COSEWIC
Assessment and Update Status Report

on the

Gulf of St. Lawrence Aster
Symphyotrichum laurentianum

in Canada

THREATENED
2004

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Previous report:

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COSEWIC
Assessment Summary

Assessment Summary – May 2004

Common name
Gulf of St. Lawrence aster

Scientific name
Symphyotrichum laurentianum

Status
Threatened

Reason for designation
An annual halophyte of maritime littoral habitats endemic to the Gulf of St. Lawrence. It is found at nearly 30 extant sites with some very large populations, especially on the Magdalen Islands, but has a very small total area of occupancy of much less than five square kilometers. Many of the populations are subject to natural fluctuations in size and at times suffer important losses due to severe storm events. On-going impacts also exist from human recreational activities and losses of habitat due to development activities.

Occurrence
Quebec, New Brunswick and Prince Edward Island

Status history
Designated Special Concern in April 1989. Status re-examined and designated as Threatened in May 2004. Last assessment based on an update status report.

COSEWIC
Executive Summary

Gulf of St. Lawrence Aster
Symphyotrichum laurentianum

Species information

Gulf of St. Lawrence Aster, *Symphyotrichum laurentianum* (synonym: *Aster laurentianus*), is a halophytic, herbaceous annual that occurs in coastal habitats in New Brunswick (NB), Prince Edward Island (PE) and the Magdalen Islands (MI). It is a rare endemic of the Gulf of St. Lawrence. Twenty-nine populations are known and verified, including 15 in the MI, eight in PEI and six in NB. Apart from these, there are four historical occurrences, whose habitat has been destroyed or that have not been seen for more than 25 years (one in the MI, two in PEI and one in NB).

Distribution

Gulf of St. Lawrence Aster has been reported from five areas of the Magdalen archipelago, for a total of 16 occurrences, one of which is historical. One of the populations constitutes a new observation relative to the data of Gilbert et al. (1999) and three are new relative to the data in the last COSEWIC report (Houle and Haber, 1990). Virtually all of the individuals are concentrated at three sites: the Havre aux Basques lagoon, the Bassin aux Huîtres and the Barachois salt marsh at Fatima.

The New Brunswick populations are known from four localities. One is located on Miscou Island, another near Tracadie (Val-Comeau), a third in Kouchibouguac National Park and one at Bouctouche Dune. There are a total of seven occurrences, one of which is historical. Recent survey efforts have located four new occurrences since 1999.

Of the ten occurrences in Prince Edward Island, two are historical. These are all the same as in Gilbert et al. (1999), but the East Marsh occurrence has been subdivided into two separate populations. Most of the occurrences are reported in Prince Edward Island National Park. The one at Tignish, Prince County, in the north of the island, has not been seen since 1986.

Habitat

Gulf of St. Lawrence Aster occurs on wet, predominantly sandy substrates exposed to equinoctial high waters and storm waves: sheltered beaches near sea level

on open and slightly sloping ground and areas of scattered vegetation in high salt marshes.

Biology

Gulf of St. Lawrence Aster is in full flower by mid-September and fruits in late September. Fruit dispersal is in late October (Houle, 1988b). The development of Gulf of St. Lawrence Aster in the greenhouse is very rapid (two-three months). Gulf of St. Lawrence Aster and the other species of the genus *Symphyotrichum* are self-fertile. Although unidirectional interspecific hybrids can be produced experimentally, this species is reproductively isolated by two factors: geographic isolation and self-fertility.

Population Sizes and Trends

The total population in the Magdalen Islands is estimated at more than 12 million individuals, distributed over approximately 10 ha. The higher population estimate, compared to the data of Houle and Haber, appears to be explained both by a more exhaustive survey and perhaps by ecological conditions favourable to the species during the surveys, in particular the low water level in the lagoons in 1994. Certain populations have declined or disappeared, possibly owing either to vegetation canopy closure, coverage by eelgrass debris or burial under sand following storms or human activity. Since the habitat is denuded more or less cyclically by natural phenomena (waves, storms, etc.), the disappearance of these sub-populations may be only temporary.

The seven New Brunswick populations total approximately 2,000 to 3,000 individuals; however, there have been large fluctuations in the last two years due mainly to storm events. The population at the St. Louis wharf in Kouchibouguac National Park has probably disappeared since 1979. The population around the lighthouse on Miscou Island has not been seen since 1984 and has almost certainly disappeared. In contrast, four new populations have been discovered: one on Miscou Island (Malbaie south), two in Kouchibouguac National Park and one at Bouctouche Dune.

Of the ten populations in Prince Edward Island, two are historical (Brackley Point and Grand Tracadie). Of the six sites surveyed in 1999 in Prince Edward Island National Park, one has since been subdivided into two separate occurrences (East Marsh). Outside the park, only the occurrence at Tignish, Prince County, in the north of the island, was still extant in 1986. In the national park, the Dune Slack and East Marsh B localities have the largest populations, together comprising nearly 100,000 individuals.

Limiting Factors and Threats

Interspecific competition plays a significant role in the population dynamics of Gulf of St. Lawrence Aster. Vegetation canopy closure is not conducive either to its reproductive effort or to its survival rate. Light appears to be the most important abiotic

factor in the growth and reproduction of Gulf of St. Lawrence Aster. Thus, natural disturbance from wave action, ice or storm events appears to play a role in maintaining or creating habitat. Anthropogenic disturbances such as cottage construction and fill operations completely destroy the species' habitat.

Special Significance of the Species

Gulf of St. Lawrence Aster is an example of an endemic taxon restricted to the Gulf of St. Lawrence. Other rare species are sometimes associated with this species. There is no known economic use for Gulf of St. Lawrence Aster, nor any particular use by Aboriginal peoples.

Existing Protection or Other Status Designations

The occurrences located in Prince Edward Island and Kouchibouguac national parks are protected by the park managers and monitored annually. Gulf of St. Lawrence Aster has been designated by COSEWIC as Special Concern in Canada in 1989. The species is currently designated threatened in Quebec and endangered in New Brunswick. It is considered rare, but has not yet received any special designation in Prince Edward Island.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species and include the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal organizations (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership, chaired by the Canadian Museum of Nature), three nonjurisdictional members and the co-chairs of the species specialist and the Aboriginal Traditional Knowledge subcommittees. The committee meets to consider status reports on candidate species.

DEFINITIONS (AFTER MAY 2004)

Species	Any indigenous species, subspecies, variety, or geographically or genetically distinct population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.

** Formerly described as “Not In Any Category”, or “No Designation Required.”

*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

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on the

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Symphyotrichum laurentianum

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2004

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SPECIES INFORMATION

Name and classification

Scientific Name:	*Symphyotrichum laurentianum* (Fernald) Nesom
Original description:	Fernald, M.L. 1914. Some Halophytic, Annual Asters of the Maritime Provinces. Rhodora 16: 57-80.
Type specimen:	Prince Edward Island, Brackley Point, August 31, 1912. Fernald, Long and St. John 8166; Holotype: GH!; Isotypes†: BM!, DS!, F!, GH!, MO!, MT!, NY!, UC/JEPS! (!: specimens located by F. Houle, 1988a)
Synonyms:	*Aster laurentianus* Fernald *Aster laurentianus* var. *magdalenensis* Fernald *Aster laurentianus* var. *contiguus* Fernald *Brachyactis laurentiana* (Fernald) Botschantzev *Brachyactis ciliata* ssp. *laurentiana* (Fernald) A.G. Jones
English name:	Gulf of St Lawrence Aster, Rayless Aster
French name:	Aster du Saint-Laurent
Family:	Asteraceae
Major Plant Group:	Dicot flowering plants

Description

Halophyte, annual, glabrous throughout, fleshy; stem 0.1 to 4 dm high; subsimple or with axillary racemose one-headed branches or occasionally with elongate branches (Figure 1); leaves very soft and fleshy, quite smooth, sessile or subsessile, entire, eciliate, linear-lanceolate to spatulate, obtuse or acutish, often mucronate, 1.1 to 6.5(10) cm long, 2 to 9.8(15) mm wide, maximum width situated on average at 0.6 of length; heads 0.5 to 1.4(2) cm wide; involucre hemispherical-campanulate; phyllaries mostly foliaceous and fleshy, lanceolate, oblong or spatulate, mostly subequal, often slightly ciliate at base, 5 to 11(18) mm long, 1 to 2.5(4) mm wide; the outer corollas numerous, in many rows, fertile, filiform, 2 to 5 mm long, rayless or the ligule a mere rudiment and shorter than style, whitish to pinkish; central corollas few, fertile, filiform, 3 to 5.4 mm long, with 4-5 toothed campanulate limb, whitish to pinkish, about equalling the purplish stigmas; achenes pubescent; pappus abundant, equalling or overtopping the flowers; chromosome number: $2n = 14$ (Houle and Brouillet, 1985); electrophoregrams for six enzymes (PHA, IS, SOD, PER, PGI and GOT) in Houle (1988a).

In the field, this species can be recognized by the following characteristics: annual, glabrous, halophytic plant with ligules very short and inconspicuous or wanting, in many rows. No other local species has these characteristics.

Figure 1. Illustration of Gulf of St. Lawrence Aster (by Réjean Roy).

DISTRIBUTION

Global range

Gulf of St. Lawrence Aster is an endemic species of the Gulf of St. Lawrence region. It is found only in Quebec, New Brunswick and Prince Edward Island (Houle and Haber, 1990; Gilbert et al., 1999). Its global distribution is therefore extremely limited (Figure 2). It colonizes sites of brackish sands in the Magdalen Islands, in Prince Edward Island and in New Brunswick. The localities are all within regions of comparable warmth and low elevations.

Canadian range

Distribution in Quebec. The distribution of Gulf of St. Lawrence Aster in the Magdalen Islands (MI), the only location where the species grows in Quebec, has been described in detail by Gagnon (1996), Gagnon et al. (1995a, 1995b) and Houle et al. (2002). During these surveys, all the sites mentioned in Houle and Haber (1990) were located again and three new sites (Localities 6, 14 and 16, Figure 3) were discovered. Certain occurrences recognized in the report by Gilbert et al. (1999), populations of

Figure 2. Canadian distribution of Gulf of St. Lawrence Aster.

which are segmented, were subdivided into two or three separate occurrences by Houle et al. (2002). In this report, we recognize these new subdivisions as separate occurrences.

The Magdalen Islands currently have 16 separate occurrences of Gulf of St. Lawrence Aster, including one dating from 1912 (Fernald, 1914), which has never been found again. The Havre aux Basques lagoon has three large populations, while others contain only a limited number of individuals. The total population of this species in the Magdalen Islands was estimated, in 2002, at more than 12 million individuals distributed over slightly less than 10 ha. A summary of the information gathered at each Quebec locality is provided in Table 1.

