The Status of
Lindley's Aster
(*Symphyotrichum ciliolatum*)

in Newfoundland and Labrador

Photo: John E. Maunder

THE SPECIES STATUS ADVISORY COMMITTEE
REPORT NO. 21

October 15, 2009

RECOMMENDED STATUS

Recommended status:	**Current designation:**
Endangered	None

Criteria met:

B2. area of occupancy <500 km^2
- (a) known to exist at **<**5 localities
- (b) continuing decline observed, inferred or projected in:
  - ii) area of occupancy
  - iii) area, extent and/or quality of habitat
  - iv) number of locations or populations

Reasons for designation:

Qualifies as "*endangered*" under criteria B2 (a), (b) ii), iii) and iv):

- Area of occupancy <50 km^2
- Number of extant localities possibly 5, although only 3 of these localities (Top of Port au Port Peninsula, Table Mountain, and Romaines Brook) have been located/relocated within the last 25 years. The Harry's River and Crabbes River populations have not been relocated within the last 25 years, and may or may not be still extant.
- The area of occupancy, and the area, extent and quality of habitat at the Romaines Brook site have all seriously declined due to flood-control-related riverbed modification; continuing management of this riverbed is expected to further diminish the area, extent and quality of the habitat
- The area, extent and quality of habitat at the Table Mountain site has seriously declined throughout the many years that the site has served as a radar and communications site; this decline is projected to continue into the future
- The area, extent and quality of habitat at the Port au Port Peninsula site is expected to decline significantly in the face of ongoing seismic exploration and future oil drilling activities; with increased clearing of cover vegetation for seismic lines and for oil drilling operations, hybridization with *Symphyotrichum novi-belgii* is expected to significantly compromise the genetic makeup of the species in the future

The original version of this report was prepared by John Maunder in 2007. A revised version was submitted by that same author in 2009, incorporating newly-obtained field data provided by Claudia Hanel, Wildlife Division, Government of Newfoundland and Labrador.

STATUS REPORT

Symphyotrichum ciliolatum (Lindley *ex* Hooker) Á. and D. Löve
Lindley's Aster, Fringed Blue Aster; Fr: aster ciliolé.

Synonyms:

Aster ciliolatus Lindley *ex* Hooker
Aster ciliolatus Lindley *ex* Hooker var. *comatus* (Fernald) A. G. Jones
Aster foliaceus Lindley *ex* DC. var. *subgeminatus* Fernald [*in part*]
Aster lindleyanus Torrey and A. Gray var. *ciliatus* (Lindley *ex* Hooker) A. Gray
Aster wilsonii Rydberg

Family: Asteraceae (Composites)

Life Form: Herbaceous, perennial forb.

Systematic/Taxonomic Clarifications:

Symphyotrichum ciliolatum is a widespread and well-defined species. However, in the Gulf of St. Lawrence region, including Newfoundland, it hybridizes frequently with *Symphyotrichum novi-belgii* var. *novi-belgii* (New York Aster) to produce the relatively common hybrid *Symphyotrichum* ×*subgeminatum* (Fernald) G. L. Nesom. *Symphyotrichum* ×*subgeminatum* has been collected in western Newfoundland, and in the Gaspé, Québec (Brouillet *et al.* 2006). The biosystematics of both the species and the hybrid have been studied by Brouillet (1981).

Synonyms of the hybrid *Symphyotrichum* ×*subgeminatum* (Fernald) G. L. Nesom):

Aster foliaceus Lindley *ex* DeCandolle var. *subgeminatus* Fernald [TYPE LOCALITY: Table Mountain, Port au Port, Newfoundland] [*in part*]
Aster foliaceus Lindley var. *geminata* Fernald [*in part*]
Aster subgeminatus Fernald [*in part*]
Aster subgeminatus (Fernald) B. Boivin [*in part*]

An analysis of recent collections, conducted during the course of the present study, has revealed that the "*Symphyotrichum ciliolatum*-like" populations from Table Mountain, Romaines Brook, and the top of the Port au Port Peninsula (Fig. 1), ALL contain examples of both *Symphyotrichum ciliolatum* and the hybrid *Symphyotrichum* ×*subgeminatum* (Claudia Hanel, Wildlife Division, Government of Newfoundland and Labrador personal communications, September 2007, February 2009).

No equivalent information is presently available for the historical "*Symphyotrichum ciliolatum*-like" populations at Harry's River and Crabbes River (see Fig. 1). However, for the purposes of this report, it has been reasonably assumed, based upon the configuration of the three recent populations, that the two historical populations also contained both *Symphyotrichum ciliolatum* and *Symphyotrichum* ×*subgeminatum.* An expert re-examination of the original collections (located in the Gray Herbarium and the British Museum), and/or the rediscovery of one or both of the historical populations, would possibly help to confirm this reasonable assumption.

Because its story is so intricately intertwined with *Symphyotrichum ciliolatum* in Newfoundland, the hybrid *Symphyotrichum* ×*subgeminatum* [and its various backcrosses], will be further discussed in this report whenever it is necessary to provide context and/or clarity.

Nonetheless, the designatable unit addressed in this report is the species *Symphyotrichum ciliolatum*, and all primary discussions will refer to that designatable unit, except where specifically noted.

Distribution

Global:

North America (excluding Canada): United States of America: northern states as far west as Montana, *including* Maine, Vermont, New Hampshire, Massachusetts, New York, Michigan, Indiana, Wisconsin, Illinois, Minnesota, North Dakota, South Dakota, Montana, Wyoming (Brouillet *et al.* 2006).

National:

Widely distributed: Newfoundland and Labrador (Newfoundland only), Nova Scotia, New Brunswick, Québec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, Yukon, Northwest Territories (Brouillet *et al.* 2006).

Provincial:

Newfoundland: known only from 4 restricted localities in the Stephenville-St. George's Bay area (two of them being "historical"), and 1 broader locality on higher ground on the central portion of the Port au Port Peninsula (Figure 1).

Labrador: a single Labrador report of *Symphyotrichum ciliolatum*, from ±17 km S of the mouth of the Fig River at Lake Winokapau, has been rejected, on the advice of aster specialist Luc Brouillet (l'Université de Montréal, personal communication, January 10, 2007), on the dual basis that the location and habitat seem highly unlikely, and that there appears to be no supporting collection.

Annotated Provincial Range Map

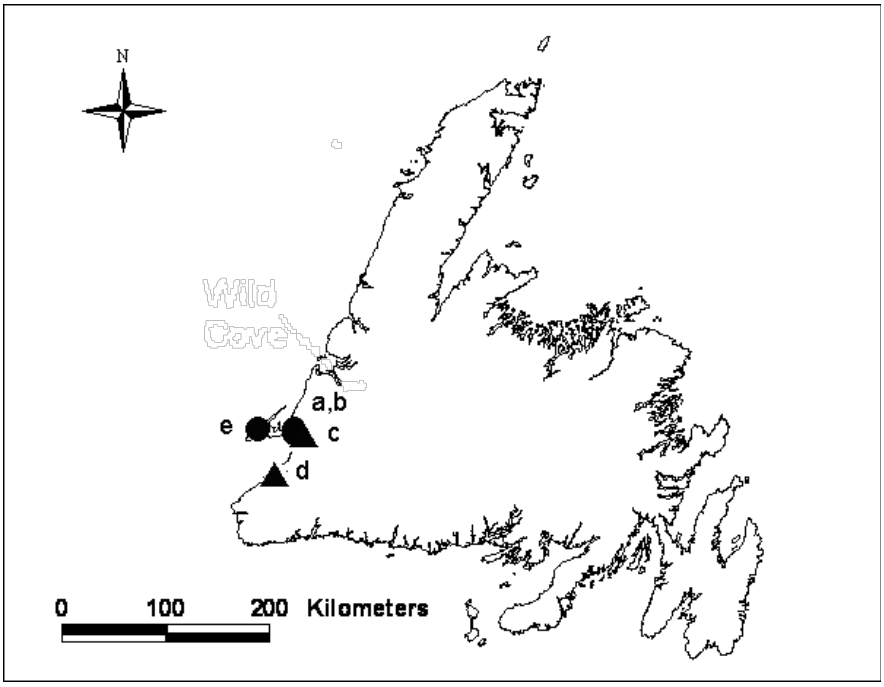

Figure 1. Known occurrence localities for *Symphyotrichum ciliolatum* in Newfoundland (dots = recent localities; triangles = historical localities): [a] Romaines Brook, [b] Table Mountain, [c] Harry's River (historical), [d] Crabbes River (historical), [e] central Port au Port Peninsula. [But, with regard to "historical localities", see the discussion in the section entitled: "Systematic/Taxonomic Clarifications"]

