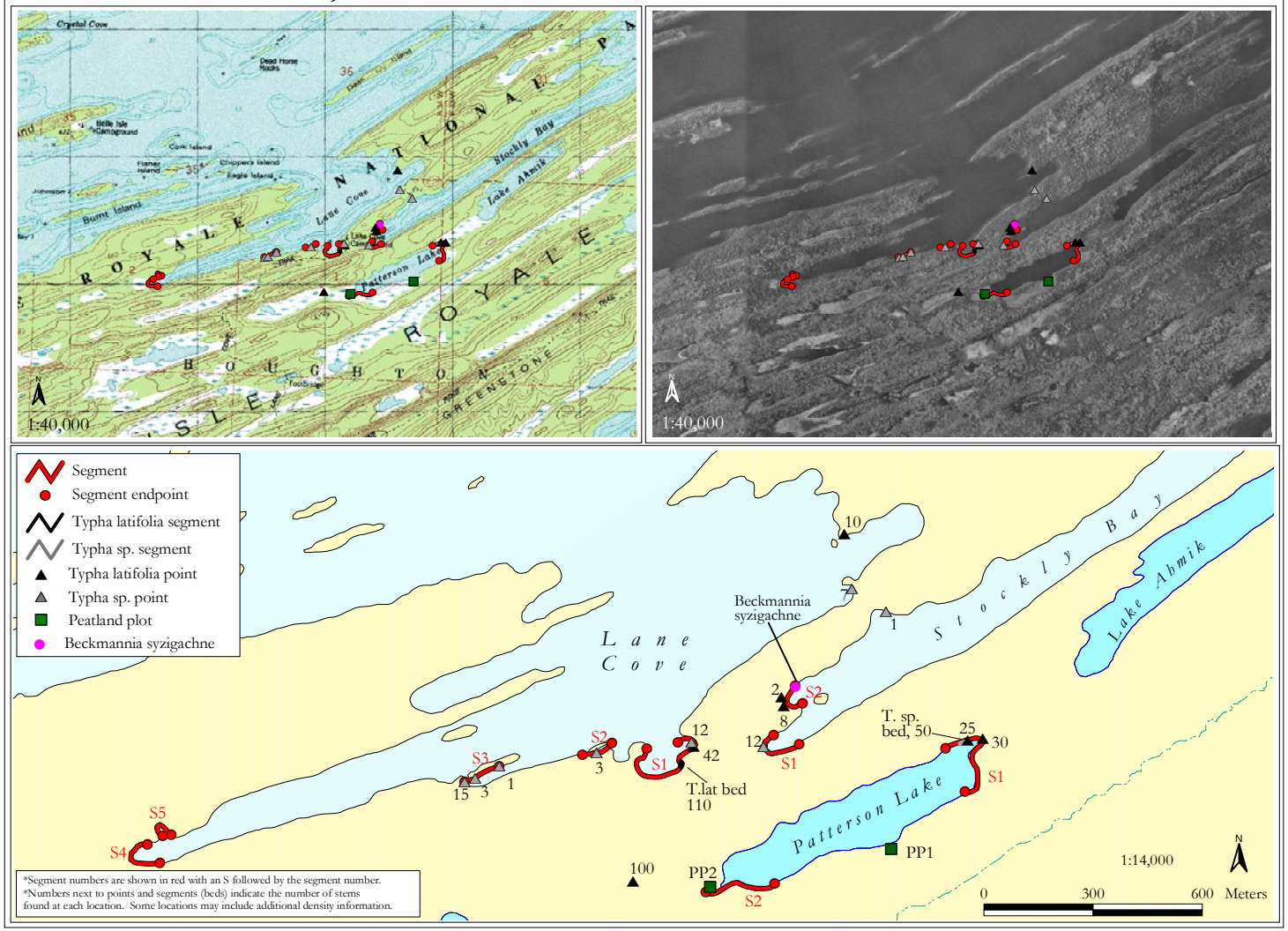
INTERMEDIATE LAKE 2003







LANE COVE, PATTERSON LAKE AND STOCKLY BAY 2004



LANE COVE TRAIL PEATLAND PLOTS 2003

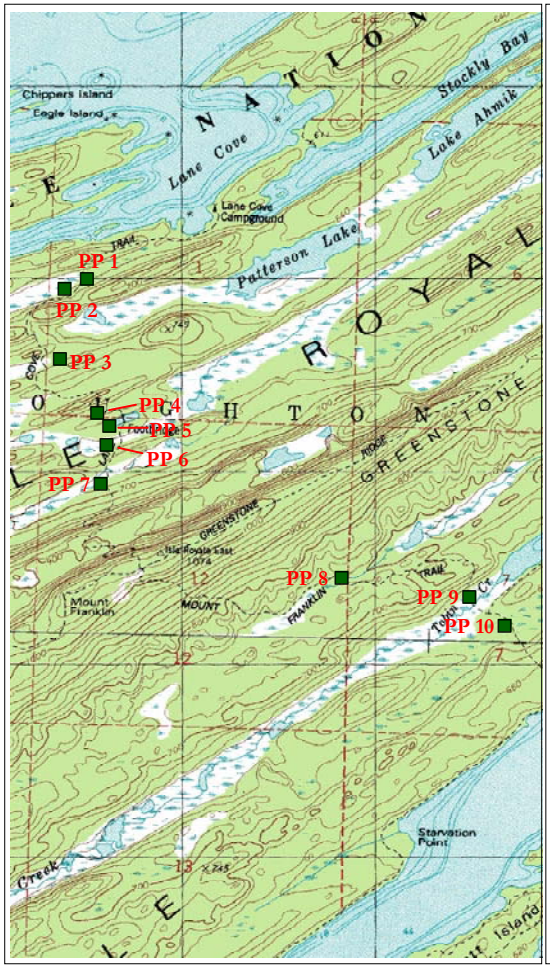
SITE DESCRIPTION

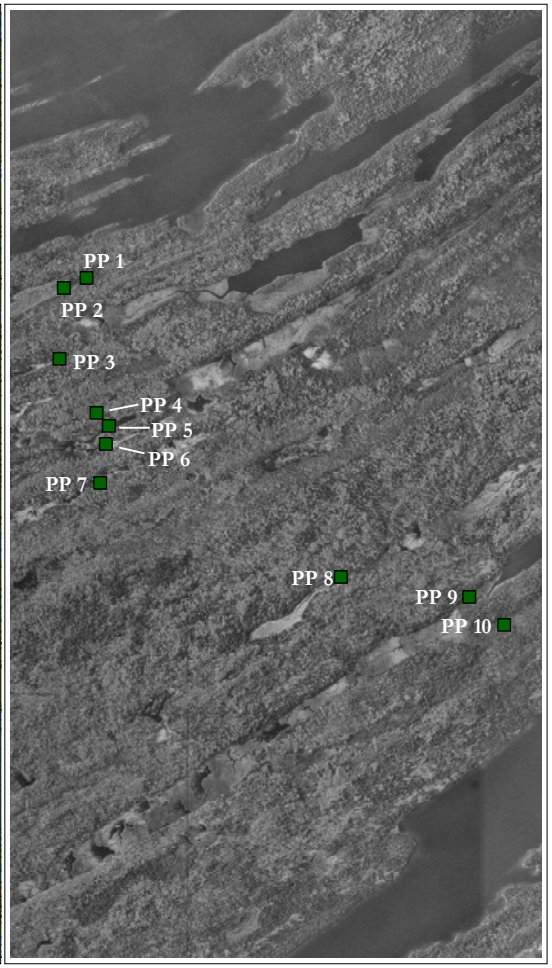
PP 1 - White Cedar Swamp
PP 2 - Boreal Rich Fen
PP 3 - Active Beaver Dam
PP 4 - Black Ash Swamp
PP 5 - Bluejoint Meadow (inactive beaver meadow)
PP 6 - Bluejoint Meadow (inactive beaver meadow)
PP 7 - Bluejoint Meadow/ Alder Thicket
PP 8 - Bluejoint Meadow (below recently active beaver dam)
PP 9 - Alder Thicket along creek
PP 10 - Alder Thicket/Open Black Ash-Conifer Swamp

N

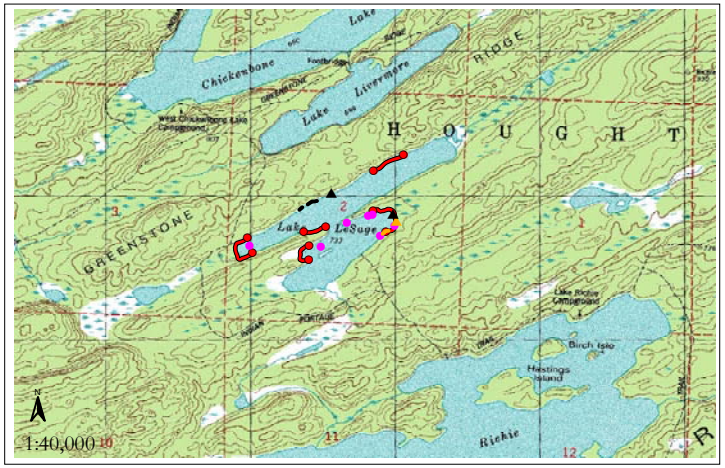
0 500 1000 Meters

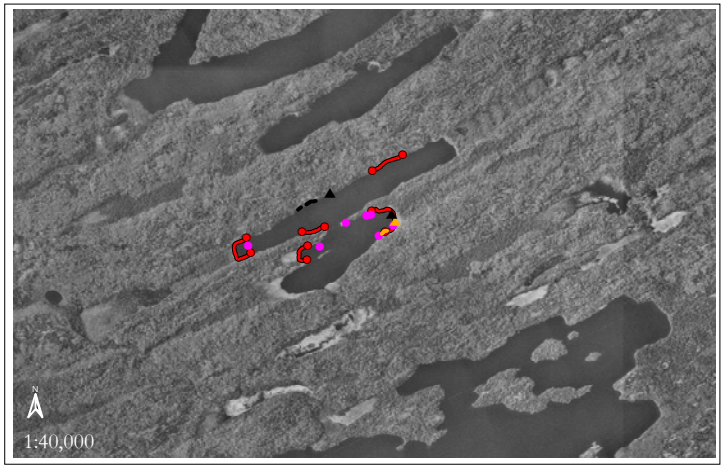
0 500 1000 Meters





LAKE LESAGE 2003



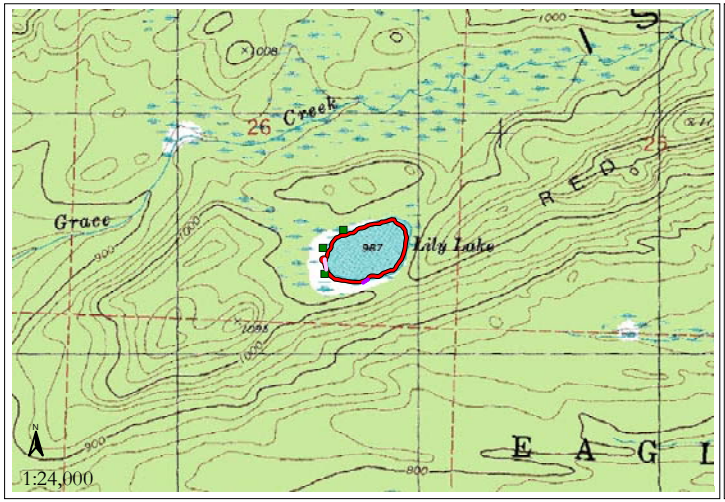


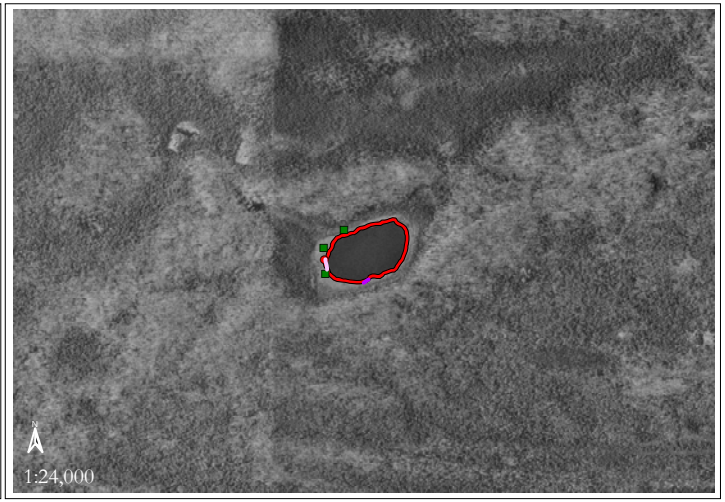
Segment
Segment endpoint
Typha latifolia segment
Phragmites australis segment
Typha latifolia point
Phragmites australis point
Other species

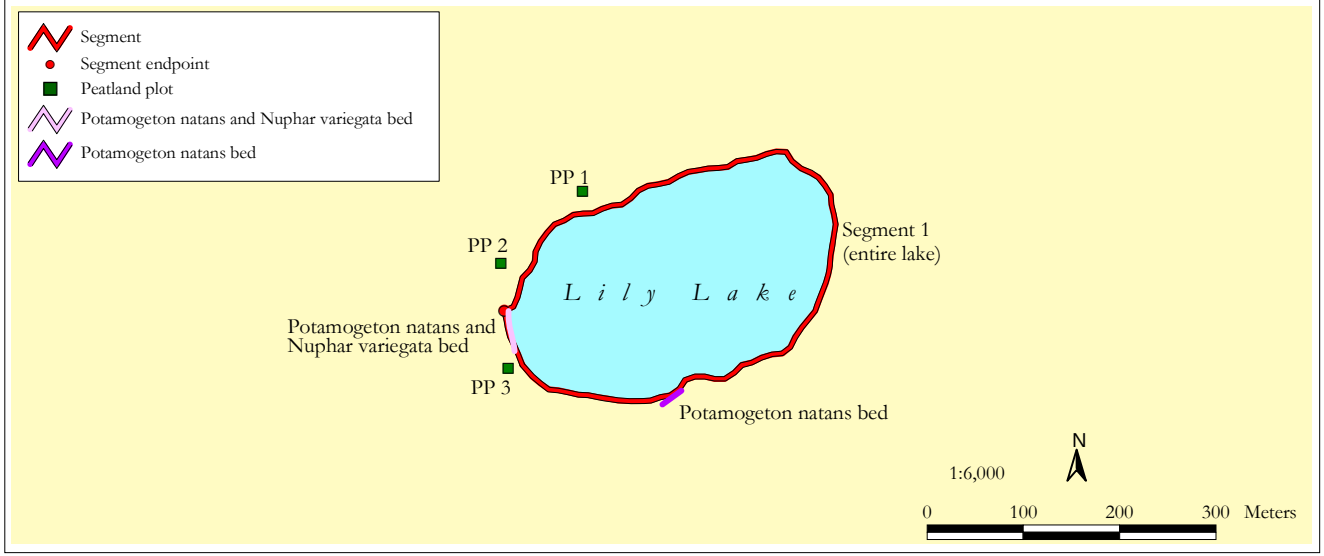
Lake LeSage
S5
10 stems
2 patches
No stem count
Scirpus acutus
S1
No stem count
Sparganium fluctuans
Scirpus acutus
S3
Potamogeton richardsonii
S4
Nuphar variegata
2-3 sq. meters
S2
No stem count
1 m depth
Scirpus acutus
1:12,000
0 300 600 Meters

*Segment numbers are shown in red with an S followed by the segment number.
*Numbers next to points and segments (beds) indicate the number of stems found at each location. Some locations may include additional density information.