Distribution in New Brunswick. Recent survey efforts have located four new occurrences in New Brunswick since 1999. For the original COSEWIC status report, Houle (1988b) surveyed two sites in New Brunswick, on Miscou Island (lighthouse) and near Tracadie (Val-Comeau). Gulf of St. Lawrence Aster populations are now known in four areas. One on Miscou Island (Malbaie south), discovered in 2002 (Sabine Dietz, Piper Project, pers. comm.), another near Tracadie (Val-Comeau), a third in

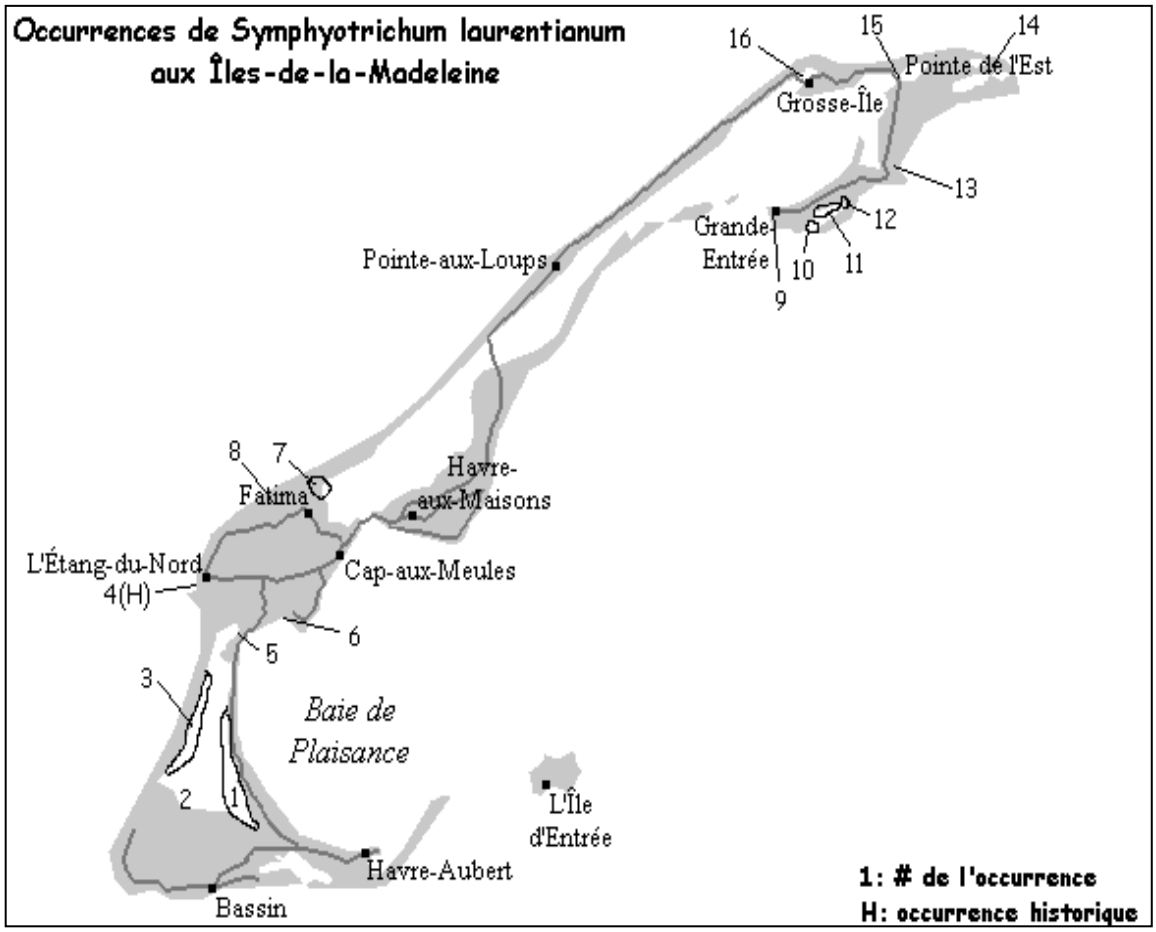

Figure 3. Distribution of Gulf of St. Lawrence Aster in the Magdalen Islands.
Occurrences of *Symphyotrichum laurentianum* in the Magdalen Islands
1: occurrence #
H: historical occurrence

Kouchibouguac National Park (two occurrences) and one at Bouctouche Dune (Godbout, 2000). There are therefore a total of seven occurrences (Figure 4), one of which is almost certainly historical in Kouchibouguac Park (St. Louis wharf). This locality, from which a specimen was collected in 1979 and identified as *A. brachyactis* by Munro (Hinds, 1983), was not found by Houle (1988b). The specimen itself is now untraceable in the herbaria consulted (DAO, GH, NBM and UNB). A reconnaissance survey conducted in 1999 (Dietz and Chiasson, 2001) also failed to find any population at this locality. A summary of the information gathered at each New Brunswick locality is provided in Table 2. Additional fieldwork at sites 2 and 7 conducted in 2003 after the completion of this report are included in the report (M. Toner, pers. comm.).

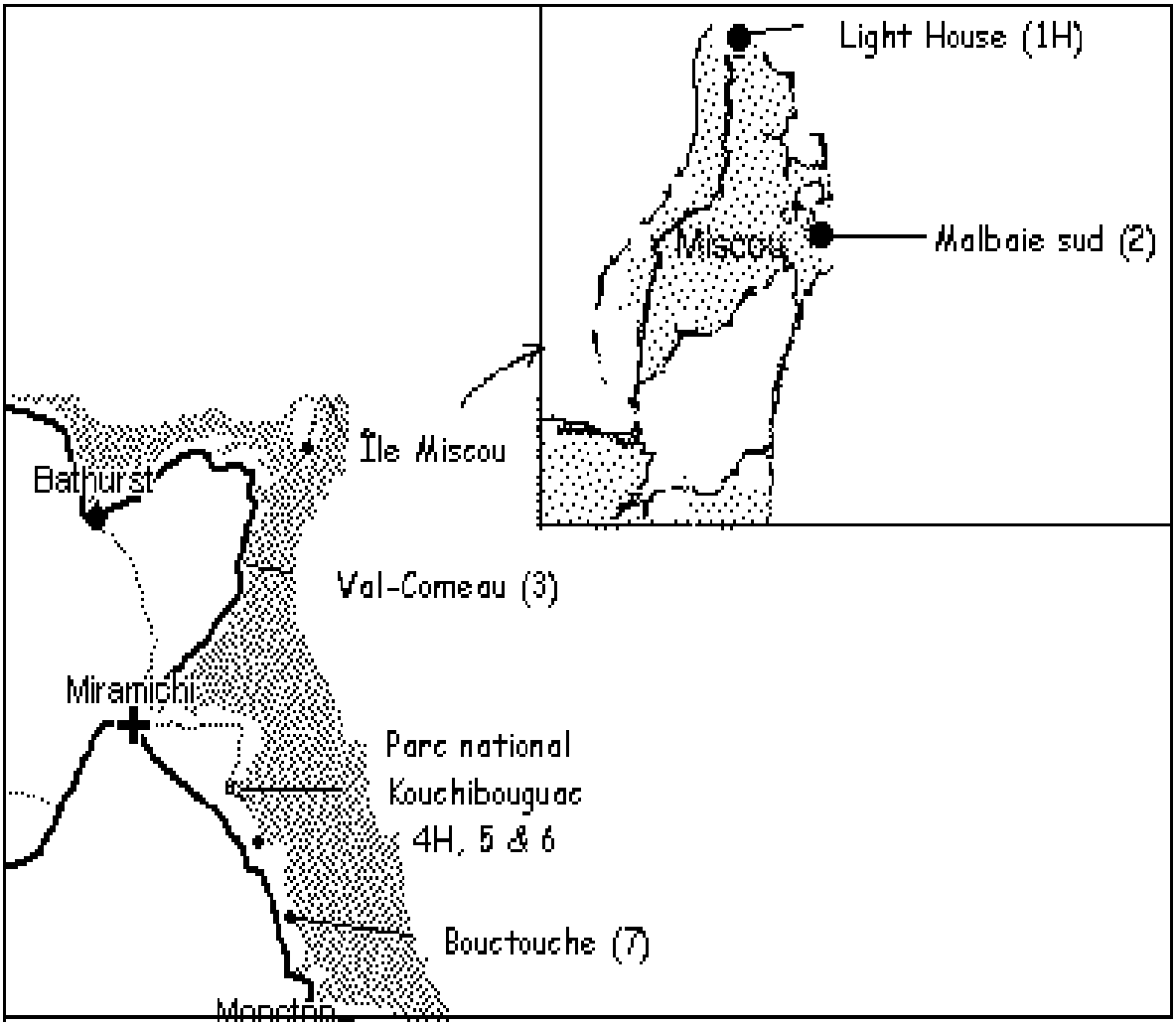

Figure 4. Distribution of Gulf of St. Lawrence Aster in New Brunswick.
Malbaie south (upper right insert)
Kouchibouguac National Park
1: occurrence #
H: historical occurrence

Table 1. Quebec occurrences of Gulf of St. Lawrence Aster (Magdalen Islands).