Description

A medium-sized perennial aster, with purple-blue flowers; basal leaves with broad, shallowly cordate [ie. square/indented-based] blades (usually withering by flowering time). [The leaf blades of the common hybrid *Symphyotrichum* ×*subgeminatum* are not cordate].

Habitat

Generally: rich, open, often ± calcareous, boreal deciduous forests (aspen or aspen-birch-fir-spruce), edges of woods, clearings, aspen or bur oak thickets, sometimes open pine forests, streambanks, trails, roadsides. 0 -2000+ m. (Brouillet *et al.* 2006).

Newfoundland: semi-open, often calcareous, birch/white spruce forest, forest edges, gravelly shores of lowland rivers, high altitude softwood scrub, and exposed arctic-alpine limestone barrens. 0-400 m.

Overview of Biology

Hybridization is a very significant aspect of aster biology. It occurs quite readily where related species are found together, and many aster populations contain numerous, often fertile, hybrid individuals, which sometimes backcross with one or more of the parent species. Nevertheless, as long as “core populations” of “pure” plants persist, there is generally no significant threat to the persistence of either parent species (Brouillet 1981).

On the Port au Port Peninsula, approximately 80% of *Symphyotrichum ciliolatum*-like individuals are estimated to be pure *Symphyotrichum ciliolatum,* approximately 12% are apparently *Symphyotrichum* ×*subgeminatum,* and the rest are presumably *Symphyotrichum* ×*subgeminatum* introgressed with *Symphyotrichum ciliolatum.* At six locations *Symphyotrichum ciliolatum* and *Symphyotrichum* ×*subgeminatum,* or *Symphyotrichum* ×*subgeminatum* introgressed with *Symphyotrichum ciliolatum* were encountered together.

Symphyotrichum novi-belgii - the co-parent (along with *Symphyotrichum ciliolatum*) of the hybrid *Symphyotrichum* ×*subgeminatum* - is apparently absent in barrens habitat; its requirement for moisture apparently being higher than that of *Symphyotrichum ciliolatum.* It is therefore not surprising that, of the three habitat types present on the top of the Port au Port Peninsula, the barrens habitat harbours the lowest percentage of hybrids (~8.5%, compared to ~12% for forest habitat, and ~23% for softwood scrub habitat). Thus barrens habitat would appear to provide a critical reservoir of pure or nearly pure *Symphyotrichum ciliolatum*.

[The above information was provided by Claudia Hanel, February 2009.]

Flowers have been observed at Romaines Brook on August 1, 2006 and September 11, 2000.

Population Size and Area of Occupancy

None of the known, extant, populations of *Symphyotrichum ciliolatum* have been sufficiently surveyed to allow for a rigorous determination of population size.

Indeed, the situation is greatly complicated by the widespread occurrence of the hybrid *Symphyotrichum* ×*subgeminatum*; particularly in the sense that it is never a simple matter to distinguish "pure" examples of *Symphyotrichum ciliolatum* from examples of *Symphyotrichum* ×*subgeminatum*, especially in the field.

Nevertheless, a recent rough estimate of about 581,000 individuals was derived, specifically for the Port au Port Peninsula population of *Symphyotrichum ciliolatum*, by Claudia Hanel, using broadly-based transect survey data [information provided by Claudia Hanel, February 2009]. Since the Port au Port Peninsula appears to harbour the vast proportion of the Newfoundland population, the grand total number of individuals for the Island probably does not exceed about 600,000 individuals.

The area of occupancy for *Symphyotrichum ciliolatum* in Newfoundland can only be generally estimated. On the basis of recent field sampling, Claudia Hanel defined an area of 39.6 km^2 to be the "main area of occurrence" of the species on the central Port au Port Peninsula, estimating that about 90% of the population on that Peninsula was contained therein. Assuming that the additional 10% of that population occurs at approximately the same local density, but in more widely-distributed scattered portions, an AO of about 45 km^2 seems to be a reasonable estimate for the entire Peninsula. Adding to this initial total, the areas of the two very small (estimates to be <1 km^2) additional known recent localities at Table Mountain and Romaines Brook, a total AO for the Province of just under 50 km^2 is probably reasonably accurate.

Aboriginal, Traditional and Local Ecological Knowledge

No published or other evidence has been found regarding the aboriginal use of *Symphyotrichum ciliolatum* in Newfoundland. In particular, a specific inquiry to the Federation of Newfoundland Indians in 2007 yielded no definitive information. Arnason *et al.* (1981) failed to mention the species in their comprehensive study of eastern Canada ethnobotany.

Trends

The small sub-population formerly occurring on the open river gravels on the western side of Romaines Brook was apparently *completely* extirpated during the drastic river re-channeling operations carried out during the late summer of 2006

(see: “Threats and Limiting Factors” section, below). The fate of the somewhat larger sub-population occurring both on the open river gravels, and in at least some of the backwater river channels, on the eastern side of Romaines Brook, may very well have been somewhat similar, but high water levels, during the late Fall of 2006, prevented a close inspection of these areas. No recent observations have been made at this locality.

No information on trends is available for the extant Table Mountain or recently-discovered Top of Port au Port Peninsula populations.

Threats and Limiting Factors

Seismic Exploration Activities and the Prospect of Oil Drilling:

In 2007/2008, during the course of “pre-seismic” investigations anticipating major exploratory oil-drilling on the Port au Port Peninsula, approximately 100 km of seismic line were cut, to a width of 2.5 m, to allow for the passage of the drill rig.

To mitigate damage to *Symphyotrichum ciliolatum*, the Provincial Wildlife Division recommended that scrub less than 0.5 m in height not be cut and that drilling with a tracked vehicle be done as early as possible in the summer to provide some recovery time before flowering in August and September. However, at the time of this writing, it appears that actual drilling and blasting have yet to be carried out. The short-term (1.5 year) effect of the line cutting is unknown as no permanent study plots were marked and no resurveys have been conducted since the lines were cut.

According to aster specialist Luc Brouillet (personal communication to Claudia Hanel, April 2008) both *Symphyotrichum ciliolatum* and *Symphyotrichum novi-belgii* would be expected to quickly recover from any disturbance as they are able to resprout after disturbance. However, Brouillet believes that the disturbance caused by both the exploration itself, and by subsequent use of the cut lines by ATVs and moose, could allow the entry of *Symphyotrichum novi-belgii* into scrub and barren areas where it is not currently found, possibly encouraging increased hybridization, and thus a reduction in the percentage of “pure” *Symphyotrichum ciliolatum*. The exposure of bare soil on the cut lines and their subsequent use by ATVs and moose could also facilitate the entry of invasive weedy exotic species such as Coltsfoot (*Tussilago farfara*) or Canada Thistle (*Cirsium arvense*) that could, potentially, outcompete the asters.

