

Fig 18. *Limosella subulata*, less than 2 cm high, on moist sand beside brackish pool near No. 3 Life Saving Station.

4. SUCCESSIONAL TRENDS

Conclusions regarding succession are based entirely on circumstantial evidence, but this has frequently been the basis for interpretations of succession in ecological studies. Such interpretations may be modified and improved as new information accumulates.

Since Marram-Forb vegetation occurs only along the oceanic shores, it appears that it is maintained by active wind deposition of sand. The Marram communities also are characterized by windblown sand but they are frequently inland and often receive only eroded sand from older shifting dunes and blowouts. With decreasing sand deposition, Marram communities appear to be replaced by Marram-Fescue vegetation, which, with a longer period of stability is apparently replaced by Shrub Heath vegetation. This latter community is confined to stable and protected inland sites. With increased sand deposition Shrub Heath and Marram-Fescue vegetation may be replaced by a more Marram-dominated community. Only the sand-loving Marram (*Ammophila breviligulata*; Greek *Amos* = sand, *philein* = love) is adapted to establish on and grow up through rapidly accumulating sand. Extensive smothering of vegetation by windblown sand has been documented (see section 2(e) and St. John 1921).

There is also evidence for a succession in pond and pond-edge vegetation. One of the pools at West Light appears to have infilled and separated from periodic seawater inflow quite recently, judging by the lack of organic material on the sandy bottom. It was likely somewhat brackish in the recent past but, although the pH is still relatively high, the salt level and conductivity are relatively low (Table X, no. 6). *Potamogeton perfoliatus* var. *bupleuroides* is dominant in water 0.5 to 1.0 m deep in this pool, and patches of *Scirpus maritimus* and *Sparganium angustifolium* occur

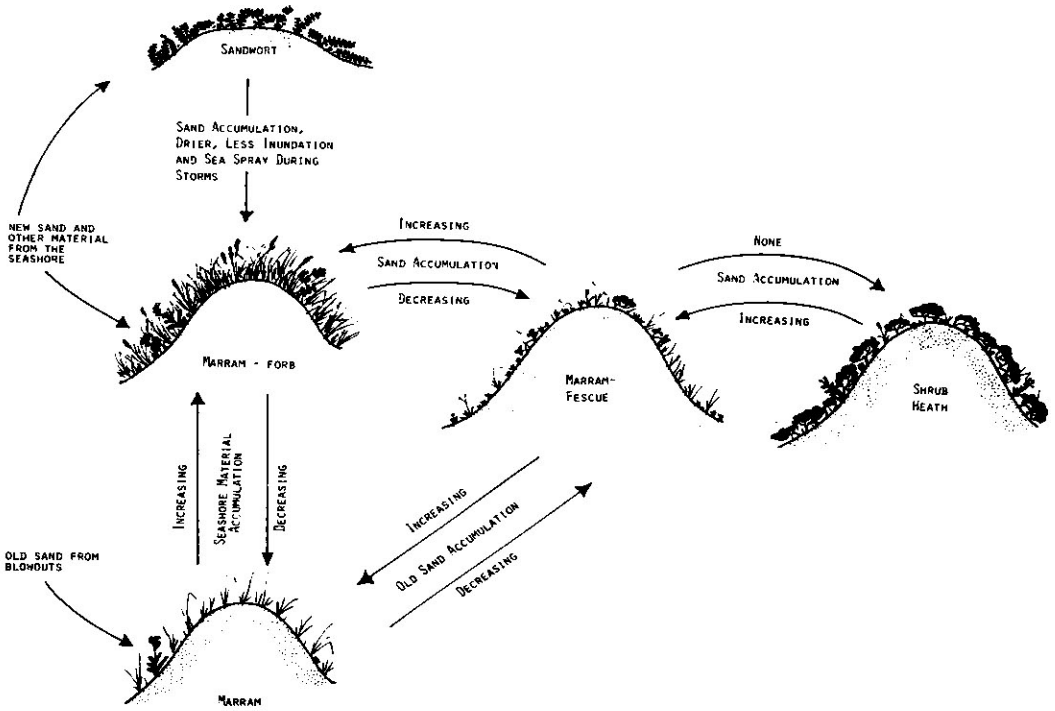


Fig 19. Summary of probable vascular plant succession on dry sites.

in water up to 0.5 m deep. *Spergularia marina* var. *leiosperma*, *Limosella subulata*, and *Juncus bufonius* occur on the moist shores. The higher pH, the predominantly sandy bottom and shores, and the halophytic species composition of the West Light pool suggests a succession of vegetation in newly formed pools, beginning with species adapted to higher salt levels when the pools are first formed and isolated from the sea. This may be followed by a decrease in salt content and conductivity accompanied by replacement by species that are not adapted to (and do not require) high salt levels. Gradually pH and perhaps nutrient availability decline, organic matter increases, and pools become increasingly acidic, with a group of softwater aquatic species (see 3(g)) becoming prevalent. Of course new seawater inflows can occur, with a return to salty or at least brackish conditions. Other evidence for a succession from brackish to fresh water vegetation, and the periodic inflow of seawater restoring brackish vegetation is discussed under section 3(e) and summarized in Fig. 20.

With continuous sand deposition in pools accompanied by increasing time of isolation from the sea, a brackish pool or a fresh pool may be replaced by Cranberry Heath. Exposure of old peat layers beneath pure sand along the coast suggests that dense and sparse Marram vegetation on dunes has replaced wetlands or heaths in some areas.

5. FLORISTIC COMPOSITION AND PHYTOGEOGRAPHY

The total recorded flora of Sable Island is comprised of 154 native species and 79 introduced species (see note on the distinction in section 6). Introduced species have taken over some islands to the exclusion of native and endemic taxa (Melville 1979). This has not been the case on Sable Island. Almost all of the native species