#	#*	Year	Status of the population	Area	Source
	1	1985	200 individuals		Gagnon et al. 1995b
		1994	10^5 - 10^6 ind.	5 ha	
		1995	10^5 - 10^6 ind.	5 ha	
1	1	1999	10^6 - 10^7 ind.	> 1,000 m^2	Houle et al. 2002
		2000	10^6 - 10^7 ind.	> 1,000 m^2	
		2001	10^6 - 10^7 ind.	> 1,000 m^2	
2	1	1999	10^5 - 10^6 ind.	> 1,000 m^2	
		2000	10^5 - 10^6 ind.	> 1,000 m^2	
		2001	10^5 - 10^6 ind.	> 1,000 m^2	
3	1	1999	10^6 - 10^7 ind.	> 1,000 m^2	
		2000	10^6 - 10^7 ind.	> 1,000 m^2	
		2001	10^6 - 10^7 ind.	> 1,000 m^2	
4	2				
		1912	?		Fernald 1914
		1992	Not found		Gagnon 1996
		1999	Not found		Houle et al. 2002
		2000	Not found		
		2001	Not found		
5	3				
		1985	60 ind.		Houle 1988
		1995	Not found		Gagnon 1996
		1999	10^2 - 10^3 ind.	5 m^2	Houle et al. 2002
		2000	10^2 - 10^3 ind.	5 m^2	
		2001	10^0 - 10^1 ind.	5 m^2	
6	4				
		1995	1 ind.		Gagnon 1996
		1999	Not found		Houle et al. 2002
		2000	Not found		
		2001	Not found		
	5				
		1985	20 ind.		Gagnon 1996
		1995	10^4 - 10^5 ind.	0.5 ha	Gagnon 1996
7	5	1999	10^5 - 10^6 ind.	> 1,000 m^2	Houle et al. 2002
		2000	10^5 - 10^6 ind.	> 1,000 m^2	
		2001	10^5 - 10^6 ind.	> 1,000 m^2	
8	5	1999	10^4 - 10^5 ind.	> 1,000 m^2	
		2000	10^4 - 10^5 ind.	> 1,000 m^2	
		2001	10^2 - 10^3 ind.	30-300 m^2	
9	6				
		1985	1 ind.		Houle 1988b
		1992	Not found		Gagnon 1996
		1995	Not found		
		1999	Not found		Houle et al. 2002
		2000	Not found		
		2001	Not found		
	7				
		1912	Very abundant		Fernald 1914
		1985	150 ind. 2 populations		Gagnon 1996
		1995	10^5 - 10^6 ind.	3 ha	
10	7	1999	10^5 - 10^6 ind.	1,000-2,000 m^2	Houle et al. 2002
		2000	10^3 - 10^4 ind.	600-1,500 m^2	
		2001	10^1 - 10^2 ind.	500-1,000 m^2	
11	7	1999	10^1 - 10^2 ind.	10-100 m^2	
		2000	10^1 - 10^2 ind.	10-100 m^2	
		2001	10^1 - 10^2 ind.	10-100 m^2	

#	#*	Year	Status of the population	Area	Source
12	7	1999	10^5 - 10^6 ind.	1,000-2,000 m^2	
		2000	10^5 - 10^6 ind.	1,000-2,000 m^2	
		2001	10^3 - 10^4 ind.	600-1,500 m^2	
13	8				
		1985	200 ind.		Gagnon et al. 1995a
		1994	10^2 - 10^3 ind (2 pop.)		
		1995	Not found		
		1999	10^1 - 10^2 ind.	< 10 m^2	Houle et al. 2002
		2000	10^1 - 10^2 ind.	< 10 m^2	
		2001	10^1 - 10^2 ind.	< 10 m^2	
14	9				
		1994	10-100 ind.	5 m^2	Gagnon et al. 1995a
		1999	10^2 - 10^3 ind.	100-600 m^2	Houle et al. 2002
		2000	10^2 - 10^3 ind.		
		2001	10^2 - 10^3 ind.		
15	10				
		1985	30 ind.		Houle 1988b
		1994	10-100 ind.	25 m^2	Gagnon et al. 1995a
		1999	10^3 - 10^4 ind.	100-500 m^2	Houle et al. 2002
		2000	10^3 - 10^4 ind.		
		2001	10^3 - 10^4 ind.		
16	-	2001	10^3 - 10^4 ind.	0.1 ha	Houle et al. 2002

* The second # refers to the occurrence numbering used by Gilbert et al. (1999).

Table 2. New Brunswick occurrences of Gulf of St. Lawrence Aster.

#	#*	Year	Status of the population	Area	Source
1	1	1963	Not surveyed		Houle 1988b
		1984	100 individuals		
		2002	Not found		S. Blaney (pers. comm.)
2	-	2002	1,000 ind.	< 8,000 m^2	Sabine Dietz (pers. comm.)
		2003	1,500		L. Richardson (pers. comm.)
3	2	1984	100 ind.		Houle 1988b
		1999	100 ind.	< 10^4 m^2	Maureen Toner (pers. comm.)
		2000	~2,000 ind.	< 10^4 m^2	
		2001	15 ind.	10 m^2	
		2002	12 ind.	< 2 m^2	
4	3				
		1979	Not surveyed		Hinds 1983
		1984	Not found		Houle 1988b
		1999	Not found		Dietz and Chiasson 2001
5	-				
		2000	> 1,000 ind.		Godbout 2000
		2001	Not found		Éric Tremblay (pers. comm.)
		2002	Not found		
6	-				
		2000	4 ind.		Godbout 2000
		2001	Not found		Éric Tremblay (pers. comm.)
		2002	Not found		
7	-				
		2000	500-1,000 ind.		Godbout 2000
		2000	2 ind.		Godbout 2000
		2002	Flooded		Mazerolle 2003
		2003	100		Mazerolle 2003

* The second # refers to the occurrence numbering used by Gilbert et al. (1999).

Distribution in Prince Edward Island. There are currently 10 known occurrences of Gulf of St. Lawrence Aster in Prince Edward Island, two of which are historical (Figure 5). Guignion et al. (1995) located six sites solely within Prince Edward Island National Park. One of these, East Marsh, has since been subdivided into two separate occurrences, East Marsh A and B (Denyse Lajeunesse, PEI National Park, pers. comm.). The type locality of Brackley Point has disappeared following development work carried out in the park. However, large populations have been observed elsewhere in the park, the largest at Blooming Point, namely occurrences 4, 5, 6 and 7 (Western Wetland, Dune Slack and East Marsh A and B). Elsewhere in Prince Edward Island, a population was located at Tignish, Prince County, on the northern tip of the island (Houle 1988b), but not seen again subsequently in 2001 or in 2002 (Sean Blaney, Atlantic Data Center, pers. comm.). All that remains of the Grand Tracadie site in Queens County is a single specimen collected by Fernald, Long and St. John in 1912 (GH!, *in* Houle, 1988b). During a brief visit in the 1984-86 period, Houle did not find any Gulf of St. Lawrence Aster there. A summary of the information gathered at each PEI locality is provided in Table 3.

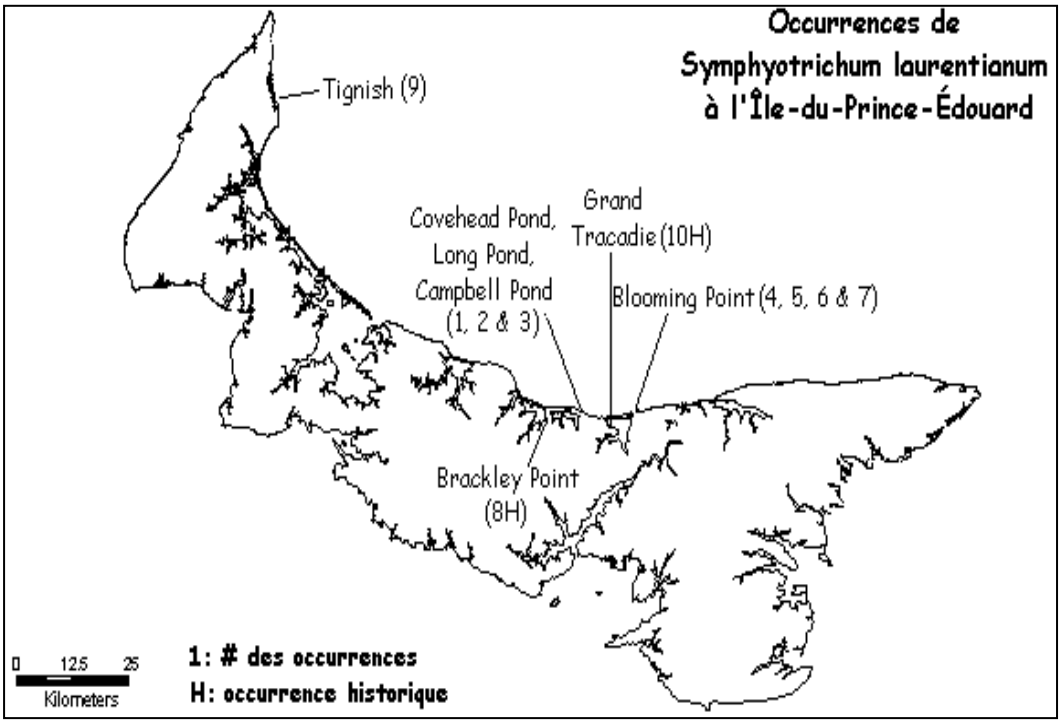

Figure 5. Distribution of Gulf of St. Lawrence Aster in Prince Edward Island.
Occurrences of *Symphyotrichum laurentianum* in Prince Edward Island
1: occurrence #
H: historical occurrence

Table 3. PEI occurrences of Gulf of St. Lawrence Aster.

#	#*	Year	Status of the population	Area	Source
1	1	1986	12 individuals		J. Whitford Env. Ltd. 1994
		1992	164 individuals		Guignion et al. 1995
		1993	214 ind.		
		1997	763 ind.		PEINP
		1998	412 ind.		PEINP
		1999	174 to 243 ind.		PEINP and Stewart and Lacroix 2001
		2001	123 ind.		PEINP
		2002	10 ind. flooded		UPEI
2	2	1986	1 ind.		J. Whitford Env. Ltd. 1994
		1992	1 ind.		Guignion et al. 1995
		1993	1 ind.		
		1997	Not found		PEINP
		1998	Not found		
		1999	Not found		
		2000	Not found		
		2001	Not found		
3	3	1992	30 ind.		Guignion et al. 1995
		1993	3 ind.		
		1997	4 ind.		PEINP
		1998	Not found		
		1999	Not found		
		2000	Not found		
		2001	Not found		
4	4	1992	450 ind.		J. Whitford Env. Ltd. 1994
		1993	Not found		Guignion et al. 1995 and PEINP
		1998	Not found		Ben Hoteling
		1999	Not found		Stewart and Lacroix 2001
5	5	1992	15-20,000 ind.		Guignion et al. 1995
		1993	15-20,000 ind.		
		1998	126,000 ind.	900 m^2	Ben Hoteling (PEINP)
		1999	117,000 ind.	1,200 m^2	
		2000	52,000 ind.	1,000 m^2	
		2002	2,223 ind.		UPEI
	6	1992	48-60,000 ind.		Guignion et al. 1995
		1993	48-60,000 ind.		
6	6	1998	38,700 ind.	900 m^2	Ben Hoteling (PEINP)
		1999	17,100 ind.	900 m^2	
		2000	2,000 ind.	1,000 m^2	
		2001	133 ind.		UPEI
7	6	1998	38,400 ind.	900 m2	Ben Hoteling (PEINP)
		1999	61,500 ind.	1,500 m2	
		2000	106,000 ind.	2,000 m2	
		2002	44,133 ind.		UPEI
8	7	1912	Not surveyed		Houle 1988b
		1953	Not surveyed		
		1984	12 ind.		Guignion et al. 1995
		1992	Filled		
9	8	1912	Not surveyed		Fernald 1914
		1986	10 ind.		Houle 1988b
		2001	Not found		S. Blaney (pers. comm.)
		2002	Not found		K. MacQuarrie, INT*
10	9	1912	Not surveyed		Houle 1988b
		1984	Not found		
		1986	Not found		

- The second # refers to the occurrence numbering used by Gilbert et al. (1999).
- PEINP: Data collected by the staff of the Prince Edward Island National Park (Denyse Lajeunesse, pers. comm., November 15, 2002)
- UPEI: Data of Dr. C.R. Lacroix, from the University of Prince Edward Island (D. Lajeunesse, pers. comm.)
- Ben Hoteling: instructor at Holland College; observations by him and his students (D. Lajeunesse, pers. comm.)
- INT: Island Nature Trust, Prince Edward Island; pers. comm. of Kate MacQuarrie, November 12, 2002.