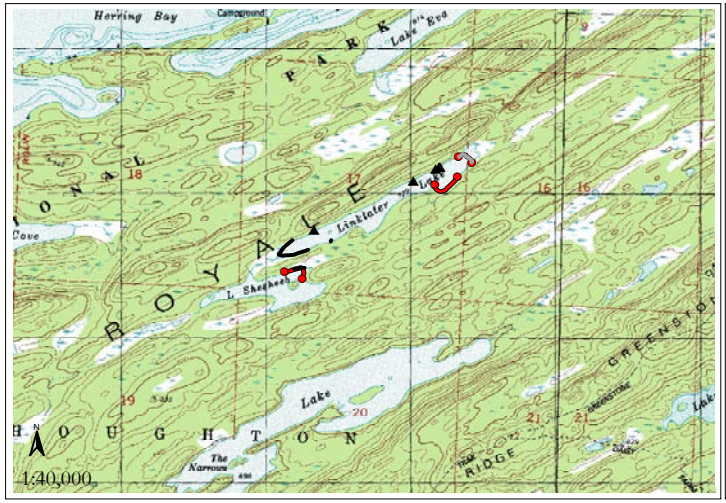
LILY LAKE 2004

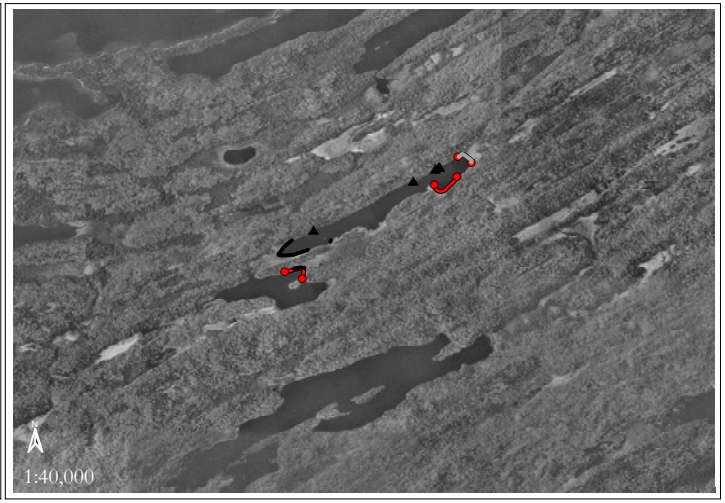


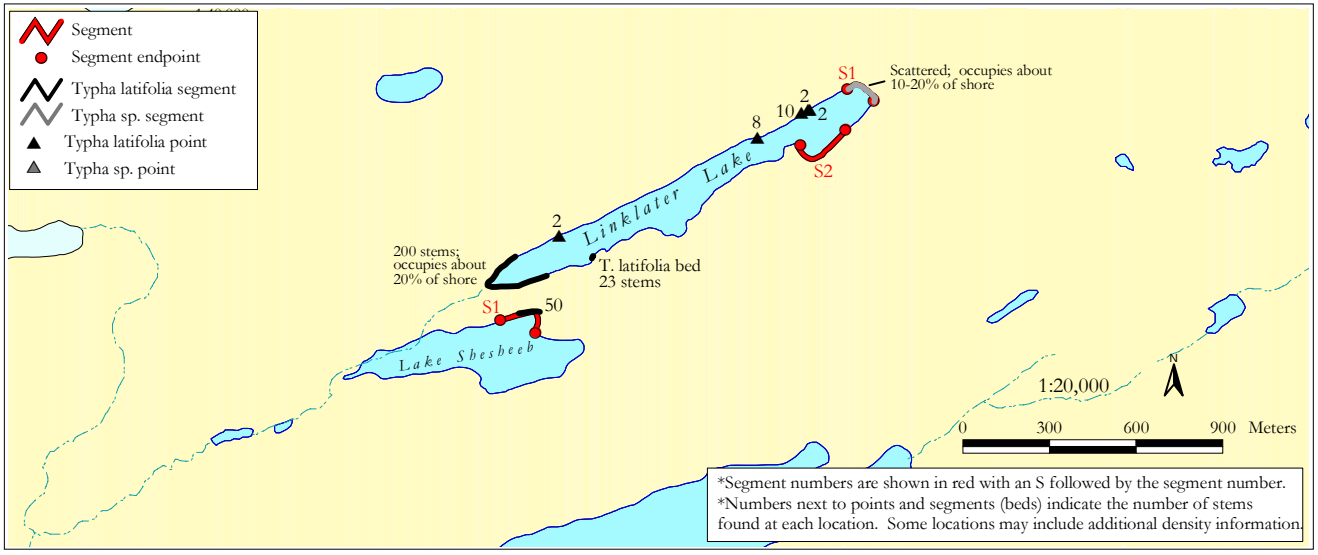




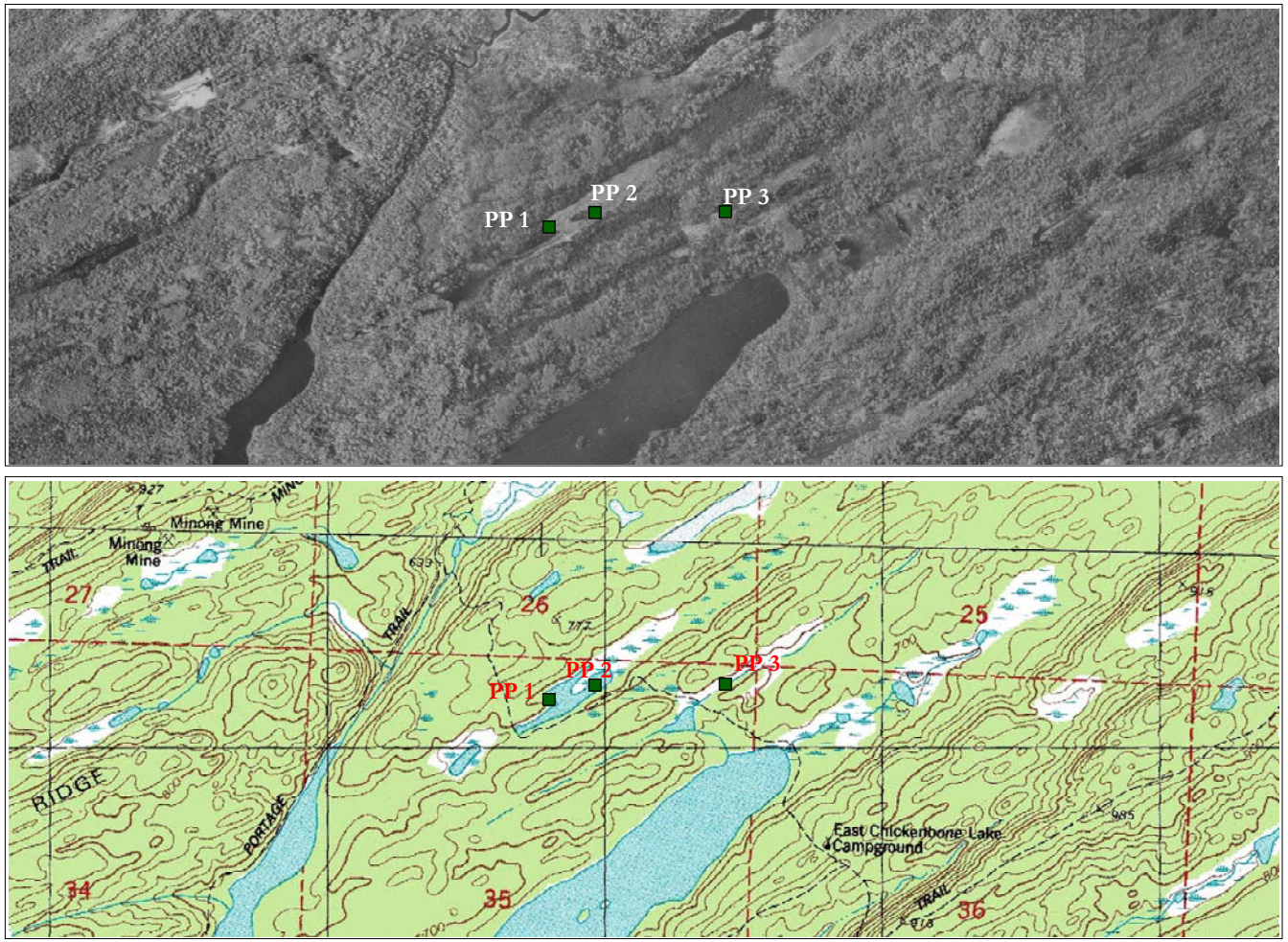
LINKLATER LAKE AND LAKE SHESHEEB 2004



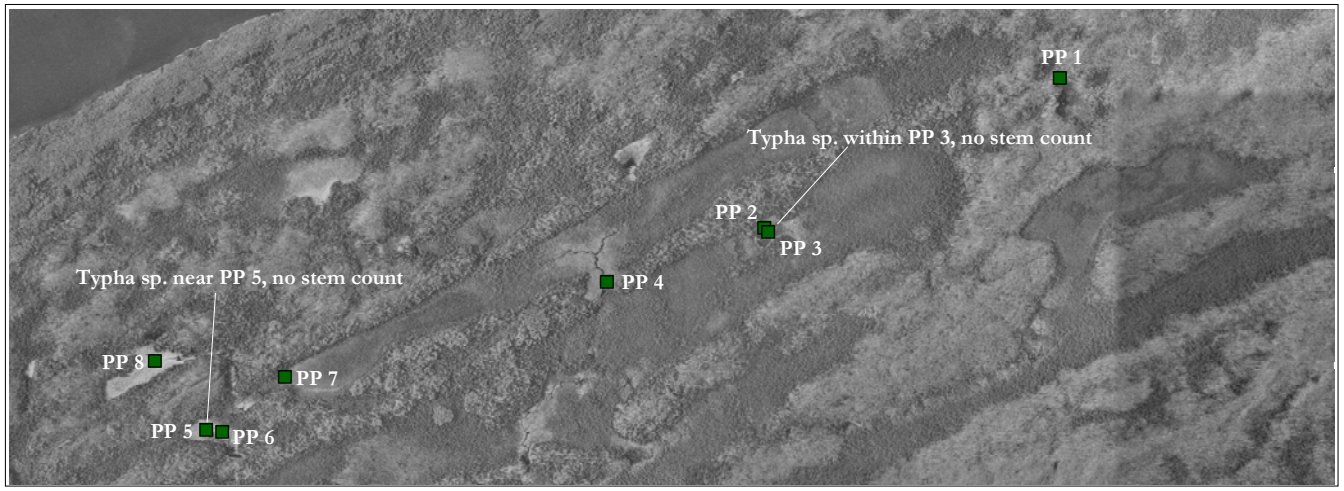


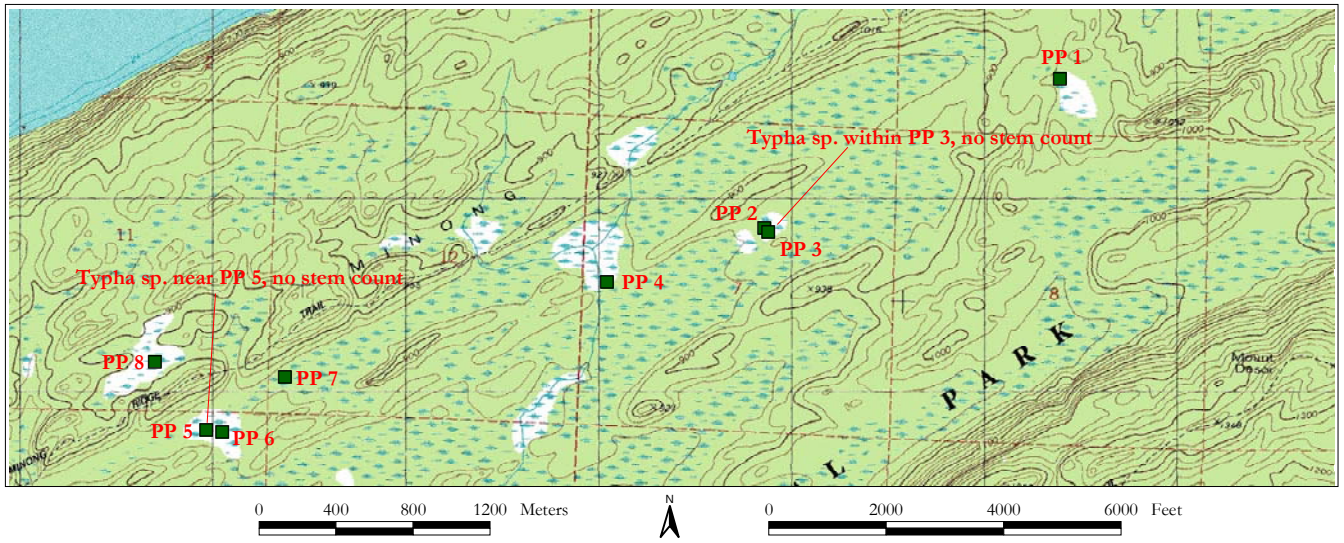


McCARGOE COVE PEATLAND PLOTS 2005

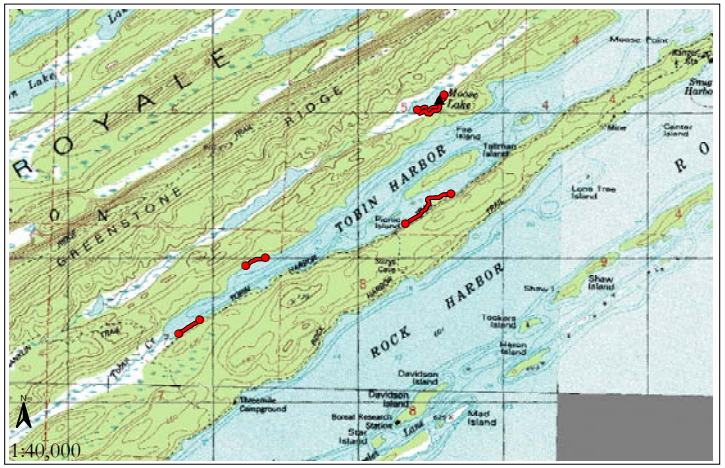


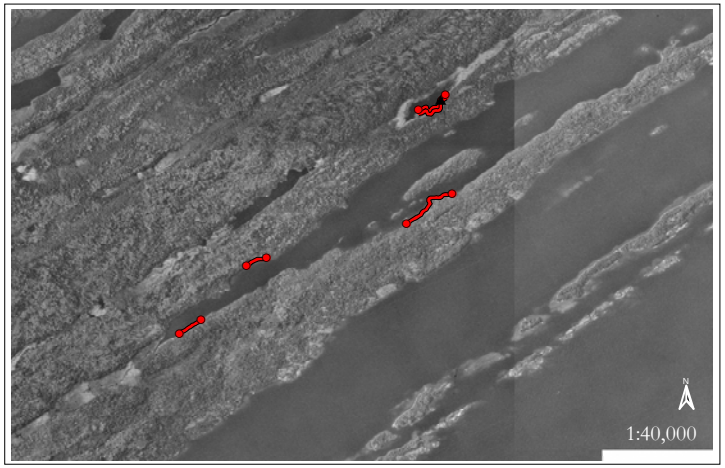
MINONG RIDGE PEATLAND PLOTS 2004

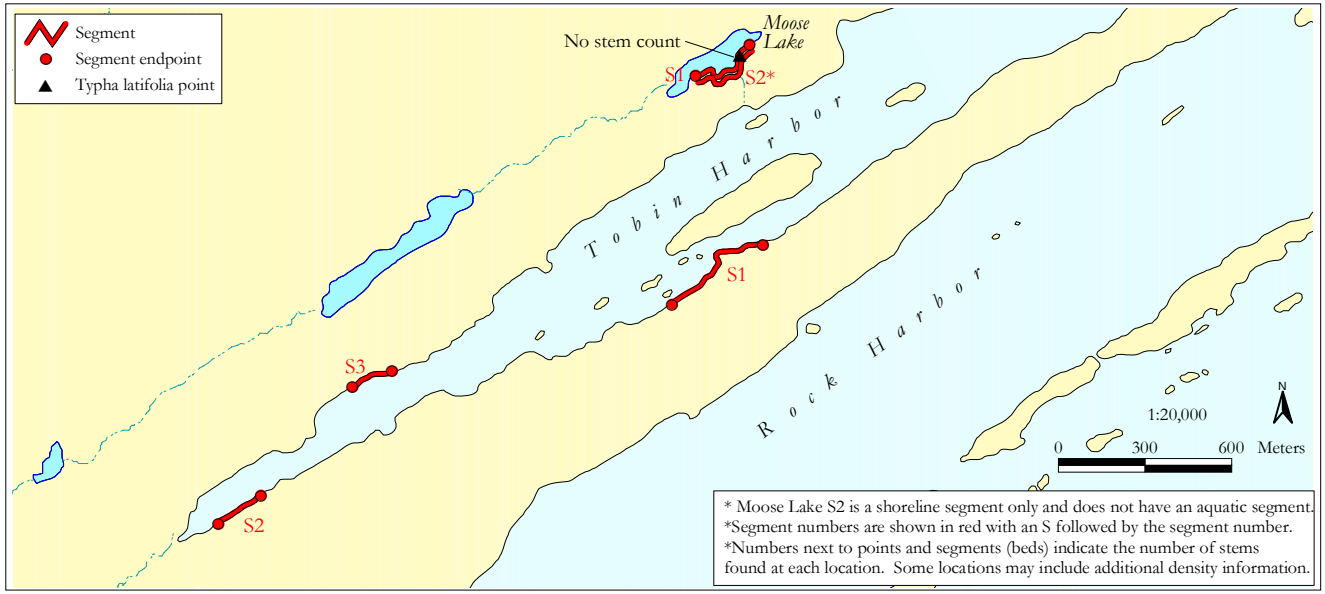




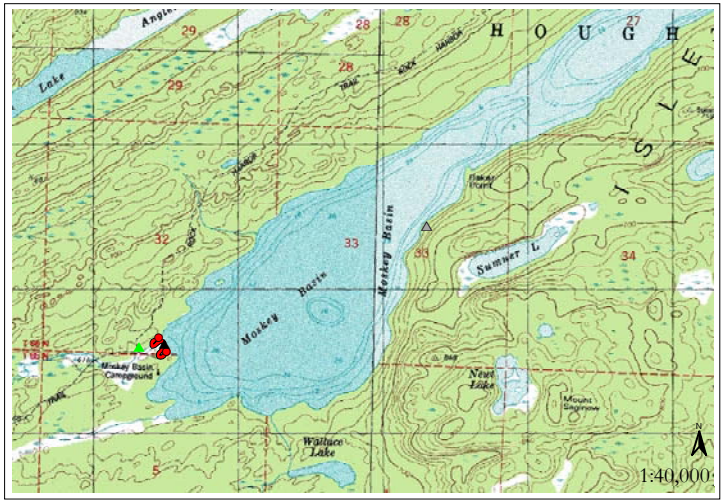
MOOSE LAKE AND TOBIN HARBOR 2003

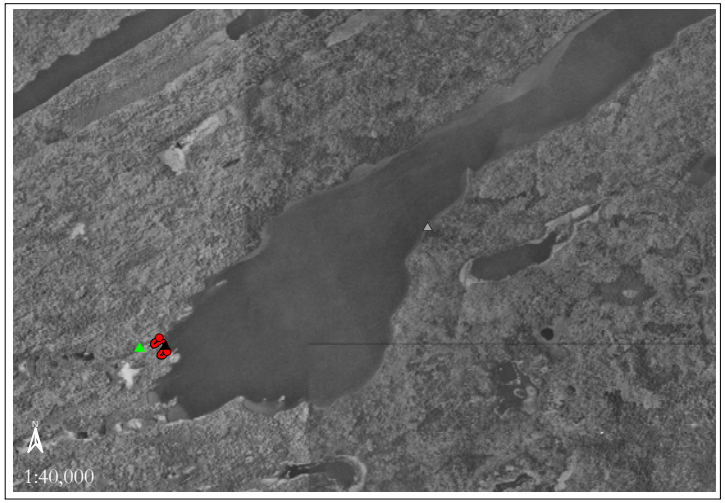


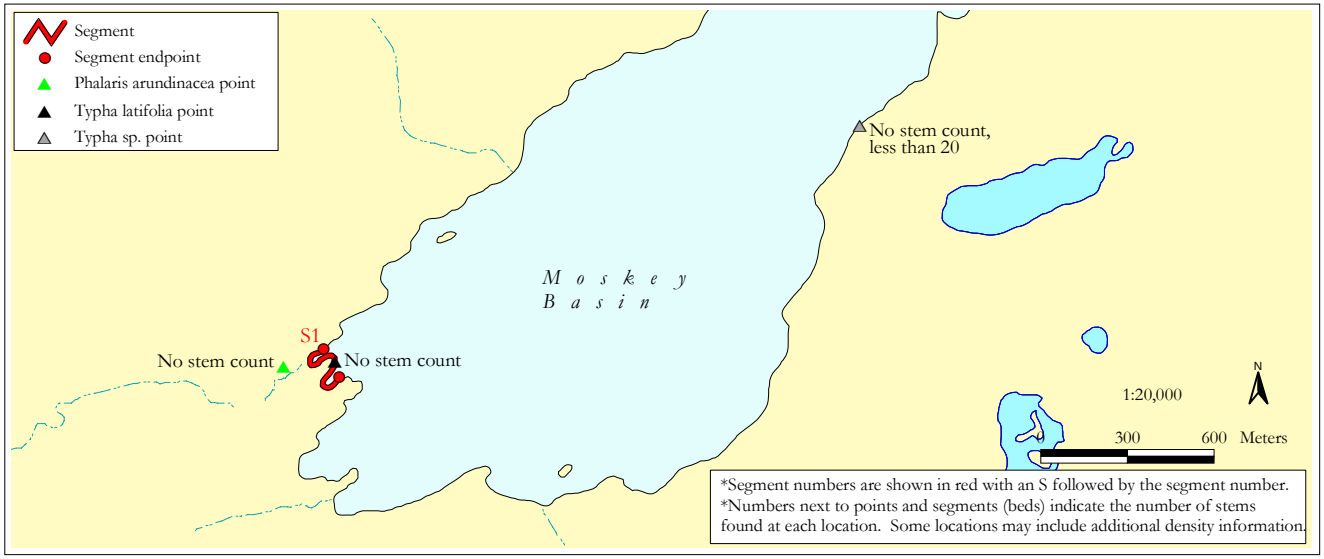




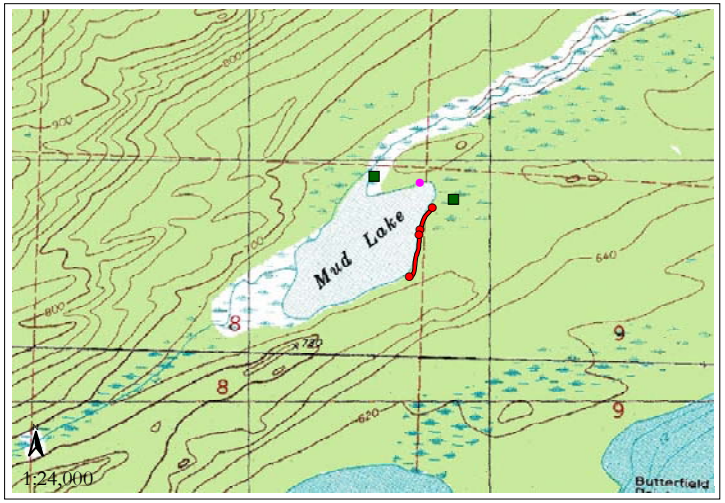
MOSKEY BASIN 2003



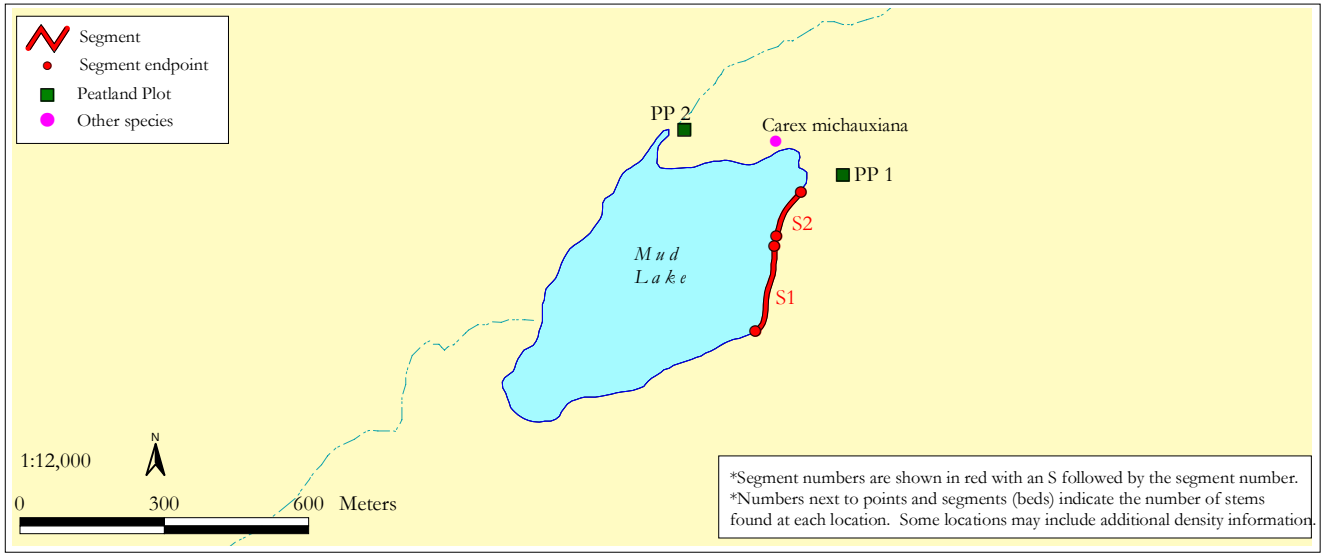