While the actual area disturbed by the seismic lines is less than 1% of the area covered by the densest Lindley’s Aster concentration, a much larger area could be influenced by indirect effects.

[The above information was provided by Claudia Hanel, February 2009.]

The effects of possible, future, oil exploration and drilling activities is unknown.

Hybridization:

In Newfoundland, there seems to be no immediate danger of pure *Symphyotrichum ciliolatum* disappearing due to hybridization. Nonetheless, as stated above, Brouillet believes that the disturbance caused by oil exploration, and the subsequent use of the cut lines by ATVs and moose, could allow the entry of *Symphyotrichum novi-belgii* into scrub and barren areas where it is not currently found and could possibly encourage increased hybridization.

It should be noted that, in Newfoundland, hybridization is not limited to a single area and pure *Symphvotrichum ciliolatum* and *Symphyotrichum* x subgem*inatum* occur interspersed on the landscape.

[The above information was provided by Claudia Hanel, February 2009.]

Riverbed Modification:

As the result of catastrophic flooding in the Stephenville area in late September, 2005, widespread rivercourse modification work was undertaken by highways and municipal authorities, in an attempt to minimize *future* flood damage. Additional widespread repairs were carried out on damaged roads and other sensitive river-associated infrastructure.

One of the areas receiving major attention was the floodplain of Romaines Brook. There seems to have been some real concern about the continuing safety of the highway bridge over the river's mouth. Moreover, there was a real need to do something about a forestry/gravel pit access road running along the west bank of the river for about a kilometre and then turning upward into the hills, that had incurred serious wash-out damage, and become impassable for almost a kilometre.

In late summer 2006, heavy equipment set about to: [1] re-route the lower kilometre of the river, towards the *east*, away from the forestry/gravel pit access road, [2] rebuild the damaged forestry/gravel pit access road, and [3] bolster the river bank area near the base of the highway bridge.

The rivercourse modification operation involved dyking and severely canalizing the river, in a very planned and deliberate way. In the process of this work, most of the lower one kilometre of the riverbed and floodplain was completely dug up, and re-distributed, largely toward the western flanks of the river, to rebuild, ballast, and protect the forestry/gravel pit access road, and to fundamentally

change the course of the river's flow. Only one low island, and a small gravel bar, both in the downriver section of the floodplain, were spared.

The longterm consequences of this extensive rivercourse modification operation, for *Symphyotrichum ciliolatum*, seem to be: [1] that sub-population/s formerly occurring on the open river gravels on the western side of the river, and possibly, also, some of the additional sub-populations formerly occurring on the east side of the river, have been completely extirpated, and [2] that the inevitable changes to water table and seasonal flooding regimes, caused by the dyking and channelizing of the main rivercourse, will almost certainly critically affect any of the remaining sub-populations occurring within the backwater river channels, on the eastern side of the brook.

Floodplain management and modification seems likely to become a recurring theme at Romaines Brook.

Existing Protection

None at present.

However, it should be noted that the Table Mountain occurrence of *Symphyotrichum ciliolatum* is at least partly circumscribed by the only known Provincial occurrence of the Low Northern Rockcress (*Braya humilis* [= *Neotorularia humilis*]) (ref. Tilley *et al*., 2005), which is Provincially listed as "Endangered". Thus, any future protection afforded to the Low Northern Rockcress on Table Mountain might be expected to also protect at least some of the nearby *Symphyotrichum ciliolatum* occurrence.

Rank or Status	Rank or Status
Global	
G-rank	G5
IUCN	not assessed
National	
N-rank	NNR (not ranked)
National General Status	4
COSEWIC	not assessed
Provincial	
Provincial General Status	2*
Newfoundland S-Rank	S1*
Newfoundland General Status	2*
Labrador S-Rank	considered not to be present
Labrador General Status	considered not to be present
Adjacent Jurisdictions	
Nova Scotia S-Rank	S2S3
Nova Scotia General Status	3
Prince Edward Island S-Rank	not present
Prince Edward Island General Status	not present
New Brunswick S-Rank	S5
New Brunswick General Status	4
Québec S-Rank	S5
Québec General Status	4

[Note: Where available, ranking data from the biodiversity databases of the individual Provinces has been used. Otherwise, General Status ranks are based upon the "General Status of Species in Canada (2005)", and S-Ranks are based upon **"**NatureServe Explorer". Where there is apparent discrepancy, NatureServe Explorer ranks are considered to be the least current.]

* [The Newfoundland/Provincial S-Ranks and General Status ranks predate the discovery of the large population on the Port au Port Peninsula in 2007.]

Special Significance

Table Mountain is the TYPE LOCALITY for *Aster foliaceus* var. *subgeminatus*, which includes the hybrid form *Symphyotrichum* ×*subgeminatus*, found only in western Newfoundland and in the Gaspé, Québec.

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Collections Examined

Provincial Museum of Newfoundland and Labrador

Eight herbarium collections.

Provincial Wildlife Division

Fourteen as yet uncatalogued specimens, plus numerous photographs, document this occurrence; all were determined, for the purpose of this report, by Luc Brouillet.

TECHNICAL SUMMARY

Distribution and Population Information	**Criteria Assessment**
Extent of occurrence (EO)(km^2)	approximately 1600 km km^2 (including historical localities)
Area of occupancy (AO) (km^2)	rough estimate based upon recent field sampling; probably just under 50 km^2
Number of extant locations	probably 5 (3 of these being in close proximity); however, only 3 of these have been located/ relocated within the last 25 years
Specify trend in # locations, EO, AO (decline, stable, increasing, unknown)	declining
Habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat	declining
Generation time (average age of parents in the population) (indicate years, months, days, etc.)	unknown; perennial
Number of mature individuals (capable of reproduction) in the Provincial population (or, specify a range of plausible values)	roughly estimated to be about 600,000 mature individuals
Total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals or number of populations	unknown overall; but almost certainly declined at Romaines Brook
Are there extreme fluctuations (>1 order of magnitude) in number of mature individuals, number of locations, AO and/or EO?	unknown, but unlikely
Is the total population severely fragmented (most individuals found within small and isolated populations)	yes
Rescue Effect (immigration from an outside source)	
Does species exist elsewhere?	yes
Status of the outside population(s)? [adjacent Provinces only]	Nova Scotia, sensitive; Prince Edward Island, does not occur; New Brunswick and Québec, secure.
Is immigration known or possible?	presumably possible
Would immigrants be adapted to survive here?	unknown
Is there sufficient habitat for immigrants here?	unknown

Appendix A. Population Information

Recently verified occurrences/range use (recorded within the last 25 years)
Verified occurrences consist of observations supported by the collection of a voucher specimen (i.e. a sample to be identified/confirmed by experts and deposited in a herbarium).

In Newfoundland, *Symphyotrichum ciliolatum* definitely occurs. However, some *Symphyotrichum ciliolatum*-like specimens collected from Romaines Brook have been confirmed to be *Symphyotrichum* ×*subgeminatum* by Stuart Hay of l'Herbier Marie-Victorin at l'Université de Montréal. Additional specimens from Romaines Brook have been confirmed to be *Symphyotrichum* ×*subgeminatum* introgressed (backcrossed) with the *Symphyotrichum novi-belgii* parent, by Luc Brouillet, also of l'Herbier Marie-Victorin at l'Université de Montréal. Luc Brouillet is an aster specialist, and the senior author of the Flora of North America *Symphyotrichum* treatment (Brouillet *et al.* 2006).

