

**RECOVERY STRATEGY  
FOR  
THE GULF OF ST. LAWRENCE ASTER  
(*SYMPHYOTRICHUM LAURENTIANUM*)  
IN  
NEW BRUNSWICK, CANADA**

**2007**





## **Context**

The Gulf of St. Lawrence Aster (*Symphyotrichum laurentianum*) is an annual coastal marsh plant endemic to Quebec, Prince Edward Island, and New Brunswick. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed the species as *Special Concern* in 1989, and later re-evaluated its status as *Threatened* in Canada in 2004 owing to its limited distribution, fluctuating population size, and continued pressures on its habitat. The Gulf of St. Lawrence Aster has been listed as *Endangered* under the *New Brunswick Endangered Species Act* since 1996.

The Recovery Strategy for the Gulf of St. Lawrence Aster (*Symphyotrichum laurentianum*) in New Brunswick, Canada was prepared by the Species at Risk Program, Fish and Wildlife Branch of the New Brunswick Department of Natural Resources in consultation with scientific experts, government biologists, and stakeholder groups. This document is provided as guidance to all parties interested in recovery of the species, and we encourage researchers, conservationists, and other non-government organizations to use this document when planning projects involving this species and its recovery.

## **Recovery Strategy Acceptance**

The Recovery Strategy for the Gulf of St. Lawrence Aster (*Symphyotrichum laurentianum*) in New Brunswick, Canada is the best current advice on the approach to recovery of the Gulf of St. Lawrence Aster in New Brunswick.



Mr. Mike Sullivan  
Director, Fish and Wildlife Branch  
Department of Natural Resources  
Government of New Brunswick

Date: September 2007

**Recommended Citation:** Recovery Strategy for the Gulf of St. Lawrence Aster (*Symphyotrichum laurentianum*) in New Brunswick, Canada. 2007. New Brunswick Department of Natural Resources, Fredericton, New Brunswick.

**Disclaimer:** The Recovery Strategy for the Gulf of St. Lawrence Aster (*Symphyotrichum laurentianum*) in New Brunswick, Canada was prepared by the Species at Risk Program, Fish and Wildlife Branch of the Department of Natural Resources in consultation with scientific experts, government biologists, and stakeholder groups. It defines the recovery goals, objectives, and the recovery approaches necessary to protect and recover the species. It does not necessarily represent the views of individuals or the official positions of organizations consulted with respect to the strategy. The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives. Implementation of the strategy is subject to appropriations, priorities, and budgetary constraints of the provincial departments and other non-government organizations.

**Acknowledgements:** We wish to thank the many organizations and individuals who, over the years, have contributed to the body of knowledge of the Gulf of St. Lawrence Aster. Production of this document would not have been possible without their contributions:

- Dominique Berube, NBDNR, and Sean Blaney, ACCDC, provided expertise to the recovery strategy on coastal dynamics and species ecology, respectively.
- Parks Canada-Kouchibouguac National Park (KNP) contributed to the research and acquisition of knowledge on the aster in this province by providing logistical support and funding research projects and stewardship initiatives.
- The staff of the Irving Eco-centre, La Dune de Bouctouche, who have spearheaded efforts in the field to look for new occurrences, supported research, and developed stewardship opportunities, most notably a multi-jurisdiction workshop on the Gulf of St. Lawrence Aster in November 2005.
- The Piper Project, for their work in searching for new occurrences of the Aster and their continued efforts to monitor the known sites in the province.

## **Executive Summary**

The Gulf of St. Lawrence Aster is an annual halophyte endemic of the Northumberland coastline of New Brunswick, the Magdalen Islands of Quebec, and Prince Edward Island. It is restricted to low-lying areas behind sand dunes around salt marshes, ponds, and lagoons, infrequently flooded by high tides and storms. It requires full sunlight and little interspecific competition for optimal growth. In 2005 it was confirmed at only 2 sites in New Brunswick, Miscou Island and Val-Comeau.

The primary reasons behind the listing of the Gulf of St. Lawrence Aster as *Endangered* in New Brunswick and *Threatened* in Canada is its fluctuating population size, limited geographic distribution, and continued pressures on its restricted habitat. The habitat of the Gulf of St. Lawrence Aster is dynamic and subject to various natural and anthropogenic disturbances, with the primary habitat-altering disturbance being tide and storm events. Plants and habitat are also subject to pressure from recreational vehicle traffic on salt marshes and dunes.

Recovery of this species is biologically feasible. However, active intervention to supplement populations may be ineffective due to natural processes, such as storm disturbance and saltmarsh succession, which affect the habitat availability, abundance, and distribution. Therefore, the recovery goals for this species are the protection of current sites from anthropogenic disturbance and the monitoring of existing sites and potential habitat. These goals will be achieved through the development and implementation of a monitoring protocol to assess distribution and abundance, protection using existing acts and regulations pertaining to coastal ecosystems, education, and stewardship.

**TABLE OF CONTENTS**

Executive Summary ..... v

SPECIES INFORMATION: ..... 1

1.0 INTRODUCTION ..... 1

2.0 RECOVERY ..... 1

    2.1 Recovery Feasibility ..... 1

    2.2 Recovery Goals and Objectives ..... 2

2.2.1 Recovery goals ..... 2

2.2.2 Recovery objectives and rationale ..... 3

2.2.3 Broad strategy to address threats ..... 6

3.0 BACKGROUND ..... 9

    3.1 Description of the Species ..... 9

3.1.1 The species ..... 9

3.1.2 Populations and distribution ..... 9

    3.2 Description of the Species' Needs ..... 12

3.2.1 Biological needs, ecological role, and limiting factors ..... 12

3.2.2 Habitat needs ..... 13

4.0 THREATS AND BARRIERS TO RECOVERY ..... 14

    4.1 Natural Threats to Recovery ..... 14

4.1.1 Flooding and overwash ..... 14

4.1.2 Gradual habitat modification ..... 15

4.1.3 Competition ..... 15

    4.2 Anthropogenic Threats to Recovery ..... 16

4.2.1 Recreational vehicle use ..... 16

4.2.2 Development ..... 16

4.2.3 Modifications to water levels or circulation patterns ..... 16

5.0 KNOWLEDGE GAPS ..... 17

6.0 LITERATURE CITED ..... 18

APPENDIX I: Monitoring protocol for the Gulf of St. Lawrence Aster, as developed at the Gulf of St. Lawrence Aster workshop, Nov. 7-8, 2005. .... 21

APPENDIX II: Estimates of population size for Gulf of St. Lawrence Aster occurrences in New Brunswick. .... 23

## **SPECIES INFORMATION:**

1. **Scientific Name:** *Symphyotrichum laurentianum*
2. **Common Name:** Gulf of St. Lawrence Aster
3. **Current New Brunswick Status & Year of Designation:** Endangered (1996)
4. **Current COSEWIC Status & Year of Designation:** Threatened (2004)
5. **Status in the United States:**
6. **Global range:** QC, NB, PE
7. **Range in Canada:** QC, NB, PE
8. **Rationale for COSEWIC Status:** 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.