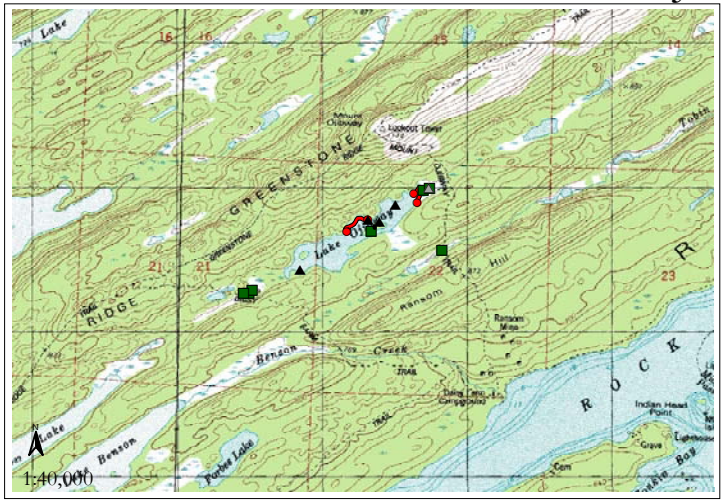
MUD LAKE 2005

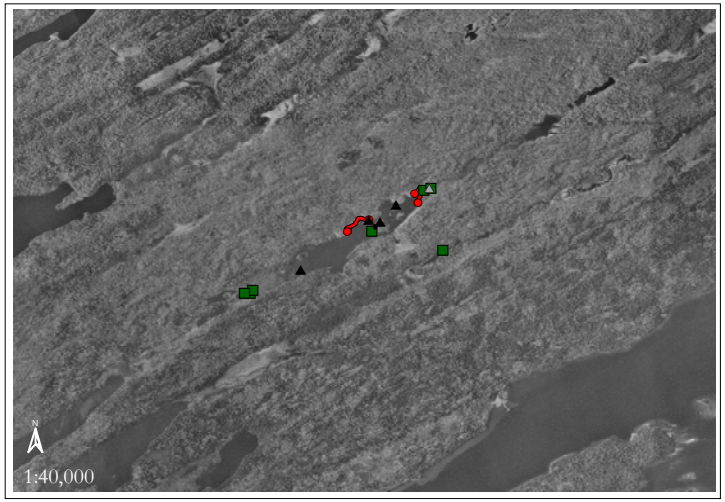






LAKE OJIBWAY 2004





Segment
Segment endpoint
Typha latifolia segment
Typha latifolia point
Typha sp. point
Peatland plot

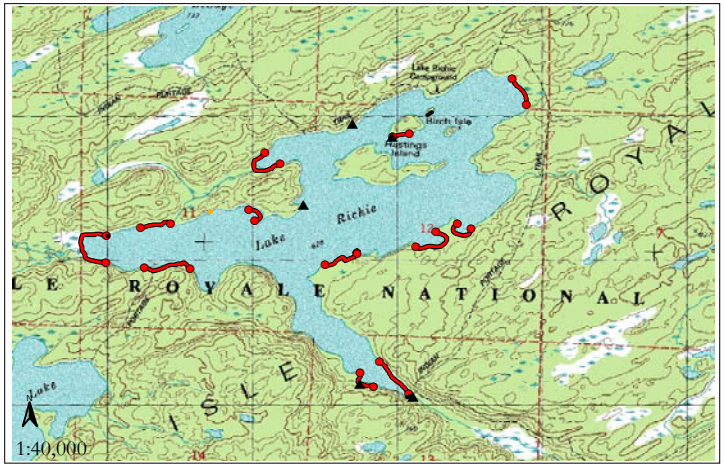
S2
6
PP2
PP1
25
S1
2
35
80 (10m linear bed)
PP3
80 (15m linear bed)
Mount Ojibway Trail PP1
Lake Ojibway
6

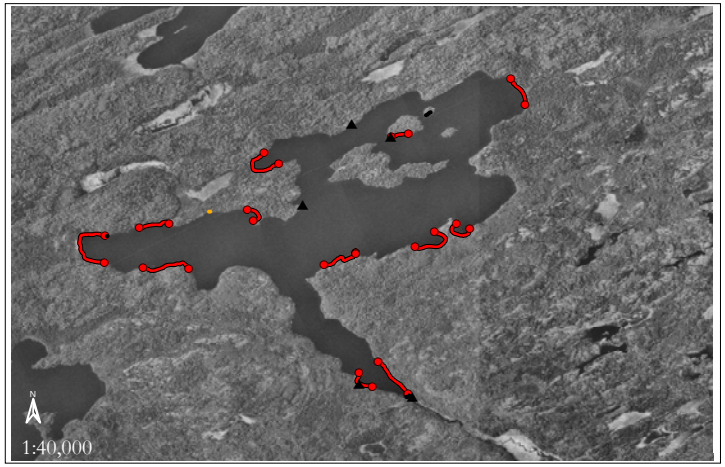
PP3 PP2
PP1
Daisy Farm Trail
Boardwalk Wetland Plots

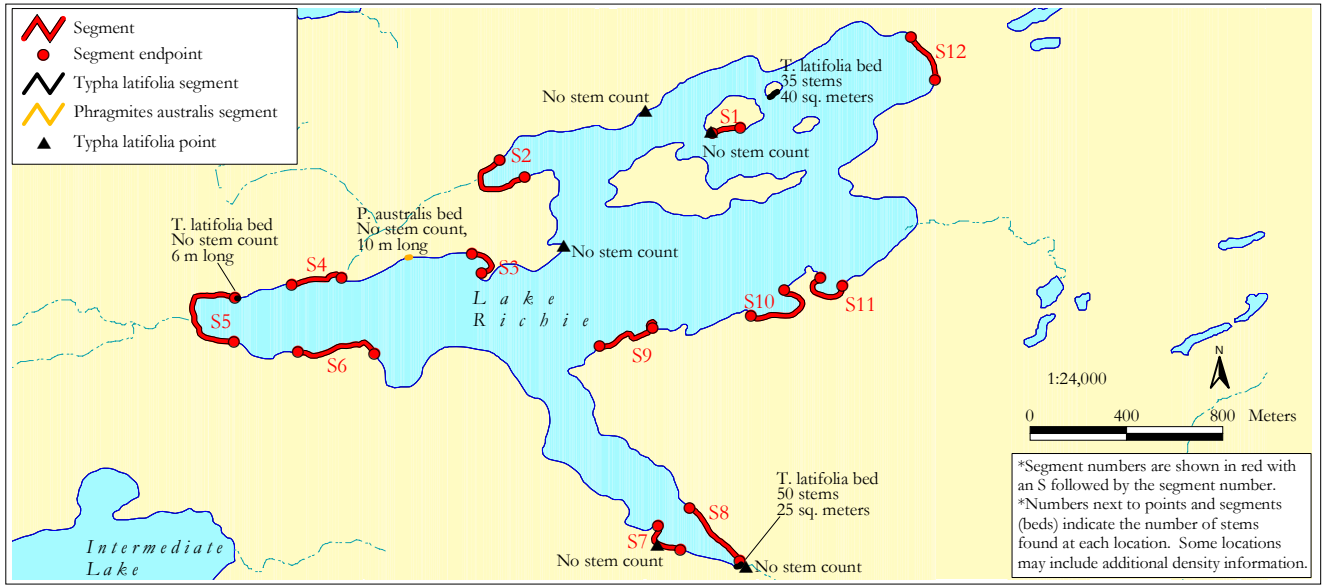
1:12,000
N
0 300 600 Meters

*Segment numbers are shown in red with an S followed by the segment number.
*Numbers next to points and segments (beds) indicate the number of stems found at each location. Some locations may include additional density information.

