Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Gulf of St. Lawrence Aster (*Symphyotrichum laurentianum*) in Canada

Gulf of St. Lawrence Aster

2012

Canada

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For copies of the recovery strategy, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

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PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (SARA) (S.C. 2002, c.29), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years.

The Minister of the Environment and the Minister responsible for the Parks Canada Agency are the competent ministers for the recovery of the Gulf of St. Lawrence Aster and have prepared this strategy, as per section 37 of SARA. It has been prepared in cooperation with the governments of Québec (Ministère de Développement durable, de l'Environnement et des Parcs), New Brunswick (Department of Natural Resources) and Prince Edward Island (Ministry of Environment, Energy and Forestry) as per section 39 (1) of SARA.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Gulf of St. Lawrence Aster and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada, the Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

Vincent Carignan and Matthew Wild (Environment Canada, Canadian Wildlife Service – Quebec Region) wrote this recovery strategy in collaboration with the Gulf of St. Lawrence Aster recovery team (Patricia Désilets [Ministère du Développement durable, de l'Environnement et des Parcs du Québec], Samara Eaton [Environment Canada, Canadian Wildlife Service – Atlantic Region], Sean Blaney [Atlantic Canada Conservation Data Centre], Rosemary Curley [Prince Edward Island Department of Environment, Energy and Forestry], Philip McCabe, Kirby Tulk and Eric Tremblay [Parks Canada Agency], Maureen Toner [New Brunswick Department of Natural Resources] as well as Liette Vasseur [Laurentian University]).

Many other collaborators contributed to the document: David Mazerolle (Atlantic Canada Conservation Data Centre), Alain Richard (Attention Frag'Îles), Karine Picard and Alain Branchaud (Environment Canada, Canadian Wildlife Service – Quebec Region), Marie-José Ribeyron and Manon Dubé (Environment Canada, Canadian Wildlife Service – National Capital Region), Line Couillard and Guy Jolicoeur [Ministère du Développement durable, de l'Environnement et des Parcs du Québec], Mary Lynn McCourt (PEI Dept of Environment, Energy and Forestry), Diane Amirault-Langlais, Jennifer Stewart and Mark McGarrigle.

EXECUTIVE SUMMARY

Gulf of St. Lawrence Aster (*Symphyotrichum laurentianum*) is an annual facultative halophyte endemic to the Gulf of St. Lawrence. The species occurs on wet, predominantly sandy substrates exposed to equinoctial high tides and storm waves, sheltered beaches and areas of scattered vegetation in high salt marshes. It occupies a narrow band of habitat parallel to the shoreline, limited on the one hand by the salinity of the water, winds, waves and deposition of debris or wrack and, on the other, by competition with other species less tolerant of these conditions. The species was assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada in 2004 and was listed accordingly in Schedule 1 of the *Species at Risk Act* in 2005.

As an annual plant that grows in a dynamic habitat, population size and area of occupancy are expected to fluctuate from year to year. Nevertheless, the total population size estimate for Canada fell from more than 4.5 million individuals in 2001 to approximately 520,000 in 2007. Twenty eight occurrences[1] of this species have been documented in Canada, including 12 in Quebec, six in New Brunswick and ten in Prince Edward Island. Occurrences may not be detectable every year, re-establishing themselves from a seed bank that may have a 10-year viability when conditions are suitable.

The threats to Gulf of St. Lawrence Aster are habitat loss related to shoreline development, increased erosion caused by climate change (sea level rise), artificial changes to hydrological processes, disturbances associated with recreational activities (trampling, all-terrain vehicles) and interspecific competition by exotic or invasive species.

There are unknowns regarding the feasibility of recovery of the Gulf of St. Lawrence Aster. Nevertheless, in keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA as would be done when recovery is determined to be feasible. This recovery strategy addresses the unknowns surrounding the feasibility of recovery.

The population and distribution objectives are to maintain and, if possible, increase the population size and the area of occupancy of the Gulf of St. Lawrence Aster within each of the 16 occurrences identified as priority targets, including nine in Quebec, four in New Brunswick and three in Prince Edward Island. The general strategies and approaches for achieving these objectives are defined in the section on strategic direction for recovery.

Critical habitat for the Gulf of St. Lawrence Aster is identified in the present recovery strategy as the area of suitable habitat within 300 m of each observation point[2] compiled between 1999 and 2009 for the 16 priority occurrences.

One or more action plans for the Gulf of St. Lawrence Aster will be developed within five years following the publication of the recovery strategy in the Species at Risk Public Registry.

[1] An area of land and/or water in which a species or natural community is, or was, present (NatureServe, 2002).
[2] Each observation point represents one or several individuals in an occurrence.

RECOVERY FEASIBILITY SUMMARY

In considering the criteria established by the Government of Canada (2009), unknowns remain as to the recovery feasibility of the Gulf of St. Lawrence Aster. Nevertheless, in keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA as would be done when recovery is determined to be feasible. This recovery strategy addresses the unknowns surrounding the feasibility of recovery:

1. **Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.**

Yes. In the past 10 years, reproductive (flowering) individuals have been observed in most Canadian occurrences. Reintroduction has been tested in Prince Edward Island National Park since 2008.

2. **Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.**

Yes. Suitable habitat has been identified in New Brunswick during field surveys (Projet Siffleur, 2004; Mazerolle, 2005). Also, the Quebec conservation plan indicates that the species' habitat appears to be abundant in the Magdalen Islands (Couillard and Jolicoeur, 2008).

3. **The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.**

Unknown. Although it appears that the threats that pose the greatest levels of concern could be avoided or mitigated by the proposed recovery approaches, the answer to this question remains unknown, since we do not know the main cause for the steady population declines.

4. **Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.**

Unknown. Since the main cause of population decline is unknown, it is currently impossible to determine if the necessary recovery techniques exist.

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1. COSEWIC SPECIES ASSESSMENT INFORMATION

Date of Assessment: May 2004

Common Name (population): Gulf of St. Lawrence Aster

Scientific Name: *Symphyotrichum laurentianum*

COSEWIC 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.

Canadian Occurrence: Quebec, New Brunswick and Prince Edward Island

COSEWIC Status History: Designated Special Concern in April 1989. Status re-examined and designated as Threatened in May 2004.

2. SPECIES STATUS INFORMATION

The Gulf of St. Lawrence Aster is endemic to Canada (100% of the populations). The species was listed as Threatened in Schedule 1 of the *Species at Risk Act* (L.C. 2002, ch. 29) in July 2005. It is also listed as Threatened in Quebec according to the *Act Respecting Threatened and Vulnerable Species* (L.R.Q., ch. E-12.01) and Endangered in New Brunswick according to the *Endangered Species Act* (ch. E-9.101). It has no status on Prince Edward Island.