## **1.0 INTRODUCTION**

The Gulf of St. Lawrence Aster is an annual plant species endemic to the Gulf of St. Lawrence region, found along margins of salt marshes, ponds, lagoons, and coastal dunes. It is known only from Canada, along the Northumberland coastline of New Brunswick, Prince Edward Island, and the Magdalen Islands of Quebec. Threats to the aster are both natural (flooding, overwash, competition from other plants) and anthropogenic (development, recreation vehicles). Fluctuations exist in both the distribution and abundance year-to-year because it is an annual species, perpetuates by seed only, and occupies a dynamic habitat.

## **2.0 RECOVERY**

### **2.1 Recovery Feasibility**

The recovery of the Gulf of St. Lawrence Aster in New Brunswick is biologically feasible. However, increasing the number of individuals, or even maintaining the aster at its present level of abundance, will be a difficult process. As an annual species, it relies entirely on production of seed and the seed bank for future populations, resulting in fluctuating population sizes and changes in relative distribution year-to-year. Further, the habitat the Gulf of St. Lawrence Aster occupies is dynamic and subject to various natural and human pressures.

The (re)introduction or augmentation of existing populations is not a viable option for recovery at the present time in New Brunswick; active intervention to supplement populations may be ineffective because the most significant impacts on habitat availability and population size are storm disturbance and saltmarsh succession which

are unpredictable and uncontrollable natural processes. Therefore, the focus of this recovery strategy is the *monitoring and the protection of existing sites and potential suitable habitat from human-caused threats to recovery.*

## **2.2 Recovery Goals and Objectives**

The recovery goals and objectives are first steps towards ensuring the long-term recovery of the Gulf of St. Lawrence Aster. For the purposes of this document, “sites” will hereby refer to the general locations or regions where the aster is found (Miscou Island and Val-Comeau). Subdivision of populations at each site will be referred to by location (ie. Miscou Island – Middle Miscou Beach, Malbaie-Sud), or referred to as a “sub-population”.

### 2.2.1 Recovery goals

1. *Protect survival habitat (current sites) of Gulf of St. Lawrence Aster in New Brunswick from anthropogenic disturbances.*
2. *Monitor existing and potential sites. Emphasis should be on distribution and abundance of Gulf of St. Lawrence Aster and the effects of natural disturbance on abundance, distribution, and habitat.*

#### *Rationale for recovery goals*

The primary reasons behind the listing of the Gulf of St. Lawrence Aster as *Endangered* in New Brunswick and *Threatened* in Canada is the fluctuating population size, few number of sites, limited geographic distribution, and the continued natural and anthropogenic pressures on its restricted habitat. The habitat of the Gulf of St. Lawrence Aster is dynamic and subject to various natural and anthropogenic disturbances, with the primary habitat-altering disturbance being tide and storm events. It is not possible to predict or mitigate the long-term impacts of these events on the Aster’s habitat. The inability to address the primary mechanism behind habitat and plant loss makes reintroduction, translocation, and/or habitat modification or reclamation a non-viable goal at the present time. Therefore, the emphasis for recovery *at this time* should be the protection and monitoring of all known sites for the aster in New Brunswick.

Survival habitat refers to the habitat that is currently or regularly occupied, and required for the survival of populations at those sites. For an annual species such as Gulf of St. Lawrence Aster, which relies solely on seed dispersal and successful germination for plants in subsequent years, determination of survival habitat requires that sites be followed for a number of years in order to determine the current distribution. The time frame for determining survival habitat will differ between sites due to environmental features affecting distribution that are unique to each site, such as wind or topography. Intervening portions of a site that are apparently suitable habitat but with no plant records should not be included; if plants occupy new portions of a site in subsequent years, these areas can be added to the map of survival habitat.

### 2.2.2 Recovery objectives and rationale

The focus of the recovery strategy will be on existing sites. Extensive work has already been conducted to locate additional occurrences along the Northumberland coastline of New Brunswick, with few additional potential locations left. Certain threats can be removed or mitigated (recreational vehicle use, development) while others cannot be mitigated or removed because they are naturally occurring phenomena (storm events, tidal flow). For more complete details or information on threats to the Gulf of St. Lawrence Aster, please refer to section 4.0 *Threats and Barriers to Recovery*.

Specific objectives of the recovery strategy may be organized into the following categories in order of priority:

#### (1) Monitoring and Surveys

Objective:

- i. *Continued monitoring of occurrences using existing protocol (Appendix I).*
- ii. *Consolidate known information and existing data on the Gulf of St. Lawrence Aster, identify and map all locations searched, identify and complete searches of all suitable habitat along the Northumberland coastline of New Brunswick, and randomly survey high potential sites for new occurrences.*

The action plan and monitoring plan are separate documents to be addressed at a later time, but the general concept of monitoring should be mentioned here.

Surveys in New Brunswick have so far varied in both timing and completeness. Consistent population monitoring is required in order to address recovery goal (2) and should include the following components:

- Application of a methodology for identifying, surveying, and tracking known aster sites, as developed jointly with other jurisdictions involved in the recovery of the aster.
- Methodology for identifying, surveying, and tracking *potential* Gulf of St. Lawrence Aster sites. A number of sites have been identified as potential suitable habitat which has not been previously surveyed. Distribution information of the species suggests that any monitoring protocol be open to possible population expansion. Provision should be made for randomized surveys of sites that have been identified as having high potential for occurrence of the Aster.
- Continued monitoring of sites which once supported Gulf of St. Lawrence Aster populations but presently do not support individuals (recent, inactive occurrences). This is necessitated by insufficient information on the seed viability and seed bank.
- Data management. An accounting of each site visited, personnel, date, site conditions, etc. This will provide more information about distribution of the species and track areas which have been intensively surveyed but where none of the Asters have been found.

Given the lack of knowledge concerning seed viability (3-10 years), sites currently believed “lost” or unproductive in the last 10 years should continue to be monitored to determine if the Aster can successfully re-establish. Monitoring potential Gulf of St. Lawrence Aster sites, as well as surveys of sites identified as having a high potential for occurrence of the Aster, is also an important component of the monitoring and survey protocol given the limited knowledge of distribution patterns. Focus for this step should be on areas which could provide suitable Gulf of St. Lawrence Aster habitat within a reasonable distance of currently known sites.

(2) Protection

Objective:

- iii. *Develop mechanisms for sharing information and data on the Gulf of St. Lawrence Aster and its habitat between government departments and agencies.*

Of the three confirmed sites in New Brunswick, Kouchibouguac National Park falls under federal jurisdiction and Miscou Island and Val-Comeau are a combination of provincially and privately owned property under provincial jurisdiction.

On provincial lands, the Gulf of St. Lawrence Aster is protected under New Brunswick Regulation 96-26 of the *New Brunswick Endangered Species Act*. This legislation protects individual plants and any habitat deemed critical to their survival. Thus, it is prohibited under the Act for any individual or organization to willfully or knowingly, or attempt to, possess, disturb, interfere, harm, or destroy an individual aster plant or habitat critical to its survival. Exceptions are made for the use of plants for scientific purposes relating to recovery of the species or for educational purposes.