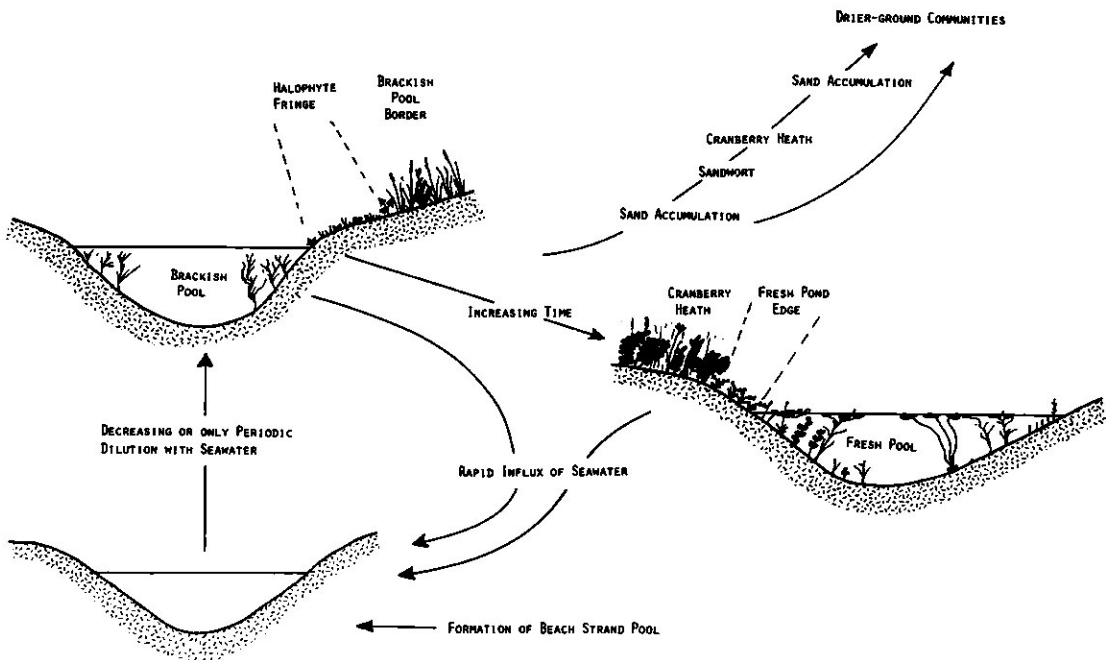


Fig 20. Summary of probable vascular plant succession in pools and pool borders.

found by the early botanists are still present (although some are rare) and the major plant communities are characterized by native species. Despite the intensive introduction of woody plants (section 2(d) and section 6 preamble) and disturbance due to cultivation, livestock, and feral horses, an introduced weedy flora has not become well established and introductions are generally confined to disturbed areas near buildings. In fact, many of the introduced species found by earlier botanists are now extinct, since they were not recorded during our survey (see section 6).

(a) *Phytogeography*

St. John (1921) classified the native flora of Sable Island into three major groups on the basis of the geographical distributions of the constituent species. His separations are somewhat arbitrary and here we take a more general view emphasizing distributional limits.

Most of the native flora is typical of mainland Nova Scotia and northeastern North America (e.g. *Eriocaulon septangulare*, *Lysimachia terrestris*, *Juncus articulatus*, *Myriophyllum tenellum*, and *Viburnum cassinoides*). Many generally widespread species occur (including *Convolvulus sepium*, *Cornus canadensis*, *Drosera rotundifolia*, *Smilacina stellata*, and *Scirpus vallisidus*). In addition there are many species that are widespread along the north Atlantic Coast (including *Ammophila breviligulata*, *Eleocharis parvula*, *Lathyrus maritimus*, *Rumex maritimus*, and *Zostera marina*). The portion of the flora that is characteristic of the general region comprises about 95 taxa representing 62.5% of the native flora (Table XII). The remaining 70 are characteristic of areas to the north, to the south, across the Atlantic, or are generally restricted to a small geographical area.

Boreal. Twenty-four native taxa on Sable Island representing 15.8% of the native flora (Table XIII), are characteristic of areas to the north. The distribution of *Em-*

Table XII Phytogeographic affinities of the Sable Island flora.

	No. of Taxa	%
Characteristic of the general region (northeastern, generally widespread, widespread along the Atlantic coast)	95	62.5
Boreal	24	15.8
Southern	8	5.3
Amphi-Atlantic	2-4	1.3-2.6
Restricted	13	8.6
Unknown (phytogeography not readily ascertained)	8	5.3

Table XIII List of plant taxa with northern affinity occurring on Sable Island.

Anaphalis margaritacea (L.) Benth. & Hook. var. *subalpina* Gray
Angelica lucida L.
Carex deflexa Hornem.
Empetrum nigrum L.
Euphrasia bottnica Kihlm.
Fragaria virginiana Duch. var. *terrae-novae* (Rydb.) Fern. & Wieg.
Galium trifidum L. var. *trifidum*
Hippuris vulgaris L.
Juniperus communis L. var. *megistocarpa* Fern. & St. John
Juniperus horizontalis Moench.
Lonicera villosa (Michx.) R. & S. var. *pubescens*
Lycopodium inundatum L.
Potentilla pacifica Howell
Potentilla palustris (L.) Scop. var. *parviflora* (Raf.) Fern.
Potentilla tridentata Ait.
Prenanthes nana (Bigel.) Torr.
Ranunculus flammula L. var. *filiformis* DC.
Rhinanthus crista-galli L.
Sparganium angustifolium Michx.
Spiranthes romanzoffiana Cham.
Senecio pseudo-arnica Less.
Thalictrum pubescens Pursh. var. *hebecarpum* (Fern.) Boivin
Torreyochloa pallida (Torrey Church var. *fernaldii* (A.S. Hitchc.)
Dore ex Koyama & Kawano
Triglochin palustris L.

Table XIV List of plant taxa with southern affinity occurring on Sable Island.

Carex emmonsii Dewey
Myrica pensylvanica Loisel
Rhus radicans L. ssp. *radicans*
Teucrium canadense L.
Gnaphalium obtusifolium L.
Viola lanceolata L.
Sisyrinchium angustifolium Mill.
Viola primulifolia L.