NatureServe (2009) gives the Gulf of St. Lawrence Aster a priority conservation rank of G2 (Imperiled) for its range-wide distribution, of N2 (Imperiled) in Canada and S2 (Imperiled) in Quebec, S1 (Critically Imperiled) in New Brunswick and S1S2 (Critically Imperiled/Imperiled) in Prince Edward Island.

3. SPECIES INFORMATION

3.1 Species Description

Gulf of St. Lawrence Aster is an annual facultative halophyte[3], with simple or slightly branched stem, 0.1 to 40 cm high. Leaves, 1 to 10 cm long, are smooth, fleshy, sessile or subsessile, entire, eciliate, linear-lanceolate[4] to spatulate, obtuse or acutish, often mucronate.[5] Inflorescence with somewhat hemispherical head, 0.5 to 2 cm in diameter, with involucre[6] composed of foliaceous phyllaries[7], slightly pubescent at base. Outer flowers filiform and rayless; central flowers, few, also filiform. The fruit is an achene with pappus[8] equalling or slightly overtopping the flowers (Brumbt, 2001; COSEWIC, 2004). The first COSEWIC report (Houle, 1988) mentioned that seeds may survive for about 10 years in the seed bank. However, a recent study in Prince Edward Island indicates that the percentage of viable seeds in the persistent seed bank is practically non-existent (2%), as the majority of the seeds germinate within the first year of being produced (Kemp and Lacroix, 2004).

3.2 Population and Distribution

The Gulf of St. Lawrence Aster is a species endemic to the Gulf of St. Lawrence. It is found only in Quebec, New Brunswick and Prince Edward Island (Houle and Haber, 1990; Gilbert *et al*., 1999; Figure 1). Since this annual plant grows in a dynamic habitat, population size and area of occupancy are expected to fluctuate from year to year. Nevertheless, a pronounced downward trend has been observed in recent years (COSEWIC, 2004) and the reasons are not fully known.

[3] Halophyte: A species associated with salt habitats.
[4] Lanceolate : Spear-shaped.
[5] Mucronate: terminating in a sharp, stiff point called a mucron.
[6] Involucre: series of imbricated bracts at the base of an inflorescence.
[7] Foliaceous phyllaries: leaf-like involucral bracts subtending the flower head of a composite plant.
[8] Pappus: small egret attached to the seeds of certain species of plants, facilitating their dispersal by wind.

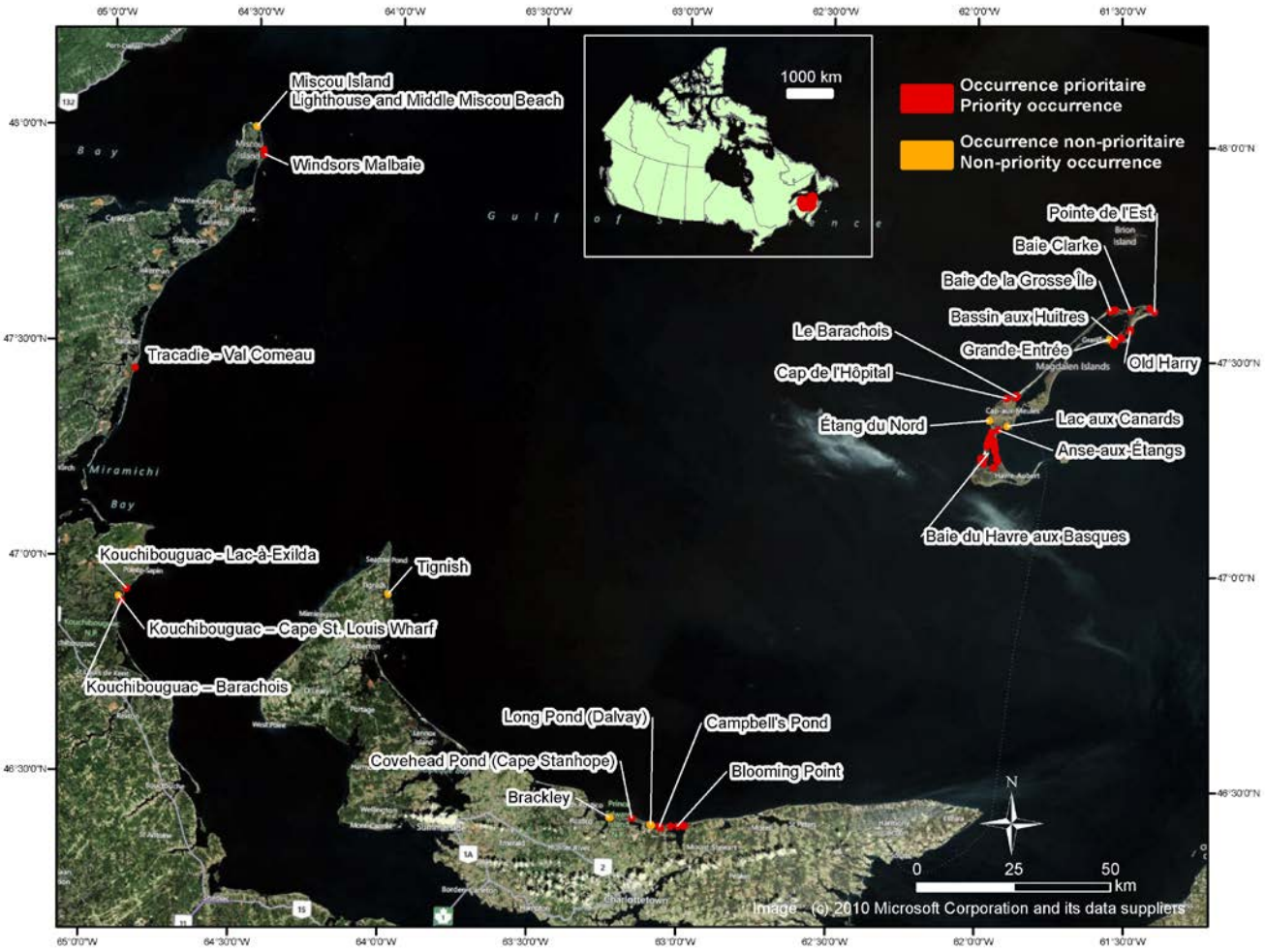

Figure 1. Global distribution of the Gulf of St. Lawrence Aster (inset) with localisation of each occurrence.