In addition to the *New Brunswick Endangered Species Act*, there are other policies and regulations that limit, restrict, or ban activities in areas which may be considered habitat for the aster. The New Brunswick Department of Environment (DENV) administers the *Coastal Areas Protection Policy for New Brunswick* and the *New Brunswick Wetlands Conservation Policy*. The *Coastal Areas Protection Policy for New Brunswick* is designed to protect coastal areas through regulation of activities that occur on and around coastal lands, salt marshes, dunes, and beaches. The *New Brunswick Wetlands Conservation Policy* drafted in 2002 affords protection for coastal marshes, which are considered Provincially Significant under the policy and receive the highest degree of protection.

Also administered by DENV is the *Watercourse and Wetland Alteration Regulation permit program*, which requires anyone working within 30 m of a wetland (including coastal marshes) to obtain a permit. This includes, but is not limited to, activities involving construction, vegetation removal, disturbing the ground, and draining of the wetland.

Existing provincial regulations should be sufficient to provide protection to the species and its habitat. Given that the species is found on both privately owned land and land owned by the province, as well as the number of different regulations coordinated by

different provincial departments (DNR and DENV), improving information exchange between departments as well as the public, and the development of a mechanism to deliver this information, will be key to better protection of the aster and its habitat.

The mechanism for delivering information to each department should consist of a centralized database, available to each department, with detailed location information on the aster. With this system, any issuing of permits or requests within or near the survival habitat of the species should automatically trigger a response from the appropriate personnel within DNR.

### (3) Stewardship and Education

Objective:

- iv. *Encourage partnerships with community organizations to promote long-term stewardship opportunities for the species.*
- v. *Foster opportunities for landowners to assist in the protection of the Gulf of St. Lawrence Aster and its habitat through increased public awareness and involvement.*
- vi. *Support education measures to raise awareness regarding rare and endangered plants along the coast, as well as the coastal ecosystem they occupy.*

As of 2006, the Gulf of St. Lawrence Aster is confirmed as productive on 2 sites in New Brunswick, both of which have some or all of the area as private land holdings. The cooperation of landowners will enable successful monitoring and management of the Gulf of St. Lawrence Aster in New Brunswick.

Priorities of any stewardship and education plans should include:

- Ensuring landowners are provided access to information about the aster, and provided information on related management or recovery issues/concerns which affect them. This includes not just the aster on currently known sites, but those sites which have the greatest potential for having the Gulf of St. Lawrence Aster in the future.
- Ensuring landowners are aware of opportunities to participate in conservation initiatives and/or programs.
- Supporting education measures on the Gulf of St. Lawrence Aster to raise public awareness.
- Encouraging partnerships with community and conservation organizations in the pursuit of long-term stewardship initiatives.

The New Brunswick Department of Natural Resources has been supporters of Non-government organizations (NGOs) work on the aster. The staff of the Irving Eco-centre, La Dune de Bouctouche (in partnership with universities and Parks Canada-KNP) has undertaken research on the Aster, surveys of marshes for rare coastal plants along the Northumberland coastline, and public awareness campaigns through interpretive

signage and brochures. The Piper Project has been, and continues to be, involved in monitoring of the Aster at sites in New Brunswick.

(4) Research

Objective:

- vii. *Address questions relating to seed viability and the impact of S.ciliatum on populations of Gulf of St. Lawrence Aster.*
- viii. *Take necessary steps to ensure that (re)introduction and/or augmentation is available should this become necessary for future recovery efforts.*

Research should focus on studies of seed viability. Houle (1988) mentions that under laboratory conditions, achenes are still considered viable after 3 years. There is also the probability of seeds remaining viable for up to 10 years, given information known on closely related species *Aster brachyactis*, since renamed *Symphyotrichum ciliatum* (Houle and Haber 1990). However, no definitive length of time has been given for seed viability of Gulf of St. Lawrence Aster. Sites in the province have been subjected in frequent overwash events, most notably in 2000 when the sub-populations in Kouchibouguac National Park disappeared (Mazerolle 2004). An experiment in habitat modification and reclamation in 2003 produced one plant at the Kouchibouguac site in 2004 (Mazerolle 2004), indicating a reliance on the seed bank to produce individuals. Knowledge of seed viability will be an important factor in determining the focus of monitoring efforts.

Although (re)introduction or augmentation of existing populations is not a viable option for recovery at the present time in New Brunswick, it may become a necessary step for recovery of the species in the future. With only two currently known sites for the province, *ex situ* seed banking should be explored as a necessary measure to address this potential future need. Preliminary efforts are already underway, with seeds from both the Miscou and Val-Comeau sites stored at the E.C Smith Herbarium of the Biology Department at Acadia University in Wolfville, N.S. since 2005.

### 2.2.3 Broad strategy to address threats

Threats to the Gulf of St. Lawrence Aster and its habitat are described in detail in section 4.2, but are briefly mentioned here. These include natural threats to recovery such as flooding and overwash (4.1.1), gradual habitat modification through natural, long-term processes of tides and winds (4.1.2), and vegetation competition (4.1.3). Anthropogenic threats to the aster and its habitat are recreational vehicle use on dunes and salt marshes (4.2.1), development (4.2.2), and modifications to natural water levels and circulation patterns, such as the infilling of streams (4.2.3).

A general approach to mitigate or remove threats to the recovery of Gulf of St. Lawrence Aster in New Brunswick is shown in Table 1. Activities are ranked according to priority, with those mentioned as “high” requiring immediate attention. The primary threat to Gulf of St. Lawrence Aster and its habitat are natural disturbance patterns; complete removal of this threat is not possible. Steps to address this threat focus more on monitoring to determine the level of impact on the population than removal.

***New Brunswick Gulf of St. Lawrence Aster Recovery Strategy***

**Table 1: Broad approaches and strategies to meeting recovery goals and objectives.**

<b>Broad Approach/ Strategy</b>	<b>Objective</b>	<b>Threat Addressed</b>	<b>Priority</b>	<b>General Steps</b>	<b>Anticipated Effects (Measurable Targets)</b>
Monitoring and surveys	i, ii	NA	High	<ul style="list-style-type: none"> <li>• Implement monitoring protocol as developed at Nov. 2005 conference (p.20)</li> <li>• Assess status of sites-monitor for habitat degradation and disturbances</li> <li>• Map all current, inactive, and historic sites, as well as all sites which have been visited but no aster was present</li> <li>• Determine suitable habitat for potential population expansion (recovery habitat)</li> <li>• Survey potential habitat which has not been visited previously</li> <li>• Randomly survey of sites with a high potential for new occurrences</li> </ul>	Repeatable, standardized process to facilitate recovery efforts for the species and allow for sharing of information between jurisdictions. Definitive knowledge of location of the aster on the ground. Discovery of new occurrences of the aster or population expansion.
Habitat protection-Enforcement	iii	Development, Water level modifications	High	<ul style="list-style-type: none"> <li>• Identify mechanisms for sharing data and information with DNR and other government agencies</li> <li>• Identification of all “high risk” areas (sites and surrounding suitable areas) in database-areas flagged to provide signal if any requests are made on property</li> <li>• Departmental staff alerted when applications/inquiries are made concerning known sites and potential habitat</li> </ul>	Increased efficiency in enforcement response to threats to the aster and its habitat.
Habitat protection-stewardship	iii, iv, v, vii	Recreational vehicles	High	<ul style="list-style-type: none"> <li>• Explore avenues for interested local ATV organizations to participate in process and targeted stewardship opportunities</li> <li>• Provide support to local organizations to create/adopt stewardship opportunities</li> </ul>	Reduction in amount/intensity of ATV traffic in sensitive areas. Increased public awareness of coastal ecosystems and human impacts
Research-invasive species	vii	Vegetation competition	High	<ul style="list-style-type: none"> <li>• Determine if <i>S. ciliatum</i> is present at known sites/surrounding sites</li> <li>• Assess threat of competition and hybridization with <i>S. ciliatum</i> for current Gulf of St. Lawrence Aster population</li> </ul>	Potential impact of <i>S. ciliatum</i> at each site is known.