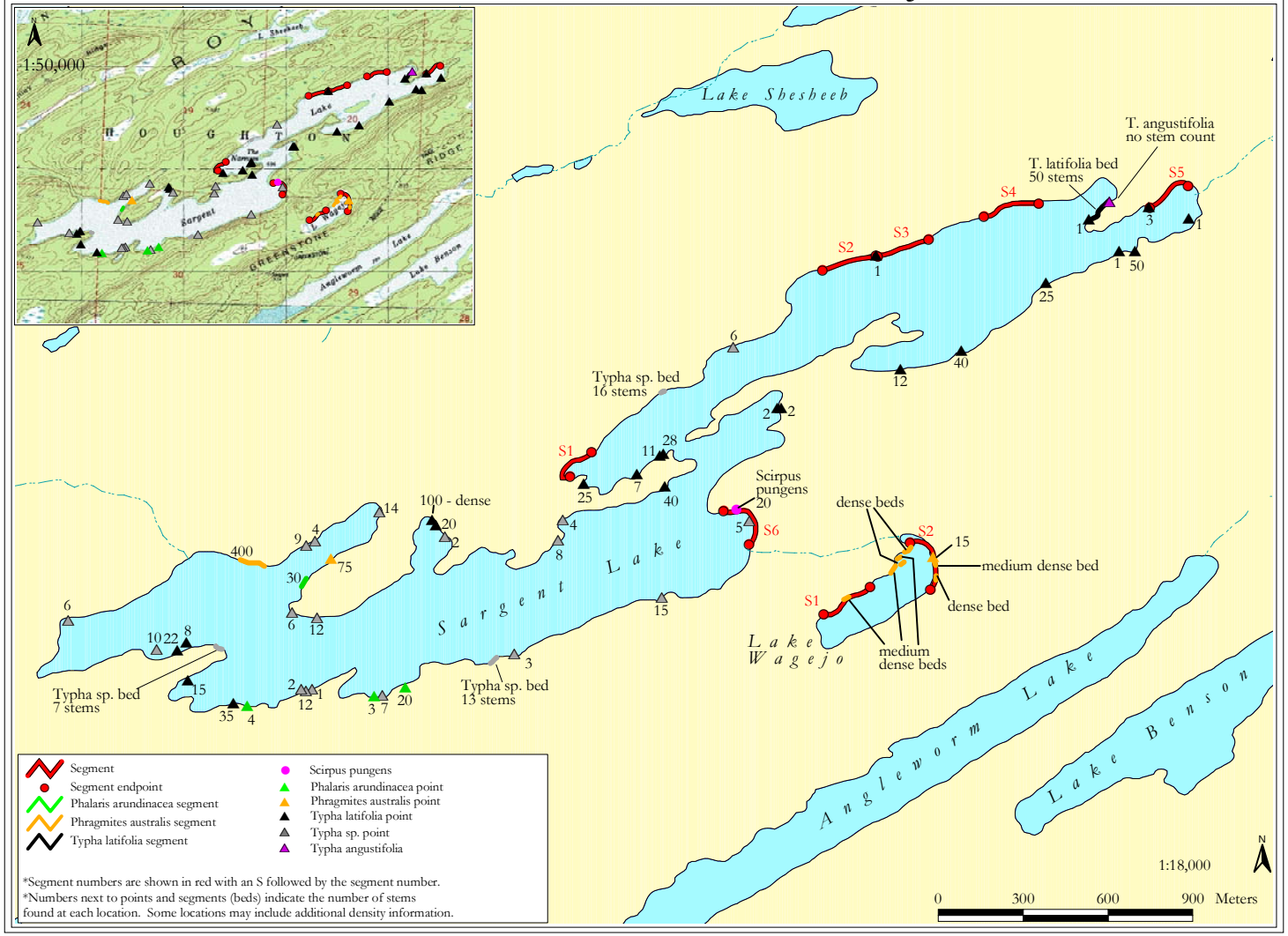
LAKE RICHIE 2003



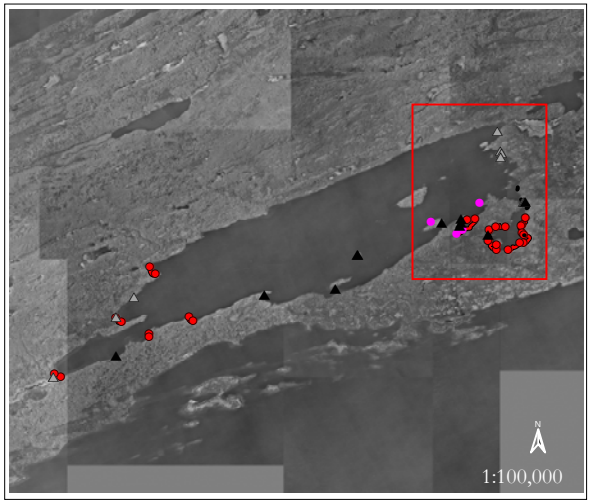


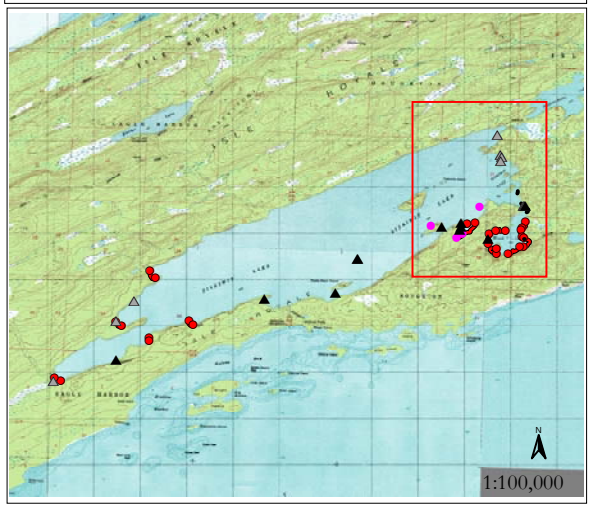


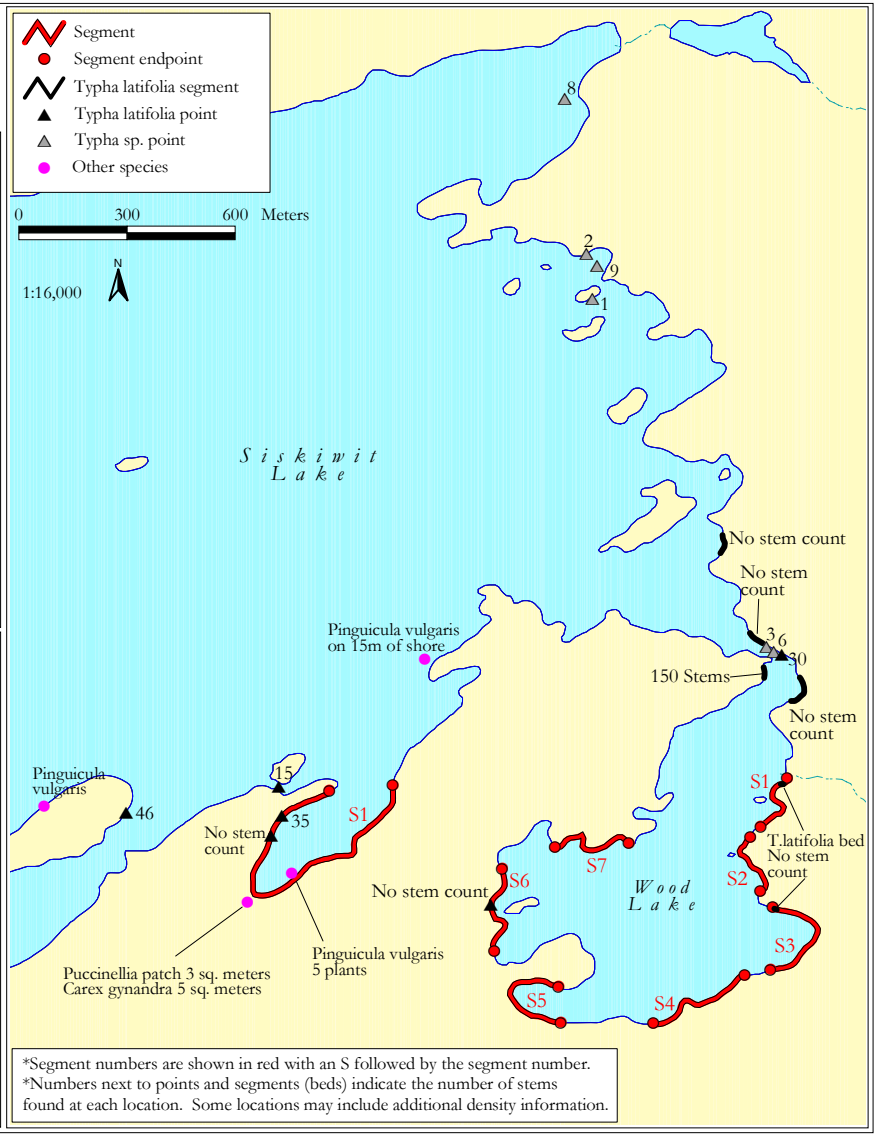
SARGENT LAKE AND LAKE WAGEJO 2004

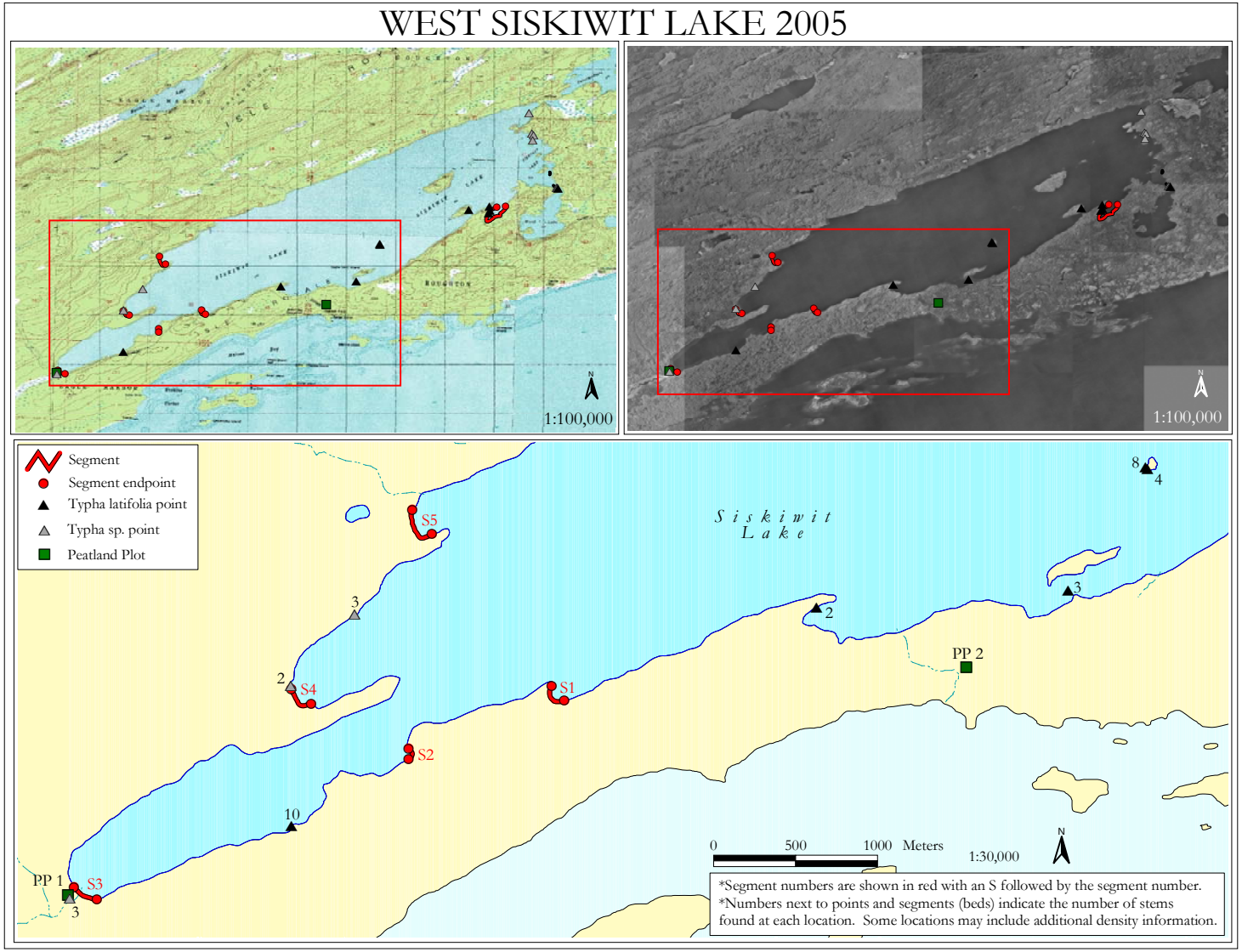


WOOD LAKE (2003) & EAST SISKIWIT LAKE (2005)

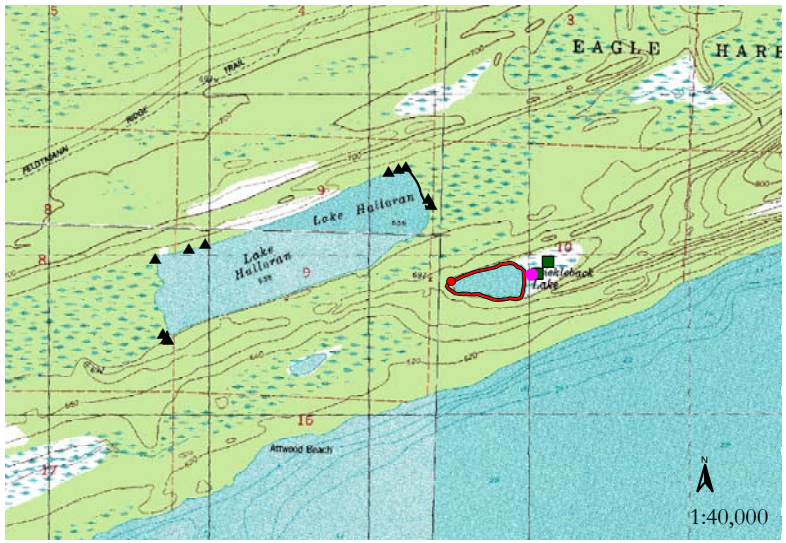


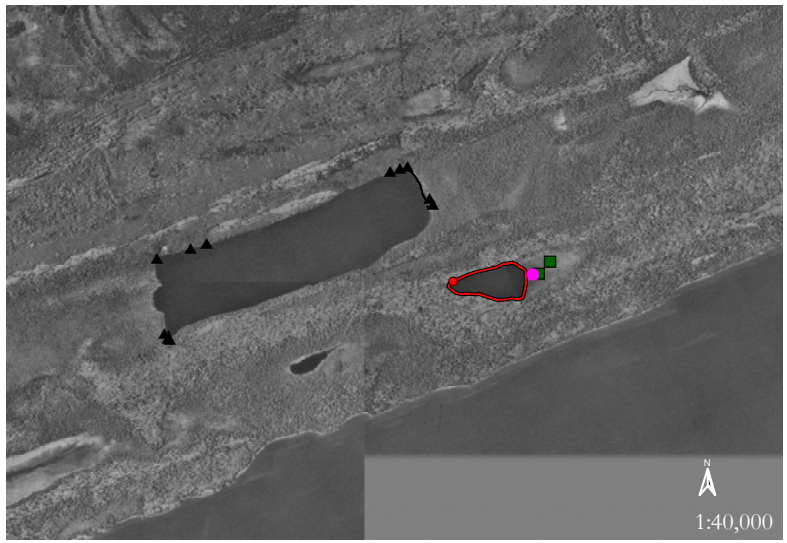


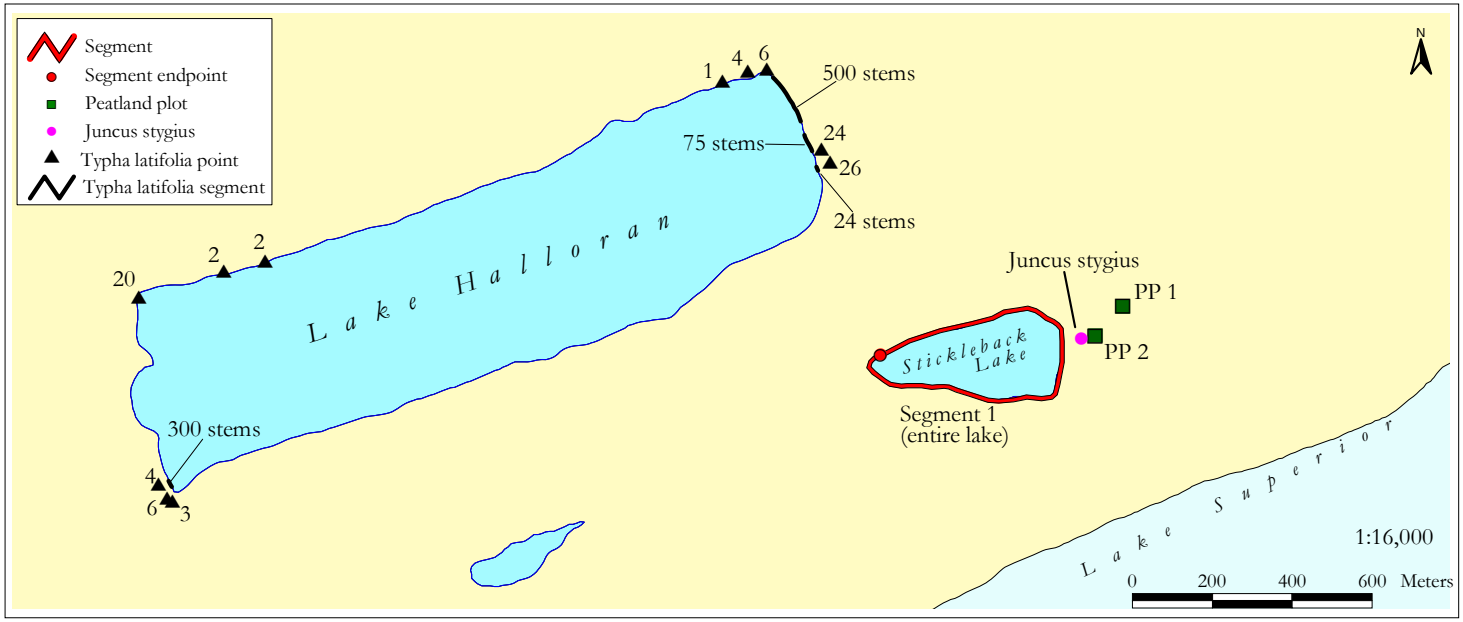



WEST SISKIWIT LAKE 2005
1:100,000
1:100,000
Segment
Segment endpoint
Typha latifolia point
Typha sp. point
Peatland Plot
Siskiwit Lake
S1
S2
S3
S4
S5
PP 1
PP 2
8
4
3
2
3
2
10
3
0
500
1000 Meters
1:30,000
*Segment numbers are shown in red with an S followed by the segment number.
*Numbers next to points and segments (beds) indicate the number of stems found at each location. Some locations may include additional density information.

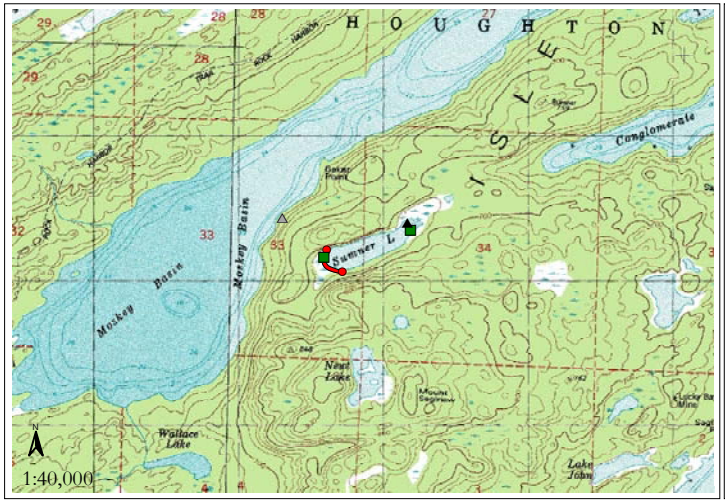
STICKLEBACK LAKE 2004 AND LAKE HALLORAN 2006