HABITAT

Habitat requirements

In the maritime climate where Gulf of St. Lawrence Aster is found, the average temperature ranges from 18 to 20ºC in July and from -5 to -10ºC in January (Thannheiser, 1984). A high level of humidity, with frequent fog and regular winds also characterize the climatic zone occupied by Gulf of St. Lawrence Aster. The microclimate is distinguished by its full sunlight, more or less saline habitats flooded only at extreme high waters and during storms, corresponding to a submergence of about 10 cm in the Magdalen Islands (Gilbert et al*.,* 1999). This habitat is relatively protected from the winds by dunes.

Gulf of St. Lawrence Aster occurs on wet, predominantly sandy substrates exposed to equinoctial high waters and storm waves, sheltered beaches and areas of scattered vegetation in high salt marshes (Gagnon et al*.*, 1995a and b). It grows near sea level on open and slightly sloping ground (Gilbert et al*.* 1999) and requires full light for its growth (Reynolds et al*.*, 2001; Houle et al*.*, 2002). Its germination and growth can be affected by saltwater, but the seeds are quite resistant to salt and can germinate again in freshwater after being immersed in saltwater (Houle et al*.*, 2002, Houle et al*.*, 2001).

The dynamic nature of coastal features creates much year-to-year variation in the abundance and distribution of Gulf of St. Lawrence Aster at a given site. Deposition and erosion may have an impact on germination and survival. For example, the deposition of eelgrass debris or sand on its habitat in the aftermath of storms in New Brunswick and Prince Edward Island in 2001 and 2002 contributed to the recent population declines (Éric Tremblay, Kate MacQuarrie and Jean Gagnon, pers. comm.).

The salinity of the substrate is also a limiting factor in the distribution of Gulf of St. Lawrence Aster (Reynolds and Houle, 2002). The influence of freshwater at growing sites is evident from the list of companion plants of Gulf of St. Lawrence Aster (Godbout, 2000).

Hydrology and moisture conditions are also important. For example, water availability during bud differentiation appears to be critical, with drought conditions causing reproductive failure, making populations potentially susceptible to local extinction (Houle and Belleau, 2000). Substrate particle size appears to be of little importance since this Aster occurs on fine sand, coarse sand, gravel and clay (Houle 1988b). The average pH of its substrate ranges from 5.5 (Grandtner, 1967) to 6.9 (CDPNQ, 2002).

In short, a combination of the following factors contributes to its presence: a maritime climate, a slow current favouring fine sediment deposition, the deposition of silt or sand by extreme high waters and storm floods, a particular flood frequency during the growing season, a non-saline substrate in the germination and growth period, the proximity of the water table, some protection from wind, a certain percentage of

exposed substrate, little interspecific competition, full sunlight, exposure to certain natural (waves, storms) or artificial changes (Jacques Whitford Env. Ltd., 1994; Gilbert et al., 1999; Houle and Belleau, 2000; Houle et al. 2001; Reynolds et al., 2001; Houle et al., 2002; Reynolds and Houle, 2002).

Trends

Associated species of Gulf of St. Lawrence Aster are taxa of salt marshes, coastal dunes or littoral fringes. They are nitrophytes and obligate to salt-tolerant halophytes (Dansereau, 1959; Grandtner, 1966, 1967; Chapman, 1976; Lamoureux and Grandtner, 1976; Géhu and Grandtner, 1982; Thannheiser, 1984).

Most coastal species, including Gulf of St. Lawrence Aster, can be considered colonizers of new or changeable habitats. Also, natural or artificial disturbances in secondary associations can enable Gulf of St. Lawrence Aster to become established. It generally appears not as a dominant species or, if dominant, only on clearly defined and relatively small patches in the community types. For example, in *Spartina alterniflora*, *Carex paleacea* or *Scirpus pungens* associations.

Gulf of St. Lawrence Aster is an annual and the habitats it occupies fluctuate significantly. Its populations therefore have the particular characteristic of being quite variable in number following natural (e.g., storms) or artificial disturbances.

Protection/ownership

All the known populations occur in coastal habitats, including beaches, lagoons, dunes and dune slacks. In Quebec, all the sites where Gulf of St. Lawrence Aster is found are under provincial jurisdiction, since beaches fall under the Department of Environment and Wildlife, whereas dunes and dune slacks fall under the Department of Energy and Resources (Chap. 20 of the *Loi des terres des Îles-de-la-Madeleine*, 1958-59: An Act to facilitate the redemption of constituted rents in the Magdalen Islands. Chapter 20, Statuts de Québec. 1958-59, Assented to, the 18th of December, 1958.).

In Prince Edward Island, most of the sites are located in Prince Edward Island National Park. The wet sand marsh at the Tignish site is on littoral land under provincial jurisdiction.

In New Brunswick, Gulf of St. Lawrence Aster is protected under the provincial Endangered Species Act and one site falls within a national park. Of the remaining sites, two (Tracadie and Miscou) are on lands with multiple owners, including the Crown. The sites at the Bouctouche Dune are on private land, though in an area that is managed for conservation.

BIOLOGY

General

Gulf of St. Lawrence Aster was first collected by J. Macoun, at Brackley Point, Prince Edward Island, on September 5, 1888 and distributed as *Aster subulatus* Michx. (CAN, GH, NY) (Macoun, 1883-1903; Hurst, 1933). It was subsequently reported under *A frondosus* (Nutt.) T.&G. (Fernald and Wiegand, 1910; Britton and Brown, 1913; Hurst, 1940), and finally named *A. laurentianus* (Fernald, 1914). The genus *Aster* was recently revised by Nesom (1994), who transferred to the genus *Symphyotrichum* all the taxa whose base chromosome number is n = 8 and n = 7.

Fernald (1914, 1925, 1950) found that Gulf of St. Lawrence Aster had shown a marked tendency to produce insular varieties. He described three: one confined to Prince Edward Island and to the southern end of the Magdalen Islands (var. *laurentianus*), one to the northern end of the Magdalen archipelago (var. *magdalensis*) and a third to the sands of northern New Brunswick (var. *contiguus*).

More recently, Boivin (1966-67, 1972) used *A. brachyactis* as a synonym of *A. laurentianus*, with the latter having priority of use. Several authors have agreed with this position (Rousseau, 1968; Scoggan, 1978-1979; Jones, 1980; Semple and Brouillet, 1980; Morton, 1981; Jones and Young, 1983; Semple et al., 1983; Hinds, 1983, 1986). Jones (1984) treated Gulf of St. Lawrence Aster as a subspecies of *A. brachyactis*. However, after close examination of isotypes and topotypes (CAN, DAO), Catling and McKay (1980) recognized Gulf of St. Lawrence Aster as a distinct taxon. Houle (1988a) demonstrated that morphological, phenological and ecological differences between Gulf of St. Lawrence Aster and *A. brachyactis*, observed both in the field and in the laboratory, warrant their recognition. The stability of the diagnostic characteristics and the reproductive isolation between the taxa justify the rank of species. The geographic isolation of Gulf of St. Lawrence Aster also suggests this.

Gulf of St. Lawrence Aster belongs to a small group of annuals (*Aster sensu lato*, section (*Conyzopsis*) that are widely distributed in saline or brackish habitats and somewhat transitional in their floral structure between the true *Asters* and the genera *Erigeron* and *Conyza*. This has led to confusion about its generic placement and to the creation of a distinct genus, *Brachyactis* (Ledebour, 1845-46; Gray, 1873; Hooker, 1876; Löve and Löve, 1982; Jones, 1984, 1985). Since the revision by Nesom (1994), the name retained for Gulf of St. Lawrence Aster is now *Symphyotrichum laurentianum* (Fernald) Nesom.

The only close relatives of Gulf of St. Lawrence Aster are *S. frondosus* (synonym: *A. frondosus*) of the Great Basin region of western North America and *S. brachyactis* (synonym: *A. brachyactis*) of saline and brackish habitats in Central Asia and the Great

Plains region of North America. Certain constant and stable characteristics clearly distinguish the three species. The key characteristics are as follows:

Marginal flowers 5.5 to 8 mm long; often regularly imbricated phyllaries, the outer series shorter than the inner.
S. frondosus

Marginal flowers 2 to 5 mm long; phyllaries generally non-imbricated, all similar in shape.

Leaves linear-attenuate to narrowly lanceolate, ciliate, thin and scabrous; stem pubescent, 15 to 60 cm high; remains in the rosette stage several months before producing its floral stem.
S. brachyactis

Leaves linear-oblong to spatulate-oblanceolate, eciliate, more or less fleshy; stem glabrous, 1 to 30 cm high; bolts as soon as the first basal rosette of leaves is formed after germination.
S. laurentianus

Ecological similarities between these three species have been revealed by the presence of common associated species (Houle, 1988b). *S. brachyactis* exhibits a broad ecological amplitude; it can colonize habitats similar to those of the other two species, but seems to prefer salt plains. *S. frondosus* is rather restricted to xeric habitats of the Rockies, while *S. laurentianus* is restricted to coastal habitats in the Gulf of St. Lawrence.

The varieties of Gulf of St. Lawrence Aster described by Fernald (1914, 1950) have not been recognized. The three morphotypes can be identified in Fernald's collection, but cannot be distinguished in Houle's collection, which is now more representative of the species. Furthermore, the diagnostic characteristics of these varieties are influenced by culture conditions. Hence, this variability probably reflects the phenotypic plasticity of Gulf of St. Lawrence Aster.

Biogeography and phylogeny

Gulf of St. Lawrence Aster inhabits the salt marshes of the Magdalen Islands, the east coast of New Brunswick and the north shore of Prince Edward Island (Houle and Haber, 1990; Guignion et al., 1995; Godbout, 2001;). Its closest relative is *Symphyotrichum brachyactis,* an Aster of the margins of temporary salt ponds of the prairies and Central Asia, considered a weed in Quebec in areas where salt has been introduced by human activity. The two species are autogamous, and in this respect they differ from the other Asters (Houle, 1988a). Both derive from an annual species in the southwestern United States, *S. frondosus*. The latter has fine rays that attract insect

pollinators and can ensure cross-fertilization, but it is also capable of self-fertilization. It inhabits the margins of temporary salt ponds in the semi-deserts of this region. In addition to the reduction of the rays and autogamy, these three species share a unique genetic characteristic within the genus *Aster sensu lato*: instead of 9 or 8, the haploid number of chromosomes is 7, which confirms that they are related.