***New Brunswick Gulf of St. Lawrence Aster Recovery Strategy***

Research-seed viability	vii	NA	Medium	<ul style="list-style-type: none"> <li>• Collection of seed from aster sites in NB</li> <li>• Seeds from storage grown each year to determine viability</li> </ul>	<p>Definitive knowledge of seed viability, which could support long-term storage of genetic material (if this becomes necessary as part of future recovery efforts).</p> <p>Determination of when a site can be classified as “historic” in order to facilitate allocation of resources.</p>
Research- <i>ex situ</i> seed banking	viii	NA	Medium	<ul style="list-style-type: none"> <li>• Explore partnership opportunities for the establishment of an <i>ex situ</i> seed bank for NB seeds</li> <li>• Explore possibility of a multi-jurisdictional <i>ex situ</i> seed bank</li> <li>• Collection of seed from currently known sites in NB</li> </ul>	<p>Establishment of an <i>ex situ</i> seed bank for a reintroduction or translocation program, should it become necessary.</p> <p>The protection of the genetic variability of the Gulf of St. Lawrence through multi-site seed storage.</p>

## **3.0 BACKGROUND**

### **3.1 Description of the Species**

#### 3.1.1 The species

The Gulf of St. Lawrence Aster is a small, annual halophyte endemic to Prince Edward Island, New Brunswick, and the Magdalene Islands. Growing in sandy, brackish soils in areas infrequently flooded by salt water, *S. laurentianum* Fernald is found in salt marshes and around ponds in dune slacks, along the shores of shallow lagoons, on sand flats in back of the dunes, and along sandy beaches of protected coves (Houle 1988, Houle and Haber 1990, Guignion et al. 1995, Houle and Valery 2003). It appears generally not as a dominant species, or, if dominant, only on clearly defined and relatively small patches in the community types, requiring full sunlight and little interspecific competition for growth (Houle 1988). It was first collected by John Macoun on September 5 1888 at Brackley Point, PEI (now PEI National Park). Fernald and coworkers subsequently collected new specimens from the same locality on August 31 1912 and described them as the new species *Aster laurentianus* (Fernald 1914). The species was reclassified *Symphyotrichum laurentianum* through taxonomic work by Nesom in 1994 (COSEWIC 2004).

The Gulf of St. Lawrence aster is adapted to living in occasionally flooded, highly saline habitats. The aster is typically less than 30cm tall, with an unbranched or branched stem and fleshy leaves. Plant emergence is mid June and the plant flowers in late August-early September, with seed dispersal mid to late October. Unique to this aster is that it is completely lacking the ray flowers (the “petals” around the edges of the flower heads). The showiest part of the plant is the white seed head, fully expanded just before dispersal in mid-October, making it easy to identify in the field at this time (Houle and Haber 1990, Houle et al. 2001, Stewart and Lacroix 2001). For a complete description of the plant please refer to Fernald (1914) and Houle and Haber (1990).

Populations are infrequently covered by extreme high tides and storm floods, and storms, high winds, and waves continuously shape and modify the shoreline. Because of the dynamic nature of its habitat, the germination potential of the species, and survival of seedlings in the wild, population size and distribution varies from year-to-year both between and within sites.

#### 3.1.2 Populations and distribution

##### *Current distribution*

Globally, the Gulf of St. Lawrence Aster is restricted to coastal shorelines of the Gulf of St. Lawrence region in parts of New Brunswick, PEI, and the Magdalene Islands. In total, there have been 33 recorded sub-populations of Gulf of St. Lawrence Aster, 4 of which are considered historical (COSEWIC 2004). There are 4 known (active and inactive) Gulf of St. Lawrence Aster sites for New Brunswick: Miscou Island, Val-Comeau, and 2 in Kouchibouguac National Park (Fig. 1).