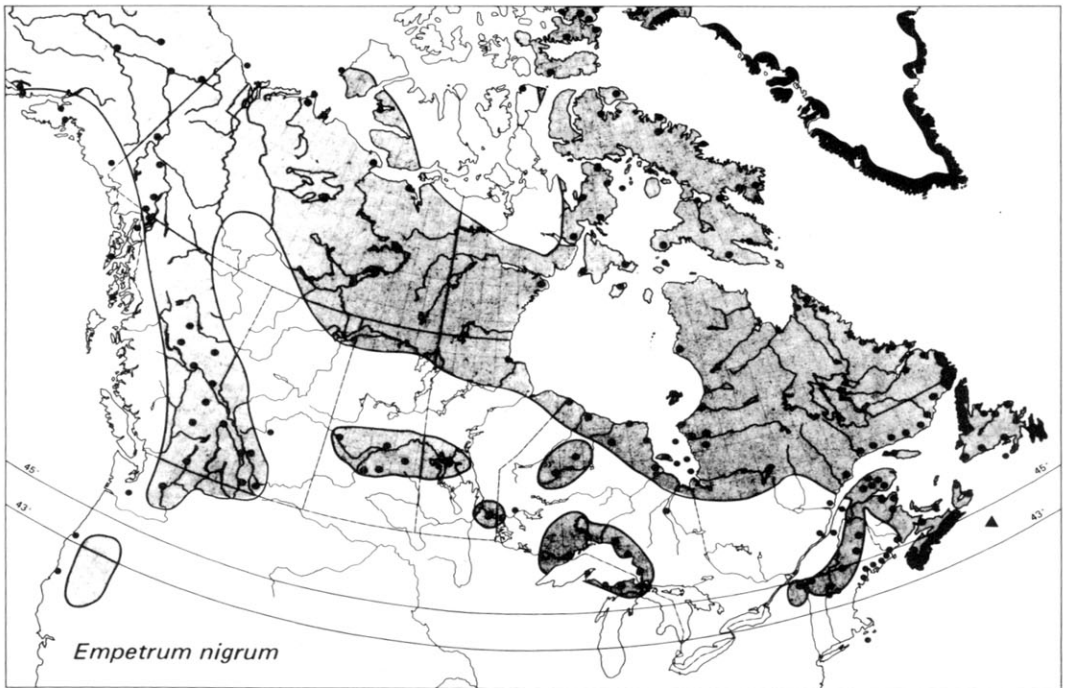


Fig 21. North American distribution of *Empetrum nigrum* based on Fernald (1925), Hult n (1970) and specimens at CAN and DAO. Sable Island is shown with a solid triangle.

petrum nigrum (Fig. 21) provides a good example. With few exceptions its area of geographical distribution is north of 45°N and it is on the southern edge of its range on Sable Island. The examples of boreal species extend beyond vascular plants, and include the lichen *Coelocaulon aculeatum* (I. Brodo, pers. comm.). With regard to the fauna, the Least Sandpiper is near the southern limit of its breeding range on Sable Island (McLaren 1981).

Southern. At least 8 taxa on Sable Island, representing 5.3% of the native flora are characteristic of regions to the south (Table XIV) and these species are at or very near to their northern geographical limits. A good example is provided by *Rhus radicans* var. *radicans* (Fig. 22). Sable Island represents the absolute northeastern limit of this species. Among the bryophytes, *Fontinalis sullivantii* and *Dicranum condensatum* are both rare in the Maritimes and are at their northern limits on Sable Island (R. Ireland, pers. comm.). A southern affinity is also present in the fauna, an example being the northernmost breeding colony of the Roseate Tern (McLaren 1981).

Amphi-Atlantic. Two of the native plants belonging to this category have a very restricted North American distribution but are widespread in Europe. The distribution of *Potamogeton oblongus* (Fig. 23) provides a good example, and corresponds generally to the distribution of *Juncus bulbosus* (Hult n 1958). *Polygonum raii* also belongs to this category but like *Centaurium umbellatum*, its status as a native plant on Sable Island has been questioned. *Lobelia dortmanna* has an amphi-Atlantic distribution but is much more widespread in North America than the preceding species. Two or four native species represent 1.3 or 2.6 of the native flora respectively.

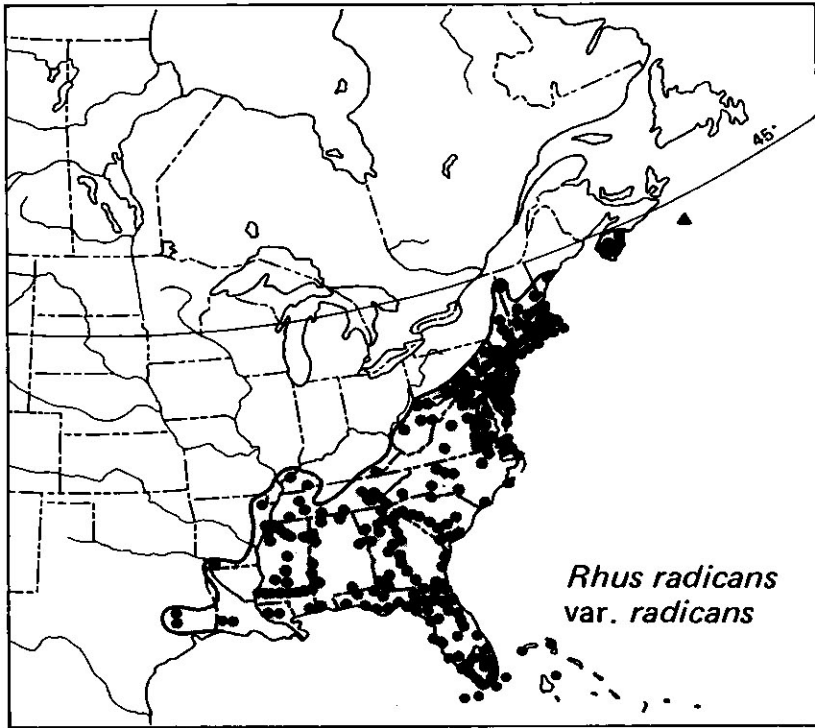


Fig 22. Distribution of *Rhus radicans* var. *radicans* based on Gillis (1971) and specimens at CAN and DAO. Sable Island is indicated with a solid triangle.

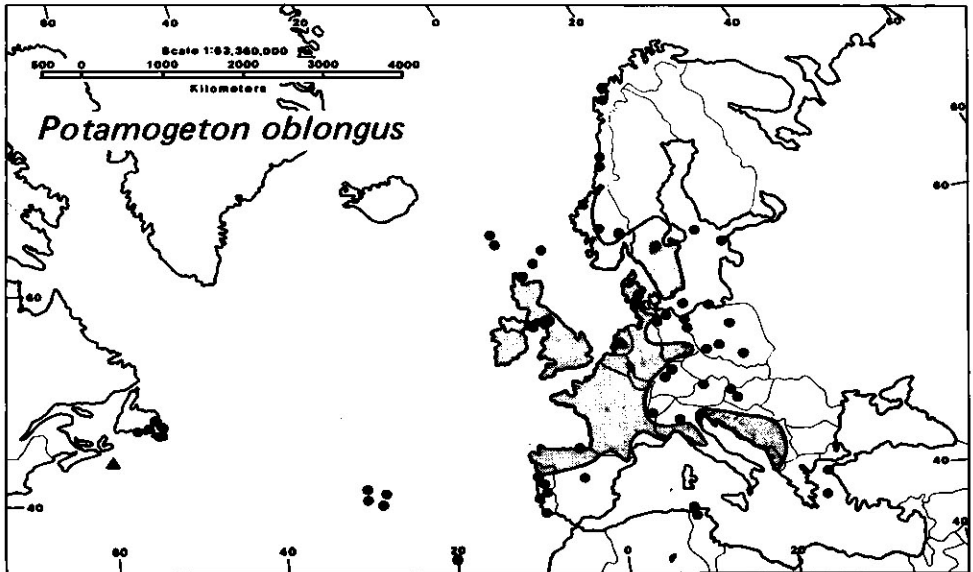


Fig 23. Distribution of *Potamogeton oblongus* based on Hult n (1958) and specimens at CAN and DAO. Sable Island is indicated with a solid triangle.