On the Port au Port Peninsula, approximately 80% of *Symphyotrichum ciliolatum*-like individuals have been estimated to be pure *Symphyotrichum ciliolatum,* 12% are apparently *Symphyotrichum* ×*subgeminatum,* and a very small proportion are *Symphyotrichum* ×*subgeminatum* introgressed with *Symphyotrichum ciliolatum.* At six locations *Symphyotrichum ciliolatum* and *Symphyotrichum* ×*subgeminatum,* or *Symphyotrichum* ×*subgeminatum* introgressed with *Symphyotrichum ciliolatum* were encountered together [information provided by Claudia Hanel, February 2009]

The proportions of pure, versus hybrid, *Symphyotrichum ciliolatum* with the 2 other known, extant, populations is unknown.

Symphyotrichum ciliolatum – [Figs. A-1, A-2]

Table Mountain:

June 24, 1999. Table Mountain, S part of, on ridge north of curve in road to Coast Guard radar towers. Limestone barren with turf patches. UTM: NAD 83 21U 377559 5383918. [Observers: M. Anions, C. Wentzell; C. Hanel; R. Charest. Collection: MA 99-17-4 = NFM 2993 (Provincial Museum of Newfoundland and Labrador), determined by J. E. Maunder; young scrappy specimens, with no flowers; however, see the July 8, 2007 entry, below.

July 8, 2007. Table Mountain, S part of, on ridge north of curve in road to Coast Guard radar towers. Limestone barren with turf patches. UTM: NAD 83 21U 377432 5383673. Observers: C. Hanel; J. E. Maunder. Collection: CH 070708-3, tentative identification by C. Hanel, Provincial Wildlife Division; identified, by Luc Brouillet, as "cf. ciliolatum" on the basis of photos by Claudia Hanel; confirming photos taken by John Maunder (Fig. 2).

Romaines Brook:

July 14, 1999. Romaine's Brook, approximately 1 km N of the highway on the W shore of the river. Riverside gravel. UTM: NAD 83 21U 376559 5380068. [Observer: C. Hanel. Collection: CH 990714-1 = NFM 5155 (Provincial Museum of Newfoundland and Labrador), determined by C. Hanel, *appears to be a good example.*]

September 11, 2000. Romaines River, S-side of dry side channel on E-side of river, approx. 600 m N of the bridge of road 460 over Romaines River. Bouldery bed of mostly dry side channel 5-15 m wide; perhaps seasonally flooded; vegetation ranging from sparse herb-dominated to moderately dense, *Salix*-dominated; substrate moist sand between boulders; open. UTM: NAD 83 21U 376658 5379669. [Observer: C. Hanel. Collection: CH 000911-1 = NFM 5581 (Provincial Museum of Newfoundland and Labrador), determined by Stuart Hay, *appears to be a classic example*.]

September 11, 2000. Romaines River, forest on E-side of river, approx. 1.3 km N of the bridge of road 460 over Romaines River. *Betula*/*Picea glauca* forest; not generally flooded annually; understory with a nearly continuous cover of *Rhytidiadelphus triquetrus* and patches of low herbs and shrubs dominated by *Rubus pubescens* and *Symphyotrichium ciliolatum*; substrate fresh sandy silt; partial to full shade. UTM: NAD 83 21U 376741 5380309. [Observer: C. Hanel. Collections: CH 000911-13 = NFM 5541 (Provincial Museum of Newfoundland and Labrador), determined by Stuart Hay; CH 000911-19A = NFM 5542 (Provincial Museum of Newfoundland and Labrador), determined by Luc Brouillet.]

Port au Port Peninsula:

Fourteen specimens and numerous photographs document this occurrence; all determined by Luc Brouillet.

Symphyotrichum ×*subgeminatum* - [Fig. A-1, A-2]

Romaines Brook:

September 11, 2000. Romaines River, forest on E-side of river, approx. 1.3 km N of the bridge of road 460 over Romaines River. *Betula*/*Picea glauca* forest; not generally flooded annually; understory with a nearly continuous cover of *Rhytidiadelphus triquetrus* and patches of low herbs and shrubs dominated by *Rubus pubescens* and *Symphyotrichium ciliolatum*; substrate fresh sandy silt; partial to full shade. UTM: NAD 83 21U 376741 5380309. [Observer: C. Hanel. Collection: CH 000911-19B = NFM 5543 (Provincial Museum of Newfoundland and Labrador), determined by Luc Brouillet, Dec. 6, 2001 (“cf.” is handwritten on

label; though the specimens certainly seem to represent this hybrid); CH 000911-20A = NFM 5582 (Provincial Museum of Newfoundland and Labrador), determined as "*Symphyotrichum* cf. *novi-belgii* × *ciliolatum"* by Luc Brouillet.]

Port au Port Peninsula:

September 2007. Top of Port au Port Peninsula. Luc Brouillet identified one specimen from this area with certainty and three others more tentatively. Several photographs taken at this location were also tentatively identified as *Symphyotrichum* ×*subgeminatum*.

Symphyotrichum ×*subgeminatum* introgressed (backcrossed) - [Fig. A-1, A-2]

Romaines Brook:

September 11, 2000. Romaines River, forest on E-side of river, approx. 1.3 km N of the bridge of road 460 over Romaines River. *Betula*/*Picea glauca* forest; not generally flooded annually; understory with a nearly continuous cover of *Rhytidiadelphus triquetrus* and patches of low herbs and shrubs dominated by *Rubus pubescens* and *Symphyotrichium ciliolatum*; substrate fresh sandy silt; partial to full shade. UTM: NAD 83 21U 376741 5380309. [Observer: C. Hanel. Collections: CH 000911-20B = NFM 5561 (Provincial Museum of Newfoundland and Labrador), determined as "*Symphyotrichum* cf. *novi-belgii* × *ciliolatum"* [= *Symphyotrichum* ×*subgeminatum*] by Luc Brouillet, with the additional somewhat cryptic annotation: "Perhaps a backcross with *Symphyotrichum novi-belgii* × *ciliolatum* [= *Symphyotrichum* ×*subgeminatum*]! Luc Brouillet Dec. 6 2001".]

Port au Port Peninsula:

September 2007. Top of Port au Port Peninsula. Two of the specimens from this area examined by Luc Brouillet could represent this backcross, but the identification was tentative. Both cases represented a backcross of *Symphyotrichum* ×*subgeminatum* with *Symphyotrichium ciliolatum*. Several photos could not be identified with certainty to either *Symphyotrichum* ×*subgeminatum* or *S. novi-belgii* by Luc Brouillet, and may also represent the backcrossed individuals.