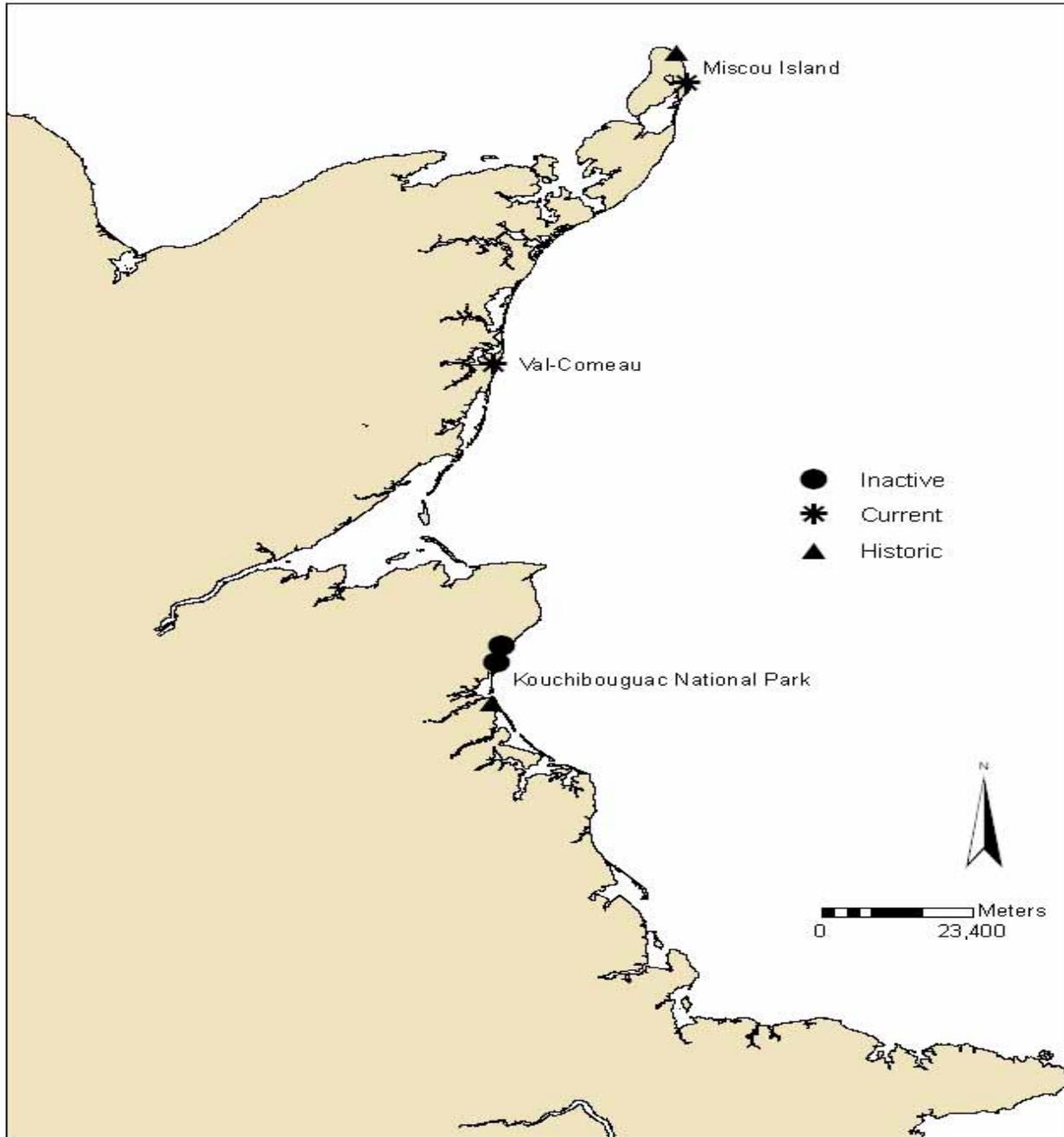


Figure 1: Map of New Brunswick showing current and inactive occurrences of Gulf of St. Lawrence aster. Current refers to those sites producing individuals as of 2005 while inactive refers to those sites which did not produce individuals in 2005. Historic sites are those sites which have not produced individuals in more than 25 years (Miscou Island lighthouse and the Cap St.-Louis wharf at Kouchibouguac National Park).

Notable for this species is the significant amount of variation in the population estimates; for example, the total number of plants over the entire range was estimated at less than 1000 in 1990 by Houle and Haber but a re-evaluation of sites in 1992 and 1993 found between 75,000- 80,000 plants on PEI alone (Guignon et al. 1995). A number of factors have been mentioned to explain the variability in the population estimates. Because it is an annual plant, population numbers are heavily reliant on viable seed production and successful germination; a good crop year could potentially result in more plants. The dynamic nature of the habitat, a result of storm events and tidal flow, alters the amount of available habitat from year-to-year. It is also possible that favourable climatic conditions (such as a particularly dry summer) has been responsible for increased plant numbers at some sites (Gilbert et al. 1999). Finally, there has been a significant increase in the search efforts for Gulf of St. Lawrence Aster in all three provinces in recent years (COSEWIC 2004).

Despite the fluctuations in population size expected for an annual species in a dynamic habitat, there is evidence to suggest that the numbers represent a decline in Gulf of St. Lawrence Aster populations in New Brunswick (Appendix II). Estimates for 2005 indicate there are less than 1600 individuals confirmed from two sites in the province: Val-Comeau and Miscou Island. A population of asters at the Bouctouche site originally thought to be Gulf of St. Lawrence Aster was discovered in 2005 to be *Symphotrichum ciliatum*, rayless alkali aster, an exotic first collected in New Brunswick by H. Hinds (1986) along and near Hall's Creek below the Universite de Moncton (taken from records at the Cornell Herbarium, UNB Fredericton). Recent examination of the herbarium record from the original discovery in Bouctouche in 2000 indicates it was misidentified as *S. laurentianum* and in fact it was *S. ciliatum* (S. Clayden, Curator of Botany, New Brunswick Museum, January 26 2006, pers. comm.).

#### *Historic distribution*

Information on past distribution and abundance patterns of Gulf of St. Lawrence Aster in New Brunswick is limited. The dynamic nature of its habitat, limitations to growth, and reliance on seed dispersal/germination for persistence of populations in subsequent years makes the distribution of *S. laurentianum* difficult to assess. Although it has been found since 2000 at 4 sites in the province, only 2 of these sites were confirmed to have Gulf of St. Lawrence Aster in 2005. Two additional sites are considered historic: Miscou Island lighthouse, where the aster has not been seen since 1979 despite repeated visits to the area over the years; and, near the Cap St.-Louis wharf in Kouchibouguac National Park, where it has not been seen since 1979. The exact location of the discovery near the St. Louis wharf is unclear, and efforts to locate the voucher specimen collected from the site have proven unsuccessful (Houle 1988).

It would appear that numerous coastal locations along northeastern New Brunswick provide habitat potentially suitable for this species. It is unknown why it is not more widely distributed in New Brunswick. Limited dispersal ability and low population size may be the primary factors restricting distribution along the Northumberland coastline. Surveys conducted by Irving Eco-centre, La Dune de Bouctouche staff in 2000 identified 17 potential Gulf of St. Lawrence Aster sites between Jourmain National Wildlife Area and Escuminac with no new occurrences (Godbout 2001). The Piper Project has

surveyed 43 potential Gulf of St. Lawrence Aster sites along the Acadian peninsula since 2000, and through this discovered the sites of Val-Comeau and Miscou Island (L. Richardson, Piper Project, Nov. 7-8 2005, pers. comm.). Eight more sites have been identified as potential Gulf of St. Lawrence Aster habitat, and future survey efforts should focus on these areas (L. Richardson, Piper Project, Nov. 7-8 2005, pers. comm.). A recent survey by Mazerolle (2004) along the Northumberland coast of New Brunswick found no new occurrences beyond those previously known. However, it is recognized that the survey was limited in scope due to time and resources, so it is possible that not all areas that could support Gulf of St. Lawrence Aster were surveyed (Mazerolle 2004).

### **3.2 Description of the Species' Needs**

#### **3.2.1 Biological needs and limiting factors**

Seedlings of *S. laurentianum* emerge in early to mid-June in a narrow band along the edges of sheltered beaches and salt marshes, at a time when the herbaceous canopy is already well-developed. Since canopy development is not homogeneous, seedlings are exposed to varying light levels and varying levels of competition with other marsh plants. At high density, simple, short stems are produced (10-15 cm high), but at low densities plants are usually taller (40 cm) and their stems are quite ramified (Boudreau and Houle 1998). Plants flower late August to mid September (Houle and Haber 1990; Houle et al. 2001, Stewart and Lacroix 2001) and fruits start appearing in late September with dispersal in October (Houle and Haber 1990). Species is self-fertilizing, with dissemination of seeds mostly by wind, but they can also float in water (Boudreau and Houle 1998). Because of the short timeframe from seedling stage to reproduction (June to October), any delay in timing of emergence would diminish survival, affecting both present and subsequent population numbers (Boudreau and Houle 1998).

The most important factor limiting growth is low light availability, with salinity and nutrient availability having little effect (Houle and Valery 2003). Interspecific competition restricts available light and appears to be the primary factor influencing establishment of the species, as evident by the limited distribution and location within the salt marsh, occupying areas where few plants are able to survive the fluctuations in salinity. When competition is eliminated, *S. laurentianum* becomes more abundant, particularly in the upper portion of the topographic gradient where abiotic conditions are less limiting (lower salinity, reduced exposure to waves, less eelgrass debris and sand). Gulf of St. Lawrence aster exhibits opportunistic characteristics, able to absorb more nutrients when they are made available and then take advantage of release from taller plant species (Houle and Valery 2003).