Table XV List of restricted plant taxa occurring on Sable Island (+ = type locality, ** = endemic, * = largely endemic.)

	<i>Juniperus communis</i> L. var. <i>megistocarpa</i> Fernald & St. John
†*	<i>Juncus pelocarpus</i> Mey. var. <i>sabulonensis</i> St. John
	<i>Platanthera lacera</i> (Michx.) Don var. <i>terrae-novae</i> (Fern.) Luer
†*	<i>Calopogon tuberosus</i> (L.) BSP var. <i>latifolius</i> (St. John) Boivin
†	<i>Polygonum hydropiperoides</i> Michx. var. <i>psilostachyum</i> St. John
	<i>Rubus X arcuans</i> Fernald & St. John
†*	<i>Lathyrus palustris</i> L. var. <i>retusus</i> Fernald & St. John
†**	<i>Epilobium nesophilum</i> Fern. var. <i>sabulonense</i> (Fern.) Fern.
†**	<i>Oenothera cruciata</i> Nutt. var. <i>sabulonensis</i> Fernald
†*	<i>Bartonia paniculata</i> (Michx.) Muhl. var. <i>sabulonensis</i> Fernald
†	<i>Lycopus uniflorus</i> Michx. var. <i>ovatus</i> Fernald
	<i>Agalinus neoscotica</i> (Greene) Fernald
†**	<i>Hieracium scabrum</i> Michx. var. <i>leucocaule</i> Fernald & St. John

Restricted. Thirteen taxa have been reported from Sable Island that have a very restricted total distribution (Table XV). This represents 8.6% of the native flora (Table XII). Some of these were described by St. John (1921) as "endemic" taxa. An endemic plant is one that occurs in a very limited geographical area. Such plants are especially vulnerable to interference by man and domestic animals and by competition from introduced weeds and crop plants (Melville 1979). The distinctive features of the restricted taxa of Sable Island (Table XV) have not been considered sufficiently discrete for recognition at the species level and all have been accorded the rank of form or variety by the authors recognizing them. These taxa are recognized by some authors, notably St. John (*loc. cit.*) and Fernald (1950), but are disregarded completely by others, presumably because they are considered to be indistinct variations on the common theme of a more widespread taxon. A careful study of variation in the taxa, and in their close relatives, and a consideration of the effects of environment may help to resolve some of these differences of opinion. It is not our purpose here to make taxonomic judgments other than to say that we are presently unaware of any comprehensive study that indicates that the restricted taxa should not be recognized. Interestingly, our preliminary studies of *Calopogon tuberosus* (L.) BSP var. *latifolius* (St. John) Boivin suggest that it is worthy of taxonomic recognition, despite its rejection by many recent authors (Catling and Lucas, in prep.).

Of the thirteen restricted taxa, three are endemic to Sable Island and four are also known from a limited area in the Gulf of St. Lawrence (Magdalen Islands, St. Pierre and Miquelon, or southwestern Newfoundland). Sable Island is the type locality for 9 of the restricted taxa (Table XV).

In the following paragraphs we have listed each of the restricted taxa (in alphabetical order of their genus names), with their places of publication, the most up-to-date information on total distribution and reference to their distinguishing features. Details regarding their occurrence on the island may be found in section 6.

Restricted Taxa

Agalinus neoscotica (Greene) Fernald (*Agalinus paupercula* (Gray) Britton var. *neoscotica* Pennell and St. John, Boston Society of Natural History Proceedings, 36(1):93. 1921). This species, although rather restricted, is common where it occurs (*i.e.* Sable Island and western Nova Scotia). It was described from Middleton, Nova Scotia (type probably at ND-G). *Agalinus neoscotica* is distinguished by its calyx lobes, which exceed the calyx tube and the relatively short corolla with scarcely spreading lobes.

- Bartonia paniculata* (Michx.) Muhl. var. *sabulonensis* Fernald. (*B. iodandra* Robinson var. *sabulonensis* Fernald, Boston Society of Natural History Proceedings, 36(1):89. 1921). This variety was described from Sable Island (type at GH), and was subsequently reported from St. Pierre and Miquelon (Fernald 1950, p. 1165). It is distinguished by the dichotomously branching inflorescence, more clavate peduncles, basally connate calyx with oblong lobes, and corolla 3-5 mm long.
- Calopogon tuberosus* (L.) BSP var. *latifolius* (St. John) Boivin, (= *Calopogon pulchellus* (SW) R.Br. f. *latifolius* St. John, Boston Society of Natural History Proceedings, 36(1):67. 1921). This small, wide-leaved variety was described from Sable Island (type at GH) and subsequently reported from the Magdalen Islands (Fernald 1950, p. 476). It is distinguished by its broadly lanceolate leaves, which approximately equal the height of the very short scape.
- Epilobium nesophilum* (Fernald.) var. *sabulonense* (Fernald.) Fernald. (*Epilobium molle* Torr. var. *sabulonense* Fernald; *Rhodora* 20:31. 1918). Described from Sable Island (type at GH), where it was found around fresh pools at No. 3 Life Saving Station. This variety has apparently not been found elsewhere (Fernald 1950, p. 1059). It is distinguished by its oblong-lanceolate leaves with a blunt or merely acutish (instead of attenuate) tip, and longest fruiting pedicels 1.0 - 1.5 cm long.
- Hieracium scabrum* Michx. var. *leuocaule* Fernald and St. John, *Rhodora*, 16:182. 1914. This variety was described from Sable Island (type at GH) and has never been reported from anywhere else. The variety *leuocaule* is distinguished from other varieties by its possession of both glands and dense white tomentum to 0.7 mm long on the lower internodes, more than 15 crowded leaves, and both leaf surfaces glandular pilose (Fernald 1950, p. 1566).
- Juncus pelocarpus* Mey. var. *sabulonensis* St. John, Boston Society of Natural History Proceedings, 36(1):67. 1921. This variety was described from Sable Island (type at GH), but was subsequently reported also from southwestern Newfoundland (Fernald 1950, p. 416). It differs from the typical variety in being a smaller, prostrate plant with curving culms.
- Juniperus communis* L. var. *megistocarpa* Fernald and St. John, Boston Society of Natural History Proceedings, 36(1):58. 1921. The type (GH) of this large-fruited, trailing variety is from the Magdalen Islands but Sable Island collections are cited in the original description. This is the only variety of *J. communis* that occurs on Sable Island. It occurs along coasts from Nova Scotia to Newfoundland, Labrador, Ungava, and Hudson Bay.
- Lathyrus palustris* L. var. *restusus* Fernald and St. John, Boston Society of Natural History Proceedings, 36(1):81. 1921. Described from Sable Island (type at GH), the range of this variety was subsequently extended to the islands of St. Pierre and Miquelon (Fernald 1950, p. 935). The leaves are notched at the rounded leaf apex.
- Lycopus uniflorus* Michx. var. *ovatus* Fernald and St. John, Boston Society of Natural History Proceedings, 36(1): 92. 1921. Described from Sable Island (type at GH), but reports from Canso, N.S. and the state of Oregon accompanied the type description. This was the only variety reported from the island by St. John, but interestingly was not included by Fernald (1950, p. 1246). This variety is distinguished by its more or less sessile, ovate-lanceolate leaves, which are coarsely serrate with forwardly directed teeth.
- Oenothera cruciata* Nutt. var. *sabulonensis* Fernald, *Rhodora*, 51:67. 1949. Described from Sable Island (type at GH), this variety has apparently not been reported elsewhere. Obovate-oblong petals, canescent-strigose stems, and crowded leaves are characteristic.