Distribution

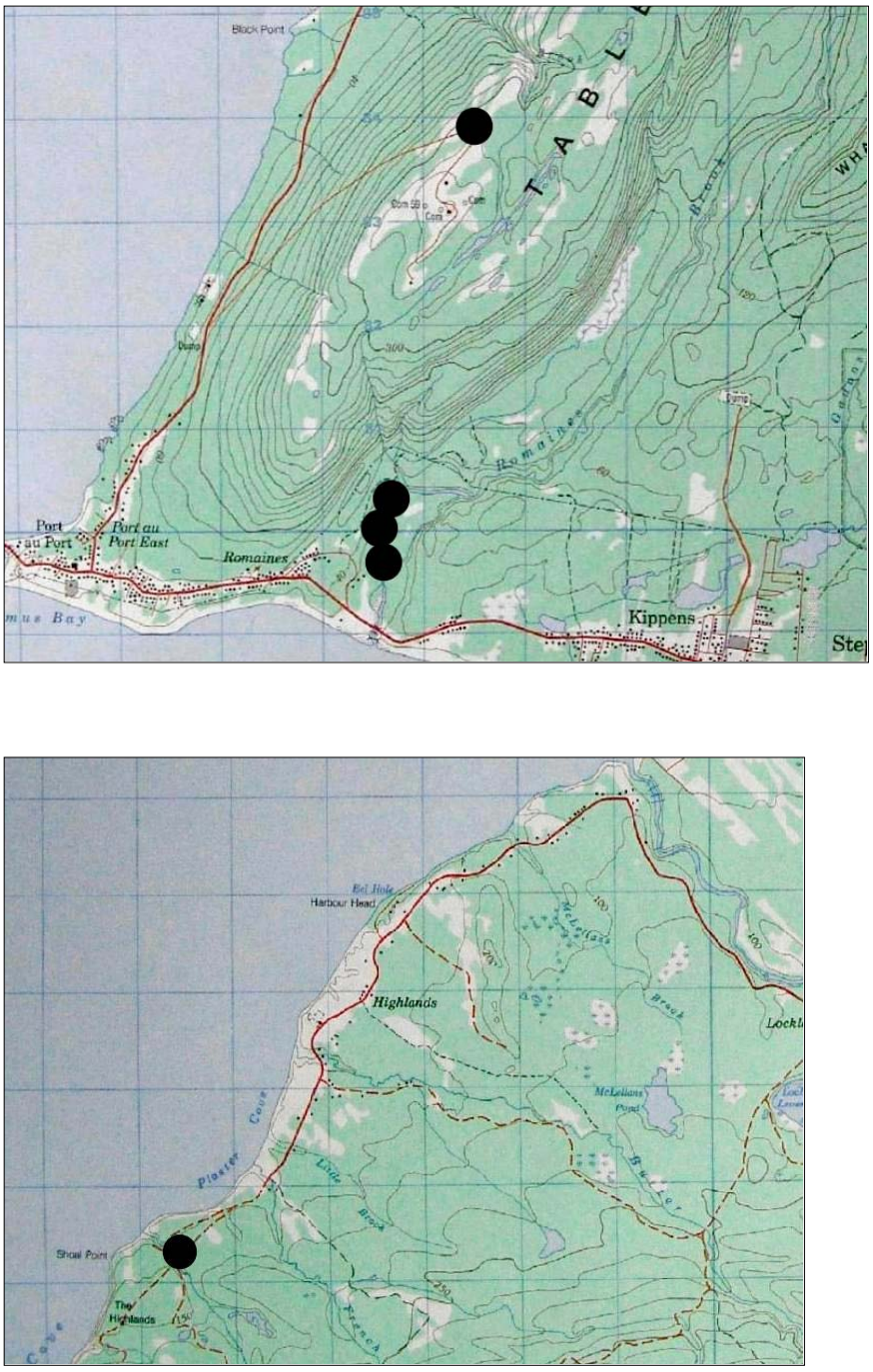


Figure A-1. Specific locations of *Symphyotrichum ciliolatum* and hybrids in Newfoundland: [top] Romaines Brook and Table Mountain; [bottom] Crabbes River ("historical" locality; actually on high ground SW of Highlands [but, the location of the dot is very approximate]). [The precise locality of the "historical" Harry's River record is unknown, so no large scale map is presented]

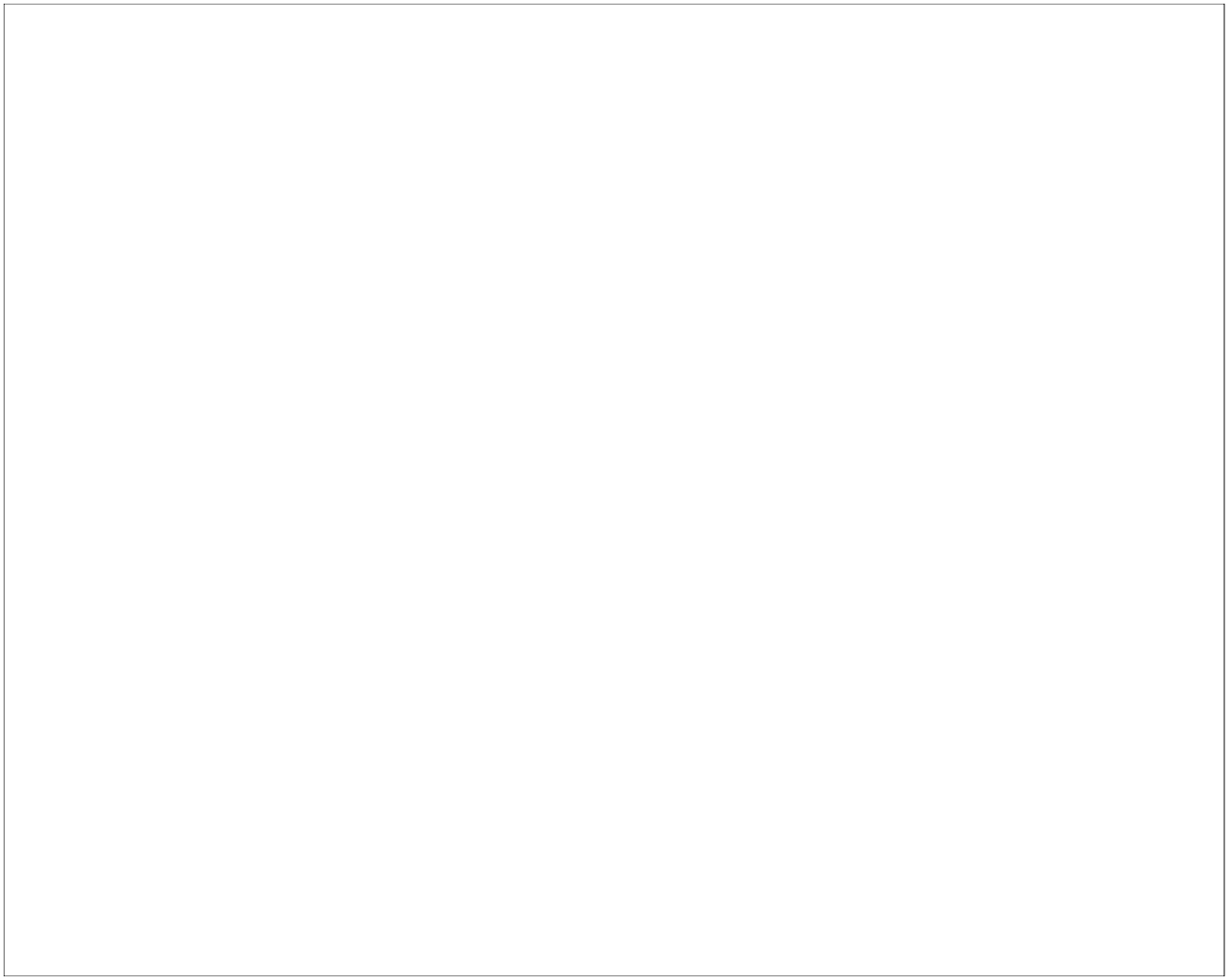


Figure A-2. Locations of *Symphyotrichum ciliolatum* and hybrids in Newfoundland: Port au Port Peninsula. Transect data from outlined “core area” was used to arrive at an estimate of the number of individuals. [Map provided by Claudia Hanel, February 2009.]

The discovery, in 2007, of the robust Port au Port Peninsula population has helped to solve the long-standing mystery concerning the apparently obvious fact that there *must* have been a sustainable population of “pure *ciliolatum*” residing *somewhere* in the general vicinity of the previously-know Newfoundland populations, with numbers sufficient to renew both the known “pure *ciliolatum*” populations and the numerous known hybrid ×*subgeminatum* occurrences.

Indeed, the westerly location of the newly-discovered Port au Port Peninsula populations offers an entirely credible source for all of the other known Newfoundland populations, via wind-blown seed, in that the Port au Port population lies almost directly upwind of these same populations, within the prevailing westerly/southwesterly wind regime of the west coast of the Island.