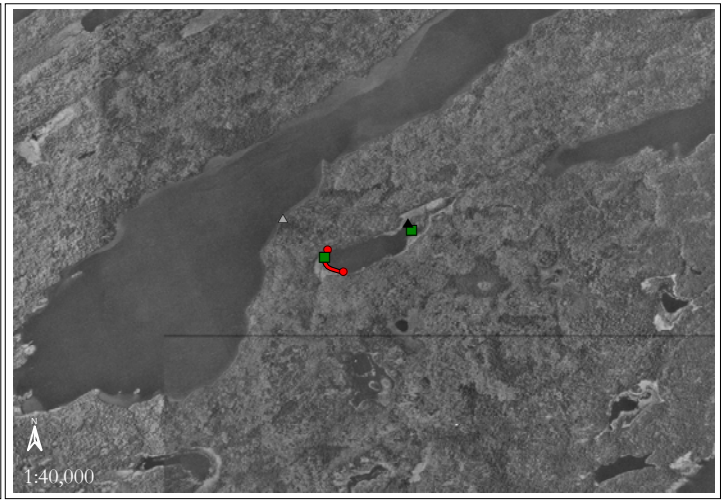


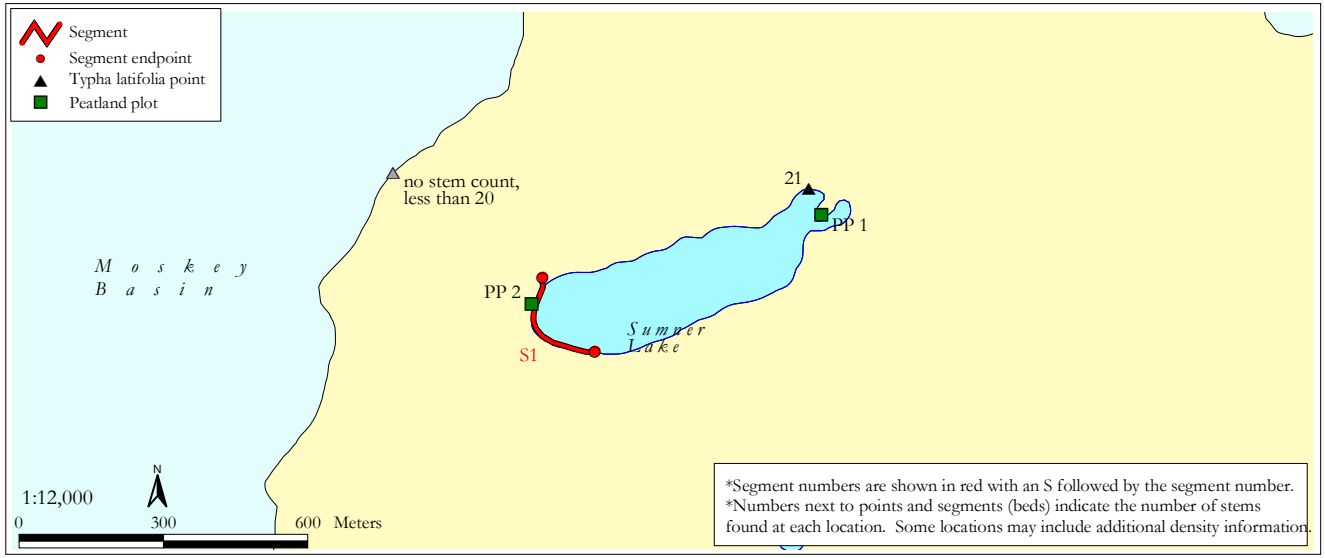




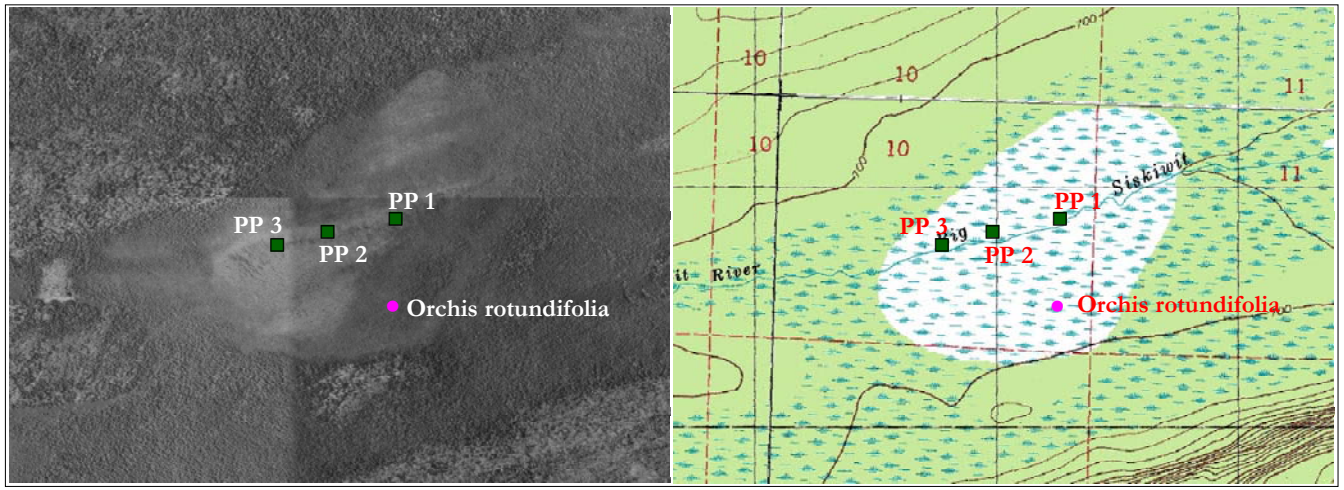
SUMNER LAKE 2004



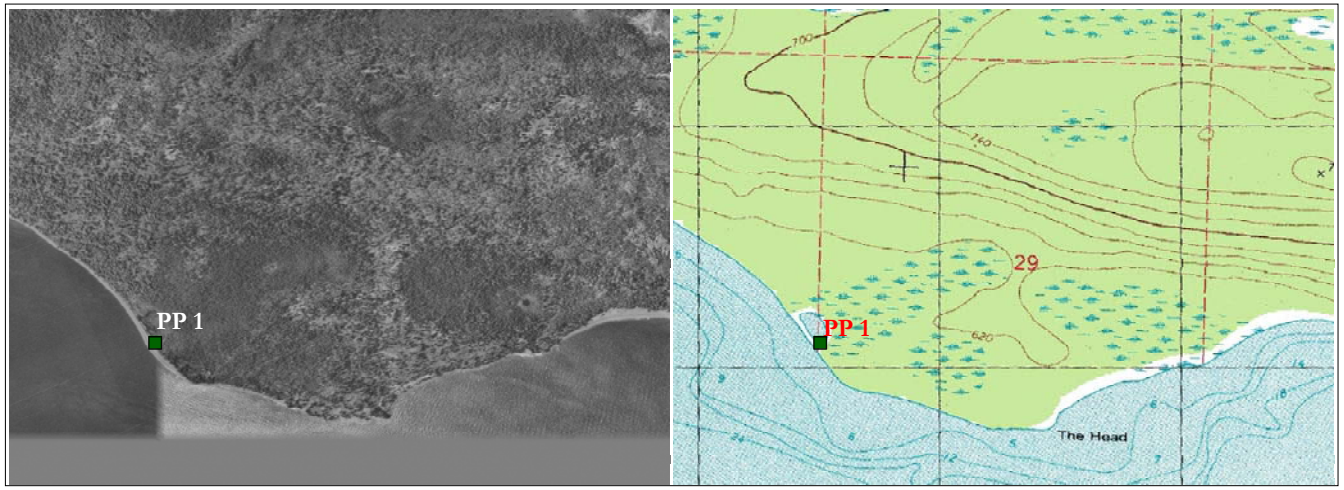




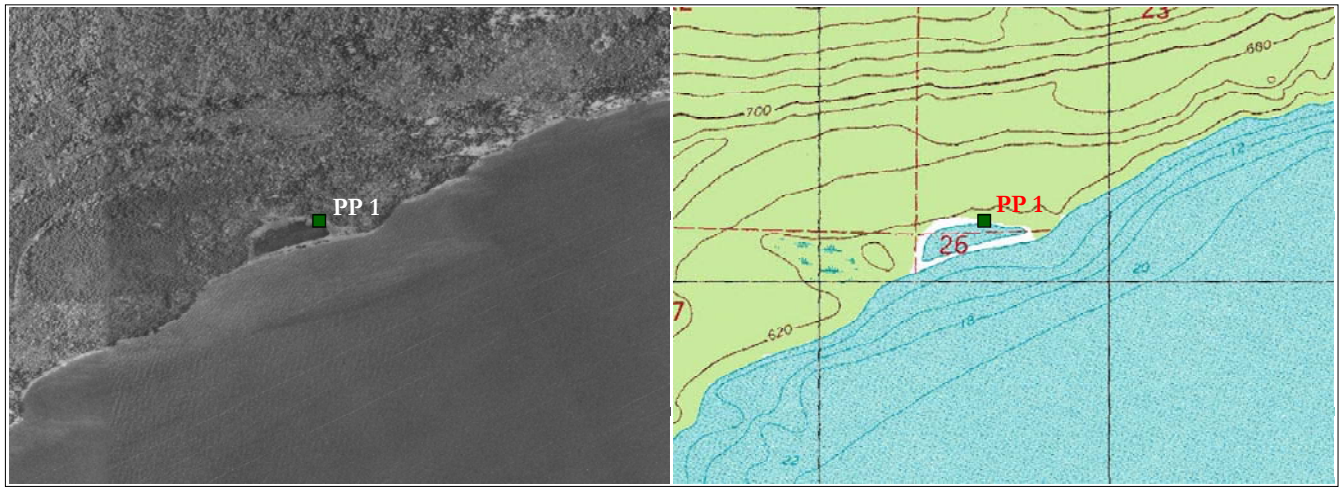
SISKIWIT FEN PEATLAND PLOTS 2004



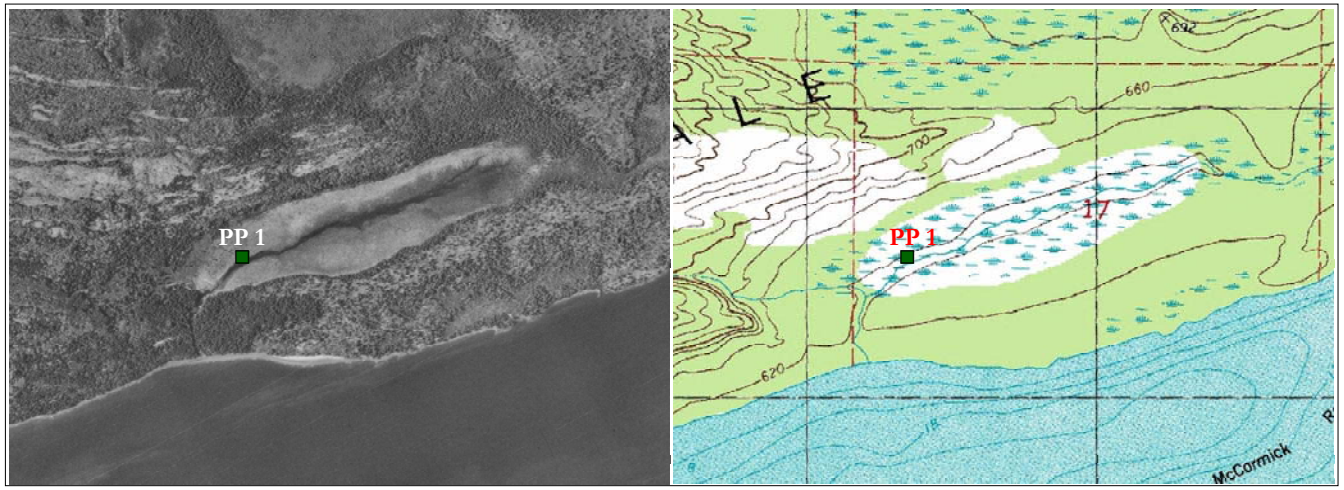
SUPERIOR SHORELINE FEN 1 PEATLAND PLOTS 2004



SUPERIOR SHORELINE FEN 2 PEATLAND PLOTS 2004



SUPERIOR SHORELINE FEN 3 PEATLAND PLOTS 2004

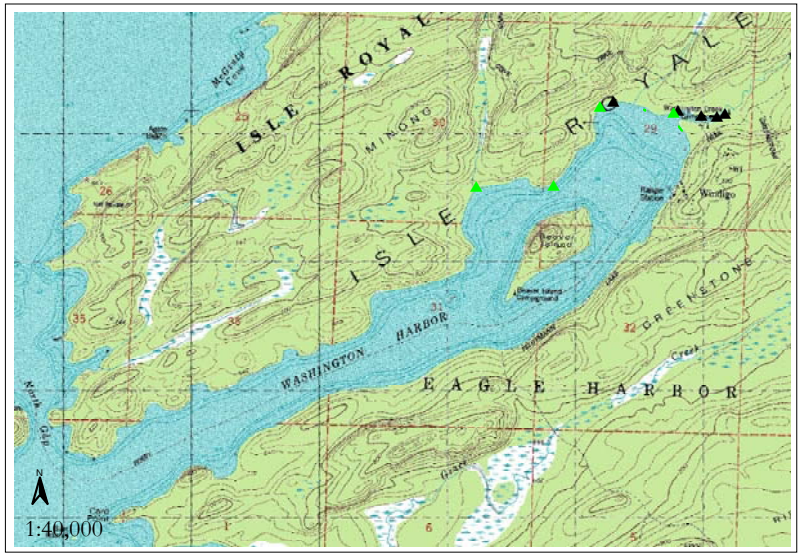


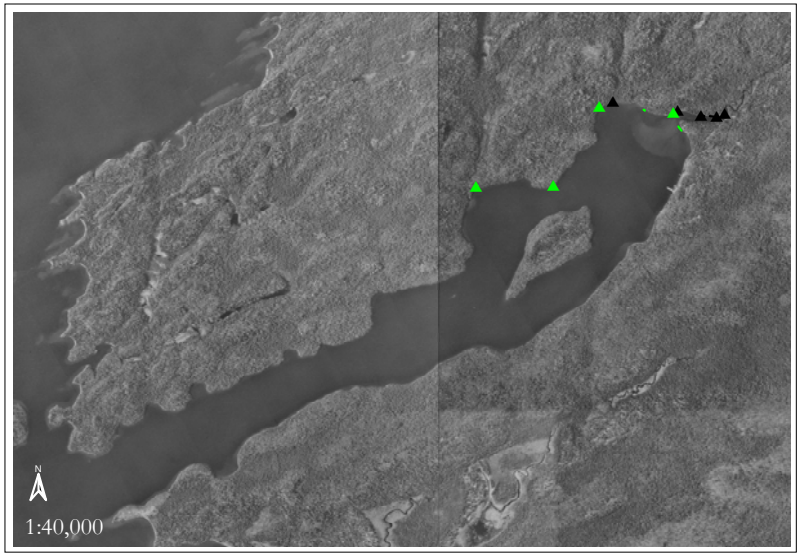
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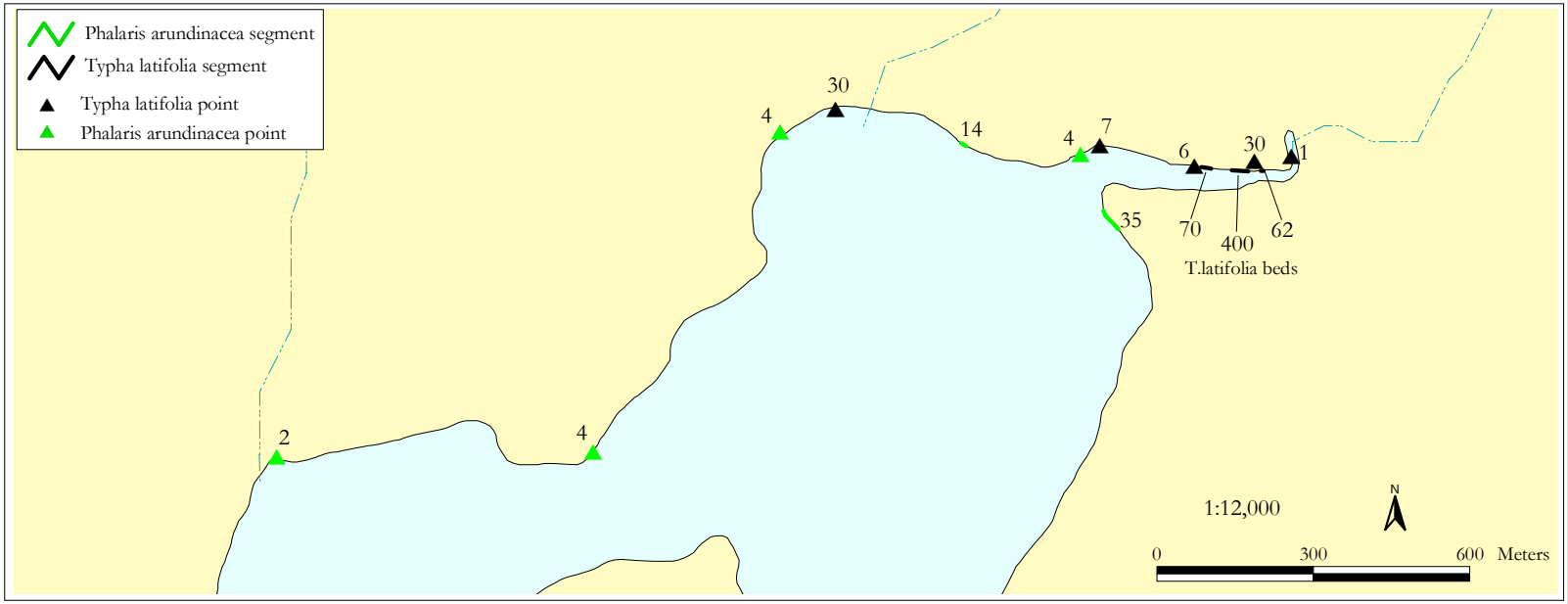
N

0 800 1600 2400 Feet

WASHINGTON HARBOR 2006







Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons.

	Genus	Species	Notation[1]	Author[2]
1	*Abies*	*balsamea*	ABIBAL	(L.) Miller.
2	*Acer*	*rubrum*	ACERUB	L.
3	*Acer*	*spicatum*	ACESPI	Lam.
4	*Achillea*	*millefolium*	ACHMIL	L.
5	*Agrostis*	*gigantea*	AGRGIG	Roth.
6	*Agrostis*	*hyemalis*	AGRHYE	(Walter) BSP.
7	*Alnus*	*incana*	ALNINC	(L.) Moench.
8	*Alnus*	*viridis*	ALNVIR	(Villars) Lam.
9	*Alisma*	*triviale*	ALITRI	Pursh.
10	*Amelanchier*	spp.	AMESPP	Medikus.
11	*Anaphalis*	*margaritacea*	ANAMAR	(L.) Benth. & Hook.
12	*Andromeda*	*glaucophylla*	ANDGLA	L.
13	*Anemone*	*canadensis*	ANECAN	L.
14	*Aralia*	*nudicaulis*	ARANUD	L.
15	*Arethusa*	*bulbosa*	AREBUL	L.
16	*Armoracia*	*lacustris*	ARMLAC	(A.Gray) Al-Shehbaz & V.Bates
17	*Aronia*	*melanocarpa*	AROMEL	(Michx) Elliot
18	*Aster*	*lanceolatus*	ASTLAN	Willd.
19	*Aster*	*macrophyllus*	ASTMAC	L.
20	*Aster*	*puniceus*	ASTPUN	L.
21	*Aster*	spp.	ASTSPP	L.
22	*Aster*	*umbellatus*	ASTUMB	Miller
23	*Asteraceae*	spp.	ASTESP	
24	*Athyrium*	*filix-femina*	ATHFIL	(L.) Roth.
25	*Beckmannia*	*syzigachne*	BECSYZ	(Steud.) Fern.
26	*Betula*	*papyrifera*	BETPAP	Marshall.
27	*Betula*	*pumila*	BETPUM	L.
28	*Bidens*	*beckii*	BIDBEC	Torr.
29	*Bidens*	*cernua*	BIDCER	L.
30	*Bidens*	*connata*	BIDCON	Muhl.
31	*Botrychium*	*multifidum*	BOTMUL	(S.G. Gmelin) Rupr.
32	*Brasenia*	*schreberi*	BRASCH	J. F. Gmelin.
33	*Calamagrostis*	*canadensis*	CALCAN	(Michx.) P. Beauv.
34	*Calamagrostis*	spp.	CLGSPP	Adans.
35	*Calla*	*palustris*	CALLAP	L.
36	*Callitriche*	*hermaphroditica*	CALHER	L.
37	*Callitriche*	*palustris*	CLTPAL	L.
38	*Callitriche*	spp.	CALSPP	L.
39	*Calopogon*	*tuberosus*	CALTUB	(L.) BSP.
40	*Caltha*	*palustris*	CALPAL	L.
41	*Campanula*	*aparinoides*	CAMAPA	Pursh.

Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons (continued).

	Genus	Species	Notation[1]	Author[2]
42	*Cardamine*	*pensylvanica*	CARPEN	Muhl.
43	*Carex*	*aquatilis*	CARAQU	Wahlenb.
44	*Carex*	*arctata*	CARARC	W. Boott.
45	*Carex*	*atratiformis*	CARATR	Britton.
46	*Carex*	*aurea*	CARAUR	Nutt.
47	*Carex*	*bebbii*	CARBEB	(L. H. Bailey) Fern.
48	*Carex*	*brunnescens*	CARBRU	(Pers.) Poiret.
49	*Carex*	*buxbaumii*	CARBUX	Wahlenb.
50	*Carex*	*canescens*	CARCAN	L.
51	*Carex*	*chordorrhiza*	CARCHO	L.
52	*Carex*	*crinita*	CARCRI	Lam.
53	*Carex*	*cryptolepis*	CARCRY	Mackenzie.
54	*Carex*	*diandra*	CARDIA	Schrank.
55	*Carex*	*disperma*	CARDIS	Dewey.
56	*Carex*	*echinata*	CARECH	Murray.
57	*Carex*	*exilis*	CAREXI	Dewey.
58	*Carex*	*flava*	CARFLA	L.
59	*Carex*	*gracillima*	CARGRA	Schwein.
60	*Carex*	*gynandra*	CARGYN	Schwein.
61	*Carex*	*hystericina*	CARHYS	Muhl.
62	*Carex*	*interior*	CARINT	L Bailey.
63	*Carex*	*intumescens*	CARINU	Rudge.
64	*Carex*	*lacustris*	CARLAC	Willd.
65	*Carex*	*lasiocarpa*	CARLAS	Ehrh.
66	*Carex*	*leptalea*	CARLEP	Wahlenb.
67	*Carex*	*limosa*	CARLIM	L.
68	*Carex*	*livida*	CARLIV	(Wahlenb.) Willd.
69	*Carex*	*michauxiana*	CARMIC	Boeckeler
70	*Carex*	*norvegica*	CARNOR	Retz.
71	*Carex*	*oligosperma*	CAROLI	Michx.
72	*Carex*	*pauciflora*	CARPAU	Lightf.
73	*Carex*	*paupercula*	CARPAP	Michx.
74	*Carex*	*retrorsa*	CARRET	Schweinitz.
75	*Carex*	*rostrata*	CARROS	Stokes.
76	*Carex*	spp.	CARSPP	L.
77	*Carex*	spp. (Ovales type)	CAROVA	L.
78	*Carex*	spp. (Stellulatae type)	CARSTE	L.
79	*Carex*	*stipata*	CARSTI	Muhl.
80	*Carex*	*stricta*	CARSTR	Lam.
81	*Carex*	*trisperma*	CARTRI	Dewey.
82	*Carex*	*utriculata*	CARUTR	F. Boott
83	*Carex*	*vesicaria*	CARVES	L.
84	*Carex*	*viridula*	CARVIR	Michx.
85	*Caryophyllaceae*	spp.	CAYSPP	

Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons (continued).

	Genus	Species	Notation[1]	Author[2]
86	*Castilleja*	*septentrionalis*	CASSEP	Lindl.
87	*Ceratophyllum*	*demersum*	CERDEM	L.
88	*Chamaedaphne*	*calyculata*	CHACAL	(L.) Moench.
89	*Chara*	spp.	CHASPP	
90	*Chelone*	*glabra*	CHEGLA	L.
91	*Chrysanthemum*	*leucanthemum*	CHRLEU	L.
92	*Cicuta*	*bulbifera*	CICBUL	L.
93	*Cinna*	*latifolia*	CINLAT	(Trevir.) Griseb.
94	*Cirsium*	*arvense*	CIRARV	(L.) Scop.
95	*Cirsium*	spp.	CIRSPP	Miller
96	*Cirsium*	*vulgare*	CIRVUL	(Savi) Tenore.
97	*Cladium*	*mariscoides*	CLASPP	(Muhl.) Torr.
98	*Clematis*	*virginiana*	CLEVIR	L.
99	*Clintonia*	*borealis*	CLIBOR	(Aiton) Raf.
100	*Comandra*	*umbellata*	COMUMB	(L.) Nutt.
101	*Coptis*	*trifolia*	COPTRI	(L.) Salisb.
102	*Corallorhiza*	*trifida*	CORTRI	Chatel.
103	*Cornus*	*canadensis*	CORCAN	L.
104	*Cornus*	*sericea*	CORSER	L.
105	*Cyperaceae*	spp.	CYPSPP	
106	*Cypripedium*	*acaule*	CYPACA	Aiton.
107	*Danthonia*	*spicata*	DANSPI	(L.) F. Beauv.
108	*Deschampsia*	*flexuosa*	DESFLE	(L.) Trin.
109	*Diervilla*	*lonicera*	DIELON	Miller.
110	*Drosera*	*anglica*	DROANG	Hudson.
111	*Drosera*	*intermedia*	DROINT	Hayne.
112	*Drosera*	*linearis*	DROLIN	Goldie.
113	*Drosera*	*rotundifolia*	DROROT	L.
114	*Dryopteris*	*carthusiana*	DRYCAR	(Villars) H.P. Fuchs.
115	*Dryopteris*	*cristata*	DRYCRI	(L.) A. Gray.
116	*Dryopteris*	*intermedia*	DRYINT	(Muhl.) A. Gray.
117	*Dryopteris*	spp.	DRYSPP	Adans., nom. conserv.
118	*Dulichium*	*arundinaceum*	DULARU	(L.) Britton.
119	*Elatine*	sp.	ELATSP	L.
120	*Eleocharis*	*acicularis*	ELEACI	(L.) Roemer & Schultes.
121	*Eleocharis*	*ovata*	ELEOVA	(Roth) Roemer & Schultes
122	*Eleocharis*	*palustris*	ELEPAL	L.
123	*Eleocharis*	*pauciflora*	ELEPAU	(Lightf.) Link.
124	*Eleocharis*	spp.	ELESPP	R. Br.
125	*Eleocharis*	*tenuis var. borealis*	ELETEN	(Svenson) Gleason
126	*Elodea*	*canadensis*	ELOCAN	Michx.
127	*Elymus*	*canadensis*	ELYCAN	L.
128	*Elymus*	*trachycaulus*	ELYTRA	(Link) Gould
129	*Epilobium*	*angustifolium*	EPIANG	L.
130	*Epilobium*	*ciliatum*	EPICIL	Raf.

Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons (continued).