Quebec

The Magdalen Islands is the only location where the species occurs in Quebec. Following the recent merge of adjoining occurrences by the Government of Quebec officials, the Centre de données sur le patrimoine naturel du Québec (CDPNQ, 2011) reports 12 occurrences on the islands, including three in which no individuals have been observed between 1999 and 2009[9] (Table 1; Couillard and Jolicoeur, 2008). In 2011, the former occurrences of Baie du Havre aux Basques – Eastern Sector, Étangs de l'Ouest and Pointe aux canots were merged into a single occurrence called Baie du Havre aux Basques (Vincent Piché, CDPNQ, personal communication). In 2002, the total population of this species in Quebec was estimated at more than 4.5 million individuals (Table 1), distributed over slightly less than 10 ha. Recent counts indicate a population of less than 520,000 individuals in 2007.

[9] This 10-year period was chosen by the recovery team when the production of the recovery strategy began as being representative of the viability of seeds.

New Brunswick

There are six known occurrences for the species in New Brunswick. The Miscou Island – lighthouse and Middle Miscou Beach occurrence incorporates records (1963, 1984) with imprecise location around the lighthouse (D. Mazerolle, pers. comm.). The Kouchibouguac- Cap Saint-Louis Warf occurrence found in the COSEWIC (2004) report does not have a supporting voucher to confirm the identity of the Gulf of St. Lawrence Aster (S. Blaney, pers. comm). This occurrence was only noted in 1977 during the Kouchibouguac National Park plant inventory and the habitat does not seem to correspond to preferred conditions reported in the literature (D. Mazerolle, pers. comm.). However, as a precaution, it is maintained in Table 1. In 2005, the population size of the Gulf of St. Lawrence Aster in New Brunswick was estimated at approximately 1,500 individuals (Table 1).

Prince Edward Island

According to the Atlantic Canada Conservation Data Center (ACCDC), there are ten occurrences of the Gulf of St. Lawrence Aster in Prince Edward Island, seven of which are located in Prince Edward Island National Park (PEI NP). Due to their close proximity, the ACCDC and PEI NP officials consider five of the occurrences (Dune Slack, East Marsh 1, East Marsh 2, Western Wetland and Grand Tracadie) as part of the same population named the Blooming Point occurrence in Table 1 (S. Blaney, pers. comm.). This recovery strategy is therefore considering a total of six occurrences in Prince Edward Island. In three of these occurrences, no individuals have been found between 1999 and 2009. The total population on Prince Edward Island was estimated at more than 30,000 individuals in 2004. In 2007, population inventories indicated that the population had decreased to less than 500 individuals.

Table 1. Abundance data for the Gulf of St. Lawrence Aster for the period 1999-2009 [a]

Occurrence name	Province	COSEWIC ID [b]	CDPNQ/ ACCDC ID	Last observation	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Baie du Havre aux Basques	QC	1,2,3	4135/ 14761/ 15762	2010	2 510 000	3 500 000	>4 000 000	500 000	21 623	1 500 500	603 400		506 000		
Cap de l'Hôpital	QC	8	14759	2010			100-1 000			1 500	266		200		NA
Le Barachois	QC	7	4143	2010	10 000		100 000- 1 000 000			100 000	1 000		10 000		>6 500
Bassin aux Huitres	QC	10-11-12	4142	2009			>20 000			> 1000	55 000		100-500		>2000
Baie de la Grosse Île	QC	16	14760	2007			1- 100			10 000– 100 000	0		NA		
Baie Clarke	QC	15	4139	2005	1 000- 10 000		1 000- 10 000			1 000	1 000		0		
Pointe de l'Est	QC	14	4138	2007	100-1000		100-1000				3 000		10		
Anse aux Étangs	QC	5	4137	2001	100-1 000	100-1 000	10			0					
Old Harry	QC	13	4140	2001	10-100		10-100			0					
Étang du Nord	QC	4	4136	1912	0	0	0								
Lac aux Canards	QC	6	4144	1995	0	0	0								
Grande-Entrée	QC	9	4141	1985	0	0	0								
Windsors Malbaie	NB	2	1048834/ 1048835					>1 000	2 400	300	15	40			
Tracadie – Val Comeau	NB	3	1048837	2005	100	1 000	15	12	0	0	1 500				
Kouchibouguac – Lac-à-Exilda	NB	5	1048836			1 000- 2 000	0	0	0	0	0	0	0	0	0
Kouchibouguac – Barachois	NB	6	174551			4	0	0	0	1	0	0	0	0	0
Kouchibouguac – Cape Saint-Louis Warf	NB	4	1048849							0					
Miscou Island – Lighthouse and Middle Miscou Beach	NB	1	1048832												
Blooming Point [c] *	PEI	4,5,6,7	1048845/ 1048846/ 1048847/ 1048848	2009	117 600	160 000		46 489	12 000- 55 000	31 000- 75 000	1000- 1500	3 000	482	0	128 [d]
Covehead Pond (Cape Stanhope)	PEI	1	1049102	2005	174		123	10	15	15	0	0	0	0	0
Campbell's Pond	PEI	3	1049113	2008	0	0	0	0	0	0	0	0	0	18	0
Long Pond (Dalvay)	PEI	2	1048842	1993	0	0	0							0	
Brackley	PEI	8	1049101	1983-1986											
Tignish	PEI	9	1048839	1983-1986			0	0							

The occurrences in bold are considered as priority targets occurrences in the population and distribution objectives. The occurrence followed by an asterisk is a target for reintroduction.

[a] The data was compiled using CDPNQ, ACCDC, and COSEWIC (2004) data and expert knowledge (see section 3.2 for details).

[b] Numbers assigned to the occurrences in COSEWIC (2004)

[c*] Blooming Point includes the five following occurrences: Dune Slack, East Marsh 1, East Marsh 2, Western Wetland and Grand Tracadie

[d] In 2008, plants were reintroduced at East Marsh (1 and 2) and the Dune Slack. In 2009, 128 individuals were located near the sites of reintroduced plants at East Marsh (1 and 2). In June of 2009, 413 individuals were counted around the transplants at the Dune Slack (D. Mazerolle, pers. Comm.) but 0 individuals were counted in September by Atkinson (2010).