Historical Verified Occurrences/Range Use (recorded prior to the last 25 years)

Symphyotrichum ciliolatum/Symphyotrichum ×*subgeminatum* [see the section entitled "Systematic/Taxonomic Clarifications" in the main report] –

Table Mountain, Stephenville:

August 16, 1910. Table Mountain. Wet runs and boggy spots in limestone barrens, upper slopes and tablelands. Altitude 200-300 m. [Observers: M. L. Fernald, K. M. Wiegand, J. Kittredge. Collection: 4121. GH (Gray Herbarium).]

August 16, 1910. Table Mountain. Damp bushy ravine in limestone tableland. [Observers: M. L. Fernald, K. M. Wiegand, J. Kittredge. Collection: 4126. GH (Gray Herbarium).] [TYPE collection for: *Aster foliaceus* Lindl. *ex* DC. var. *subgeminatus* Fernald 1915.]

Harry's River:

August 18, 1910. Harry's River. Gravelly beach. [Observers: M. L. Fernald, K. M. Wiegand, J. Kittredge. Collection: 4120. GH (Gray Herbarium).]

Crabbes River:

September 10, 1930. "Crabbes". [More precisely, "Bluff on coast at highlands" [= the town of Highlands, SW of] (Kennedy 1931)] [Observer: R. B. Kennedy. Collection: Kennedy 545. GH (Gray Herbarium), BM (British Museum).]

Other Observations (unverified occurrences)

Apparently none.

Recent Search Effort (areas searched within the last 25 years with estimate of effort)

General rare plant surveys of the west and northeast coasts of the Island were conducted by members of the Newfoundland Rare Plant Project (*q.v.*), specifically during 1999 to 2001, when 1645 individual sites were surveyed and 7622 plant collections were made. Additional general rare plant surveys have been conducted within the Province by various National Parks personnel, and by J. E. Maunder of the Provincial Museum and H. Mann of Sir Wilfred Grenfell College (early 1970's to present), as well as by N. Djan-Chékar of the Provincial Museum (2002 to present). Significant additional general collecting has been conducted,

on the south coast of the Island, by R. Etcheberry, of St.-Pierre et Miquelon (1986, 1987, 1989, 1990, 1992, and 1993).

Targeted rare plant surveys were conducted by personnel from the Université de Montréal, during the course of the preparation of the publication “The Rare Vascular Plants of the Island of Newfoundland” (Bouchard *et al.* 1991), in: 1984 and 1985 (Gros Morne National Park), 1986 (southwest coast, and the general Port au Port area), 1987 (Great Northern Peninsula), 1988 (Baie Verte Peninsula, Notre Dame Bay, and central and eastern Newfoundland), 1989 (Gros Morne National Park, and the south coast), and 1990 (west coast, and Great Northern Peninsula).

Geographically focused rare plant surveys were conducted by personnel from the Université de Montréal, during the course of the preparation of contracted rare plant reports for Port au Choix National Historic Park (Bouchard *et al*. 1993), L’Anse aux Meadows National Historic Park (Bouchard *et al*. 1993), Gros Morne National Park (Anions, 1994; Bouchard *et al.,* 1985, 1986, 1991, 1994, 1996; and Brouillet *et al.,* 1998), and Terra Nova National Park (Brouillet *et al.* 1997). Additional geographically focused rare plant surveys were conducted in the Squid Cove and Doctors Brook areas, and the Labrador Straits region by C. Hanel (2004, 2005a, 2005b).

In 2007, in anticipation of imminent oil-drilling-related seismic investigations, significant botanical surveys were carried out over a large portion of the Port au Port Peninsula, particularly on the interior plateau, by both Government and private agencies. The 2007 surveys were performed in areas where seismic lines were to be cut in August 2007 a few remote barrens area were visited with a helicopter during three days of surveys.

The oil company also employed environmental monitors, who walked approximately 100 km of survey transect, encompassing most of the planned seismic lines on the entire Peninsula. During all surveys observers recorded location coordinates and made population estimates where asters suspected to be *Symphyotrichum ciliolatum* or their hybrids were encountered. In many cases they took photographs or specimens as well. Field identifications were later vetted against the photographs and specimens collected to confirm initial field observations.

[The information in the previous two paragraphs was provided by Claudia Hanel, February 2009.]

Potential Sites Unexplored

The forested and barren hills of western Newfoundland have, on balance, been poorly searched. The potential for new discoveries has been strongly illustrated by the recent significant finds on the high limestone plateau of the Port au Port Peninsula.

Appendix B. Supplementary Details

Description – [Fig. B-1]

Symphyotrichum ciliolatum

Herbaceous perennial. **Plants** 30-100 cm tall; from elongated herbaceous rhizomes. **Stems** 1-3+, erect (straight to ± flexuous); glabrate to sparsely hirsute or strigillose, especially distally. **Leaves** thin, margins coarsely and sharply serrate to crenate-serrate or serrulate, ciliate to scabrous; apices acute or acuminate, mucronulate, abaxial faces glabrate to sparsely hirsute; midveins usually densely hirsute, sometimes glabrous, adaxial glabrous or glabrate to scabrellous. **Basal leaves** usually withering by flowering time (sometimes persistent on small plants); long-petiolate (petioles slightly winged, sheathing, ciliate); blades ovate, (24)40-120(270) × 15-70 mm; bases usually shallowly cordate, sometimes rounded; often densely ciliolate along petiole and veins. **Mid-stem leaves** often withering by flowering time, winged-petiolate; blades ovate to oblanceolate or lanceolate, (24)60-150 × (10)20-60 mm, reduced upwards; bases subcordate to cuneate; pubescence similar to basal leaves. **Upper leaves** sessile or sometimes subsessile (petioles widely-winged); blades lance-ovate to linear-lanceolate or linear, 18-75 × (2)5-25 mm; bases cuneate, sometimes ± clasping; pubescence similar to basal leaves; margins serrulate or entire and sparsely ciliate. **Heads** (6)13-50(100+) in the open, paniculiform arrays; branches ascending. **Peduncles** 0.2-1.5+ cm, unequal, reduced distally, sparsely to moderately hirsutulous; bracts 0-4, subulate or linear, intergrading into phyllaries. **Involucres** campanulate, (4)5-6.5 mm. **Phyllaries** in 3-5 graduated series; narrowly oblong-lanceolate to oblong-oblanceolate or linear-oblanceolate (innermost), ± unequal; bases indurate 1/3-2/3; margins narrowly scarious, erose, hyaline or infrequently purplish, sparsely ciliolate; green zones lanceolate to linear-lanceolate or linear; apices acuminate to long-acuminate, faces glabrous. **Ray florets** (12)14-25; corollas pale to deep blue or bluish purple; laminae (8.3)10-15 × 1-2.3 mm. **Disc florets** 14-25(35); corollas yellow becoming reddish purple, 4.3-6.4 mm; tubes shorter than funnelform throats; lobes narrowly triangular, 0.5-1.1 mm. **Cypselae** [ie. “seeds”] yellowish white, obovoid, compressed, 1-2 mm, 5-6-nerved, faces glabrate to sparsely strigillose; pappi white to pinkish, 3-6 mm, equalling disc corolla. **2*n*** = 48 (Modified after Brouillet *et al.* 2006, and Semple *et al.* 2002).

Photos: Nathalie Djan-Chékar

Figure B-1. Description (*Symphyotrichum ciliolatum*): [a] whole plant (with a somewhat reduced inflorescence!) showing cordate leaf bases, [b] closer view of inflorescence; both examples from Romaines Brook.

Photos: John E. Maunder [top], Claudia Hanel [bottom]

Figure B-2. Description (*Symphyotrichum ciliolatum*): [top] non-flowering plant, showing cordate leaf bases, [bottom] closeup, showing cordate leaf bases; both examples from Table Mountain.