	Genus	Species	Notation[1]	Author[2]
131	*Epilobium*	*leptophyllum*	EPILEP	Raf.
132	*Epilobium*	spp.	EPISPP	L.
133	*Epilobium*	spp. *(ciliatum or coloratum)*	EPISCC	Raf. or Biehler
134	*Equisetum*	*arvense*	EQUARV	L.
135	*Equisetum*	*fluviatile*	EQUFLU	L.
136	*Equisetum*	*palustre*	EQUPAL	L.
137	*Equisetum*	*scirpoides*	EQUSCI	Michx.
138	*Equisetum*	spp.	EQUSPP	L.
139	*Equisetum*	*sylvaticum*	EQUSYL	L.
140	*Eriocaulon*	*aquaticum*	ERIAQU	(Hill) Druce.
141	*Eriophorum*	*gracile*	ERIGRA	Koch.
142	*Eriophorum*	spp.	ERISPP	L.
143	*Eriophorum*	*tenellum*	ERITEN	Nutt.
144	*Eriophorum*	*vaginatum*	ERIVAG	L.
145	*Eriophorum*	*viridicarinatum*	ERIVIR	(Engelm.) Fernald.
146	*Eupatorium*	*maculatum*	EUPMAC	L.
147	*Euthamia*	*graminifolia*	EUTGRA	(L.) Nutt
148	*Fragaria*	*virginiana*	FRAVIR	Duchesne.
149	*Fraxinus*	*nigra*	FRANIG	Marshall.
150	*Galium*	*asperellum*	GALASP	Michx.
151	*Galium*	spp.	GALSPP	L.
152	*Galium*	spp. *(tinctorium/trifidum)*	GALSTT	L.
153	*Galium*	*tinctorium*	GALTIN	L.
154	*Galium*	*triflorum*	GALTRI	Michx.
155	*Gaultheria*	*hispidula*	GAUHIS	(L.) Muhl.
156	*Gentiana*	*rubricaulis*	GENRUB	Schwein.
157	*Geocaulon*	*lividum*	GEOLIV	(Richardson) Fern.
158	*Glyceria*	*borealis*	GLYBOR	(Nash) Batchelder.
159	*Glyceria*	*canadensis*	GLYCAN	(Michx.) Trin.
160	*Glyceria*	*grandis*	GLYGRA	S. Wats.
161	*Glyceria*	spp.	GLYSPP	R.Br., nom. conserv.
162	*Glyceria*	*striata*	GLYSTR	(Lam.) A. Hitchc.
163	*Gymnocarpium*	*dryopteris*	GYMDRY	(L.) Newman.
164	*Habenaria*	*clavellata*	HABCLA	(Michx.) Sprengel.
165	*Habenaria*	*dilatata*	HABDIL	(Pursh) Hook.
166	*Habenaria*	*hyperborea*	HABHYP	(L.) R. Br.
167	*Habenaria*	*psycodes*	HABPSY	(L.) Sprengel.
168	*Habenaria*	spp.	HABSPP	Willd.
169	*Habenaria*	*viridis*	HABVIR	(L.) R. Br.
170	*Halenia*	*deflexa*	HALDEF	(J. E. Smith) Griseb.
171	*Heracleum*	*lanatum*	HERLAN	Michx.
172	*Hieracium*	*aurantiacum*	HIEAUR	L.
173	*Hieracium*	*kalmii*	HIEKAL	L.
174	*Hieracium*	*pilosella*	HIEPIL	L.
175	*Hieracium*	spp.	HIESPP	L.

Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons (continued).

	Genus	Species	Notation[1]	Author[2]
176	*Hippurus*	*vulgaris*	HIPVUL	L.
177	*Hypericum*	*boreale*	HYPBOR	(Britton) E. Bickn.
178	*Hypericum*	*canadense*	HYPCAN	L.
179	*Hypericum*	*majus*	HYPMAJ	(A. Gray) Britton.
180	*Huperzia*	*selago*	HUPSEL	(L.) Bernhardi ex Schrank & Martius
181	*Hypericum*	*majus*	HYPMAJ	(A. Gray) Britton
182	*Hypericum*	spp.	HYPSPP	L.
183	*Impatiens*	*capensis*	IMPCAP	Meerb.
184	*Iris*	*versicolor*	IRIVER	L.
185	*Isoetes*	*echinospora*	ISOECH	Durieu.
186	*Isoetes*	*lacustris*	ISOLAC	L.
187	*Isoetes*	spp.	ISOSPP	L.
188	*Juncus*	*brevicaudatus*	JUNBRE	(Engelm.) Fern.
189	*Juncus*	*effusus*	JUNEFF	L.
190	*Juncus*	*nodosus*	JUNNOD	L.
191	*Juncus*	*pelocarpus*	JUNPEL	E. Meyer
192	*Juncus*	spp.	JUNSPP	
193	*Juncus*	*stygius var. americanus*	JUNSTY	Buchenau
194	*Juncus*	*tenuis*	JUNTEN	Willd.
195	*Juncus*	*tenuis var. dudleyi*	JUNDUD	(Wieg.) F. J. Herm.
196	*Juniperus*	*communis*	JUNCOM	L.
197	*Kalmia*	*polifolia*	KALPOL	Wangenh.
198	*Lactuca*	*biennis*	LACBIE	(Moench) Fern.
199	*Lactuca*	*canadensis*	LACCAN	L.
200	*Lactuca*	spp.	LATSPP	L.
201	*Lamiaceae*	spp.	LAMSPP	
202	*Larix*	*laricina*	LARLAR	(Duroi) K. Koch.
203	*Lathyrus*	*ochroleucus*	LATOCH	Hook.
204	*Ledum*	*groenlandicum*	LEDGRO	Oeder.
205	*Leersia*	*oryzoides*	LEEORY	(L.) Swartz.
206	*Lemna*	*trisulca*	LEMTRI	L.
207	*Liliaceae*	spp.	LILSPP	
208	*Lilium*	*philadelphicum*	LILPHI	L.
209	*Linnaea*	*borealis*	LINBOR	L.
210	*Liparis*	*loeselii*	LIPLOE	(L.) Rich.
211	*Lobelia*	*dortmanna*	LOBDOR	L.
212	*Lonicera*	*caerulea*	LONCAE	L.
213	*Lonicera*	*canadensis*	LONCAN	Marshall.
214	*Lonicera*	*dioica*	LONDIO	L.
215	*Lonicera*	spp.	LONSPP	L.
216	*Lycopodium*	*clavatum*	LYCCLA	L.
217	*Lycopodium*	*inundatum*	LYCINU	L.
218	*Lycopodium*	*lucidulum*	LYCLUC	Michx.
219	*Lycopodium*	*obscurum*	LYCOBS	L.
220	*Lycopus*	*americanus*	LYCAME	Muhl.

Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons (continued).

	Genus	Species	Notation[1]	Author[2]
221	*Lycopus*	*uniflorus*	LYCUNI	Michx.
222	*Lysimachia*	spp.	LYSSPP	L.
223	*Lysimachia*	*terrestris*	LYSTER	(L.) BSP.
224	*Lysimachia*	*thyrsiflora*	LYSTHY	L.
225	*Maianthemum*	*canadense*	MAICAN	Desf.
226	*Melampyrum*	*lineare*	MELLIN	Desr.
227	*Mentha*	*arvensis*	MENARV	L.
228	*Menyanthes*	*trifoliata*	MENTRI	L.
229	*Mitella*	*nuda*	MITNUD	L.
230	*Moneses*	*uniflora*	MONUNI	(L.) A. Gray.
231	*moss*	spp.	MOSSPP	
232	*moss*	spp. (aquatic)	MOSSAQ	
233	*Myrica*	*gale*	MYRGAL	L.
234	*Myriophyllum*	*alterniflorum*	MYRALT	DC.
235	*Myriophyllum*	*farwellii*	MYRFAR	Morong.
236	*Myriophyllum*	*heterophyllum*	MYRHET	Michx.
237	*Myriophyllum*	*sibiricum*	MYRSIB	Komarov.
238	*Myriophyllum*	spp.	MYRSPP	L.
239	*Myriophyllum*	*tenellum*	MYRTEN	Bigelow.
240	*Myriophyllum*	*verticillatum*	MYRVER	L.
241	*Najas*	*flexilis*	NAJFLE	(Willd.) Rostkov. & Schmidt.
242	*Nitella*	spp.	NITSPP	
243	*Nuphar*	*variegata*	NUPVAR	Durand.
244	*Nymphaea*	*odorata*	NYMODO	Aiton.
245	*Nymphaea*	*tetragona*	NYMTET	Georgi.
246	*Onoclea*	*sensibilis*	ONOSEN	L.
247	*Ophioglossum*	*vulgatum var. pseudopodum*	OPHVUL	(S. F. Blake) Farw.
248	*Orchidaceae*	spp.	ORCSPP	
249	*Orchis*	*rotundifolia*	ORCROT	Banks.
250	*Osmunda*	*regalis*	OSMREG	L.
251	*Parnassia*	*palustris*	PARPAL	L.
252	*Phalaris*	*arundinacea*	PHAARU	L.
253	*Phleum*	*pratense*	PHLPRA	L.
254	*Phragmites*	*australis*	PHRAUS	(Cav.) Trin.
255	*Physocarpus*	*opulifolius*	PHYOPU	(L.) Maxim.
256	*Picea*	*glauca*	PICGLA	(Moench) Voss.
257	*Picea*	*mariana*	PICMAR	(Miller) BSP.
258	*Picea*	spp.	PICSPP	A. Dietr.
259	*Pinguicula*	*vulgaris*	PINVUL	L.
260	*Poa*	*alpina*	POAALP	L.
261	*Poa*	*palustris*	POAPAL	L.
262	*Poa*	spp.	POASPP	L.
263	*Poaceae*	spp.	POACSP	
264	*Pogonia*	*ophioglossoides*	POGOPH	(L.) Ker Gawler.
265	*Polygala*	*paucifolia*	POLPAU	Willd.

Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons (continued).

	Genus	Species	Notation[1]	Author[2]
266	*Polygonum*	*amphibium*	POLAMP	L.
267	*Polygonum*	*sagittatum*	POLSAG	L.
268	*Polygonum*	spp.	POLSPP	L.
269	*Populus*	*tremuloides*	POPTRE	Michx.
270	*Potamogeton*	*alpinus*	POTALP	Balbis.
271	*Potamogeton*	*amplifolius*	POTAMP	Tuckerman.
272	*Potamogeton*	*epihydrus*	POTEPI	Raf.
273	*Potamogeton*	*filiformis*	POTFIL	Pers.
274	*Potamogeton*	*foliosus*	POTFOL	Raf.
275	*Potamogeton*	*gramineus*	POTGRA	L.
276	*Potamogeton*	*natans*	POTNAT	L.
277	*Potamogeton*	*obtusifolius*	POTOBT	Mert. & Koch.
278	*Potamogeton*	*praelongus*	POTPRA	Wulfen.
279	*Potamogeton*	*pusillus*	POTPUS	L.
280	*Potamogeton*	*richardsonii*	POTRIC	(Ar. Bennett) Rydb.
281	*Potamogeton*	*robbinsii*	POTROB	Oakes.
282	*Potamogeton*	*spirillus*	POTSPI	Tuckerman.
283	*Potamogeton*	spp.	POTSPP	L.
284	*Potamogeton*	*zosteriformis*	POTZOS	Fern.
285	*Potentilla*	*anserina*	POTANS	L.
286	*Potentilla*	*fruticosa*	POTFRU	L.
287	*Potentilla*	*norvegica*	POTNOR	L.
288	*Potentilla*	*palustris*	POTPAL	(L.) Scop.
289	*Potentilla*	spp.	PTNSPP	L.
290	*Prenanthes*	*alba*	PREALB	L.
291	*Prenanthes*	spp.	PRESPP	L.
292	*Prunus*	*virginiana*	PRUVIR	L.
293	*Pteridium*	*aquilinum*	PTEAQU	(L.) Kuhn.
294	*Pyrola*	*elliptica*	PYRELL	Nutt.
295	*Pyrola*	*secunda*	PYRSEC	L.
296	*Pyrola*	spp.	PYRSPP	L.
297	*Ranunculus*	*abortivus*	RANARB	L.
298	*Ranunculus*	*flammula*	RANFLA	L.
299	*Ranunculus*	*hispidus*	RANHIS	Michx.
300	*Ranunculus*	*longirostris*	RANLON	Godron.
301	*Ranunculus*	*macounii*	RANMAC	Britton.
302	*Ranunculus*	*pennsylvanicus*	RANPEN	L.f.
303	*Ranunculus*	spp.	RANSPP	L.
304	*Rhamnus*	*alnifolia*	RHAALN	L'Her.
305	*Rhynchospora*	*alba*	RHYALB	(L.) Vahl.
306	*Rhynchospora*	*fusca*	RHYFUS	(L.) Aiton f.
307	*Ribes*	*triste*	RIBTRI	Pallas.
308	*Riccia*	*fluitans*	RICFLU	L.
309	*Rubus*	*idaeus*	RUBIDA	L.
310	*Rubus*	*pubescens*	RUBPUB	Raf.

Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons (continued).

	Genus	Species	Notation[1]	Author[2]
311	*Rubus*	spp.	RUBSPP	L.
312	*Rubus*	spp. (dewberry)	RUBDEW	L.
313	*Rumex*	*crispus*	RUMCRI	L.
314	*Rumex*	spp.	RUMSPP	L.
315	*Sagittaria*	*cuneata/ graminea rosette*	SAGROS	Sheldon/ Michx.
316	*Sagittaria*	*graminea*	SAGGRA	Michx.
317	*Sagittaria*	*latifolia*	SAGLAT	Willd.
318	*Sagittaria*	*rigida*	SAGRIG	Pursh.
319	*Sagittaria*	spp.	SAGSPP	L.
320	*Salix*	*discolor*	SALDIS	Muhl.
321	*Salix*	*pedicellaris*	SALPED	Pursh.
322	*Salix*	*petiolaris*	SALPET	J. E. Smith
323	*Salix*	spp.	SALSPP	L.
324	*Sambucus*	*racemosa*	SAMRAC	L.
325	*Sarracenia*	*purpurea*	SARPUR	L.
326	*Scheuchzeria*	*palustris*	SCHPAL	L.
327	*Scirpus*	*acutus*	SCIACU	Muhl.
328	*Scirpus*	*atrovirens*	SCIATR	Willd.
329	*Scirpus*	*cespitosus*	SCICES	L.
330	*Scirpus*	*cyperinus*	SCICYP	(L.) Kunth.
331	*Scirpus*	*hudsonianus*	SCIHUD	(Michx.) Fern.
332	*Scirpus*	*microcarpus*	SCIMIC	C. Presl.
333	*Scirpus*	*pungens*	SCIPUN	Vahl.
334	*Scirpus*	spp.	SCISPP	L.
335	*Scirpus*	*subterminalis*	SCISUB	Torr.
336	*Scirpus*	*validus*	SCIVAL	Vahl.
337	*Scutellaria*	*galericulata*	SCUGAL	Pursh.
338	*Scutellaria*	*lateriflora*	SCULAT	L.
339	*Sium*	*suave*	SIUSUA	Walter.
340	*Smilacina*	*trifolia*	SMITRI	(L.) Desf.
341	*Solidago*	*canadensis*	SOLCAN	L.
342	*Solidago*	spp. (red stem)	SOLRED	L.
343	*Solidago*	spp. (umbel)	SOLUMB	
344	*Solidago*	*uliginosa*	SOLULI	Nutt.
345	*Sonchus*	spp.	SONSPP	L.
346	*Sorbus*	*decora*	SORDEC	(Sarg.) C.K. Schneider.
347	*Sparganium*	*americanum*	SPAAME	Nutt.
348	*Sparganium*	*angustifolium*	SPAANG	Michx.
349	*Sparganium*	*chlorocarpum*	SPACHL	Rydb.
350	*Sparganium*	*emersum*	SPAEME	Rehmann.
351	*Sparganium*	*eurycarpum*	SPAEUR	Engelm.
352	*Sparganium*	*fluctuans*	SPAFLU	(Morong) Robinson.
353	*Sparganium*	spp.	SPASPP	L.
354	*Sparganium*	spp. (2 ranked)	SPASP2	L.
355	*Sparganium*	spp. (floating leaves)	SPASPF	L.

Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons (continued).

	Genus	Species	Notation[1]	Author[2]
356	*Sparganium*	spp. (rosette)	SPASPR	L.
357	*Sparganium*	*minimum*	SPAMIN	(Hartman) Fries.
358	*Sphagnum*	*spp.*	SPHSPP	L.
359	*Spiraea*	*alba*	SPIALB	Duroi.
360	*Spiranthes*	*cernua*	SPICER	(L.) Rich.
361	*Spiranthes*	spp.	SPISPP	Rich.
362	*Streptopus*	*amplexifolius*	STRAMP	(L.) DC.
363	*Streptopus*	*roseus*	STRROS	Michx.
364	*Subularia*	*aquatica*	SUBAQU	L.
365	*Symplocarpus*	*foetidus*	SYMFOE	(L.) Nutt.
366	*Taraxacum*	*officinale*	TAROFF	Weber ex Wiggers.
367	*Taxus*	*canadensis*	TAXCAN	Marshall.
368	*Thalictrum*	*dasycarpum*	THADAS	Fischer & Ave-Lall.
369	*Thalictrum*	spp.	THASPP	L.
370	*Thelypteris*	*palustris*	THEPAL	Scholt.
371	*Thelypteris*	*phegopteris*	THEPHE	(L.) Slosson.
372	*Thuja*	*occidentalis*	THUOCC	L.
373	*Tofieldia*	*glutinosa*	TOFGLU	(Michx.) Pers.
374	*Triadenum*	*fraseri*	TRIFRA	(Spach) Gleason.
375	*Trientalis*	*borealis*	TRIBOR	Raf.
376	*Trifolium*	*pratense*	TRIPRA	L.
377	*Triglochin*	*maritimum*	TRIMAR	L.
378	*Trillium*	*cernuum*	TRICER	L.
379	*Trisetum*	*spicatum*	TRISPI	(L.) K. Richter.
380	*Typha*	*angustifolia*	TYPANG	L.
381	*Typha*	*latifolia*	TYPLAT	L.
382	*Typha*	spp.	TYPSPP	L.
383	*unknown*	spp. (herbaceous)	UNKHER	
384	*Utricularia*	*cornuta*	UTRCOR	Michx.
385	*Utricularia*	*gibba*	UTRGIB	L.
386	*Utricularia*	*intermedia*	UTRINT	Hayne.
387	*Utricularia*	*minor*	UTRMIN	L.
388	*Utricularia*	*vulgaris*	UTRVUL	L.
389	*Vaccinium*	*angustifolium*	VACANG	Aiton.
390	*Vaccinium*	*macrocarpon*	VACMAC	Aiton.
391	*Vaccinium*	*myrtilloides*	VACMYR	Michx.
392	*Vaccinium*	*oxycoccos*	VACOXY	L.
393	*Vaccinium*	spp.	VACSPP	L.
394	*Vaccinium*	spp. (cranberry)	VACCRA	L.
395	*Vallisneria*	*americana*	VALAME	L.
396	*Viburnum*	*edule*	VIBEDU	(Michx.) Raf.
397	*Viburnum*	*opulus*	VIBOPU	L.
398	*Viola*	*blanda*	VIOBLA	Willd.
399	*Viola*	*macloskeyi*	VIOMAC	F. Lloyd
400	*Viola*	spp.	VIOSPP	L.

Appendix C. Summary list of taxa encountered in all the types of wetland sampling throughout the 2003-2005 field seasons (continued).

	Genus	Species	Notation[1]	Author[2]
401	*Xyris*	*montana*	XYRMON	H. Ries.
402	*Zosterella*	*dubia*	ZOSDUB	(Jacg.) Small

[1] Abbreviations used in ordination analyses files.

[2] The primary authority for this list is Gleason and Cronquist's *Manual of Vascular Plants of Northeastern United States and Adjacent Canada* (1991), except for non-vascular taxa that are referenced in Crow and Hellquist's *Aquatic and Wetland Plants of North Eastern North America* (2000).

Appendix D. Isle Royale peatland sampling locations, 2003-2005.

Coordinates are the centers of 10 m x 10 m peatland plots in UTM Zone 16, NAD 83.