3.3 Needs of the Gulf of St. Lawrence Aster

The Gulf of St. Lawrence Aster is a pioneer annual plant of littoral habitats that occurs on wet, predominantly sandy substrates exposed to equinoctial high tides and storm waves, sheltered beaches and areas of scattered vegetation in high salt marshes (Gagnon *et al*., 1995a,b). The dynamic nature of littoral habitats combined with the dispersal capabilities of the species results in a high interannual variability in the population size and area of occupancy of the species.

Suitable habitat for the Gulf of St. Lawrence Aster is situated near sea level on open and slightly sloping ground (Gilbert *et al*., 1999) exposed to full light (Reynolds *et al*., 2001; Houle *et al*., 2002). The species occupies a narrow band parallel to the shoreline, limited on the one hand by the salinity of the water, winds, waves and deposition of debris or wrack and, on the other hand, by competition with other species less tolerant of these conditions (Couillard and Jolicoeur, 2008). Substrate particle size appears to be of little importance since this aster occurs on fine sand, coarse sand, gravel and clay (Houle, 1988). The average pH of the substrate ranges from 5.5 to 6.9 (COSEWIC, 2004).

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).

The salinity of the substrate is also a limiting factor in the distribution of Gulf of St. Lawrence Aster (Reynolds and Houle, 2002). Seed germination is inhibited by salinity greater than 20 g salt/L (Houle *et al*., 2001 and 2002; Reynolds *et al*., 2001). The salinity of the substrate also has a significant negative effect on the emergence of the seedlings. Salinity as low as 1‰ reduce emergence by a third. The growth of the plants is significantly reduced by a salinity 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, the Gulf of St. Lawrence Aster has a great tolerance to high salinity (COSEWIC, 2004).

Boudreau and Houle (1998) and Houle *et al*. (2002) have demonstrated that interspecific competition plays a significant role in the population dynamics of the Gulf of St. Lawrence Aster. 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 accumulations of eelgrass debris and sand). Similarly, the overall reproductive success of the plants (number of fruits produced) increases when interspecific competition is absent. Competition associated with natural vegetation succession could reduce the quality of the Gulf of St. Lawrence Aster habitat by causing vegetation canopy closure and a reduction in available light for the species (Houle *et al*., 2002; Houle and Valéry, 2003).

4. THREATS

4.1 Threat Assessment

Table 2. Threat Assessment Table

Threat	Level of Concern[1]	Extent	Occurrence	Frequency	Severity[2]	Causal Certainty[3]
Habitat loss or degradation						
Shoreline development	High	Generalized	Historical / Anticipated[4]	Single	High	Medium
Climate and natural disasters						
Increased erosion caused by climate change (sea level rise)	High	Generalized	Current	Continuous	Medium	High
Changes in ecological dynamics or natural processes						
Artificial changes in hydrological processes	Medium	Localized	Historical / Anticipated	Single	Medium	Medium
Disturbance or harm						
Recreational activities	Medium	Generalized	Current	Seasonal	Medium	High
Alien, invasive or introduced species or genome						
Interspecific competition	Medium	Generalized	Current	Continuous	Unknown	Medium

[1] *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table).*

[2] *Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).*

[3] *Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).*

[4] *Each threat assessment criterion is evaluated in terms of each occurrence and for the entire range. Two qualifiers in a box indicate that the identified threat does not have the same impact for each qualifier (Single occurrence / Entire range).*

4.2 Description of Threats

Known threats are listed below according to a decreasing level of concern.

Shoreline development

Shoreline development such as residential development and construction of roads, jetties, beach boardwalks or paths, as well as infilling and dredging operations can change or even completely destroy the species habitat. Shoreline development is believed to have impacted several occurrences in the past. In Prince Edward Island, the population at Brackley disappeared following wetland infilling (COSEWIC, 2004).

Increased erosion caused by climate change (sea level rise)

Wave action and storms are a natural part of the dynamic habitat colonized by the Gulf of St. Lawrence Aster and have both beneficial and detrimental effects on its presence. Major storms and extreme high tides result in the direct loss of habitat due to flooding, increased erosion and a larger accumulation of sand and eelgrass (*Zostera marina*) debris (wrack) which can affect the growth of the Gulf of St. Lawrence Aster. For example, two populations in Kouchibouguac National Park (New Brunswick) have not been seen again since a storm in 2000 (COSEWIC, 2004). Climate change could exacerbate this process by causing rising sea levels and more frequent storms. The significant erosion and higher water level in the lagoons observed in the Magdalen Islands suggest that these changes have already taken place (Couillard and Jolicoeur, 2008).

Artificial changes in hydrological processes

Artificial changes in saltwater levels or circulation patterns (permanent opening or closing of a lagoon, etc.) can affect the viability of the Gulf of St. Lawrence Aster occurrences by altering the disturbance cycle needed to maintain its habitat. This situation has occurred, for example, at Bassin aux Huîtres (Magdalen Islands) where water circulation was modified after the entrance to the lagoon was moved (COSEWIC, 2004).

Recreational activities

All terrain vehicule (ATV) traffic in the Gulf of St. Lawrence Aster habitat leads to the direct destruction of individuals. ATV tracks have been observed in several occurrences in Quebec, including Barachois, Baie de la Grosse Île, Baie Clarke, Pointe de l'Est and Bassin aux Huîtres (Couillard and Jolicoeur, 2008). This activity also appears to be a problem in Kouchibouguac National Park (New Brunswick; Dietz and Chiasson, 2001). However, ATVs may also have a temporary beneficial effect by exposing substrate, thereby creating suitable habitat for seed germination. Gulf of St. Lawrence Aster has occasionally been observed growing in ATV tracks in Quebec (COSEWIC, 2004). However, in the long term, the plant communities in these disturbed environments are modified, which could adversely affect the species by increasing the level of competition (Couillard and Jolicoeur, 2008). In addition, ATV traffic leads to soil compaction and weakening of the dunes that shelter the species.

Trampling associated with recreational activities, hunting and fishing can also destroy Gulf of St. Lawrence Aster individuals. In its conservation plan for the occurrences in the province, Quebec's Ministère du Développement durable, de l'Environnement et des Parcs (Department of sustainable development, environment and parks) identified these activities as threats for the occurrences of Baie du Havre aux Basques, Cap de l'Hôpital, Bassin aux Huîtres and Barachois (Couillard and Jolicoeur, 2008).