The origin of the genus *Symphyotrichum* (*Conyzopsis* section of the genus *Aster sensu lato*), results from the reduction in the number of chromosomes from 8 to 7, from the reduction in the size of the rays and from the acquisition of the annual growth habit (Houle, 1988a). *S. frondosus* was the first species. It then extended its range to the temporary salt ponds of the western Rockies. A fortuitous migration event enabled a small population to cross this geographic barrier toward the east, giving rise to *S. brachyactis*, whose rays are no longer visible outside the head. This event probably occurred during the glaciations of the Quaternary. Subsequently, during the eastward and northward migration following the retreat of the ice, a population reached the Gulf of St. Lawrence. Gulf of St. Lawrence Aster then adapted to the conditions of the tide-influenced salt marshes. This is a case of rapid and relatively recent speciation.

The speciation process that gave rise to Gulf of St. Lawrence Aster is therefore the result of the glaciations of the Quaternary and of the accompanying upheavals and migrations. The ambient conditions that have prevailed since that time on the territory occupied by the species have shaped it to make it what it has become today.

Phenology

Gulf of St. Lawrence Aster does not flower until late August. It reaches full flower in mid-September and fruits in late September. Fruit dispersal is in late October (Houle, 1988b).

The development of Gulf of St. Lawrence Aster in the greenhouse is very rapid (2-3 months compared to 6-8 months for *S. brachyactis* and *S. frondosus*). Also, under uniform growth conditions, Gulf of St. Lawrence Aster is a generally smaller plant, with fewer and smaller basal leaves and heads (Houle, 1988a).

Reproduction

Gulf of St. Lawrence Aster and the other species of the genus *Symphyotrichum* are self-fertile (Houle, 1988a). The floral morphology of *S. laurentianus* and of *S. brachyactis* therefore displays characteristics of self-fertile species: ligules and nectaries small or absent, style generally included in stamen tube and pappus overtopping corolla even before anthesis. The self-pollination and floral morphology of these two species indicate a close relationship between them. They could rapidly fix morphological features within the genotype. *S. frondosus*, on the other hand, is frequently visited by insects in the field and can probably also reproduce by cross-pollination, conforming to the ancestral mode in *Aster sensu lato*.

The artificial interfertility of *S. brachyactis* (f) X *S. frondosus* (m), *S. laurentianus* (f) X *S. frondosus* (m) and *S. laurentianus* (f) X *S. brachyactis* (m) has been demonstrated by Houle (1988a) with the production of 7, 7 and 45 fertile F1 hybrids respectively and the production of F2 hybrids by natural self-pollination (Houle, 1988a). The hybrid status of the progeny is confirmed by the inheritance of paternal characteristics. A closer genetic affinity is indicated between *A. laurentianus* and *A. brachyactis* by the higher degree of crossability.

Reciprocal crosses have been impossible to perform, suggesting unidirectional interfertility from *A. frondosus* to *A. brachyactis* and to *A. laurentianus*. It appears that in this genus, only ancestral species can cross-breed with derived species. Although unidirectional interspecific hybrids can be produced experimentally, Gulf of St. Lawrence Aster is reproductively isolated by two factors: geographic isolation and self-fertility.

However, the recent expansion of *S. brachyactis* along salted roads in New Brunswick within the range of *S. laurentianum* could eventually complicate the situation through hybridization (Sean Blaney, Atlantic Data Base, pers. comm., 2002). *S. brachyactis* is still rare, but known in Saint John, Sussex and the Moncton area. It seems to be only a matter of time before it reaches the Northumberland coast, where it could easily invade the salt marshes.

Survival

Boudreau and Houle (1998) and Houle et al. (2002) have demonstrated that interspecific competition appears to play a significant role in the population dynamics of Gulf of St. Lawrence Aster. Vegetation canopy closure is not conducive to either its reproductive effort or its survival rate. Thus, disturbance appears to play a role in maintenance of populations.

In addition, anthropogenic disturbances such as cottage construction and fill operations completely destroy the species' habitat. This is believed to have been the cause of the loss of at least two sites, though the potential for such pressure on current populations is less clear. While the impact of ATVs may be temporarily favourable (a population has been observed colonizing ruts in Clarke Bay (Île de l'Est, MI)), the long-term effect of this disturbance would depend on the extent of immediate damage to the plants and their habitat, as well as the subsequent potential for severe erosion events.

Physiology

Seed germination is inhibited by salinity greater than 20 g salt/L (Houle et al., 2001 and 2002; Reynolds et al., 2001). However, the seeds conserve their viability when subjected to salinities of up to 40 g salt/L for a period of 30 days. The salinity of the substrate has a significant negative effect on the germination and emergence of the seedlings. Salinities as low as 1‰ reduce emergence by a third, although an additional

increase of up to 5‰ has no additional effects. The growth of the plants is significantly reduced by salinities of 10 to 40‰. However, the number of inflorescences per plant does not appear to be affected by salinity. Therefore, in the stages following emergence and establishment, Gulf of St. Lawrence Aster has a very great tolerance to high salinities.

Of the factors of salinity, nutrient availability and light, only light has a significant effect on growth and reproduction. Hence, in a situation of interspecific competition, light rather than nutrients is the resource for which the various species compete with Gulf of St. Lawrence Aster. On the other hand, Gulf of St. Lawrence Aster exhibits certain characteristics associated with opportunistic plants, such as excessive nutrient absorption, even if it behaves like a plant tolerant to saline and nutritional stresses.

Water stress during the juvenile stage, which is the stage of reproductive bud differentiation, reduces inflorescence production by 83%. Such stress at the seedling or adult stage affects only the total biomass and the leaf surface (Houle and Belleau, 2000; Houle et al., 2002).

Movements/dispersal

According to the various surveys carried out since the publication of the original status report Houle and Haber (1990), namely those of Gagnon et al. (1995b and 1996), Houle et al. (2002), Godbout (2000 and 2001), the Piper Project (Sabine Dietz, pers. comm., 2002) and those conducted under the aegis of the Prince Edward Island National Park (Denyse Lajeunesse, pers. comm., 2002), it appears that, apart from the new populations discovered at previously unexplored or little explored sites, its distribution has not changed and that it remains very faithful to the known occurrence sites. Within a site, its movements are subject to regular fluctuations of topography, salinity and areas of eelgrass deposition (Houle et al., 2002; Reynolds and Houle, 2002), which also determine its density. The local distribution of Gulf of St. Lawrence Aster is also influenced by interspecific competition in the upper portion of the topographic gradient.

Interspecific interactions

Interspecific competition is an important factor controlling the distribution of Gulf of St. Lawrence Aster at a given site (Houle, 2002). When competition is eliminated, it becomes more abundant, particularly in the upper portion of the topographic gradient, where abiotic conditions are less limiting (e.g. lower salinity and reduced exposure to waves and to eelgrass debris and sand). Similarly, the overall reproductive success of the plants (number of fruits produced) increases when interspecific competition is absent. The main effect of the competitors and the one that has the greatest impact on Gulf of St. Lawrence Aster is the reduction in available light.

Houle and Legault (1986) as well as Boudreau and Houle (1998) determined the species frequently associated with Gulf of St. Lawrence Aster. According to Houle and

Legault, they are, in order of prevalence: *Juncus bufonius*, *Atriplex patula*, *Rumex maritimus* var. *fueginus*, *Agrostis alba* var. *palustris*, *Potentilla anserina* ssp. *egedii*, *Plantago maritima*, *Bidens cernua*, *Ranunculus cymbalaria*, *Spergularia marina* var. *leiosperma* and *Glaux maritima* var. *obtusifolia*. The complete list of the 50 species associated with Gulf of St. Lawrence Aster is in Houle (1988a). According to Boudreau and Houle, the most abundant species of two communities of the Magdalen Islands are *Spartina pectinata*, *Juncus balticus*, *Atriplex hastata*, *Ranunculus cymbalaria*, *Eleocharis smallii*, *Sonchus arvensis*, *Agrostis stolonifera* and *Calystegia sepium*. To these are added *Scirpus acutus* and *Lomatogonium rotatum* (Dietz and Chiasson, 2001).

Lepidoptera larvae have been observed on Gulf of St. Lawrence Aster individuals at Havre-aux-Basques (Boudreau and Houle, 1998). The larvae appeared to be feeding on the leaves. They could have an impact on the plants' reproductive performance and on population dynamics. In 1994, a few individuals of a beetle, *Trirhabda borealis*, were found feeding on Gulf of St. Lawrence Aster on a small island in the Havre aux Basques lagoon (Jean Gagnon, pers. comm.). The impact of this predator on the plant is not known.

Behaviour/adaptability

Since Gulf of St. Lawrence Aster is an annual that colonizes a relatively denuded substrate, the density of the vegetation cover and competition with other species undoubtedly represent a major constraint to its establishment and maintenance. The dynamic process whereby the habitat is reshaped, denuded (for example by summer storms) and recolonized more or less cyclically could largely explain the significant population fluctuations as well as the apparent disappearance of some populations. Since the seeds of Gulf of St. Lawrence Aster can probably survive for about 10 years (Houle, 1988b), they could persist in the soil until ecological conditions again become favourable, when new gaps appear in its habitat.

Gulf of St. Lawrence Aster has a high seed set (50-60% in greenhouse, Houle, 1988a). The presence of dispersed fruits has been noted in all fruiting populations. Fruit dispersal is by wind and water. The cultivation of the species does not require a dormancy period, scarification or salt concentrations. Common conditions for germinating seeds in vermiculite can be used. After two weeks, 80% of achenes germinate. However, the species' survival rate in nature appears to be highly dependent on favourable seasonal conditions, as its rarity attests. Storm events resulting in the deposition of eelgrass debris, burial under sandy deposits or submergence of the habitat have occurred in the last two years in New Brunswick and Prince Edward Island, and appear to have had an impact on several populations (Kate MacQuarrie and Éric Tremblay, pers. comm., 2002). The situation will be monitored in order to determine whether the affected populations will reappear or recover.

Under laboratory conditions, the achenes are still viable after three years. Expected longevity is around 10 years, according to culture data of a related taxon, *S. brachyactis*, using achenes collected by Hudson (1979, *in* Houle, 1988b).