Symphyotrichum ×subgeminatum

Fernald (1950) wrote: “In aspect, suggesting no. 21 [ie. suggesting *A. tardiflorus* = the F1 hybrid between *S. cordifolium* and *S. puniceum*], very slender, 2.5-5 dm. high, glabrous; cauline leaves only 3-5 below the inflorescence, thin membranaceous, the narrowly ovate to lanceolate low-toothed blades acuminate, constricted below to winged, half-clasping bases, the narrow bases of the lowest leaves up to twice the length of the blade; inflorescence interruptedly spiciform, 1 or 2 heads borne on short pedicels in axils of the uppermost 2-5 elongate and much overtopping leaves; involucres 5-6 mm. high, with subequal phyllaries, the outer ones foliaceous and about 1 mm. broad; ligules 10-15, blue-violet, 1-1.3 cm. long.”

Habitat

Romaines Brook, variously:

Birch/white spruce forest, not generally flooded annually, with a mossy understory comprising a nearly continuous cover of *Rhytidiadelphus triquetrus* and patches of low herbs and shrubs dominated by *Rubus pubescens* and *Symphyotrichium ciliolatum*. Substrate fresh sandy silt. Partial to full shade.

Edge of birch/white spruce forest. Bouldery bed of mostly dry side channel 5-15 m wide, perhaps seasonally flooded. Vegetation ranging from sparse herb-dominated to moderately densely *Salix*-dominated. Substrate moist sand between boulders. Open ground.

Riverside gravels. Open ground.

Table Mountain:

Exposed arctic-alpine limestone barrens. Upper slopes and tablelands, at 200-300 m elevation. Turf patches in damp bushy ravines, and wet runs and boggy spots. [TYPE locality of *Symphyotrichum ×subgeminatum*]

Harry’s River and Crabbes River [historical localities], variously:

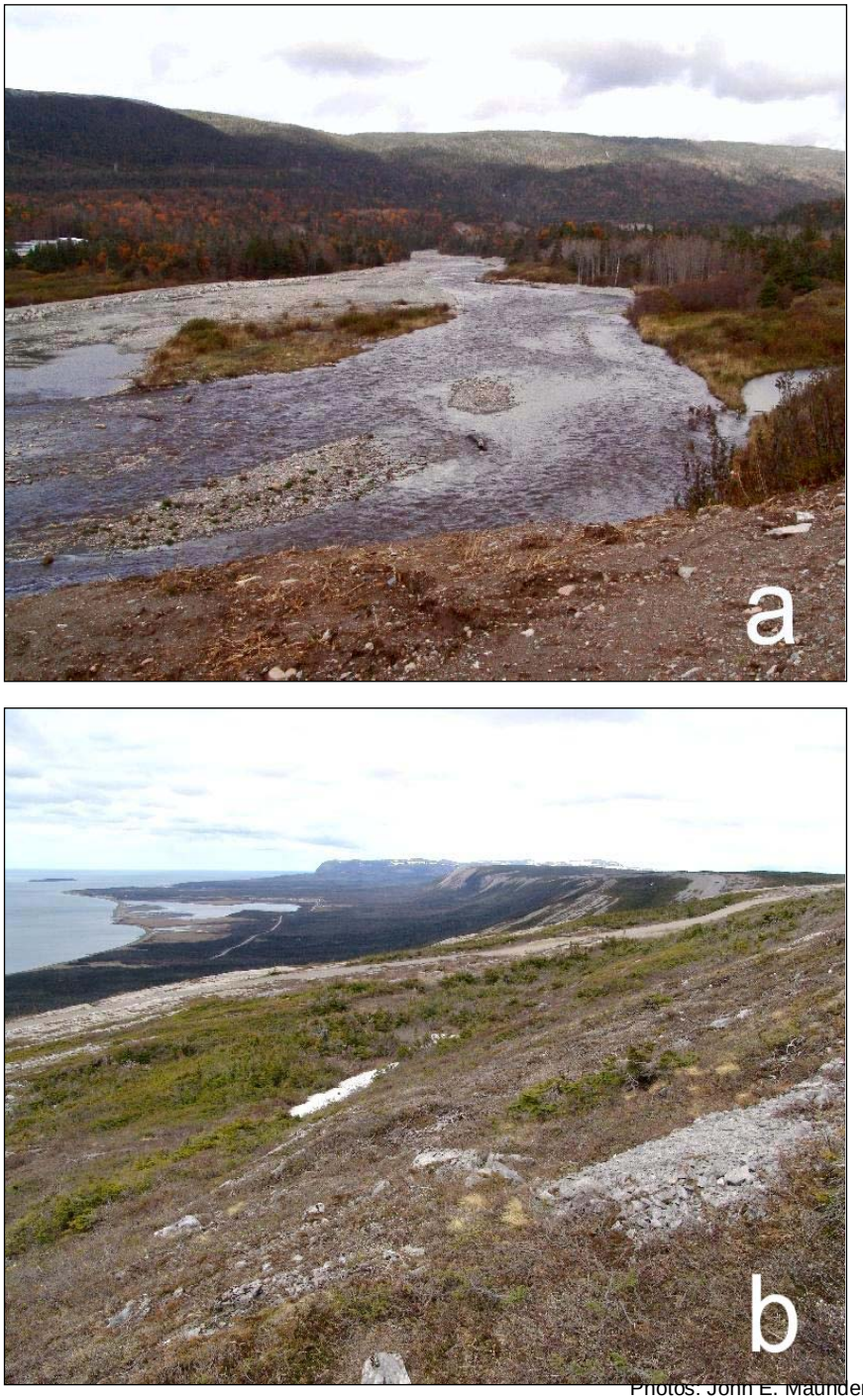
Birch/white spruce forest, not generally flooded annually, with a mossy understory comprising a nearly continuous cover of *Rhytidiadelphus triquetrus* and patches of low herbs and shrubs dominated by *Rubus pubescens* and *Symphyotrichium ciliolatum*. Substrate fresh sandy silt. Partial to full shade.

Gravelly shores of lowland rivers.

Top of the Port au Port Peninsula:

Limestone barrens, softwood scrub, and mixed forest.

It should be noted that the relative commonness of *Symphyotrichum ciliolatum* on top of the Port au Port Peninsula varies significantly between these three basic habitats: relative commonness on the barrens = 1x; relative commonness in the forest = almost 3x; relative commonness in softwood scrub = a little over 4x [information provided by Claudia Hanel, February 2009].



Photos: John E. Maunder

Figure B-3. Habitat: [a] Romaines Brook, looking north, showing river flats and channels (as well as recent damage done by channel re-routing), [b] Table Mountain, looking north, upper slopes and tablelands.