Interspecific competition

Research has shown that interspecific competition restricts the distribution of the Gulf of St. Lawrence Aster (Houle *et al*., 2002; Houle and Valéry, 2003). Brass Buttons (*Cotula coronopifolia*), a potentially invasive exotic species, and Rayless Alkali Aster, a close relative of the Gulf of St. Lawrence Aster, are of particular concern (NBDNR, 2007). The competition caused by these species could reduce the quality of the Gulf of St. Lawrence Aster habitat by causing vegetation canopy closure and a reduction in available light for the species. Brass Buttons is present in the Gulf of St. Lawrence Aster occurrences in the Magdalen Islands (Couillard and Jolicoeur, 2008) and Rayless Alkali Aster has been observed in coastal habitats in New Brunswick (NBDNR, 2007) and Prince Edward Island (C. Lacroix, pers. comm.).

5. POPULATION AND DISTRIBUTION OBJECTIVES

The population and distribution objectives for the Gulf of St. Lawrence Aster are to maintain and, if possible, increase the number of individuals and area of occupancy within each of the 16 occurrences identified as priority targets, including nine occurrences in Quebec, four in New Brunswick and three in Prince Edward Island. Since the species can show large fluctuations in the number of individuals and area of occupancy over a short period of time depending on the occurrence and extent of natural disturbances, the objectives should be considered over a period exceeding the presumed seed bank viability (≥10 years).

The priority targets for the Gulf of St. Lawrence Aster were selected based on the following criteria:

1) At least one individual has been observed between 1999 and 2009. This criterion indicates that the species has occupied the habitat in a time period that is shorter than the known seed bank viability and may produce seeds to perpetuate its presence on the site. As the habitat exceeds 10 years without the presence of the species, it becomes less probable that the species will re-establish itself there. This resulted in the selection of 16 occurrences (marked in bold in Table 1);

2) the quality of the available habitat offers a potential to reintroduce the species or to increase the number of individuals. This resulted in the selection of one occurrence (Blooming Point; marked by an asterisk in Table 1) but no additional occurrences comparatively to criterion 1.

Criterion 2 was only applied to the Blooming Point occurrence in Prince Edward Island National Park following the desire of the Parks Canada Agency to continue implementing this measure. According to Atkinson (2010), the suitable habitat for reintroduction may be limited in the three other occurrences within PEI National Park (Covehead Pond, Long Pond and Campbell Pond) however, frequent storms and other environmental factors may modify predominant habitat characteristics such that suitable locations for reintroduction may change over time. The Quebec Gulf of St. Lawrence Aster recovery plan identifies the need to study the population dynamics of the species before identifying targets for reintroducing the species in certain

occurrences and New Brunswick Department of Natural Resources would consider translocation premature in the absence of the results of current efforts on Prince Edward Island and the availability of suitable habitat over the long-term.

The eight occurrences that were not selected as priority targets have no individuals reported in the past ten years. Depending on the evolution of the species' population trends and environmental factors that may modify habitat characteristics, some of these occurrences may become priority targets in the future. The population and distribution objectives can be modified accordingly in an amended or revised recovery strategy.

6. BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Stewardship and management of the species and its suitable habitat

In Quebec, three locations (grouping five occurrences) have been designated as Plant habitat according to the *Act Respecting Threatened and Vulnerable Species* : Baie-du-Havre-aux-Basques, Barachois-de-Fatima and Bassin-aux-Huîtres. Three other occurrences are located within the Pointe-de-l'Est Provincial Faunal Wildlife Reserve and are protected under the *Act respecting the conservation and development of wildlife* (R.S.Q., c. C-61.1). ATVs are prohibited on beaches, offshore bars, marshes and swamps of the Gulf of St. Lawrence, and on dunes in the Magdalen Islands and are permitted only on designated trails developed in accordance with the *Environment Quality Act* (*Regulation respecting motor vehicle traffic in certain fragile environments*) (c. Q-2, r. 9).

In New Brunswick, three occurrences have been reported in Kouchibouguac National Park. Stewardship projects have also been initiated by the Irving Eco-Center – Dune de Bouctouche as well as Nature NB's Piper Project. In 2005, Irving Eco-Center Irving - Dune de Bouctouche, organized a meeting for researchers, governmental representatives and other concerned individuals in order to discuss conservation efforts for this and other species at risk.

In Prince Edward Island, five of the six occurrences of the province are located in Prince Edward Island National Park. These occurrences are protected under the *Canada National Parks Act* (L.C. 2000, c. 32) and the provincial *Endangered Species Act*.

Surveys and monitoring

Monitoring protocols have been developed by Québec and New Brunswick, and a common approach was agreed to at the meeting at the Irving Eco-Centre in 2005.

In Quebec, population monitoring activities have been conducted by Attention Frag'Îles and the Société de conservation des Îles-de-la-Madeleine. In New Brunswick, two local organizations have been involved to date in searches for potential habitat and new occurrences: the Irving Eco-Centre – Dune de Bouctouche and the Piper Project, a project of Nature NB (NBDNR, 2007).

Research

For several years, the laboratories of Dr. Christian Lacroix at the University of Prince Edward Island, Dr. Gilles Houle (now retired) at Laval University and Dr. Liette Vasseur at the Laurentian University have been conducting research on various components of the biology and ecology of the Gulf of St. Lawrence Aster. Their research has provided important information on several issues, including the extent and viability of the seed bank (Kemp and Lacroix, 2004), seed germination potential and morphology (Stewart and Lacroix, 2001), the effects of different environmental variables on development (Reynolds *et al*., 2001; Houle and Valéry, 2003), and the effect of salinity on distribution (Reynolds and Houle, 2002). In Prince-Edward Island National Park, green house grown seedlings have been transplanted successfully (Atkinson, 2010). The province also plans to monitor the historic Tignish occurrence (R. Curley, pers. comm.).

Seeds from two occurrences have been collected and are being stored at Acadia University (Nova Scotia) and Irving Research Nursery (Sussex, New Brunswick) pending future restoration work (NBDNR, 2007).

Communication and outreach

In Quebec, awareness-raising activities aimed at residents, visitors and school groups have been carried out by conservation organizations (Attention Frag'Îles, Société de conservation des Îles-de-la-Madeleine and Comité de développement touristique de l'Est des Îles).