Platanthera lacera (Michx.) Don var. *terraenovae* (Fernald) Luer. (*Habenaria lacera* (Michx.) R. Brown var. *terrae-novae* Fern., *Rhodora*, 28:21. 1926). This variety with less deeply lacerate lip divisions and creamy flowers was described from Newfoundland (type at GH) and is known only from Newfoundland and Sable Island, Nova Scotia (Luer 1975).

Polygonum hydropiperoides Michx. var. *Psilostachyum* St. John, Boston Society of Natural History Proceedings, 36(1):71. 1921. This glabrous variety was described from Sable Island (type at GH) but locations in the state of Washington were given along with the type description, and it was subsequently reported from Shelburne Co., Nova Scotia.

Rubus X arcuans Fernald & St. John, (*Rubus arcuans* Fernald & St. John, Boston Society of Natural History Proceedings, 36(1):78. 1921). This variety was described from Prince Edward Island (type at GH) but specimens from Sable Island, elsewhere in Nova Scotia, and Massachusetts were cited with the original description and its range has apparently not been extended beyond that point (Fernald 1950, p. 843). Distinctive features include abundant strong prickles, thickened at the base, and relatively large dark coriaceous leaves.

(b) Provincially Rare Taxa

Eight taxa occur on Sable Island that have been listed as rare in Nova Scotia (Maher et al. 1978, Table XVI). Two of these have not been recently observed. All are listed in section 6 with general comments on habitat and status. Other plants on the island may be rare in the province but judgments on this await additional taxonomic and distributional evidence.

Table XVI Plant taxa reported from Sable Island that are listed as "rare" in Nova Scotia (Maher et al. 1978). (° = not recently observed.)

Centunculus minimus L.

Coeloglossum viride (L.) Hartm. var. *virescens* (Muhl.) Luer

- ° *Epilobium nesophilum* Fern. var. *sabulonense* Fern.

Juncus bulbosus L.

Juncus pelocarpus Mey. var. *sabulonensis* St. John

Potamogeton oblongus Viviana

- ° *Senecio pseudo-arnica* Less.

Tillaea aquatica L.

(c) Summary of occurrence of significant taxa

Most (i.e. 17 of 19) of the significant (restricted, rare, endemic) species occur in vegetation types that together account for less than 5.8% of the present island surface (Table XVIII). These vegetation types, the heathlands, fresh ponds and pond borders, are the most threatened on the island. They are the most easily destroyed by accumulating sand, and they take the longest time to develop.

6. ANNOTATED LIST OF VASCULAR PLANTS

This section includes information on habitat, status and distribution on the island of 154 native and 79 introduced taxa. The list is arranged in phylogenetic sequence. Introduced taxa are marked with an asterisk (*). In some cases there has been dispute over origin. For example, some botanists have considered *Anthoxanthum odoratum* native on Sable Island (Macoun 1899, p. 218A), while others have treated it as an introduction (Erskine 1953). Similarly, St. John (1921) has suggested the possibility that *Centaureium umbellatum* is native to Sable Island, contrary to the suggestion of numerous other authors. In general, however, the distinction between native and introduced taxa is not contentious.

Table XVIII Community affiliation of various significant taxa and the areal extent of these community types on the island.

Taxon	Brackish Pool borders and borders	Fresh Pools and borders	Habitat		Cranberry Heath	Shrub Heath	Significance	
			Marram-Fescue and Marram				Restricted	Rare in N.S.
<i>Agalinus neoscotica</i>		x					x	
<i>Bartonia paniculata</i>					x			
var. <i>sabulonense</i>							x	
<i>Calopogon tuberosus</i>					x			
var. <i>latifolius</i>							x	
<i>Centunculus minimus</i>	x	x						x
<i>Coeloglossum viride</i>						x		x
var. <i>virescens</i>								
<i>Epilobium nesophilum</i>		x						x
var. <i>sabulonense</i>								
<i>Hieracium scabrum</i>						x		
var. <i>leucocaula</i>							x	
<i>Juncus bulbosus</i>		x						x
<i>Juncus pelocarpus</i>		x						x
var. <i>sabulonense</i>							x	
<i>Juniperus communis</i>								
var. <i>megistocarpa</i>						x		
<i>Lathyrus palustris</i>		x						x
var. <i>retusus</i>								
<i>Lycopus uniflorus</i>		x						x
var. <i>ovatus</i>								
<i>Oenothera cruciata</i>								
var. <i>sabulonensis</i>								x
<i>Platanthera lacera</i>								
var. <i>terrae-novae</i>						x		x
<i>Polygonum hydroperoides</i>		x						x
var. <i>psilostachyum</i>								
<i>Potamogeton oblongus</i>		x						
<i>Rubus arcuans</i>							x	
<i>Senecio pseudo-arnica</i>								x
<i>Tillaea aquatica</i>	x	x						x
Total No. Taxa	2	10		2	3	5	13	8
Total Area (ha)	12.1	49.9		1071.5	147.0			
% Island surface	0.4	1.5		31.2	4.3			

Status is based on frequency distribution: rare taxa were recorded from 1-2 locations; occasional taxa were recorded from 3-6; locations and common taxa were recorded from more than seven localities. Plant localities were counted as separate if they lie at least 0.5 km apart.

In brackets following each entry an indication is given of the taxa found during the earlier surveys of J. Macoun (JM) in 1899, H.T. Gussow (HG) in 1911, H. St. John (SJ) in 1913 (St. John 1921), and J.S. Erskine (JE) in 1952 and others reported simultaneously (Erskine 1953), and by us (CFL) during our 1981 survey with a few additional records of P.A. Keddy and A. Wilson. Additional information on previous surveys (specimen documentation, etc.) is provided in the introduction. Specimen vouchers for the 1981 survey were deposited at DAO and MICH, with some additional specimens collected by P. Keddy at CAN.