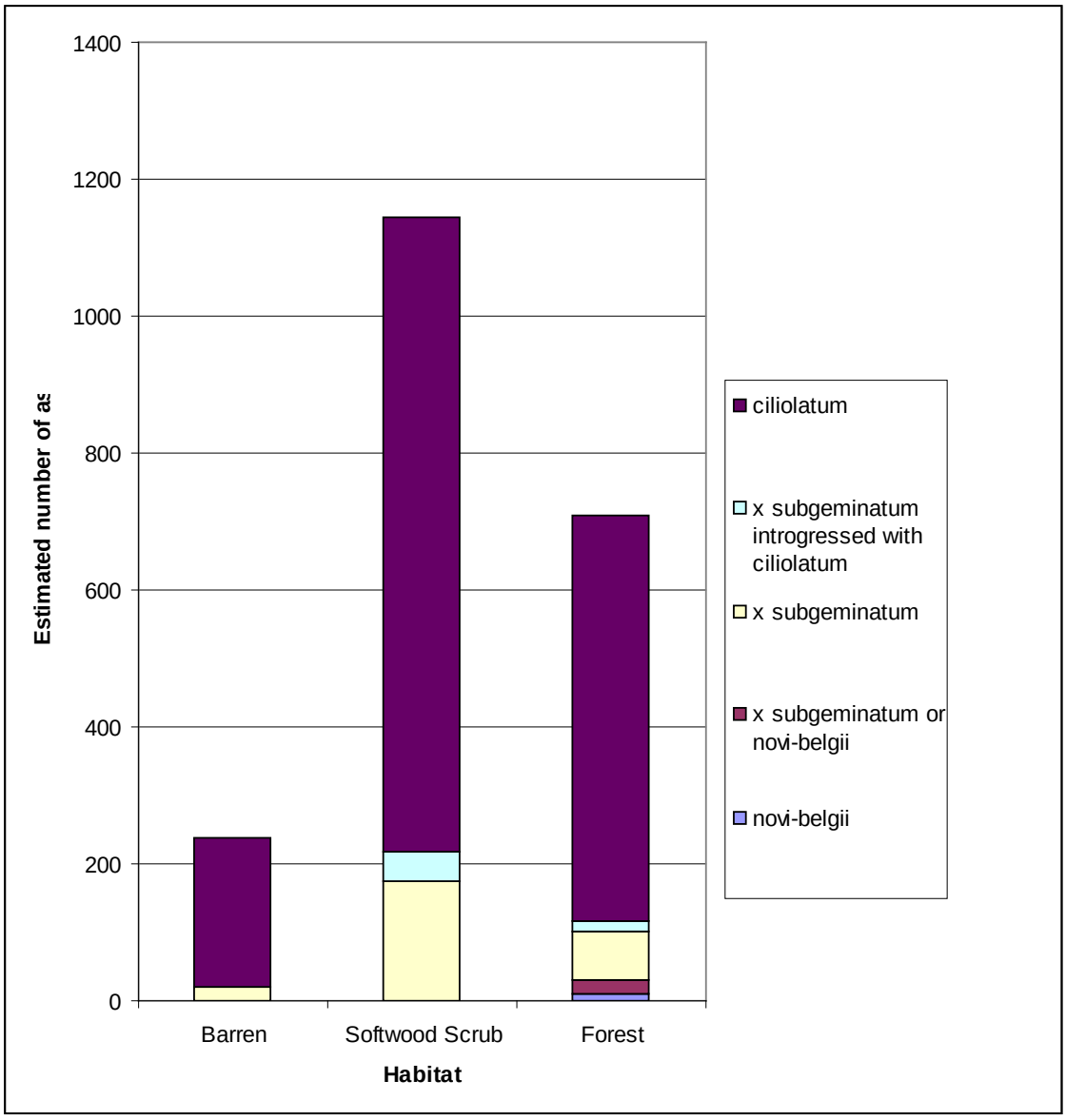


Figure B-4. Habitat: Estimated numbers of *Symphyotrichum ciliolatum* and hybrids along the seismic lines in the three different habitat types on the Port au Port Peninsula. [Figure provided by Claudia Hanel, February 2009. Note: the truncated Y-axis label should read “Estimated number of asters”]

Population Size

To arrive at a preliminary population estimate of population size, a 39.6 km^2 “main area of occurrence” on the central Port au Port Peninsula (hereafter termed the "core area") was roughly outlined (Fig. A-2). This area was stratified into three general habitat types mapped by the forest inventory (forest, softwood scrub and barren) in ArcMap v. 9.3.

Within each habitat type, the width of the transect (the distance at which the surveyors could see the asters) was estimated and the population estimated along the transect belt was extrapolated to the entire portion of the core area covered by each habitat. The percentages of the total area surveyed varied from 0.34% for softwood scrub to 0.67% for forest.

The following assumptions were made:

The density of asters was constant across the entire core area.
The transects are a representative sub-sample of the core area.
The GPS locations fell into the appropriate habitat type.

The width of the transects (twice the distance that the observer could see the asters from the line) was estimated as follows:

Barren - 12m; Softwood scrub - 4m; Forest - 6m. To arrive at a conservative estimate, these transect width estimates were double the values used in a previous analysis.

The area of the different habitat types and other figures used in the calculation are shown in Table B-1.

When extrapolated to the entire core area the estimated population was 528,000. The core area captured the majority of the population, therefore the total number of *Symphyotrichum ciliolatum* and their hybrids on the whole Port au Port Peninsula would be expected to be only about 10% higher.

[The above information, along with Table B-1, was provided by Claudia Hanel, February 2009.]

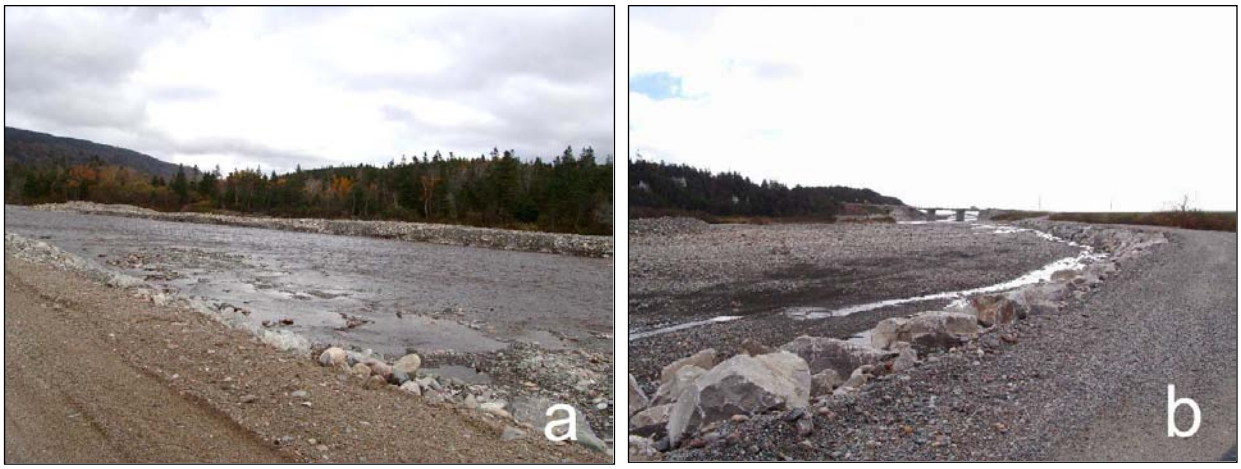
	Area (sq. m) of total habitat	Area (sq. m) surveyed	Percentage of habitat surveyed	Width (m) of transect	Number of locations of asters	Number of plants surveyed	Number of plants total
Barrens	9,039,194	55,188	0.61	12	17	348	56999
Forest	9,236,330	61,720	0.67	6	14	575	86048
Softwood scrub	21,355,383	72,836	0.34	4	49	1314	385262
Total	39,630,907	189,744			80	2237	528,309

Table B-1: Figures used for the calculation of *Symphyotrichum ciliolatum* numbers in the core area in the central Port au Port Peninsula.

Threats and Limiting Factors

Photos: John E. Maunder

Figure B-5. Threats and Limiting Factors: River-bed modification at Romaines Brook, August 1, 2006. [a] basic re-arrangement of floodplain, [b] dyked embayment, [c, d] view downriver



Photos: John E. Maunder

Figure B-6. Threats and Limiting Factors: Channelized, dyked and ballasted river banks at Romaines Brook, October 15, 2006. [a] looking northeast, [b] looking south.

Collections Examined

Provincial Museum of Newfoundland and Labrador.

NFM 2993, NFM 5155, NFM 5541, NFM 5542, NFM 5543, NFM 5561, NFM 5581, NFM 5582 [see Appendix A for details].

Provincial Wildlife Division

Fourteen as yet uncatalogued specimens, plus numerous photographs, document this occurrence; all were determined, for the purpose of this report, by Luc Brouillet.