6.2 Strategic Direction for Recovery

Table 3. Recovery Planning Table

Threat or limiting factor	Priority	General Recovery Strategy	General Description of Research and Management Approaches
Shoreline development; Artificial changes in hydrological processes; Recreational activities	High	Stewardship and management of the species and its suitable habitat	- Develop and implement targeted and strategic stewardship projects - Assess available legal or other management tools for the conservation of occurrences that are not currently protected - Conduct environmental impact assessments and practice adaptive management
Shoreline development; Artificial changes in hydrological processes; Increased erosion caused by climate change (sea level rise); Recreational activities	High	Surveys and monitoring	- Review current monitoring protocols and develop a standardized methodology to count individuals - Develop a prioritized research plan to investigate the causes of population declines - Determine the relative impacts of threats and monitor their cumulative effects on population dynamics - Monitor occurrences where no individuals have been found for more than 10 years - Clarify the number of individuals and the location of occurrences reported in the conservation data centers
Knowledge gaps	Medium	Research	- Map the area of suitable habitat surrounding observation points in all priority occurrences - Confirm and if necessary refine the 300 m zone surrounding observation points that is considered critical habitat - Produce a plan for reintroduction and propagation that includes the collection of seeds in all extant occurrences and establish an *ex situ* seed bank capable of providing reintroduction material if necessary - Confirm that portions of seed banks can be viable for more than 10 years and reassess critical habitat according to the findings - Validate the quality of the habitat at the reintroduction sites
All	Medium	Communication and outreach	- Develop and implement a communications strategy with partner organizations, special interest groups, landowners and the general public

7. CRITICAL HABITAT

7.1 Identification of the Species' Critical Habitat

The Gulf of St. Lawrence Aster is typically found in habitats that remain relatively wet throughout the growing season. The species generally grows on sites affording some protection from the full force of onshore wind and waves, at elevations just above the mean high tide level, where it is only flooded during extreme tides and storm events.

Inter-specific competition plays a major role in limiting Gulf of St. Lawrence Aster's establishment and growth. Therefore, the species generally colonizes relatively bare substrates where competing vegetation is sparse to absent. In fact, the species typically grows within openings in the vegetation, at micro-sites opened through animal activity, storm disturbance or wrack deposits.

The biophysical attributes of critical habitat described above can be found in three habitat types:

- salt marshes
    - the species grows on the edges of these marshes which are characterized by salt or brackish water and where vegetation cover is dominated by halophytes (e.g. Pacific Silverweed *Potentilla egedei*, Prairie Bulrush *Bolboschoenus maritimus*, Common Three-Square *Schoenoplectus pungens,* Smooth Cordgrass *Spartina alterniflora*, Spearscale *Atriplex hastata*, Baltic Rush *Juncus balticus,* Seashore Dock *Rumex maritimus*);
    - suitable habitat corresponds to the area between the mean high tide level and the spring high tide level;

- dune slacks
    - the species grows in interdunal hollows;
    - suitable habitat corresponds to the area between the mean high tide levels on each side of the dune slacks;

- sand/mud flats
    - the species grows on these flat areas where there is no defined drainage pattern;
    - suitable habitat corresponds to the area between the mean high tide level on the ocean side and the mean high tide level on the bay, lagoon or pond side.

Critical habitat for the Gulf of St. Lawrence Aster is identified in the present recovery strategy as the area of suitable habitat within 300 m of each observation point compiled between 1999 and 2009 for the 16 priority occurrences. When the 300 m surrounding adjacent observation points overlap, they merge in a single continuous area containing suitable habitat. Any man-made structure (ex. wharves) or zone (ex. rocks) that do not possess the biophysical attributes of suitable habitat are not identified as critical habitat.

The distance of 300 m was determined based on two aspects: 1) there is an annual variability of the area occupied by the species and the number of individuals and 2) studies on plant populations indicate that the edge effects associated with various land-use activities can affect the availability of resources over a distance of 300 m (see Henderson, 2010). Therefore, the precautionary principle was used in the determination of the extent of critical habitat surrounding each observation point. Studies could be conducted to refine this distance for the Gulf of St. Lawrence Aster (see Table 3).

Observation points were noted during fieldwork carried out between 1999 and 2009, where a GPS coordinate was recorded for each individual or clump of individuals (1 to several thousands). In the 16 priority occurrences, 106 observation points have been compiled, including 90 in Quebec, six in New Brunswick and 10 in Prince Edward Island (Appendix A).

7.2 Activities Likely to Result in the Destruction of Critical Habitat

Habitat loss (direct loss). Residential construction, construction of roads or any other infrastructure as well as dredging and infilling of coastal wetlands result in direct habitat loss

Changes in saltwater levels or circulation. The filling, moving or closing of the mouths of lagoons affect water circulation and can change water levels or salinity, important components that determine the ecological niche of the Gulf of St. Lawrence Aster. These activities can also affect the degree of exposure of occurrences to disturbance events (waves, storms, deposition of debris or wrack), which are essential to limit interspecific competition, but can destroy occurrences at high levels of exposure.

Substrate disturbance/loss of natural protective structures. Trampling and ATV traffic lead to the loss of vegetation cover, weakening, and in the longer term, erosion of dunes, thereby reducing the protection from waves and wind afforded by the dunes for the Gulf of St. Lawrence Aster. Although trampling and ATV traffic can, up to a certain point, promote establishment of the aster by exposing the substrate and eliminating competing vegetation, these activities are generally so intensive that they result in the negative impacts described above.

These examples do not represent an exhaustive list of the activities likely to destroy the critical habitat of the Gulf of St. Lawrence Aster.

8. MEASURING PROGRESS

The performance indicator presented below provides a way to define and measure progress in achieving the population and distribution objectives. Successful implementation of this recovery strategy will be assessed every five years based on the following performance indicator:

- The mean number of individuals of the Gulf of St. Lawrence Aster is maintained or increased within each of the 16 occurrences identified as priority targets over a period exceeding the seed bank viability (≥ 10 years);
- The mean area of occupancy of the Gulf of St. Lawrence Aster is maintained or increased at each of the 16 occurrences identified as priority targets over a period exceeding the seed bank viability (≥ 10 years).

9. STATEMENT ON ACTION PLANS

One or more action plans for the Gulf of St. Lawrence Aster will be developed within five years of the recovery strategy's having been posted on the Species at Risk Public Registry.