POPULATION SIZES AND TRENDS

Thirty-three occurrences of Gulf of St. Lawrence Aster are reported in the Gulf of St. Lawrence, four of which are historical. The population densities are estimated in Tables 1 to 3 based on the fieldwork of Houle (1988b), Godbout (2000 and 2001) and the Piper Project (Sabine Dietz, pers. comm., 2002) for New Brunswick, of Guignion et al. (1995), Houle (1988b), the Island Nature Trust (Stewart and Lacroix, pers. comm., 2001) and Prince Edward Island National Park (Stewart and Lacroix, pers. comm., 2001) for Prince Edward Island, and of Gagnon et al. (1995a and b) and Houle et al. (2002) for the Magdalen Islands. Gulf of St. Lawrence Aster is relatively common in the Magdalen Islands, with 15 extant occurrences, containing a total of more than 12 million individuals. In New Brunswick, five occurrences are still extant, since out of the seven occurrences, two have almost certainly disappeared. In 2002, the counts at these sites were low relative to previous years; with a total of only approximately 1,000 individuals. Until the surveys by Guignion et al. (1995), Gulf of St. Lawrence Aster was thought to be particularly rare in Prince Edward Island, since only 13 plants had been located in the national park and 10 at Tignish. Today, we know that there are probably more than 100,000 individuals at the location of the eight extant occurrences, which gives Prince Edward Island the second-largest population of the species after the Magdalen Islands.

The significant difference in the estimates of the total number of individuals for the Magdalen Islands as a whole (1985: approximately 661; 1995: more than 1 million; 2001: more than 12 million) and for Prince Edward Island (1985: 23; 1993: 63,000-80,000; 2002: ~100,000) could be explained by a more intensive survey effort between 1992 and 2001. It is also possible that particularly favourable conditions stimulated the growth of large Gulf of St. Lawrence Aster colonies between 1992-1995 and 1999-2001, particularly in the Magdalen Islands. The summer of 1994, for example, was particularly dry, which may have dried out the upper part of the marshes of the Magdalen Islands more than usual, thereby favouring Gulf of St. Lawrence Aster. According to Houle et al. (2002), the shoreline topography, the exposure to waves and the abundance of deposits of organic matter (mainly eelgrass) have a decisive impact on the local distribution of Gulf of St. Lawrence Aster. It is also possible that unfavourable climatic conditions in certain years result in a significant, although probably temporary, decline in Gulf of St. Lawrence Aster populations.

Populations in the Magdalen Islands

The populations in the Magdalen Islands include a total of 16 occurrences in 11 separate localities. Only one is considered historical (extirpated), i.e. not found for more than 25 years, according to the criteria of Labrecque and Lavoie (2002).

Havre aux Basques sector

The Havre aux Basques lagoon contains the largest population of the species in the Magdalen Islands (Localities 1, 2 and 3, Figure 3). In 1985, Houle and Brouillet had observed two sub-populations totalling approximately 200 individuals in the southwestern part of the lagoon, and near Highway 199 in the eastern zone (Houle and Haber, 1990). During the 1994 and 1995 fieldwork, Gulf of St. Lawrence Aster was reported in five locations around the lagoon (Gagnon et al., 1995a and b). The population, estimated at more than 1 million individuals, covered a total area of more than 5 ha. The largest number of individuals was found in the western sector. Houle et al. (2002) subdivided this population into three occurrences isolated from each other (eastern part of the lagoon, western part of the lagoon and Pointe aux Canots) and including to date a total of 10^6 to 10^7 individuals over 3.9 ha.

Île du Cap aux Meules sector

The Étang-du-Nord population (Locality 4) has not been located again since its discovery by Fernald in 1912, despite searches in 1992 (by J. Gagnon and C. Roy), in 1995 (Attention FragÎles) and in 1999, 2000 and 2001 (Houle et al., 2002). It is possible that human activities or gradual closure of the vegetation canopy in this sector have modified the habitat to the point of causing the disappearance of the species.

A population located at Anse aux Étangs (Locality 5) was observed in 1985 by Houle and Brouillet (Houle and Haber, 1990). They had noted approximately 60 individuals there. The site was briefly visited by J. Gagnon in 1995, but no Gulf of St. Lawrence Aster specimens were found there. Subsequently, Houle et al. (2002) found an Aster population there over an area of 5 m^2. In 1999 and 2000, there were 100 to 1,000 individuals, whereas in 2001, the population had declined to 10 to 100 individuals. It is possible that silting caused by human activity has contributed to the decline in this population.

The Lac aux Canards locality is located near Gros-Cap (Locality 6). A single individual was observed in 1995. Subsequently, despite searches, no Asters were found there between 1999 and 2001.

The Barachois marsh population (Cap de l'Hôpital), in Fatima, included some 20 individuals in 1985 (Houle and Haber, 1990). In 1995, the population was estimated at between 10,000 and 100,000 individuals, covering an area of approximately .5 ha. At the time, the site was disturbed by the passage of all-terrain vehicles and by the operation of a sandpit nearby. In 1999 and 2000, the population remained stable at between 10^5 and 10^6 individuals, over areas considered as two separate occurrences (Locality 7 and 8), by reason of their separation by unsuitable habitats over a distance of more than 1 km. In the summer of 2002, however, locality 8 declined drastically from 10^4 - 10^5 individuals to 10^2 – 10^3 plants presumably due to human activity.

Île de la Grande Entrée sector

A single Gulf of St. Lawrence Aster specimen was observed at Grande-Entrée, Île de la Grande Entrée (Locality 9) by Houle and Brouillet in 1985. The locality was not found during subsequent visits by G. Lavoie in 1992, J. Gagnon in 1995 and Houle and Hamel in 1999, 2000 and 2001.

Fernald (1914) was the first to find Gulf of St. Lawrence Aster at Grande-Entrée in 1912. He did not specify the location where he collected the specimen, but mentioned that the species was found in great abundance, covering the brackish wet sands. This site could be the same as the Bassin aux Huîtres site, which was visited in 1985 by Houle and Brouillet, who discovered approximately 150 individuals there distributed in two sub-populations. In 1995, the number of individuals was estimated at between 10^5 and 10^6, distributed over approximately 3 ha. In 1999 and 2000, Houle et al. (2002) counted an equivalent number of individuals there, but over 0.2 to 0.4 ha and separated into three populations by more than 500 m of habitat unsuitable to the species (Localities 10, 11 and 12). It appears that the habitat at this site has been modified by movement of the location of the opening of the basin apparently causing a general decline in the water level and the size of populations 10 and 12 as given in Table 1 (Line Couillard, CDPNQ, pers. comm., 2003).

Île de l'Est sector

The population on the beach at Grande Échouerie (Locality 13) was first visited by Houle and Brouillet in 1985, who discovered approximately 200 individuals there. In 1994, between 200 and 500 individuals were observed at two separate sites. However, in 1995, Gulf of St. Lawrence Aster was no longer present. It appears that this temporary absence may be explained by habitat changes due to a rise in the water level following a summer storm, the accumulation of eelgrass debris on the habitat or gradual closure of the vegetation canopy. In 1999, 2000 and 2001, only 10 to 100 Aster individuals were reported over an area of less of 10 m^2.

Between 10 and 100 individuals were observed in 1994 on Île de l'Est, at the northern tip of Étang de l'Est and at Pointe de l'Est (Locality 14). The area occupied was 5 m^2 at Étang de l'Est and less than 1 m^2 at Pointe de l'Est, where a single individual was reported. In 1999, 2000 and 2001, the population was 100 to 1,000 individuals over 100 to 600 m^2.

Near the western limit of Clarke Bay (Locality 15), some 30 individuals were counted in 1985 by Houle and Brouillet. In 1994, the population was estimated at approximately 100 individuals covering an area of 25 m^2. The temporary opening of the vegetation, caused by the passage of an all-terrain vehicle, seems to have favoured the species, since the habitat, a high marsh dominated by *Festuca rubra*, is somewhat atypical. Indeed, according to Houle (1988b), Gulf of St. Lawrence Aster is usually found in marshes dominated by *Spartina alterniflora*, *Carex paleacea* or *Scirpus*

pungens. In 1999, 2000 and 2001, the population was estimated by Houle et al. (2002) at 10^3 to 10^4 individuals, over 100 to 500 m^2.

A new Gulf of St. Lawrence Aster occurrence (Locality 16) was discovered in 2001, in the Baie de la Grosse-Île sector (Houle et al., 2002); 10^3 to 10^4 individuals occupied an area of more than 1,000 m^2.

Populations in New Brunswick

Gulf of St. Lawrence Aster populations in New Brunswick include a total of seven occurrences in four separate localities. Of these, only one is considered historical.

Miscou Island

The first Gulf of St. Lawrence Aster specimen collected at this location, by Roberts and Drury (NY and UNB), dates from 1963. Its presence there was verified in 1984, at which time some 100 individuals were counted by Houle and Legault (CAN, DAO, GH, LE, MT; Houle, 1988b). According to Sean Blaney (pers. comm., 2002), this lighthouse site has almost certainly disappeared (Locality 1, Figure 4). However, a new occurrence was discovered in 2002 at Malbaie south, where more than 1,000 plants were counted (Dietz, Piper Project, pers. comm., Locality 2). In 2003, the population estimate was 1500 plants (Lewnanny Richardson, pers comm.)

Tracadie

In Tracadie, at the end of the Val-Comeau road, a salt marsh supports a Gulf of St. Lawrence Aster population (Houle, 1988b). The first mention of this population dates back to 1913, when specimens were collected by S.F. Blake (GH, DAO, DS, NY, UC/JEPS). Houle and Legault (MT, Houle, 1988b) confirmed its presence in 1984, where they found a population of some 100 individuals (Locality 3). It had not been seen again for years, but in 1999, Jim Goltz and Maureen Bourque rediscovered it (Maureen Toner, pers. comm.). Approximately 100 plants were counted there in 1999 and more than 1,000 in 2000 (Grand Lac, Dietz and Chiasson, 2001). Only 15 plants remained at this locality in 2001 and 12 submerged plants were observed in 2002 (Sabine Dietz, pers. comm.). This site was not visited in 2003.

Kouchibouguac National Park

The St. Louis wharf locality, mentioned by Hinds (1983) for 1979, was explored briefly for Aster (Houle 1988b), but without success (Locality 4). A reconnaissance survey carried out by the park in 1999 also failed to find any Aster population, probably owing to habitat disturbances or changes (mats of eelgrass debris; Dietz and Chiasson, 2001).

In 2000, two new populations were located in Kouchibouguac National Park. One occurrence at the Lac-à-Exilda lagoon contained more than 1,000 individuals (Locality 5), while the one in Barachois contained only four plants (Locality 6).

However, a severe storm in the fall of 2000 changed the configuration of the dunes where Gulf of St. Lawrence Aster was located and the two occurrences were buried, the first under 60 cm of sand and the second under 30 cm of water (Éric Tremblay, pers. comm.). The situation has remained the same since that time.