Location	Plot Number	Town Range Section	Easting	Northing	*Abbrev.
Ahmik Lake	1	T66N R33W S06	385333.000	5334000.000	AHLK1
Ahmik Lake	2	T66N R33W S06	385179.000	5333706.000	AHLK2
Ahmik Lake	3	T66N R33W S06	385158.000	5333678.000	AHLK3
Angleworm Lake	1	T66N R34W S21/28	378481.000	5327884.000	ANLK1
Beaver Wetland	1	T63N R37W S03	351970.000	5305351.000	BEWT1
Beaver Wetland	2	T63N R37W S03	351989.000	5305249.000	BEWT2
Benson Lake	1	T66N R34W S28	379018.000	5327655.000	BELK1
Benson Lake	2	T66N R34W S28	379360.000	5327853.000	BELK2
Checker Point SE	1	T63N R37W S02	353236.000	5305764.000	CPTSE1
Daisy Farm Trail Boardwalk	1	T66N R34W S21	379495.574	5328468.654	DABD1
Daisy Farm Trail Boardwalk	2	T66N R34W S21	379516.660	5328491.017	DABD2
Daisy Farm Trail Boardwalk	3	T66N R34W S21	379458.817	5328470.257	DABD3
Eva Pond	1	T66N R34W S17	377854.000	5331008.000	EVPD1
Eva Pond	2	T66N R34W S17	377805.000	5330888.000	EVPD2
Forbes Lake	1	T66N R34W S28	379353.000	5327460.000	FOLK1
Forbes Lake	2	T66N R34W S28	379300.000	5327432.000	FOLK2
Forbes Lake	3	T66N R34W S28	378702.000	5326991.000	FOLK3
Grace Creek	1	T63N R38W S06	336489.000	5306047.000	GRCK
Huginnin Cove Trail	1	T64N R38W S20	338628.000	5311450.000	HUCO1
Huginnin Cove Trail	2	T64N R38W S21	339482.000	5311097.000	HUCO2
Lane Cove Trail	1	T66N R34W S1	383506.193	5333204.023	LACO1
Lane Cove Trail	2	T66N R34W S1	383388.194	5333154.028	LACO2
Lane Cove Trail	3	T66N R34W S1	383366.183	5332789.046	LACO3
Lane Cove Trail	4	T66N R34W S1	383559.169	5332507.057	LACO4
Lane Cove Trail	5	T66N R34W S12	383623.165	5332441.059	LACO5
Lane Cove Trail	6	T66N R34W S12	383607.162	5332343.064	LACO6
Lane Cove Trail	7	T66N R34W S12	383577.157	5332141.075	LACO7
Lane Cove Trail	8	T66N R34W S12	384827.110	5331653.073	LACO8
Lane Cove Trail	9	T66N R33W S7	385491.090	5331552.065	LACO9
Lane Cove Trail	10	T66N R33W S7	385673.081	5331405.069	LACO10
Lily Lake	1	T64N R38W S26	343690.979	5308724.032	LILK1
Lily Lake	2	T64N R38W S26	343605.868	5308649.105	LILK2
Lily Lake	3	T64N R38W S26	343613.315	5308540.774	LILK3
McCargoe Cove	1	T66N R35W S35	372796.000	5326380.000	MCCO1
McCargoe Cove	2	T66N R35W S35	372962.000	5326432.000	MCCO2
McCargoe Cove	3	T66N R35W S35	373433.000	5326435.000	MCCO3
Minong Ridge	1	T64N R37W S05	348398.000	5314827.000	MITR1
Minong Ridge	2	T64N R37W S07	346863.000	5314051.000	MITR2
Minong Ridge	3	T64N R37W S07	346885.000	5314028.000	MITR3
Minong Ridge	4	T64N R37W S07	346047.000	5313769.000	MITR4
Minong Ridge	5	T64N R38W S14	343968.000	5313001.000	MITR5

Appendix D. Isle Royale peatland sampling locations, 2003- 2005 (continued).

Location	Plot Number	Town Range Section	Easting	Northing	*Abbrev.
Minong Ridge	6	T64N R38W S14	344050.000	5312992.000	MITR6
Minong Ridge	7	T64N R38W S12	344377.000	5313277.000	MITR7
Minong Ridge	8	T64N R38W S11	343701.000	5313358.000	MITR8
Mount Ojibway Trail	1	T66N R34W S22	380830.000	5328768.000	MOJT1
Mud Lake	1	T64N R36W S09	358851.000	5314044.000	MULK1
Mud Lake	2	T64N R36W S08	358522.000	5314138.000	MULK2
Ojibway Lake	1	T66N R34W S22	380699.718	5329184.086	OJLK1
Ojibway Lake	2	T66N R34W S22	380746.315	5329196.872	OJLK2
Ojibway Lake	3	T66N R34W S22	380340.000	5328898.000	OJLK3
Patterson Lake	1	T66N R34W S01	384696.000	5333234.000	PALK1
Patterson Lake	2	T66N R34W S01	384199.000	5333130.000	PALK2
Siskiwit Fen	1	T63N R38W S10	342265.608	5304066.923	SIFN1
Siskiwit Fen	2	T63N R38W S10	341983.505	5304012.847	SIFN2
Siskiwit Fen	3	T63N R38W S10	341774.098	5303956.793	SIFN3
Siskiwit Lake	1	T64N R36W S04	360128.054	5315033.921	SILK1
Siskiwit Lake	2	T65N R35W S31	365610.328	5316422.916	SILK2
Stickleback Lake	1	T63N R37W S10	351128.000	5304154.000	STLK1
Stickleback Lake	2	T63N R37W S10	351058.000	5304079.000	STLK2
Sumner Lake	1	T66N R34W S34	380193.000	5325550.000	SULK1
Sumner Lake	2	T66N R34W S33	379591.000	5325364.000	SULK2
Superior Shoreline Fen	1	T63N R38W S29/30	337504.385	5299302.043	SUFN1
Superior Shoreline Fen	2	T63N R38W S23	342571.428	5300413.095	SUFN2
Superior Shoreline Fen	3	T63N R37W S17	347346.651	5302685.394	SUFN3

* Site abbreviations used in ordination figures.

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005.

Coordinates are UTM Zone 16, NAD 83. * bed=patch ≥5 m, point=vegetation patch <5 m. **All *Typha* sp. found were sterile plants and are assumed to be *Typha latifolia*.

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
Ahmik Lake	*Typha latifolia*	150	6 m wide bed	bed	385752	5334271	385790	5334262	37.98
Ahmik Lake	*Typha latifolia*	10		point	385272	5333720			
Ahmik Lake	*Typha* sp.**	8	In peat plot 1	point	385333.452	5334001.504			
Ahmik Lake	*Typha* sp.	10	On sedge mat	point	385401	5334042			
Angleworm Lake	*Phragmites australis*		Dense *Phragmites* bed	bed	375829	5326193	375857	5326210	31.58
Angleworm Lake	*Phragmites australis*		Dense bed, in water to 5 m shore, 50-75%	bed	376375	5326528	376392	5326537	18.51
Angleworm Lake	*Typha latifolia*	2		point	376896	5326847			
Beaver Lake	*Typha latifolia*	22		point	369110.421	5326748.851			
Beaver Lake	*Typha latifolia*	2		point	369595.27	5326898.545			
Beaver Lake	*Typha latifolia*	4		point	369096.152	5326935.776			
Beaver Lake	*Typha latifolia*	12		point	369217.232	5326782.4			
Beaver Lake	*Typha latifolia*	12		point	369361.134	5326725.442			
Benson Lake	*Phragmites australis*		Medium dense *Phragmites* bed	bed	378857	5327488	378875	5327506	25.09
Benson Lake	*Phragmites australis*		Medium dense *Phragmites* bed	bed	378888	5327520	378999	5327640	165.5
Benson Lake	*Typha latifolia*	30	On sedge mat	point	377907	5327007			
Benson Lake	*Typha latifolia*	12	On sedge mat	point	377908	5327020			
Benson Lake	*Typha latifolia*	25	On sedge mat	point	377914	5327028			
Benson Lake	*Typha latifolia*	20	On sedge mat	point	378989	5327718			
Benson Lake	*Typha latifolia*	50	On an old beaver dam	point	379097	5327743			
Benson Lake	*Typha* sp.	2		point	379078	5327747			
Chickenbone Lake	*Phalaris arundinacea*	12	2 clumps, 6 stems each	point	372352.802	5325340.339			

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
Chickenbone Lake	*Phragmites australis*	100	Scattered *Phragmites*	bed	373532.645	5326202.191	373496.343	5326186.606	37.61
Chippewa Harbor	*Phalaris arundinacea*		no stem count, trace in aquatic segment 4	point	376015.868	5320622.406			
Chippewa Harbor	*Typha latifolia*		no stem count, trace found in segment	point	376299.526	5320275.407			
Chippewa Harbor	*Typha latifolia*		no stem count, trace found in segment 2	point	376200.386	5320355.494			
Desor Lake	*Phragmites australis*	1500	Sparse but continuous patch	bed	350348.68	5314701.09	350395.62	5314783.08	100.14
Desor Lake	*Typha latifolia*	1000	Greater than 1000 stems, no gaps some fr	bed	352090.73	5316318.21	352086.75	5316281.69	38.11
Desor Lake	*Typha latifolia*	27		bed	353146.37	5316092.45	353180.19	5316089.94	34.13
Desor Lake	*Typha latifolia*	10	Over 10 m length	bed	349784.31	5315811.5	349805.1	5315805.29	21.85
Desor Lake	*Typha latifolia*	4		point	349704	5315792			
Desor Lake	*Typha latifolia*	6		point	349715.975	5315796.78			
Desor Lake	*Typha latifolia*	7		point	349927.082	5315821.282			
Desor Lake	*Typha latifolia*	1		point	349929	5315801			
Desor Lake	*Typha latifolia*	25		point	350192	5315909			
Desor Lake	*Typha latifolia*	6		point	352098.647	5316329.056			
Desor Lake	*Typha latifolia*	10		point	351972	5316189			
Desor Lake	*Typha latifolia*	9		point	352487	5315949			
Desor Lake	*Typha latifolia*	9	Specimen collected	point	353432	5316137			
Desor Lake	*Typha* sp.	2	narrow leaves, could be *T. x glauca*	point	349660	5315774			
Desor Lake	*Typha* sp.	2		point	351007	5314947			
Desor Lake	*Typha* sp.	12	very narrow leaves	point	350994	5315008			
Desor Lake	*Typha* sp.	3	narrow leaves	point	349957	5315347			
Desor Lake	*Typha* sp.	8	narrow leaves	point	351469	5315042			
Desor Lake	*Typha* sp.	4	narrow leaves	point	351564	5315019			
Desor Lake	*Typha* sp.	3		point	351612	5315008			
Desor Lake	*Typha* sp.	5		point	351723	5315023			

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
Desor Lake	*Typha* sp.	13		point	351818	5315064			
Desor Lake	*Typha* sp.	2		point	351484	5315060			
Desor Lake	*Typha* sp.	9	narrow leaves	point	353681	5315999			
Desor Lake	*Typha* sp.	1	very narrow leaves	point	353428	5315986			
Desor Lake	*Typha* sp.	1	narrow leaves	point	353604	5316006			
Desor Lake	*Typha* sp.	3		point	353568	5316212			
Desor Lake	*Typha* sp.	1		point	353126	5316084			
Desor Lake	*Typha* sp.	3		point	353108	5316054			
Desor Lake	*Typha* sp.	6		point	353111	5315995			
Duncan Bay	*Phragmites australis*		No stem or density information available	bed	387985	5335221	388071	5335247	98.48
Duncan Bay	*Phragmites australis*		No stem or density information available	bed	387892	5335166	387910	5335187	27.02
Duncan Bay	*Typha latifolia*	45		point	386367	5334086			
Duncan Bay	*Typha latifolia*	6	Along shore and in water	point	386309	5334046			
Duncan Bay	*Typha latifolia*	8	Along shore and in water	point	386288	5334014			
Duncan Bay	*Typha* sp.	4		point	386391	5333616			
Duncan Bay	*Typha* sp.	3	Growing in shallow water	point	386315	5333632			
Duncan Bay	*Typha* sp.	15		point	386681	5334043			
Duncan Bay	*Typha* sp.	2		point	386398	5333614			
Duncan Bay	*Typha* sp.	6		point	389218	5336238			
Dustin Lake	*Typha latifolia*		no stem count, found along shoreline	point	373189.969	5318159.225			
Eva Lake	*Typha latifolia*	5		point	377693	5331059			
Eva Lake	*Typha* sp.	3	no waypoint, Segment 6	point	378078.816	5331501.733			
Eva Pond	*Typha latifolia*	12		point	377838	5330894			
Eva Pond	*Typha latifolia*	50		point	377825	5331008			
Eva Pond	*Typha latifolia*	30		point	377840	5330998			
Eva Pond	*Typha latifolia*	40		point	377828	5330902			
Eva Pond	*Typha latifolia*	35		point	377814	5330902			
Five Finger Bay	*Typha* sp.	3	In 0.5 m of water	point	386943	5334899			

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
Forbes Lake	*Typha latifolia*	16		point	379366	5327213			
Harvey Lake	*Typha latifolia*	12		point	366083.284	5323377.089			
Harvey Lake	*Typha latifolia*	15		point	365939.44	5323457.745			
Harvey Lake	*Typha latifolia*	250		point	365999.45	5323538.932			
Hatchet Lake	*Phragmites australis*		clone 7 x 3 m, also near *Nymphaea tetragona*	bed	363081.567	5321051.61	363072.609	5321046.491	10.35
Hatchet Lake	*Phragmites australis*		Bed on west end of lake	bed	361375.846	5320232.728	361381.022	5320260.398	27.1
Hatchet Lake	*Phragmites australis*		Bed on NE end of lake	bed	362957.341	5321016.224	363053.998	5321037.286	98.45
Hatchet Lake	*Typha latifolia*	8		point	361736.626	5320285.18			
Hatchet Lake	*Typha* sp.	7		point	363090.566	5320922.81			
Intermediate Lake	*Phragmites australis*		no stem count, patch of *Phragmites*	point	370879.219	5321307.158			
Intermediate Lake	*Phragmites australis*		no stem count, patch of *Phragmites*	point	370837.699	5321297.093			
Intermediate Lake	*Typha latifolia*		*T. latifolia*, 20-30 meters long, half of bay	bed	370344.548	5320700.55	370337.67	5320727.198	29.12
Intermediate Lake	*Typha latifolia*	25	*T.latifolia* on opposite side of bay	point	371696	5321011			
Intermediate Lake	*Typha latifolia*	50	across bay from AGH_439	point	371616.682	5321069.341			
Intermediate Lake	*Typha latifolia*		no stem count, trace in segment 5 data	point	371577.708	5321614.97			
Lane Cove	*Typha latifolia*	110	10 m long	bed	384118	5333474	384119	5333460	16.01
Lane Cove	*Typha latifolia*	42		point	384153	5333516			
Lane Cove	*Typha latifolia*	10		point	384567	5334101			
Lane Cove	*Typha* sp.	7		point	384588	5333950			
Lane Cove	*Typha* sp.	12		point	384147	5333530			
Lane Cove	*Typha* sp.	3		point	383553	5333430			
Lane Cove	*Typha* sp.	15	Widely scattered	point	383524	5333421			
Lane Cove	*Typha* sp.	1		point	383619	5333462			
Lane Cove	*Typha* sp.	3	Found in Segment 2	point	384588	5333950			
LeSage Lake	*Phragmites australis*		Patch of *Phragmites*, to 1 m depth	bed	372912.896	5323941.568	372950.912	5323961.765	45.23

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
LeSage Lake	*Phragmites australis*		no stem count, patch of *Phragmites*	point	373005.775	5324032.636			
LeSage Lake	*Typha latifolia*		Strip of *Typha latifolia*	bed	372393.497	5324143.446	372456.499	5324168.241	69.54
LeSage Lake	*Typha latifolia*		Strip of *Typha latifolia*, 20 to 30 meters long	bed	372334.967	5324106.458	372356.916	5324122.31	27.08
LeSage Lake	*Typha latifolia*	10	2 small patches with less than 10 stems	point	372554.514	5324220.079			
LeSage Lake	*Typha latifolia*		no stem count, some *T. latifolia* at head of bay	point	372981.815	5324075.201			
Linklater Lake	*Typha latifolia*	200	Several 100's of stem in 20 clumps	bed	377182.221	5329884.987	377289.592	5329817.678	355
Linklater Lake	*Typha latifolia*	23	10m section	bed	377449.23	5329886.02	377444.86	5329876.21	10.61
Linklater Lake	*Typha* sp.		Scattered 10-20%, no stem count	bed	378328.939	5330461.629	378420	5330422	128.3
Linklater Lake	*Typha* sp.	2		point	378199.245	5330391.599			
Linklater Lake	*Typha* sp.	10	On a free-floating mat	point	378169.229	5330378.9			
Linklater Lake	*Typha* sp.	8		point	378017.858	5330292.873			
Linklater Lake	*Typha* sp.	2		point	377330.618	5329952.827			
Linklater Lake	*Typha* sp.	2		point	378193.962	5330389.129			
Livermore Lake	*Typha latifolia*	40		point	372970.769	5325104.776			
Livermore Lake	*Typha latifolia*	8		point	372693.757	5324727.178			
Livermore Lake	*Typha latifolia*	25		point	372139.65	5324523.445			
Livermore Lake	*Typha latifolia*	12		point	372098.009	5324643.162			
Livermore Lake	*Typha latifolia*	35		point	372057.399	5324585.749			
Livermore Lake	*Typha latifolia*	40		point	372481.869	5324677.267			
McCargoe Cove	*Phragmites australis*		Thick patch with some nearby *Typha*	bed	375235.34	5330030.5	374603.53	5330048.5	706.68
McCargoe Cove	*Phragmites australis*		Thick patch with some nearby *Typha*	bed	374429.36	5330069.53	374368.56	5329965	155.51
McCargoe Cove	*Typha x glauca*		Specimen #1, some *Typha x glauca*	bed	374977.64	5329856.82	374986.73	5329860.18	9.75

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
McCargoe Cove	*Typha x glauca*		Specimen #2, some *Typha x glauca*	bed	374973.61	5329854.8	375019.38	5329736.32	212.84
McCargoe Cove	*Typha latifolia*	6	No fruit	bed	372755.07	5327150.13	372763.09	5327154.93	9.35
McCargoe Cove	*Typha latifolia*	15	Rocky Shoreline	point	373124	5327638			
McCargoe Cove	*Typha latifolia*	4	Rocky Shoreline	point	373957	5328797			
McCargoe Cove	*Typha latifolia*	9	Rocky Shoreline	point	374492	5329765			
McCargoe Cove	*Typha latifolia*	8		point	374061	5329494			
McCargoe Cove	*Typha latifolia*	30	Specimen collected #3	point	372973	5328201			
McCargoe Cove	*Typha latifolia*	11		point	372952	5328154			
McCargoe Cove	*Typha latifolia*	15	no fruit	point	372940	5327353			
McCargoe Cove	*Typha latifolia*	5	no fruit	point	372950	5327332			
McCargoe Cove	*Typha latifolia*	2	no fruit	point	372658	5327163			
McCargoe Cove	*Typha latifolia*	10	no fruit	point	372658	5327140			
McCargoe Cove	*Typha latifolia*	1	no fruit	point	372752	5327146			
McCargoe Cove	*Typha latifolia*	6		point	372783	5327166			
McCargoe Cove	*Typha latifolia*		Located in Phrag Bed	point	374954.767	5330135.527			
McCargoe Cove	*Typha x glauca*	6	Narrow Leaves, possible *Typha x glauca*	point	374326	5329431			
McCargoe Cove	*Typha* sp.	8	Rocky Shoreline, no fruit	point	374479	5329612			
McCargoe Cove	*Typha x glauca*	15	Very Tall, Possibly *Typha x glauca*	point	375036	5329896			
McDonald Lake	*Typha latifolia*	75		bed	370928.249	5327667.029	370950.456	5327666.519	23.02
McDonald Lake	*Typha latifolia*	150		bed	370684.923	5327550.023	370663.694	5327542.402	23.47
McDonald Lake	*Typha latifolia*	10		point	370632.687	5327529.624			
McDonald Lake	*Typha latifolia*	6		point	371367.217	5327799.979			
McDonald Lake	*Typha latifolia*	12		point	371231.575	5327630.418			
Minong Ridge	*Typha* sp.		within Minong Wetland Plot 3, no stem count	point	346883.842	5314028.648			
Minong Ridge	*Typha* sp.		near Minong Wetland Plot 5, no stem count	point	343966.699	5313001.334			