Germination can be reduced or completely inhibited by salinity but seeds can still conserve their viability, with the effects of salinity on germination reversible (Houle et al. 2001, Houle et al. 2002). Once establishment is completed, *S. laurentianum* is relatively tolerant to substrate salinity and there is no effect on survival of seedlings which have already emerged (Houle et al. 2002).

Waterlogging and drought conditions affect the species in different ways. When drought occurs at the time of flower initiation, reproduction is impeded (Houle and Belleau 2000). Young plants are more susceptible to drought than older plants (Houle and Belleau 2000). Reproductive failures brought on by late-summer droughts may cause significant fluctuations in annual population size, making sites more susceptible to local extinction (Houle and Belleau 2000). *S. laurentianum* is very tolerant of waterlogged conditions and is capable of acclimatizing without significant reductions in plant performance. Successive periods of waterlogging and drought may have major effects on plant performance, and hence, interannual population dynamics (Houle and Belleau 2000).

### 3.2.3 Habitat needs

Overall, New Brunswick has a continental climate moderated by maritime influences in the coastal areas; as a result, coastal areas are cooler in the summer and slightly warmer in the winter than inland regions. For the Gulf coast of New Brunswick, the temperature is on average 24°C in the summer and -7.5°C during the winter months. Average wind speeds for the Gulf region are almost double that of inland areas (Airphoto Analysis Associates Consultants Ltd. 1975). Near constant winds, high humidity, and frequent fog are prominent features of the region's Gulf coast climate (Hickey 2005).

The Gulf of St. Lawrence Aster is considered a coastal pioneer species, growing near sea level on brackish sand or mud around marshes and ponds in dune slacks, on sand flats along the back of dunes, and on drier spots in saline marshes or sandy beaches (Houle 1988, Houle and Haber 1990). Generally, the habitat is characterized by full sunlight, variable substrate salinity, protection from the wind, and infrequent flooding by high tides or storm events (Houle and Haber 1990, Gilbert et al. 1999).

Natural or artificial disturbances have an impact on the distribution and abundance of the species, both negatively and positively. Disturbance exposes mineral soil and removes competing vegetation, allowing for establishment of the aster. At the population level, tide and storm events are the primary agents of disturbance, exposing mineral soil which aids in establishment, or depositing eelgrass which limits distribution on the landscape (Gilbert et al. 1999). On a smaller scale, asters have been found associated with pot holes created by Canada Geese in sites on PEI (Jacques Whitford Environmental Limited 1994), although this has not been confirmed in New Brunswick. Also, Gulf of St. Lawrence Aster has been documented colonizing ruts created by ATVs in Quebec (Gilbert et al. 1999).

Particle size of the substrate appears to be of little importance as the species has been found growing on fine sand, coarse sand, gravel, and clay (Fernald 1914, Houle 1988).

## **4.0 THREATS AND BARRIERS TO RECOVERY**

A number of factors that may constitute threats or barriers to recovery of the Gulf of St. Lawrence aster have been listed in the COSEWIC status report (COSEWIC 2004). The major threats to the aster and its habitat are natural components of the ecosystem, and have the potential to completely eliminate the plants from a site and render it unsuitable for recolonization. Some threats, such as recreational vehicle traffic on dunes, vary in terms of severity and intensity and may only impact a minor component of the aster population and its habitat. An assessment of these threats to recovery efforts, the potential impact, probability and frequency of occurrence is given below.

### **4.1 Natural Threats to Recovery**

#### 4.1.1 Flooding and overwash

Major storm events and higher than normal tidal events are infrequent but can have long-term effects on Gulf of St. Lawrence Aster populations. Overwash, the flow of water and sediment over the crest of the dune which does not directly return to where it originated, is commonly associated with storm events in these areas and can have both a direct and indirect influence on Gulf of St. Lawrence Aster populations. Areas can become submerged under water or sand, destroying plants before they have an opportunity to produce seed. Substrate and eelgrass could be deposited through tidal and storm events onto the area behind a dune, preventing sunlight from reaching the soil surface, inhibiting germination or seedling survival. Overwash and flooding are the cause of loss of two sites (Lac-a-Exilda and Barachois at KNP) (Mazerolle 2004) and one sub-population (Middle Miscou Beach) in New Brunswick (L. Richardson, Piper Project, Sept. 12 2005, pers. comm.).

However, overwash does not mean a permanent loss of the site, or negate the possible discovery of asters at an overwash site in the future. This is dependent upon the seedbank providing a sufficient number of viable seeds to allow re-establishment of the aster in the future. In this case, overwash can aid through removal of competing vegetation.

Dune elevation is an important component in the protection provided to areas directly behind the dune. Effects of a storm, such as high winds and wave action, can be stopped or lessened if the dune is of sufficient height. Low dunes are more susceptible to impacts of storm events, so the habitat behind them would be sensitive to even low intensity disturbances. Dunes are able to rebuild during the calm period between major storm events. However, dunes have been gradually reducing in size over the last 200 years, and the sediment sources which replenish them are not in an unending supply (D. Berube, Geomorphologist, DNR, Oct. 7 2005, pers. comm.). How this will affect Gulf of St. Lawrence Aster habitat and the amount of available habitat in the future is unclear.

#### 4.1.2 Gradual habitat modification

In addition to the short-term, high intensity events, there occurs a constant, gradual modification of the site over time through natural tidal flow and wave action. Dunes are migrating inland at the rate of roughly 1m per year in New Brunswick (D. Berube, Geomorphologist, DNR, Oct. 7 2005, pers. comm.). Dunes surrounding and protecting sites would be modified over time and affect aster habitat in multiple ways: slowly pushing inland towards the salt marshes, restricting available habitat; closing off or constricting the outflow of marshes, resulting in a permanently flooded area; and, weakening of the dune structure or reducing dune height, altering the level of protection they afford and allowing water, sediment, and/or vegetation to invade the area.

Given the relative long time frame over which this threat occurs, it is likely that this is not a threat which would be dealt with in the context of this recovery strategy. In the short term, succession of previously storm disturbed areas to denser community types dominated by saltmarsh grasses would pose a more immediate threat to recolonization from the seed bank (S. Blaney, March 12 2007, pers. comm.).

#### 4.1.3 Competition

Vegetative competition restricts the distribution of Gulf of St. Lawrence Aster along the landscape and, on a smaller scale, within populations. Once competition is eliminated, the aster is more abundant, particularly in the upper portion of the topographic gradient where abiotic factors (salinity and deposition of eelgrass) are less limiting (Houle et al. 2001). Eradication of competing vegetation also appears to increase survival of the aster through an increase in biomass and reproductive effort (Boudreau and Houle 1988).

Information discovered in 2005 raises concerns about the status of Gulf of St. Lawrence Aster sites. A population of asters found at the Bouctouche dune originally thought to be Gulf of St. Lawrence Aster was confirmed as *Symphotrichum ciliatum*, rayless alkali aster, an exotic first collected in New Brunswick by H. Hinds (1986) along and near Hall's Creek below the Universite de Moncton (taken from records at the Connell Herbarium, UNB Fredericton). *S. ciliatum*, whose synonyms include *Aster brachyactis* and *Symphotrichum brachyactis*, was identified as a close relative of *S. laurentianum*. Both species are thought to have arisen from *S. frondus* as a result of rapid and recent speciation following the retreat of the last Ice Age (COSEWIC 2004).