The names in the following list have been brought up-to-date through reference to recent taxonomic work. Certain older generic and species names are listed in brackets. Varieties reported for the island, but not recently accepted, are also listed in brackets following the species name.

DELETIONS

Sisyrinchium atlanticum Bickn.

Using the key in Gleason and Cronquist (1963) and Gleason (1952), the Sable Island plants key to *S. atlanticum*, (since *S. angustifolium* appears in a couplet with sessile or short-peduncled spathes). However, having examined a large amount of herbarium material at CAN and DAO, the identification of *S. atlanticum* and *S. angustifolium* has become more clear.

Many keys (e.g. Roland & Smith 1969) indicate that plants with stems over 2 mm wide, inner bract of spathe over 15 mm long, and capsule over 4 mm in diameter are referable to *S. angustifolium*. These relatively robust plants differ from the more delicate plants (referred to *S. atlanticum*) in a number of other ways as well. In a recent study, Voss (1972) suggested that the robust plant dries a darker green colour, and has the stems minutely denticulate in the margins. Our observations of plants from all over the northeast confirm these differences. The delicate plants referred to *S. atlanticum* often have a few small bumps on the edges of the stem below the peduncles (under high magnification), but never the distinctly curved teeth seen on the robust plants referable to *S. angustifolium*. The delicate plants have very narrow peduncles which are often bent at a joint at the base of the spathe. The Sable Island plants are clearly *S. angustifolium*, taking these differences into account. They are, however, somewhat narrower than most *S. angustifolium* at the top of the scape, being 2.0-2.5 mm wide.

Our previous report of *S. atlanticum* from Sable Island (Freedman, Catling & Lucas 1982) should be deleted.

Polygonum aviculare L.

The only specimens we have seen were collected in 1913 (weed at Main Station, 19 Aug. 1913, *H. St. John* 1211 (CAN); weed at No. 3 Life Saving Station, 8 Sept. 1913, *H. St. John* 1212 (CAN)). These are neither *P. monspeliense* (*P. aviculare* s.1.) nor *P. arenastrum*, and their correct assignment is dependent upon additional taxonomic work (J. McNeill, pers. comm.).

Euphrasia nemorosa (Pers.) Wallr. (*E. americana* Wettst.)

This species was reported by Gussow (*H. St. John* 1921, p. 93). The specimen at DAO (*H.T.G.*, Sept. 1911) has been revised to *E. randii* B.L. Robinson var. *randii*.

Hieracium pilosella L.

Vegetative material resembling this species was collected in two Shrub Heath communities (Freedman, Catling & Lucas 1982) and reported in the table summarizing Shrub Heath vegetation. The only vouchers collected were later determined as *H. scabrum*, so *H. pilosella* is to be deleted.

There are no other records to be deleted from previous lists. We have checked all voucher specimens that represent species reported only once or twice, and all were correctly identified. There were earlier, erroneous reports for the island, but these were all corrected by St. John (1921). Most of these earlier errors were never published, being in personal communications and names on herbarium specimen labels.

Comparison with previous surveys

The numbers of native and introduced taxa reported in previous botanical surveys are shown in Table XVII. In general the number of native species has not changed much over the past 81 years. Macoun was the only one to find *Carex deflexa*, *Polypodium virginianum*, and *Utricularia cornuta*. Gussow was the only one to find *Viola incognita* var. *forbesii*. St. John was the only one to find *Lathyrus palustris* var. *retusus*, *Galium trifidum* var. *tinctorium*, and *Prenanthes nana*. Erskine was the only one to find *Cornus canadensis*. We were the only ones to find *Onoclea sensibilis*, *Carex emmonsii*, *Juncus pelocarpus* var. *pelocarpus*, *Drosera intermedia* x *rotundifolia*, *Puccinellia pumila*, *Scutellaria galericulata*, *Spiranthes lacera* var. *lacera*, *Rhus radicans* var. *rydbergii* and *Viola septentrionalis*. All of these unique finds are supported by vouchers in institutional herbaria.

Table XVII Numbers of native and introduced taxa reported in botanical surveys of Sable Island.

	Native	Introduced
J. Macoun (1899)	124	30
H.T. Gussow (1911)	75	8
H. St. John (1913)	132	56
J.S. Erskine (1952)	109	27
B. Freedman, P.M. Catling, Z. Lucas (1981)	135	42

With introduced species the situation is quite different. The major discrepancies in the numbers of introduced taxa (Table XVII) suggest that introduced species and human disturbance on the island reached a peak around 1913. This was shortly after the great afforestation attempt of 1901 (see section 2(d)) when many weedy species were probably introduced accidentally. In addition there still were at this time livestock, farming, and extensive settlement associated with the five life saving stations along the length of the island. The decline of introductions is discussed more extensively below under "Aspects of Status".

Comparisons of the 1981 survey frequency values with past statements of frequency are not likely to be reliable since previously the terms were not quantified and were often used rather loosely.

Aspects of Status

Approximately 67.7% of the recorded flora is native and 32.3% is introduced. Of the 178 species found on Sable Island during our 1981 survey, only 65 (38%) are common plants characteristic of major vegetation types. Of the introduced flora, 46.8% is extirpated and only 6.3% (i.e. five species) is presently common. This contrasts with 5.8% of the total recorded native flora extirpated and 39.2%

Table XIX Status of the total recorded native and introduced taxa on Sable Island.

	Native		Introduced	
	No. Taxa	%	No. Taxa	%
extirpated	9	5.8	37	46.8
rare	52	34.0	27	34.2
occasional	31	20.3	10	12.7
common	61	39.2	5	6.3
Total	153	<100	79	<100

(i.e. 60 species) common (Table XIX). The decline of the 1901 plantings was particularly dramatic (see annotations). Thus, most plants introduced to the island have not been able to maintain themselves, probably due to specific climatic or other environmental conditions. At present, most introduced taxa occur only around habitations or on ground recently disturbed by man. Habitations may provide some protection from the wind. Overall, a quite different situation occurs on many other islands (especially tropical and subtropical) where introduced plants often outcompete and replace some of the native species (Melville, 1979).



Fig 24. Dense stand of *Potamogeton oblongus* in a pool near West Light.



Fig 25. *Juncus bulbosus*, an amphi-atlantic species with a very restricted North American distribution, on damp sand near West Light.

Annotated List

Lycopodiaceae—Club-moss Family

Lycopodium inundatum L.—Bog Club-moss

Occasional, in Cranberry Heath near Main Station and West Light, and less often elsewhere. JM,HG,SJ,CFL.