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APPENDIX A: AREAS CONTAINING CRITICAL HABITAT FOR GULF OF ST. LAWRENCE ASTER

Occurrence name	Province	CDPNQ/ ACCDC ID	Observation point	Latitude	Longitude	Survey period	Area (ha)	Land tenure
Cap de l'hôpital	QC	14759	1	47.418000	-61.898900	1999-2007	44.4	Non federal
			2	47.418000	-61.896200			
			3	47.418100	-61.899400			
			4	47.418300	-61.898900			
			5	47.418500	-61.896900			
			6	47.418500	-61.896800			
Baie de la Grosse Île	QC	14760	1	47.621100	-61.543300	2001-2007	80.7	Non federal
			2	47.622700	-61.540100			
			3	47.623433	-61.540300			
			4	47.623600	-61.540400			
			5	47.623800	-61.540600			
			6	47.624900	-61.525600			
Baie du Havre aux Basques	QC	4135	1	47.265600	-61.976500	1999-2007	704.5	Non federal (partial Provincial Plant habitat)
			2	47.266000	-61.976100			
			3	47.266200	-61.978200			
			4	47.266667	-61.979167			
			5	47.266900	-61.978200			
			6	47.269520	-61.982460			
			7	47.272800	-61.985440			
			8	47.276600	-61.985900			
			9	47.276900	-61.985900			
			10	47.278000	-61.979300			
			11	47.278200	-61.973600			
			12	47.278420	-61.985460			
			13	47.256300	-61.941500			
			14	47.256300	-61.940500			
			15	47.257200	-61.943200			
			16	47.271150	-61.927480			
			17	47.276660	-61.931660			
			18	47.278300	-61.931890			
			19	47.280220	-61.931010			
			20	47.294990	-61.937860			
			21	47.298670	-61.937720			
			22	47.304560	-61.938320			
			23	47.306000	-61.965500			
			24	47.307200	-61.964700			
			25	47.308500	-61.964100			
			26	47.308900	-61.963000			
			27	47.309510	-61.939960			
			28	47.310100	-61.962200			
			29	47.311700	-61.962100			
			30	47.312420	-61.940110			
			31	47.312800	-61.961600			
			32	47.312940	-61.952360			
			33	47.314500	-61.960000			

			34	47.316100	-61.960500			
			35	47.316140	-61.960450			
			36	47.317100	-61.959300			
			37	47.318940	-61.946860			
			38	47.319520	-61.941300			
			39	47.320280	-61.951760			
			40	47.323490	-61.955670			
			41	47.324300	-61.957700			
			42	47.325600	-61.956700			
			43	47.338800	-61.949500			
Anse aux Étangs	QC	4137	1	47.344000	-61.925900	1999-2004	28.1	Non federal
Pointe de l'Est	QC	4138	1	47.619960	-61.391030	1999-2007	56.3	Non federal (Provincial wildlife reserve)/ Federal (Environment Canada))
			2	47.627640	-61.407700			
Baie Clarke	QC	4139	1	47.622600	-61.472800	1999-2007	34.2	Non federal
			2	47.622900	-61.473100			
			3	47.622900	-61.472500			
			4	47.623200	-61.472200			
Bassin aux Huîtres	QC	4142	1	47.543500	-61.531100	1999-2007	141.7	Non federal (Provincial Plant habitat)
			2	47.543500	-61.530800			
			3	47.543900	-61.531800			
			4	47.544300	-61.532400			
			5	47.552300	-61.527100			
			6	47.552700	-61.526700			
			7	47.555400	-61.516600			
			8	47.555900	-61.515700			
			9	47.556000	-61.515800			
			10	47.556100	-61.515700			
			11	47.558700	-61.504400			
			12	47.558900	-61.504400			
			13	47.559000	-61.505100			
			14	47.559200	-61.505400			
			15	47.559458	-61.504681			
			16	47.559500	-61.505900			
			17	47.559500	-61.505800			
			18	47.559500	-61.504700			
Old Harry	QC	4140	1	47.573658	-61.475654	1999-2001	58.2	Non federal
			2	47.576950	-61.473750			
			3	47.578200	-61.473480			
Le Barachois	QC	4143	1	47.419563	-61.865946	1999-2007	81.1	Non federal (Provincial Plant habitat)
			2	47.419600	-61.865900			
			3	47.419700	-61.866200			
			4	47.422700	-61.861500			
			5	47.424000	-61.866900			
			6	47.424000	-61.865000			
			7	47.424200	-61.867500			
Windsors Malbaie	NB	1048834/ 1048835	1	47.948932	-64.471084	2002-2008	56.4	Non federal
			2	47.959336	-64.473895			

Kouchibouguac – Lac-à-Exilda	NB	1048836	1	46.927920	-64.883707	2000-2006	32.9	Federal (National Park)
			2	46.928620	-64.883513			
Kouchibouguac -Barachois	NB	174551	1	46.899576	-64.899011	2000-2010	28.2	Federal (National Park)
Tracadie- Val Comeau	NB	1048837	1	47.441986	-64.886610	1999-2008	28.2	Non federal
Blooming Point	PEI	1048845/ 1048846/ 1048847/ 1048848	1	46.413533	-63.022305	1999-2009	109.3	Federal (National Park)
			2	46.414199	-62.997456			
			3	46.414997	-62.979721			
			4	46.415034	-62.975116			
			5	46.415713	-62.980064			
Campbell's Pond	PEI	1049113	1	46.409186	-63.055647	1999-2009	64.9	Federal (National Park)
			2	46.412991	-63.059011			
			3	46.413113	-63.061439			
Covehead Pond	PEI	1049102	1	46.430365	-63.152076	2000-2009	31.9	Federal (National Park)
			2	46.430463	-63.152897			