COSEWIC (2004) mentions that *S. ciliatum* exhibits a broader ecological range than *S. laurentianum*, and could invade the coastal salt marshes if it reaches the Northumberland coastline. There is also the possibility of hybridization between the two species, although this is believed to be a low probability of occurrence given the self-fertilizing capabilities of *S. laurentianum* (S. Blaney, Dec. 9 2005, pers. comm.).

A re-evaluation of herbarium specimens taken from Bouctouche in 2000 suggest the plant was originally misidentified, leading to the conclusion that, in all likelihood, *S. laurentianum* was never on the Bouctouche dune. It is the first recorded instance of the presence of *S. ciliatum* on salt marshes in Atlantic Canada (S. Blaney, Dec. 9 2005,

pers. comm.). The full impact of *S. ciliatum* on Gulf of St. Lawrence Aster populations in New Brunswick is unknown and requires further research.

## **4.2 Anthropogenic Threats to Recovery**

### 4.2.1 Recreational vehicle use

All terrain vehicles (ATVs), 4x4 trucks, and SUVs destroy plants, disturb the substrate, and modify the area prior to germination, preventing emergence of individuals and altering the vegetative community (Boudreau and Houle 1988). Recreational vehicles may temporarily favour Gulf of St. Lawrence Aster by exposing substrate and removing competing vegetation. However, intensive traffic over large portions of the site occupied by the aster would have a negative consequence on the existing vegetative community and habitat through disturbance of the substrate, destruction of plants prior to seed production, soil compaction, and possible weakening of the protective dune.

Prohibitions concerning the use of recreational vehicles on salt marshes and sand dunes are difficult to enforce, given the remote and relatively isolated areas where the aster is located. Although stewardship initiatives to inform the public on ATV use in the dune/salt marsh ecosystem is a viable option, it is unclear if the efforts would produce any noticeable difference in patterns of public behaviour in the timeframe of this recovery plan.

### 4.2.2 Development

Development, such as construction of residential buildings or infilling of marshes, would modify the marsh or dune ecosystem, possibly reducing the amount of available habitat. It has been reported that development is responsible for the loss of one site locality on PEI (Guignion et al. 1995). In New Brunswick, the two sites are a combination of private and public land holdings; although there is presently no development on the sites, there is a possibility for development to occur in the future. A number of policies, most notably the *New Brunswick Wetland Conservation Policy* and *Coastal Areas Protection Policy*, will indirectly benefit Gulf of St. Lawrence Aster habitat by affording protective measures to the area where the aster is located, making this an unlikely threat to the aster and/or its habitat.

### 4.2.3 Modifications to water levels or circulation patterns

Although it has been mentioned in the COSEWIC report (2004) that artificial changes in saltwater levels or circulation patterns could alter habitat disturbance patterns and affect the health of the Gulf of St. Lawrence Aster populations, nothing has been shown to support this statement for New Brunswick populations. However, there is some debate as to whether development has assisted in maintaining the Gulf of St. Lawrence Aster at the site in Val-Comeau. Because of the continual flooding near residential buildings as a result of the marsh outflow becoming restricted, building owners are continually re-opening the stream outflow into the bay, allowing the marsh to continue to drain and potentially promoting an important component of aster habitat (L. Richardson, Piper Project, Nov. 7 2005, pers.comm.).

## **5.0 KNOWLEDGE GAPS**

Sufficient information is known about the Gulf of St. Lawrence Aster and its habitat to enable the recovery strategy to proceed. Questions surrounding seed viability should be addressed; it is currently unclear how long seeds remain viable in the seed bank, and this information can assist in monitoring of sites, allocation of resources, and determination of when a site should be categorized as “historic”.

The 2005 realization that the exotic *S. ciliatum* occurs within natural salt marsh habitats at Bouctouche raises questions about its potential competitive impacts on Gulf of St. Lawrence Aster. The proximity of *S. ciliatum* to known Gulf of St. Lawrence Aster sites should be determined in the field.

Questions relating to the long-term survival of the species (ie. the minimum number of sites/plants necessary for a self-sustaining population) remain unknown and are not a priority of the recovery strategy at this time, but may become more prominent if the goals and objectives change as new information becomes available.

## **6.0 LITERATURE CITED**

Airphoto Analysis Associates Consultants Ltd. 1975. Beach Resources: Eastern New Brunswick. New Brunswick Department of Natural Resources, Mineral Resources Branch, Miscellaneous report 2. 215pp.

Boudreau, St. and G. Houle. 1998. Ecologie de l'aster du Saint-Laurent (*Aster laurentianus* Fernald) au Iles-de-la-Madeleine, Quebec. Rapport preliminaire presente a la direction de la conservation et du patrimoine ecologique Ministere de l'Environnement et de la Faune du Quebec. 22pp. Unpublished.

De Lafontaine, G. 2004. Protocole de suivi des populations d'aster du Saint-Laurent (*Symphotrichum laurentianum*), aux Iles-de-la-Madeleine. Unpublished.

Developpement durable, Environnement et Parcs, Gouvernement du Quebec. Fevrier 2001. <http://www.mddep.gouv.qc.ca/biodiversite/especes/aster-stlaurent/aster.htm>. August 17, 2005.

COSEWIC 2004. COSEWIC assessment and update status report on the Gulf of St. Lawrence aster *Symphotrichum laurentianum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 39pp. ([www.sararegistry.gc.ca/statuse.cfm](http://www.sararegistry.gc.ca/statuse.cfm)).

Fernald, M.L. 1914. Some annual halophytic asters of the maritime provinces. *Rhodora Journal of the New England Botanical Club* 16: 57-61.

Gilbert, H., J. Labrecque, and J. Gagnon. 1999. La situation de l'aster du Saint-Laurent (*Aster laurentianus*, syn.: *Symphotrichum laurentianum*) au Canada. Ministere de l'Environnement, Direction de la conservation et du patrimoine ecologique. 34pp.

Godbout, V. 2001. Recherche de l'aster du saint-laurent (*Symphotrichum laurentianum*) dans les marais sales du sud-est du Nouveau-Brunswick. L'Eco-centre Irving, la dune de Bouctouche, Bouctouche, N.-B. 33pp.

Godbout, V. 2000. Recherche de l'aster du st.-laurent (*Aster laurentianus*) et du satyre des maritimes (*Coenonympha nepisiquit*) au Parc National Kouchibouguac et a l'Eco-centre Irving, la Dune de Bouctouche au Nouveau-Brunswick. L'Eco-centre Irving, la Dune de Bouctouche, Bouctouche, N.-B. 23pp.

Guignon, M., C. Ristau, and D. Lemon. 1995. The distribution and abundance of the Gulf of St. Lawrence Aster, *Aster laurentianus*, in Prince Edward Island National Park. *Canadian Field-Naturalist* 109(4): 462-464.

Hickey, I. November 1, 2005. The Climate of New Brunswick. <http://atlantic-web1.ns.ec.gc.ca/climatecentre/default.asp?lang=En&n=7A6129C7-1>. Last revised December 23, 2004.

Houle, F. 1988. Status report on the Gulf of St. Lawrence aster *Aster laurentianus* in Canada. Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa, ON, Canada. 21pp.