Osmundaceae—Flowering Fern Family

Osmunda cinnamomea L.—Cinnamon-Fern

Rare, fresh pond edges at West Light and east of Life Saving Station No. 3. JM,HG,SJ,CFL.

Polypodiaceae—Fern Family

Polypodium virginianum L. (*P. vulgare*)—Rock-Polypody

Extirpated, known only from Macoun's 1899 collection "on the old land at Island Pond, very rare". JM.

Onoclea sensibilis L.—Sensitive Fern

Rare. Near West Light. CFL.

Pinaceae—Pine Family

**Pinus mugo* Turra (*Pinus montana*)—Mugo Pine

Extirpated. Of five thousand planted in 1901, six survived to 1913. SJ.

**Pinus sylvestris* L.—Scotch Pine

Rare. A few trees remained from the planting of 10,000 up until 1921 (St. John 1921) but one decumbent plant (Fig. 4) protected among dunes south of Main Station, is a survivor of a recent planting.

**Picea glauca* (Moench) Voss (*P. canadensis*)—White Spruce

Rare. Two trees surviving south of Main Station, about 1/2 m high on slopes in Shrub Heath. 2,500 planted in 1901. SJ,CFL.

Cupressaceae—Juniper Family

Juniperus communis L. var. *megistocarpa* Fern & St. John—Juniper

Common in Shrub Heath. First noted on the island in 1753 (St. John 1921). JM,HG,SJ,JE,CFL.

Juniperus horizontalis Moench.—Creeping Juniper

Common in Shrub Heath. Macoun described a buried specimen with a main stem 15 cm in diameter (St. John 1921, p. 58). JM,SJ,JE,CFL.

Typhaceae—Cat-tail Family

Typha latifolia L.—Common Cat-tail

Apparently extirpated. Previously bordering fresh ponds at the east end of Wallace Lake near Life Saving Station No. 3. JM, SJ.

Sparganiaceae—Bur-reed Family

Sparganium angustifolium Michx.—Narrow-leaved Bur-reed

Occasional in fresh ponds. Locally abundant near West Light. JM,SJ,JE,CFL.

Potamogetonaceae—Pondweed Family

Potamogeton epihydrus Raf.

Common in fresh ponds. JM,SJ,CFL.

Potamogeton oblongus Vivianita (*P. polygonifolium*)

Occasional in fresh ponds. JM,SJ,JE,CFL.

Potamogeton pectinatus L.—Sago Pondweed

Rare, only seen in the brackish pond complex near Life Saving Station No. 3, but there locally abundant. JM,SJ,CFL.

Potamogeton perfoliatus L. var. *bupleuroides* (Fern.) Farw.—Red-head Pondweed

Rare, brackish ponds at Life Saving Station No. 3 and West Light. JG,HG, SJ,JE,CFL.

Potamogeton pusillus L. (*P. capitatus*)

Possibly extirpated. Previously in brackish ponds. JM,SJ.

Ruppiaceae—Ditch-grass Family

Ruppia maritima L. var. *longipes* Hagstr.—Ditch-grass

Rare, brackish ponds. Locally abundant at Life Saving Station No. 3. JM,SJ,JE,CFL.

Zosteraceae—Eelgrass Family

Zostera marina L.—Eelgrass

Occasional. Found only in East and West Wallace where it is abundant. JM,HG,SJ,CFL.

Juncaginaceae—Arrow-grass Family

Triglochin palustris L.

Rare. Found on mud flats near brackish pond by P.A. Keddy in 1975 (CAN), but not seen by us. JE,CFL.

Poaceae (Gramineae)

**Bromus inermis* Leys. —Awnless Brome

Rare. Disturbed ground around buildings at Main Station. CFL.

**Bromus secalinus* L.—Cheat Grass

Extirpated. Macoun found it "in meadow grass" and noted that it was "rare". JM.

Festuca rubra L.—Red Fescue

Common, fresh pond edges and Cranberry Heath particularly. JM,HG,SJ,CFL.

Festuca rubra var. *juncea* (Hack.) Richter—Red Fescue

Common, Marram and Marram-Fescue vegetation. CFL.

Festuca rubra L. var. *glaucescens* (Hartm.) Holm—Red Fescue

Common, Marram-Fescue vegetation in particular. SJ,JE,CFL.

Puccinellia pumila (Vasey) Hitchc.—Alkali-grass

Rare, brackish pools near West Light, north of East Wallace and near Life Saving Station No. 3. CFL.

Torreyochloa pallida (Torrey) Church var. *fernaldii* (A.S. Hitchc.) Dore ex Koyama & Kawano (*Glyceria fernaldii*)—Pale Manna-grass

Rare. Edge of pond near West Light. Macoun's collection is labelled: "in marshy spots, East End". JM,CFL.

**Poa annua* L.—Annual Bluegrass

Occasional. Around habitations and ruins, and also occasionally fresh pond edges. JM,JE,CFL.

**Poa palustris* L.—Fowl-meadow Grass

Rare. Edges of fresh ponds near Life Saving Station No. 3. JM,CFL.

**Poa pratensis* L.—Kentucky Bluegrass

Common. Found in all major vegetation types on the island. JM,HG,SJ,JE,CFL.

**Dactylis glomerata* L.—Orchard-grass

Rare. Around buildings at Main Station. CFL.

**Agropyron repens* L.—Couch-grass

Occasional. Ruins of Life Saving Stations No. 1 and No. 3 and Main Station, also brackish pond edges at No. 3 Station. JM,SJ,JE,CFL.

Agropyron repens (L.) Beauv. f. *pilosum* (Scribn.) Fern.—Couch-grass

Occasional. Seen only in Marram-Forb vegetation. As noted by St. John, this form is less associated with habitations and probably native. See Fernald, M.L. in *Rhodora* 35:183-185. 1933. SJ,JE,CFL.

Elymus arenarius L. var. *villosus* Mey.—Sea Lyme-grass

Probably extirpated. St. John (1921) noted that it was only on a ridge of dunes on the south side of Wallace Lake that was rapidly washing away and he remarked that the population was "in great danger of being destroyed". We could find no plants on the last remaining vestige of this ridge. SJ,JE.