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
Moose Lake	*Typha latifolia*		no stem count; few widely scattered	point	387564.641	5333299.52			
Moskey Basin	*Phalaris arundinacea*		no stem count, by stream channel, beaver infl.	point	377310.592	5324801.023			
Moskey Basin	*Typha latifolia*		no stem count, trace amounts in segment 1	point	377488.839	5324817.32			
Moskey Basin	*Typha* sp.		no stem count, less than 20	point	379303.918	5325636.243			
Ojibway Lake	*Typha latifolia*	80	10 m long	bed	380400.258	5328946.516	380394.454	5328955.572	10.57
Ojibway Lake	*Typha latifolia*	80	15 m long bed	bed	380366.026	5328922.578	380362.337	5328937.401	15.18
Ojibway Lake	*Typha latifolia*	2	On shore, near tree line	point	380319	5328977			
Ojibway Lake	*Typha latifolia*	6		point	379846	5328636			
Ojibway Lake	*Typha latifolia*	25	On peat mat	point	380508	5329081			
Ojibway Lake	*Typha latifolia*	35		point	380397	5328964			
Ojibway Lake	*Typha* sp.	6	Several scattered throughout	point	380737.502	5329199.935			
Otter Lake	*Typha latifolia*	40	Along 15 m of shore	bed	370027.61	5326664.32	370029.05	5326648.61	16.45
Otter Lake	*Typha latifolia*	30	Along 12 m of shore	bed	369825.796	5326688.076	369817.555	5326696.612	12.02
Otter Lake	*Typha latifolia*	3		point	369732.492	5326644			
Patterson Lake	*Typha latifolia*	25		point	384906	5333534			
Patterson Lake	*Typha latifolia*	100	Further up inlet	point	383987	5333145			
Patterson Lake	*Typha latifolia*	30	Scattered on bog mat, toward Lk Ahmik	point	384947	5333538			
Patterson Lake	*Typha* sp.	50	On sedge mat in 3 clumps	bed	384885	5333524	384899	5333529	13.62
Pickerel Cove	*Typha* sp.	20	In segment 5	point	379312.161	5332421.279			
Pickerel Cove	*Typha* sp.	2		point	377344	5331544			
Richie Lake	*Phragmites australis*		no stem count, 10 meter patch of *Phragmites*	bed	372708.24	5322538.802	372719.689	5322540.149	11.53
Richie Lake	*Typha latifolia*	35	Patch of *Typha latifolia*, 40 sq meters	bed	374210.819	5323206.221	374244.513	5323227.922	40.93
Richie Lake	*Typha latifolia*	50	Patch of *Typha latifolia* about 25 sq meters	bed	374073.85	5321256.088	374093.69	5321266.308	25.15

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
Richie Lake	*Typha latifolia*		no stem count, 6 meter patch of *Typha latifolia*	bed	372000.701	5322370.148	372006.828	5322370.403	6.15
Richie Lake	*Typha latifolia*		no stem count	point	373967.661	5323058.018			
Richie Lake	*Typha latifolia*		no stem count, found along stream	point	374114.5	5321255.935			
Richie Lake	*Typha latifolia*		no stem count	point	373355.174	5322586.805			
Richie Lake	*Typha latifolia*		no stem count, trace found in segment 7 data	point	373745.353	5321343.789			
Richie Lake	*Typha latifolia*		no stem count	point	373694.229	5323146.428			
Sargent Lake	*Phalaris arundinacea*	30		bed	375381.751	5327798.52	375402.34	5327828.456	33.92
Sargent Lake	*Phalaris arundinacea*	20	2 clumps totalling 20 culms	point	375749.145	5327441.677			
Sargent Lake	*Phalaris arundinacea*	3		point	375639.28	5327409.798			
Sargent Lake	*Phalaris arundinacea*	4	4 clumps	point	375191.255	5327377.856			
Sargent Lake	*Phragmites australis*	400		bed	375254.607	5327868.494	375164.702	5327892.177	92.11
Sargent Lake	*Phragmites australis*	75		point	375487.298	5327896.344			
Sargent Lake	*Typha angustifolia*		no stem count	point	378236.378	5329159.207			
Sargent Lake	*Typha latifolia*	50	Scattered, possible *T. angustifolia*, collected	bed	378235.509	5329161.532	378178.981	5329099.226	88.65
Sargent Lake	*Typha latifolia*	12		point	377498.679	5328567.889			
Sargent Lake	*Typha latifolia*	25		point	378011.718	5328872.29			
Sargent Lake	*Typha latifolia*	1		point	378272.013	5328984.597			
Sargent Lake	*Typha latifolia*	50		point	378328.719	5328981.23			
Sargent Lake	*Typha latifolia*	3		point	378376.637	5329139.707			
Sargent Lake	*Typha latifolia*	1		point	378517.313	5329097.102			
Sargent Lake	*Typha latifolia*	1		point	378164.166	5329095.329			
Sargent Lake	*Typha latifolia*	1		point	377413.1	5328968.641			
Sargent Lake	*Typha latifolia*	2		point	377077.242	5328428.967			
Sargent Lake	*Typha latifolia*	40		point	377713.2	5328631.073			
Sargent Lake	*Typha latifolia*	35	In three patches	point	375143.308	5327385.294			
Sargent Lake	*Typha latifolia*	2		point	377064.646	5328428.212			

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
Sargent Lake	*Typha latifolia*	8		point	374976.097	5327601.19			
Sargent Lake	*Typha latifolia*	22		point	374944.478	5327570.992			
Sargent Lake	*Typha latifolia*	100	dense clone	point	375844.197	5328031.927			
Sargent Lake	*Typha latifolia*	20		point	375858.124	5328013.023			
Sargent Lake	*Typha latifolia*	40		point	376665.713	5328151.484			
Sargent Lake	*Typha latifolia*	25		point	376379	5328162			
Sargent Lake	*Typha latifolia*	7		point	376569	5328196			
Sargent Lake	*Typha latifolia*	28		point	376661	5328269			
Sargent Lake	*Typha latifolia*	11		point	376650	5328261			
Sargent Lake	*Typha latifolia*	15		point	374981.355	5327468.093			
Sargent Lake	*Typha* sp.	16	16 stems scattered over 14 m	bed	376659.761	5328487.388			14
Sargent Lake	*Typha* sp.	13	13 stems scattered over 35 m	bed	376062.056	5327537.002			31.67
Sargent Lake	*Typha* sp.	7	7 stems scattered over 35 m	bed	375092.425	5327582.666			26.2
Sargent Lake	*Typha* sp.	5	sterile	point	376964.64	5328031.594			
Sargent Lake	*Typha* sp.	15	sterile	point	376655.296	5327759.738			
Sargent Lake	*Typha* sp.	3		point	376135.533	5327560.581			
Sargent Lake	*Typha* sp.	7		point	375669.52	5327413.113			
Sargent Lake	*Typha* sp.	1		point	375420.67	5327436.802			
Sargent Lake	*Typha* sp.	12		point	375398.942	5327428.877			
Sargent Lake	*Typha* sp.	2		point	375382.102	5327434.975			
Sargent Lake	*Typha* sp.	10		point	374872.059	5327576.04			
Sargent Lake	*Typha* sp.	6		point	374558.285	5327680.613			
Sargent Lake	*Typha* sp.	9		point	375400.582	5327944.345			
Sargent Lake	*Typha* sp.	4		point	375430.923	5327957.908			
Sargent Lake	*Typha* sp.	14		point	375657.759	5328062.318			
Sargent Lake	*Typha* sp.	6		point	375349.938	5327707.854			
Sargent Lake	*Typha* sp.	12		point	375439.043	5327690.566			
Sargent Lake	*Typha* sp.	2		point	375889.855	5327974.365			

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
Siskiwit Lake	*Typha* sp.	2	no fruit	point	361487	5316312			
Siskiwit Lake	*Typha* sp.	8	no fruit	point	369739	5320322			
Siskiwit Lake	*Typha* sp.	2	no fruit	point	369799	5319892			
Siskiwit Lake	*Typha* sp.	9	no fruit	point	369829	5319861			
Siskiwit Lake	*Typha* sp.	1	no fruit	point	369815	5319769			
Siskiwit Lake	*Typha* sp.	3	no fruit	point	370298	5318804			
Siskiwit Lake	*Typha* sp.	6	no fruit	point	370318	5318791			
Siskiwit Lake	*Typha latifolia*	30	specimen, fruit present	point	370340	5318784			
Sargent Lake	*Typha* sp.	8		point	376288.721	5327963.606			
Sargent Lake	*Typha* sp.	4		point	376305.656	5328033.673			
Sargent Lake	*Typha* sp.	6		point	376908.136	5328644.1			
Scholts Lake	*Typha latifolia*		no stem count, trace in wet meadow data	point	373803.273	5318617.87			
Shesheeb Lake	*Typha latifolia*	50		bed	377189.91	5329686.125	377266.074	5329691.912	74.63
Siskiwit Lake	*Typha latifolia*			bed	370175.71	5319115.16	370170.28	5319064.94	54.9
Siskiwit Lake	*Typha latifolia*			bed	370251.81	5318845	370287.41	5318816.2	46.55
Siskiwit Lake	*Typha* sp.	3	narrow leaves, no fruit	point	361876	5316748			
Siskiwit Lake	*Typha latifolia*	35	no fruit	point	368956	5318336			
Siskiwit Lake	*Typha latifolia*	15	inflor from last year, no fruit	point	368948	5318419			
Siskiwit Lake	*Typha* sp.	3	near peat plot trail	point	360138	5315012.991			
Siskiwit Lake	*Typha latifolia*	2	no fruit	point	364697	5316790			
Siskiwit Lake	*Typha latifolia*	10	no fruit	point	361489	5315457			
Siskiwit Lake	*Typha latifolia*	8	1 with fruit	point	366705	5317647			
Siskiwit Lake	*Typha latifolia*	4	no fruit	point	366719	5317638			
Siskiwit Lake	*Typha latifolia*	3	no fruit	point	366232	5316896			
Siskiwit Lake	*Typha latifolia*	46	fruit present	point	368525	5318346			
Siskiwit Lake	*Typha latifolia*		no stem count, trace in segment 1 data	point	368926.291	5318281.821			
Stockly Bay	*Typha latifolia*	8		point	384401	5333626			
Stockly Bay	*Typha latifolia*	2		point	384395	5333652			

Appendix E. Locations and descriptions of *Typha*, *Phragmites*, and select *Phalaris* occurrences on Isle Royale, 2003-2005 (continued).

					Start		End		
Location	Species	Stems	Description	Size*	Easting	Northing	Easting	Northing	Length (m)
Stockly Bay	*Typha* sp.	12		point	384345	5333516			
Stockly Bay	*Typha* sp.	1		point	384682	5333888			
Sumner Lake	*Typha latifolia*	21		point	380166	5325602			
Tobin Harbor	*Phalaris arundinacea*	2	a few plants of *Phalaris* on shore	point	389449.913	5333775			
Wagejo Lake	*Phragmites australis*		Dense *Phragmites* bed	bed	377513	5327919	377536	5327939	29.32
Wagejo Lake	*Phragmites australis*		Medium dense, irregular *Phragmites* bed	bed	377298	5327752	377318	5327763	21.3
Wagejo Lake	*Phragmites australis*		Medium dense *Phragmites* bed	bed	377464	5327845	377482	5327872	31.59
Wagejo Lake	*Phragmites australis*		Medium dense *Phragmites* bed	bed	377618	5327890	377628	5327875	18.1
Wagejo Lake	*Phragmites australis*		Dense *Phragmites* bed	bed	377623	5327837	377627	5327821	16.05
Wagejo Lake	*Phragmites australis*		Medium dense *Phragmites* bed	bed	377500.253	5327903.589	377488.588	5327896.423	13.62
Wagejo Lake	*Phragmites australis*		Dense *Phragmites* bed	bed	377513.108	5327884.919	377499.801	5327875.633	16.1
Wagejo Lake	*Phragmites australis*	15		point	377614	5327902			
Whittlesey Lake	*Phragmites australis*		no stem count, trace in segment 2 data	point	372058.39	5318356.693			
Whittlesey Lake	*Typha* sp.		no stem count, trace in segment 4 data	point	371435.24	5317978.351			
Wood Lake	*Typha latifolia*		Short, delineable stand	bed	370320.159	5318081.251	370326.788	5318079.041	6.99
Wood Lake	*Typha latifolia*		Short, delineable stand	bed	370337.837	5318425.09	370344.908	5318425.974	7.13
Wood Lake	*Typha latifolia*			bed	370389.94	5318721.19	370366.68	5318655.5	89.83
Wood Lake	*Typha latifolia*	150		bed	370291.41	5318720.24	370290.81	5318749.5	29.48

Appendix F. Location, voucher, and habitat information for 13 plant species not previously documented from Isle Royale National Park.

Location Information

	Species	Location	Easting[1]	Northing
1	*Armoracia lacustris* (A. Gray) Al-Shehbaz & V. Bates	Lake Ritchie. End of south bay at start of portage to Chippewa Harbor.	374102	5321240
2	*Ceratophyllum demersum* L.	Patterson Lake inlet on west end.	T66N, R34W, S1, NW1/4SE1/4	
3	*Glyceria grandis* S. Wats	Portage between Moskey Basin and Richie Lake.	377018	5324710
4	*Leersia oryzoides* (L.) Swartz.	Stream between Siskiwit Lake and Intermediate Lake	369943	5320510
5	*Malva moschata* L.	Portage between Moskey Basin and Richie Lake.	377018	5324710
6	*Myriophyllum farwellii* Morong.	West and east ends of Patterson Lake.	T66N, R34W, S1, E1/2	
7	*Myriophyllum heterophyllum* Michx.	North inlet at west end of Duncan Bay.	T67N, R33W, S31, SW1/4SW1/4 and T66N, R33W, S6, N1/2NE1/4	
8	*Ophioglossum vulgatum* var. *pseudopodum* (S. F. Blake) Farw.	Wetland along Minong Ridge.	346868	5313840
9	*Sagittaria rigida* Pursh.	West end of Linklater Lake.	378194	5330380
10	*Scirpus pungens* Vahl.	Bay on South side of Sargent Lake	376920	5328069
11	*Typha angustifolia* L.	Northeast end of Sargent Lake.	378236	5329159
12	*Xyris montana* H. Ries	Fen at Lily Lake.	T64N, R38W, S26, SW1/4	
13	*Zosterella dubia* (Jacq.) Small	East end of Richie Lake.	374430	5322440

[1] Town, Range, Section information when no GPS Coordinates available

Appendix F. Location, voucher, and habitat information for 13 plant species not previously documented from Isle Royale National Park (continued).

Voucher Information

	Synonym/ Voucher Name	Collected by	Voucher_ID	Date	Determined by	Voucher Location[1]
1	*Armoracia lacustris* (A. Gray) Al-Shehbaz & V. Bates	A.G. Harris, Jim Meeker	03-259	11-Aug-03	E.G. Voss	UMI
2	*Ceratophyllum demersum* L.	V. Hofman, J.K. Marr		7-Aug-04	E.G. Voss	UMI
3	*Glyceria grandis* S. Wats	A.G.Harris	03-261	11-Aug-03	E.G. Voss	UMI
4	*Leersia oryzoides* (L.) Swartz.	J. Marr, A.G.Harris	03-248	8-Aug-03	E.G. Voss	UMI
5	*Malva moschata* L.	A.G.Harris	03-258	10-Aug-03	E.G. Voss	UMI
6	*Myriophyllum farwellii* Morong.	V. Hofman, J. K. Marr		7-Aug-04	E.G. Voss	UMI
7	*Myriophyllum heterophyllum* Michx.	V. Hofman, J. K. Marr		8-Aug-04	E.G. Voss	UMI
8	*Ophioglossum vulgatum* var. *pseudopodum* (S. F. Blake) Farw.	J. Marr and V. Hofman	Marr 3123	16-Jul-04	J.K. Marr	UMI
9	*Sagittaria rigida* Pursh.	A.G.Harris, J. Meeker	04-084	12-Aug-04	E.G. Voss	UMI
10	*Scirpus pungens* Vahl.	A.G.Harris	04-082	10-Aug-04	E.G. Voss	UMI
11	*Typha angustifolia* L.	A.G.Harris, J. Meeker		9-Aug-04	J.E. Meeker	NC
12	*Xyris montana* H. Ries	V. Hofman		3-Jul-04	E.G. Voss	UMI
13	*Zosterella dubia* (Jacq.) Small	A.G.Harris, J. Elias, J. Meeker, Kate Thompson	03-256	10-Aug-03	E.G. Voss	UMI

[1] UMI = University of Michigan Herbarium, Ann Arbor, MI; NC = Northland College Herbarium, Ashland, WI

Appendix F. Location, voucher, and habitat information for 13 plant species not previously documented from Isle Royale National Park (continued).

Habitat Information

	Species	Habitat
1	*Armoracia lacustris* (A. Gray) Al-Shehbaz & V. Bates	Rooted in 25 cm of water in shallow sluggish stream. Silty substrate. With *Potamogeton gramineus.*
2	*Ceratophyllum demersum* L.	In inlet, growing in flocculent sediment. With *Bidens beckii, Myriophyllum* species, *Potamogeton natans, Hippuris vulgaris*, and *Sparganium minimum*. Common.
3	*Glyceria grandis* S. Wats	Rooted in middle of stream bed. 60 culms covering 3 m^2.
4	*Leersia oryzoides* (L.) Swartz.	Wet muck substrate in former stream channel. With *Eupatorium maculatum, Calamagrostis canadensis*. Several 100 culms covering 10 m^2, all apparently sterile.
5	*Malva moschata* L.	Dry ridge on portage trail.
6	*Myriophyllum farwellii* Morong.	Submergent.
7	*Myriophyllum heterophyllum* Michx.	Submergent.
8	*Ophioglossum vulgatum* var. *pseudopodum* (S. F. Blake) Farw.	In grass/sedge wet meadow; on hummock. Associated species: *Iris versicolor, Carex lasiocarpa, Campanula aparinoides*.
9	*Sagittaria rigida* Pursh.	Emergent in 60 cm of water, 100 culms.
10	*Scirpus pungens* Vahl.	Wet sand beach exposed by water level. With *Calamagrostis canadensis, Carex vesicaria, Juncus brevicaudatus*. 20 culms over 2m x 3m.
11	*Typha angustifolia* L.	Near bed of *Typha latifolia.*
12	*Xyris montana* H. Ries	Immature specimen, fen mat.
13	*Zosterella dubia* (Jacq.) Small	Submergent. Sand substrate in 2 m of water. Common.

Data Supplement

Tables showing species and cover classes for aquatic, shoreline, and peatland segments are available individually by request from

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