Bouctouche Dune

Two populations discovered in 2000 by Valérie Godbout (2000) at Bouctouche Dune included respectively 500 to 1,000 and 2 plants (Locality 7). Since 2000, the Gulf of St. Lawrence Aster has been observed at four locations at the Dune (David Mazerolle, 2003). We consider them here as a single occurrence. As was the case for those in Kouchibouguac, the site was affected by combinations of flooding and sand deposition during a storm in 2002 (David Mazerolle, 2003.). It was believed at the time that the plants had been destroyed before seed set. In 2003, roughly 100 plants were counted at this site and remained undisturbed through seed production (David Mazerolle, 2003).

Populations in Prince Edward Island

The Prince Edward Island populations include 10 occurrences, the vast majority of which are located in Prince Edward Island National Park. Two are historical. The year 2002 was a very bad year for Gulf of St. Lawrence Aster populations in Prince Edward Island National Park with several losses of populations due to storm events.

Prince Edward Island National Park

The total Gulf of St. Lawrence Aster population in Prince Edward Island National Park is currently estimated at about 40,000 individuals at the six sites of Covehead Pond, Long Pond, Campbell's Pond, Western Wetland, Dune Slack and East Marsh. From west to east on the park territory, 13 sites were visited by Guignion et al. in 1992 and 1993. All the localities where the presence of the species is confirmed are located in the eastern half of the park. They have been monitored by the park since 1997.

Covehead Pond (Locality 1, Figure 5) is the closest to the type locality of Brackley Point. It contained 164 individuals in 1992 and 214 in 1993. Between 1994 and 1996, no data were collected. In 1997, 763 individuals were reported, in 1998, 412 individuals, in 1999, between 174 and 243 individuals, in 2001, 123 individuals and in 2002, only 10 individuals (Denyse Lajeunesse, pers. comm.; Stewart and Lacroix, 2001). This site is in decline. The population was completely flooded in 2002 and the individuals counted were under 30 cm of water (Jean Gagnon, pers. comm.).

The Long Pond population (Locality 2), also visited by Houle (1988b), contained only a single individual. Its situation remained the same in 1992 and in 1993. The site was visited from 1997 to 2001 and no individuals were seen there again. Extensive dredging work is being carried out at this site. It is therefore possible that the population has completely disappeared (Lajeunesse, pers. comm.).

Campbell's Pond (Locality 3) supported 30 individuals in 1992, but only three in 1993. In 1997, four individuals were seen again there, but none from 1998 to 2001 (Lajeunesse, pers. comm.).

Three populations were recognized at Blooming Point (Western Wetland, Dune Slack and Eastern Marsh), an area not explored during previous surveys. While Western Wetland (Locality 4) had a population of 450 individuals in 1992, it was no longer present in 1993. The site was revisited in 1993, 1998 (Ben Hoteling) and 1999, but no individuals were found. The population has probably disappeared (Lajeunesse, pers. comm.).

The other two populations are the largest in all of Prince Edward Island, with estimates of 15,000-20,000 individuals at Dune Slack and of 48,000-60,000 individuals at East Marsh, both constant between 1992 and 1993. At Dune Slack (Locality 5), the populations were estimated from 1998 to 2001 by Ben Hoteling and his students (Holland College) and in 2002 by Joni Fern Kemp, a student of Christian R. Lacroix (University of Prince Edward Island). In 1998, there were 126,000 individuals over 900 m^2, in 1999, 117,600 over 1,200 m^2, in 2000, 52,000 over 1,000 m^2, in 2001, 65,250 individuals (Stewart and Lacroix, 2001) and in 2002, 2,223 individuals. The population is currently in decline (Lajeunesse, pers. comm.).

Since 1998, the East Marsh occurrence has been divided into two populations (Localities 6 and 7). They were estimated by Ben Hoteling and his students from 1998 to 2000 and by Stewart and Lacroix (2001) and Lacroix (2002, unpublished, Lajeunesse, pers. comm.) in 2001. The East Marsh A population (Locality 6) has gradually decreased from 38,700 individuals in 1998 to only 133 individuals in 2001, over an area of approximately 900 m^2. The East Marsh B population (Locality 7) is the only one that has remained of significant size in the entire national park, ranging from 38,400 to 106,000 individuals between 1998 and 2002. In 2002, the population was 44,133 individuals.

The type locality of Brackley Point (Locality 8), where Macoun collected specimens of the plant for the first time in 1888, was revisited in 1912 (Fernald, 1914), 1953 (Erskine and Smith, ACAD) and 1984 (Houle and Legault, 1986). But in 1992, Guignion et al. (1995) observed that the 12 individuals mentioned by Houle (1988b) had disappeared from the site following development work carried out by the park.

Tignish

As early as 1912, Fernald (1914) located a Gulf of St. Lawrence Aster population at Tignish, Prince County, in the north of the island. At that time, it occupied the wet sands behind the strand (GH). Its persistence was verified in 1986 by Houle (1988b), who identified it in the marshes of Tignish Shore (Locality 9). At that time, only 10 individuals were counted in this population. Since then, Sean Blaney and Rosemary Curley have returned to this site twice (pers. comm., Nov. 7 and Dec. 11, 2002), and again in the fall of 2002 with Jean Gagnon, but did not find any plants.

According to Jean Gagnon, the habitat has been modified to the point of becoming virtually unsuitable for the species. Nonetheless, Rosemary Curley intends to return again in 2003 to search for the species at Tignish.

Grand Tracadie

The Grand Tracadie locality was mentioned in a source cited by Houle (1988b) dating from 1912 (Locality 10). Searches carried out in 1984 and 1986 failed to find any plants. No other search has been carried out at this site. This locality is considered historical.

Potential sites

Two sites identified as potential habitats for Gulf of St. Lawrence Aster (Houle and Legault, 1986, P.S. map 2), namely John Archies Pond and Clarkes Pond in Prince Edward Island National Park, were visited by Houle (1988b) and by Guignion et al. (1995). Despite the presence of most of the species frequently associated with Gulf of St. Lawrence Aster, these two field studies failed to find any asters. Searches of potential sites were carried out in Prince Edward Island, but outside the national park, by Island Nature Trust (Kate MacQuarrie, pers. comm.) and Jean Gagnon (September and October 2002, pers. comm.), at numerous sites shown in Appendix 1. No new occurrence was found. According to these surveys, the Canavoy site appears to be the best potential habitat, although described by Jean Gagnon as marginal on the basis of the habitats occupied by the species in the Magdalen Islands. Kate MacQuarrie intends to return to visit this site in 2003. According to Jean Gagnon, a storm that occurred before his searches deposited large amounts of eelgrass debris in the habitats conducive to Gulf of St. Lawrence Aster.

In New Brunswick, the Piper Project and the Irving Eco-Centre have conducted searches at a large number of potential sites not yet inventoried in search of Gulf of St. Lawrence Aster (Sabine Dietz, pers. comm., Appendix 2, David Mazerolle, 2003). In Kouchibouguac National Park, given the plant's short fruiting period and the restrictions of the 2000 project (Godbout, 2000), it is quite probable that all potential sites have not yet been identified.

Mistaken occurrences

Hinds (1986) reported Gulf of St. Lawrence Aster in Bathurst (NB) on the basis of a misidentified specimen (*Hinds 5803*, NB!, *in* Houle, 1988b). The correct name of that specimen is *Symphyotrichum subulatum* (Michx.) Nesom var. *obtusifolius* Fern.

LIMITING FACTORS AND THREATS

Boudreau and Houle (1998) and Houle et al. (2002) have demonstrated that interspecific competition appears to play a significant role in the population dynamics of

Gulf of St. Lawrence Aster. Vegetation canopy closure is not conducive either to its reproductive effort or to its survival rate. Light appears to be the main abiotic factor that has a significant effect on the growth and reproduction of Gulf of St. Lawrence Aster (Houle et al., 2002). Astonishingly, the availability of nutrients has no significant effect on growth and reproduction. The salinity of the substrate has a marked inhibiting effect on seed germination, even though the seeds retain their viability when rinsed with distilled water after 30 days of exposure to salt (Houle et al., 2002). However, salinity does not appear to have an effect on reproduction. Dry, hot years could have a major impact on the populations, since Gulf of St. Lawrence Aster is sensitive to water stresses.

A major storm (September 12, 2002, “Gustave”) flooded or buried several populations in New Brunswick and Prince Edward Island under masses of eelgrass or sand (David Mazerolle, 2003, Jean Gagnon, Denyse Lajeunesse, pers. comm.). The populations of Kouchibouguac, flooded in 1999, have still not re-appeared although plants have re-established at the Dune de Bouctouche (David Mazerolle, 2003.).

Anthropogenic disturbances, such as the construction of cottages and fill operations, completely destroy the species’ habitat. This is believed to have impacted at least two sites in the past, although protection exists at several of the current sites. In Prince Edward Island National Park, the type locality of Brackley Point disappeared following development work carried out by the park. Extensive dredging operations have been carried out at the Long Pond site and it is possible that Gulf of St. Lawrence Aster disappeared following this.

ATV tracks have occasionally been observed, particularly at the Clarke Bay site (Cap de l’Est, MI), in the Barachois salt marsh, at Fatima (Cap de l’Hôpital, MI) and in the habitats of Kouchibouguac National Park (Dietz and Chiasson, 2001). The impact of these disturbances would be expected to vary with extent and intensity, but may have temporarily favoured its establishment by creating gaps in the plant cover, notably in Clarke Bay, where Gulf of St. Lawrence Aster has been found colonizing ruts.

Finally, artificial changes in saltwater levels or circulation patterns (permanent opening or closing of a lagoon, etc.) could affect the health of Gulf of St. Lawrence Aster populations by altering the disturbance cycle needed to maintain its habitat. This situation has occurred, for example, at Bassin aux Huîtres, Îles de la Grande Entrée, MI, where circulation in the basin was modified after its entrance was moved.

SPECIAL SIGNIFICANCE OF THE SPECIES

Gulf of St. Lawrence Aster is an example of an endemic taxon restricted to the Gulf of St. Lawrence (Fernald, 1925; Erskine et al., 1985; Marie-Victorin, 1964; Catling and McKay, 1980). Other rare species are sometimes associated with this species (Houle, 1988a; Gagnon et al., 1995a and b), namely:

Lomatogonium rotatum L. (rare in New Brunswick according to Hinds, 1983)

Calamagrostis neglecta (Ehrh.) Gaertn, Mey & Schreb. (rare in Nova Scotia according to Maher et al., 1978)
Rumex persicarioides L. (rare in New Brunswick according to Hinds, 1983, and in Nova Scotia, according to Maher et al., 1978)
Stellaria humifusa Rottb. (rare in Nova Scotia, according to Maher et al., 1978)
Bidens heterodoxa (Fernald) Fernald & St. John (likely to be designated threatened or vulnerable in Quebec, according to Labrecque and Lavoie, 2002)
Triglochin gaspense Lieth & D. Löve (likely to be designated threatened or vulnerable in Quebec, according to Labrecque and Lavoie, 2002)

There are no known economic uses for Gulf of St. Lawrence Aster.