- **Hordeum jubatum* L.—Squirrel-tail Grass
Rare. Brackish pond edges near West Light and at Life Saving Station No. 3. Previously a weed at Main Station (St. John 1921). JM,SJ,CFL.
- Deschampsia flexuosa* (L.) Trin.—Common Hairgrass
Rare in Shrub Heath on Grassy Plains. P.A. Keddy found it several miles east of Life Saving Station No. 3 (CAN). Our (CFL) specimens are referable to var. *montana* (L.) Ledeb. JM,HG,SJ,CFL.
- **Avena sativa* L.—Oat
Extirpated. Previously a weed at Main Station (St. John 1921, p. 63). SJ,JE.
- **Avena sativa* L. var. *orientalis* (Schreb.) Richter—Oriental Oat
Extirpated. Previously a weed at Main Station (St. John 1921, p. 63). SJ.
- Danthona spicata* (L.) Beauv.—Poverty-grass
Occasional in Shrub Heath. JM,JE,CFL.
- Ammophila breviligulata* Fern.—Marram
Common, dominant over most of the vegetated portion of the island. JM,HG, SJ,JE,CFL.
- Agrostis hyemalis* (Walt.) BSP. (*A. geminata*)—Hairgrass
Common. Both fresh pond margins and Cranberry Heath. SJ,CFL.
- Agrostis stolonifera* L. var. *major* (Gaud.) Farw. (*A. alba*)—Redtop Bentgrass
Common. Fresh pond margins and less often in Cranberry Heath. JM,HG, SJ,JE,CFL.
- **Phleum pratense* L.—Common Timothy
Rare. Life Saving Station No. 1 ruins and Life Saving Station No. 3 ruins and near West Light. JM,SJ,JE,CFL.
- **Alopecurus geniculatus* L.—Meadow Foxtail
Rare. Higher margins of brackish ponds and near ruins of Life Saving Station No. 3 and near West Light. JM,SJ,JE,CFL.
- **Spartina alterniflora* Loisel—Salt-water Cord-grass
Rare. Introduced near Life Saving Station No. 3 to help bind damp sand. CFL.
- Spartina pectinata* Link (*S. michauxiana*)—Slough-grass
Occasional. In water 1 m deep in fresh pond near West Light, pond edges near Grassy Plains and elsewhere on dune crests. JM,HG,SJ,JE,CFL.
- **Anthoxanthum odoratum* L.—Sweet Vernal Grass
Common. Shrub Heath. Macoun (1899) suggested that it may be native. JM, SJ,CFL.
- Dichanthelium acuminatum* (Swartz) Gould & Clark var. *acuminatum* (*P. languino-* var. *fasciculatum*, *P. huahucae*)—Panic-grass
Occasional. Fresh pond edges and disturbed areas in Cranberry Heath. JM, SJ,JE,CFL.
- **Echinochloa crusgalli* (L.) BSP.—Barnyard-grass
Extirpated. Previously a garden weed. SJ.
- Cyperaceae**—Sedge Family
- Eleocharis palustris* (L.) R. & S.—Spike-rush
Common on borders of fresh ponds. JM,HG,SJ,CFL.
- Eleocharis halophila* Fern. & Brack. (*E. palustris* var. *glaucescens*)—Spike-rush
Occasional. Brackish pond borders and wet sand. JM,SJ,JE,CFL.
- Eleocharis parvula* (R. & S.) Link. (*Scirpus nanus*)—Spike-rush
Rare, forming a dense sward on damp sand and in shallow brackish water north of East Wallace and near Life Saving Station No. 3. JM,HG,SJ,JE,CFL.
- Scirpus pungens* Vahl (*Scirpus americanus*)—Three-square Bulrush
Common, on pond edges. JM,HG,SJ,JE,CFL.

***Scirpus acutus* Muhl.—Hard-stem Bulrush**

Rare or extirpated. Locations uncertain. See note below under *S. validus*. SJ.

***Scirpus validus* Vahl—Soft-stem Bulrush**

Occasional, fresh and slightly brackish ponds. Erskine (1952) listed *Scirpus validus*, suggesting that *Scirpus actus* was a synonym. St. John (1921) considered all collections from the island to be *S. acutus* and gave reasons, but both Gussow's, Macoun's and our collections are apparently referable to *S. validus*. Our collections have spikelets 2x as long as wide instead of ca. 2.5x or more. The scales are rich orange-brown with a strongly contrasting midrib, instead of pale. The flecks on the back of the scales are more or less limited to the midrib region in the upper scales. St. John's specimens, although having short spikelets, have achenes 2.5 mm long and therefore may be referable to unusual plants of *S. acutus*. JM,HG,SJ,JE,CFL.

****Scirpus maritimus* L. var. *maritimus* (*S. paludosus* A. Nels. in part)—Salt-marsh Bulrush**

Probably extirpated. Our recent collections referable to the native var. *fernaldii*. SJ,JE.

***Scirpus maritimus* L. var. *fernaldii* (Buckn.) Beetle—Salt-marsh Bulrush**

Rare. Found by us only in a few slightly brackish ponds near West Light, but recorded by Macoun and St. John (1921) from ponds near Wallace Lake. Our collections as well as that of Macoun have 2 stigmas and flat achenes, but unlike var. *fernaldii* the spikelets are relatively short resembling those of var. *maritimus*. JM,SJ,JE,CFL.

***Carex hormathodes* Fern.—Sedge**

Occasional. Fresh pond edges. JM,SJ,JE,CFL.

***Carex silicea* Olney—Sedge**

Common. Marram-Fescue, Shrub Heath and Cranberry Heath vegetation. JM,SJ,JE,CFL.

***Carex echinata* Murr. subsp. *echinata*—(incl. var. *cephalantha*)—Sedge**

Common. Fresh pond edges and Cranberry Heath. JM,SJ,CFL.

***Carex canescens* L. ssp. *disjuncta* (Fern.) Toivonen—Sedge**

Occasional. Fresh pond edges. JM,SJ,JE,CFL.

***Carex deflexa* Hornem.—Sedge**

Possibly extirpated. Known only from Macoun's 1899 collection: "on old banks. Main Station". JM.

***Carex emmonsii* Dewey (*C. albicans*)—Sedge**

Rare, in Shrub Heath on Grassy Plains and east of West Light. CFL.

***Carex viridula* Michx. (*C. oederii* var. *pumila*)—Sedge**

Occasional. Fresh pond edges and moist sandy dune hollows. JM,SJ,JE,CFL.

Eriocaulaceae—Pipewort Family***Eriocaulon septangulare* With.**

Occasional. Fresh pond borders and moist sand, most abundant between West Light and Main Station. JM,SJ,JE,CFL.

Juncaceae—Rush Family***Juncus bufonius*—Toad-rush**

Occasional. Fresh pond edges and moist sand. JM,HG,SJ,JE,CFL.

***Juncus bufonius* L. var. *halophilus* Buchenau & Fern.—Toad-Rush**

Occasional. Both fresh and brackish pond edges. SJ,CFL.

***Juncus tenuis* Willd.—Path-rush**

Common, Disturbed Heathland and pond edges, especially along horse trails. JM,HG,SJ,JE,CFL.