Houle, G. and A. Belleau. 2000. The effects of drought and waterlogging conditions on the performance of an endemic annual plant, *Aster laurentianus*. Canadian Journal of Botany 78: 40-46.

Houle, F. and E. Haber. 1990. Status of the Gulf of St. Lawrence Aster, *Aster laurentianus* (Asteraceae), in Canada. Canadian Field-Naturalist 104(3): 455-459.

Houle, G., C. Brumbt, and C. Reynolds. 2001. Demographie et ecologie de l'aster du saint-laurent, *Aster laurentianus* Fernald, aux iles de la Madeleine. Rapport d'etape, Ministere de L'Environnement, Direction du patrimoine ecologique et du developpement durable.

Houle, G. and S. Valery. 2003. A mixed strategy in the annual endemic *Aster laurentianus* (Asteraceae)-a stress-tolerant, yet opportunistic species. American Journal of Botany 90(2): 278-283.

Mazerolle, D M. 2005. Status of the Gulf of St. Lawrence Aster (*Symphyotrichum laurentianum*) in New Brunswick and report on the 2005 Irving Eco-centre Gulf of St. Lawrence aster project. Irving Eco-centre, la dune de Bouctouche, Bouctouche, N.B. 57pp. Unpublished.

Mazerolle, D M. 2004. Status of the Gulf of St. Lawrence Aster (*Symphyotrichum laurentianum*) in New Brunswick and report on the 2004 Irving Eco-centre Gulf of St. Lawrence aster project. Irving Eco-centre, la dune de Bouctouche, Bouctouche, N.B. 36pp. Unpublished.

Reynolds, C.E. 2000. Etude Ecologique d'une espee endemique du Golfe du Saint-Laurent, *Aster laurentianus* Fernald. Mémoire presente a la Faculte des etudes superieures de l'Universite Laval pour obtention du grade maitre es sciences. Departement de biologie, Faculte des sciences et de genie, Universite Laval. Unpublished.

Stewart, S.E. and C.R. LaCroix. 2001. Germination potential, updated population surveys and floral, seed and seedling morphology of *Symphyotrichum laurentianum*, the Gulf of St. Lawrence Aster, in Prince Edward Island National Park. Canadian Field-Naturalist 115(2): 287-295.

**APPENDIX**

**APPENDIX I: Monitoring protocol for the Gulf of St. Lawrence Aster, as developed at the Gulf of St. Lawrence Aster workshop, Nov. 7-8, 2005.**

Monitoring should be done on a long-term, annual basis. There is a need for coordinated efforts of different jurisdictions and the different organizations that are conducting monitoring to ensure that standard measurements are employed.

Guidelines for the monitoring protocol:

The population should be defined as a polygon with information on precision of the boundaries:

1. GPS data measured at each cardinal point, at least, and if possible, make more points (datum: NAD83, lat. and long. and decimal degrees. Provide GPS margin of accuracy if non-correctable GPS receivers used).
2. A permanent post (geodesic metallic bar) with a very precise location will be included at each site (located at the most secure place in the population)
3. Ensure that all locations are noted even if not in the main population location. Individuals further than 30 m should also be located as a sub population. A rough map (that includes references to any nearby stationary objects-roads, culverts, etc.) may be drawn to accompany GPS coordinates so that locations of population and subpopulations can be seen relative to each other by those working with the data at a later time.

Site should be visited once each year at the time of seed production (mid-September-early October). Measurements collected when on site:

1. Record the number of individuals in the population. The scale of the Quebec system\* will be used. If the number is less than 5000, the plants are counted. If the population is greater than 5000 individuals count the number in randomly installed quadrats within the population and estimate the population using the information from the quadrats and the size of area the aster population occupies. Count all plants whether they are producing seed or not. Density can be drawn on paper or based on the previous quadrat measurements.
2. Record water level (high or low tide), the presence of natural disturbance (openings along the dune, breaches, eelgrass, overwash), and any presence of anthropogenic disturbance (ATV traffic). If the area is flooded record the percentage of the population that is under water.
3. Photographs should be taken of the plants, its habitat, and any other items of interest (such as ATV tracks, eelgrass deposits, overwash, etc.)
4. Percentage of overall vegetation cover (not just the aster), and if there are gaps, provide further information (whether vegetation cover is uniform, sparse, patchy, how much bare soil is present).

---

\* Method was developed by de Lafontaine (2004). Visual estimate of all sites where aster is found. Assign a class based on a logarithmic scale (*classes* : 0 no plants found; 1 – 1 to 10 plants; 2 – 10-100 plants; 3 – 10<sup>2</sup>-10<sup>3</sup> plants; 4 – 10<sup>3</sup>-10<sup>4</sup> plants; 5 – 10<sup>4</sup>-10<sup>5</sup> plants; 6 – 10<sup>5</sup>-10<sup>6</sup> plants).

## ***New Brunswick Gulf of St. Lawrence Aster Recovery Strategy***

---

5. Record the number of plants in flower, percentage of flowers and inflorescences in flowers per plant.
6. Record the average height of the largest plants in the population.

**APPENDIX II: Estimates of population size for Gulf of St. Lawrence Aster occurrences in New Brunswick.**

Site	Occurrence	Estimate	Year	Notes	
Miscou Island	Miscou Lighthouse	unknown	1963	Revisited in 2005 by DNR staff; no plants present.	
	Miscou Lighthouse	0	1984		
	Miscou Lighthouse	0	2005		
	Malbaie Sud	Malbaie Sud	>1000	2002	Overwash resulted in major habitat modification prior to 2005 site visit.
		Malbaie Sud	>1000	2003	
		Malbaie Sud	100	2004	
		Malbaie Sud	2	2005	
		Malbaie Sud	40	2006	
	Middle Miscou Beach	Middle Miscou Beach	100	2003	First discovered in 2003; site visit the next year found no plants.
		Middle Miscou Beach	0	2004	
Val-Comeau		100	1984	Frequent visits failed to relocate occurrence until 1999. 12 plants found in 2002 were submerged. Area has been flooded in 2003-2004 at the time of site visit, so it is possible there were plants present.	
		100	1999		
		1000	2000		
		15	2001		
		12	2002		
		0	2003		
		0	2004		
	1500	2005			
	unknown	2006	Unable to survey site in 2006.		
Kouchibouguac	Cape St. Louis Wharf	unknown	1979	Historical population; voucher untraceable.	
	Lac-a-Exilda	>1000	2000	Discovered for the first time in 2000. Severe storm event destroyed plants before seed production in 2000, site is now continuously flooded.	
	Lac-a-Exilda	0	2001		
	Lac-a-Exilda	0	2002		
	Lac-a-Exilda	0	2003		
	Lac-a-Exilda	0	2004		
	Lac-a-Exilda	0	2005		
	Lac-a-Exilda	0	2006		
	Barachois	4	2000	Discovered for the first time in 2000. Severe storm event destroyed plants before seed production in 2000, overwash buried site under sand.	
	Barachois	0	2001		
	Barachois	0	2002		
	Barachois	0	2003		
	Barachois	1	2004		
	Barachois	0	2005		
Barachois	0	2006			