The Mi'kmaq of the region have no particular knowledge of this species and no Aboriginal name is known. Nor are there any known traditional uses of the species.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Part of the Havre aux Basques lagoon population is located in a migratory bird staging area, but this does not give it any legal protection. Development work in the Barachois marsh at Fatima began in the fall of 1995 with the aim of protecting and enhancing the salt marsh that it supports. The Quebec Natural Heritage Information Centre (*Centre de données sur le patrimoine naturel du Québec*) was consulted in the course of this project to ensure that the issue of plant species likely to be designated threatened or vulnerable, including Gulf of St. Lawrence Aster, is taken into account.

The Prince Edward Island National Park helped fund the study by Guignion et al. (1995) and has monitored occurrences of the species since 1997. The park authorized the participation of researchers from the University of PEI and Holland College in the annual surveys (Lajeunesse, pers. comm.). In addition, Kouchibouguac National Park has drawn up a management and monitoring plan that takes into account the presence of the species in the park (Dietz and Chiasson, 2001).

International status

No international status is accorded to this species, since it is present only in Canada.

National status

Gulf of St. Lawrence Aster was designated rare in Canada in 1989, transferred to the vulnerable category when the former was replaced in 1990 (COSEWIC, 1998) and transferred to Special Concern in 1999 when the vulnerable category was replaced by special concern.

Provincial status

The species is currently designated threatened in Quebec (Government of Quebec, February 8, 2001) and endangered in New Brunswick (New Brunswick *Endangered Species Act*, 1996). In Prince Edward Island, it is considered rare (Day and Catling, 1991), but has not been designated in the list of the *Wildlife Act*.

TECHNICAL SUMMARY

Symphyotrichum laurentianum
Gulf of St. Lawrence Aster **Aster du Saint-Laurent**
Range of Occurrence in Canada: Gulf of St. Lawrence, Quebec (Magdalen Islands), Prince Edward Island, New Brunswick

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* (Based on GIS calculation of a polygon in which all points at outer limits of range are included)	perhaps ~2000
• *Specify trend in EO*	Stable
• *Are there extreme fluctuations in EO?*	No
• *Area of occupancy (AO) (km²)*	<5
• *Specify trend in AO* (Declines noted in NB and PE may not be long term trends but may possibly reflect periodic fluctuations due to such significant impacts as major storm events.)	Stable overall in Magdalen Is. but with recent declines in some populations; Possibly declining in PEI Fluctuating, possibly declining in NB
• *Are there extreme fluctuations in AO?*	Yes due to storm events and natural fluctuations in population size of this annual species
• *Number of known or inferred current locations*	28 extant (33 total, of which 4 are historical and 1 not seen since 1986)
• *Specify trend in #*	Possibly stable but varies with fluctuations in populations due particularly to storm events
• *Are there extreme fluctuations in number of locations?*	No
• *Specify trend in area, extent or quality of habitat* (Area of occurrence fluctuates depending on such impacts as major storm events; recent declines noted may reflect temporary changes but this is uncertain.)	Possibly declining in PEI for 2 years. Stable, overall, in MI;
Population Information	
• *Generation time (average age of parents in the population)*	1 year
• *Number of mature individuals*	12,000,000 (MI), 1000-2000 (NB), ~40,000 (PEI) Total: ~12,000,000
• *Total population trend:*	Stable overall due to the large numbers in MI (fluctuating, and with recent declines in some populations in MI, possibly declining in NB and in PEI)
• *% decline over the last/next 10 years or 3 generations.*	Not Applicable
• *Are there extreme fluctuations in number of mature individuals?*	Yes
• *Is the total population severely fragmented?*	Yes No
• *Specify trend in number of populations*	Stable overall (fluctuating, in MI, possibly declining in NB and in PEI)

• *Are there extreme fluctuations in number of populations?*	No but some fluctuations occur
List populations with number of mature individuals in each: See Tables 1 to 3	
Threats (actual or imminent threats to populations or habitats)	
- ATVs in its habitat (dune slacks); filling of the habitat for construction or development work - covering of populations with sand during storm events - high water levels	
Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* **USA: None**	
• *Is immigration known or possible?*	Not Applicable
• *Would immigrants be adapted to survive in Canada?*	Not Applicable
• *Is there sufficient habitat for immigrants in Canada?*	Not Applicable
• *Is rescue from outside populations likely?*	No (Endemic)
Quantitative Analysis	Not Applicable
Other Status **COSEWIC: Special Concern (1989)** **Quebec: Menacée** **New Brunswick: Endangered** **Prince Edward Island: rare but not officially listed**	

Status and Reasons for Designation

Status: Threatened	**Alpha-numeric code:** D2

Reasons for Designation: An annual halophyte of maritime littoral habitats endemic to the Gulf of St. Lawrence. It is found at nearly 30 extant sites with some very large populations, especially on the Magdalen Islands, but has a very small total area of occupancy of much less than five square kilometres. Many of the populations are subject to natural fluctuations in size and at times suffer important losses due to severe storm events. On-going impacts also exist from human recreational activities and losses of habitat due to development activities.

Applicability of Criteria

Criterion A (Declining Total Population): Not Applicable. Declines in NB and PE are relatively small in relation to huge population size in Magdalen Islands; some new populations have also been found in NB and the Magdalen Islands due to increased search effort and the recent losses of populations due to storm events are too recent to recognize as being permanently extirpated since the seeds of the species have a longevity of as much as 10 years.

Criterion B (Small Distribution, and Decline or Fluctuation: Not Applicable. Although possessing small EO and AO there is uncertainty as to whether the populations are severely fragmented due to the plants manner of seed dispersal and the uncertainty, over the long term, of the impact of fluctuating population sizes and the impact of storm events.

CRITERION C (Small Total Population, Size and Decline): Not Applicable. Total minimum population is too large.

Criterion D (Very Small Population or Restricted Distribution): Threatened under D2 with an area of occupancy <5 km^2

Criterion E (Quantitative Analysis): Not Applicable

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BIBIOGRAPHICAL SUMMARY OF THE REPORT WRITER

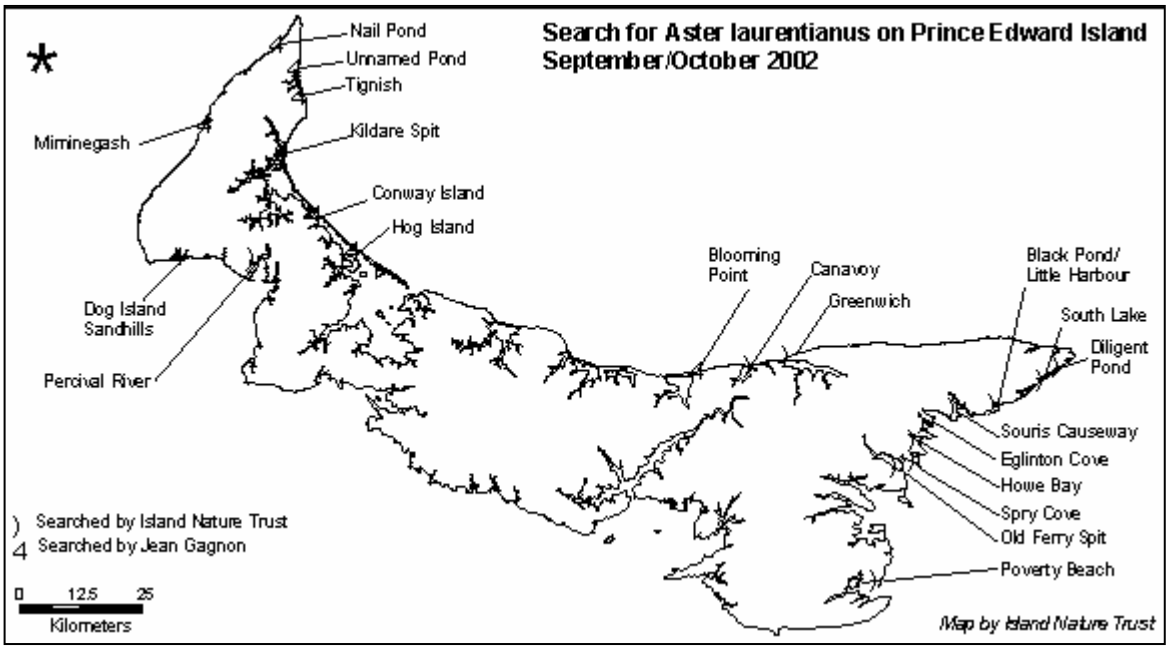
Hélène Gilbert is a bio-ecologist specializing in vegetation studies. In 1979, she earned a Master's degree in plant ecology from Laval University. Since that time, she has worked as a consultant, researcher, instructor, ecologist and botanist. Her work experience in plant ecology and in botany has covered large areas of Quebec, ranging from Northern Quebec to James Bay, from the Gaspé Peninsula to the freshwater estuary of the St. Lawrence, and from Beauce to Abitibi. Her interests encompass nature conservation in the broadest sense and she endeavours to incorporate these principles into her personal as well as professional life.

With respect to threatened plants, she carried out surveys of rare plants on private land in the Gaspé Peninsula in 2001 and in 2002, as well as updating the survey of rare plants in Forillon National Park in 2002. She also participated in the survey of rare plants in the urban parks of the Island of Montreal in 1999, she updated the status reports on three threatened or vulnerable plant species in 1999 (Ram's Head Lady's Slipper, Giant Bird's Nest and Gulf of St. Lawrence Aster) for the Quebec Department of Environment, she participated in the survey of threatened or vulnerable species in several Quebec locations for various clients and she produced a report on the predicted reactions of forest plant species at risk in light of Quebec forestry practices.

COLLECTIONS EXAMINED

No collections were examined in the course of this update.

Appendix 1. Localities explored for Gulf of St. Lawrence Aster in Prince Edward Island in September and October 2002.



Map provided by Kate MacQuarrie, of Island Nature Trust, November 12, 2002.

Appendix 2. Localities explored for Gulf of St. Lawrence Aster in New Brunswick from 1999 to 2002.

Translation key:
2002 - 1,000 or more plants

1999-2000 - approximately 1,000 plants
2001 - 15 plants
2002 - 12 submerged plants

Site visited in 1999-2000
Site visited in 2001
Site visited in 2002
Site to be visited
Site where aster was found

Piper Project - New Brunswick Federation of Naturalists