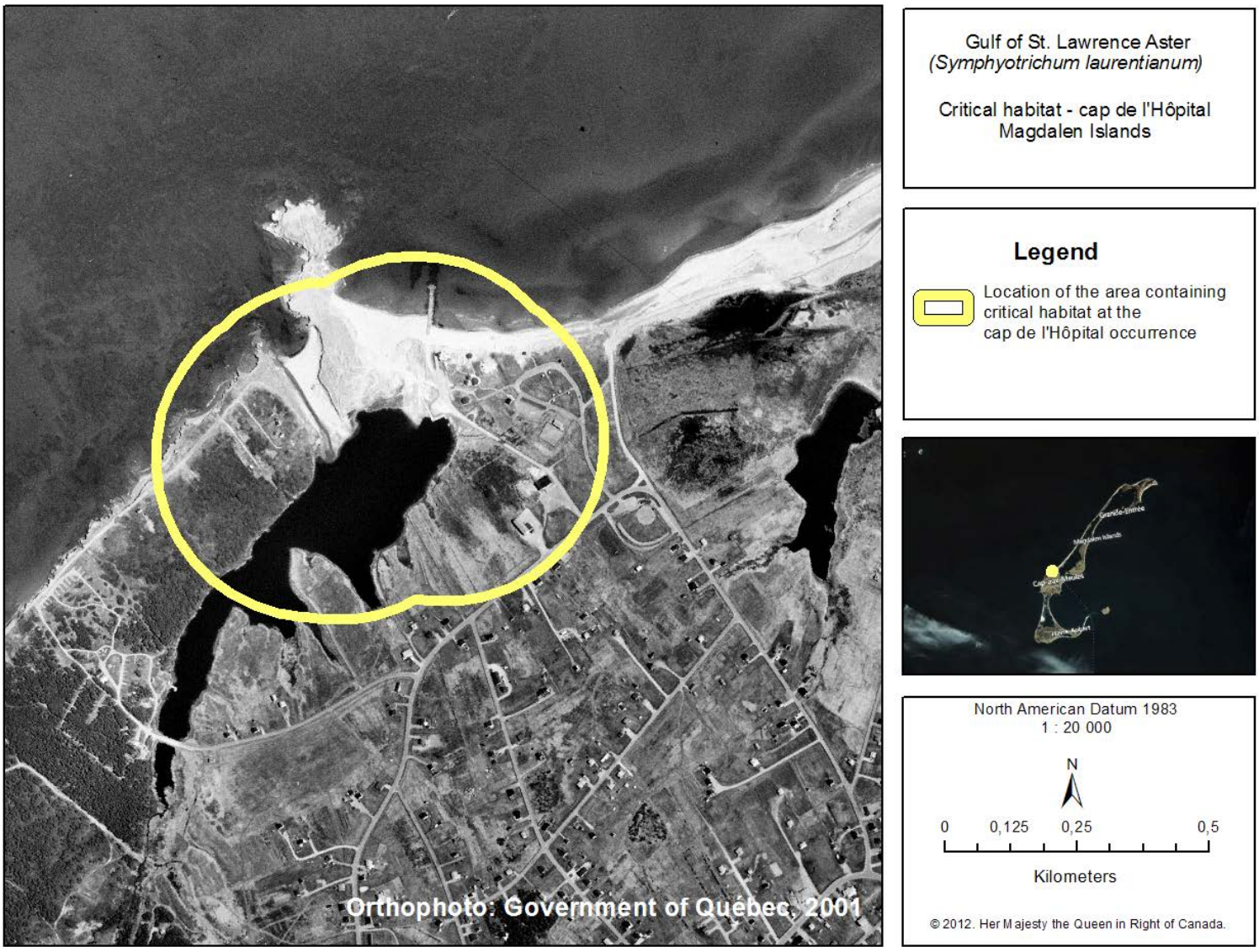

Figure A-1. Area containing critical habitat at the Cap de l'Hôpital occurrence in Quebec.

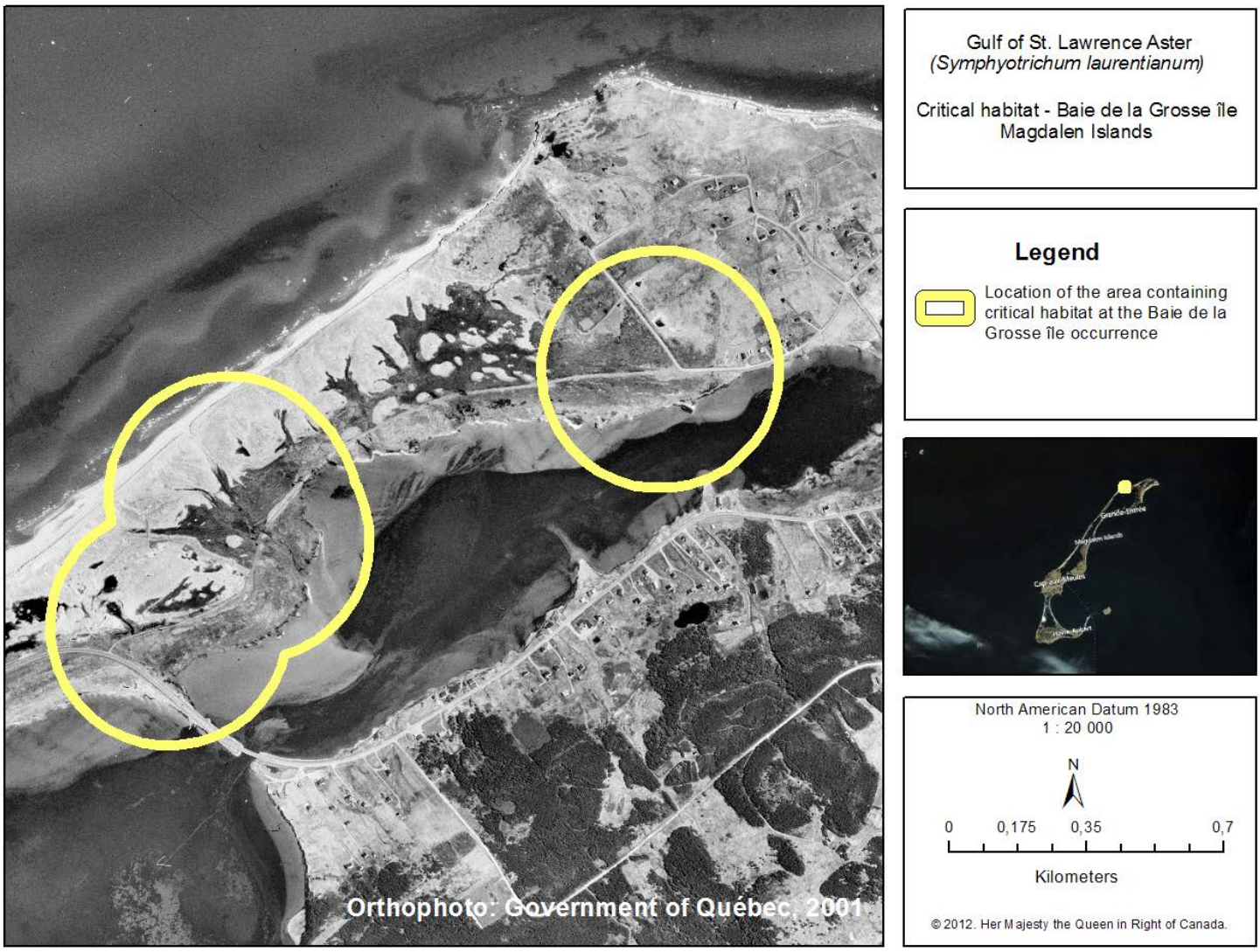

Figure A-2. Areacontaining critical habitat at the Baie de la Grosse île occurrence in Quebec.

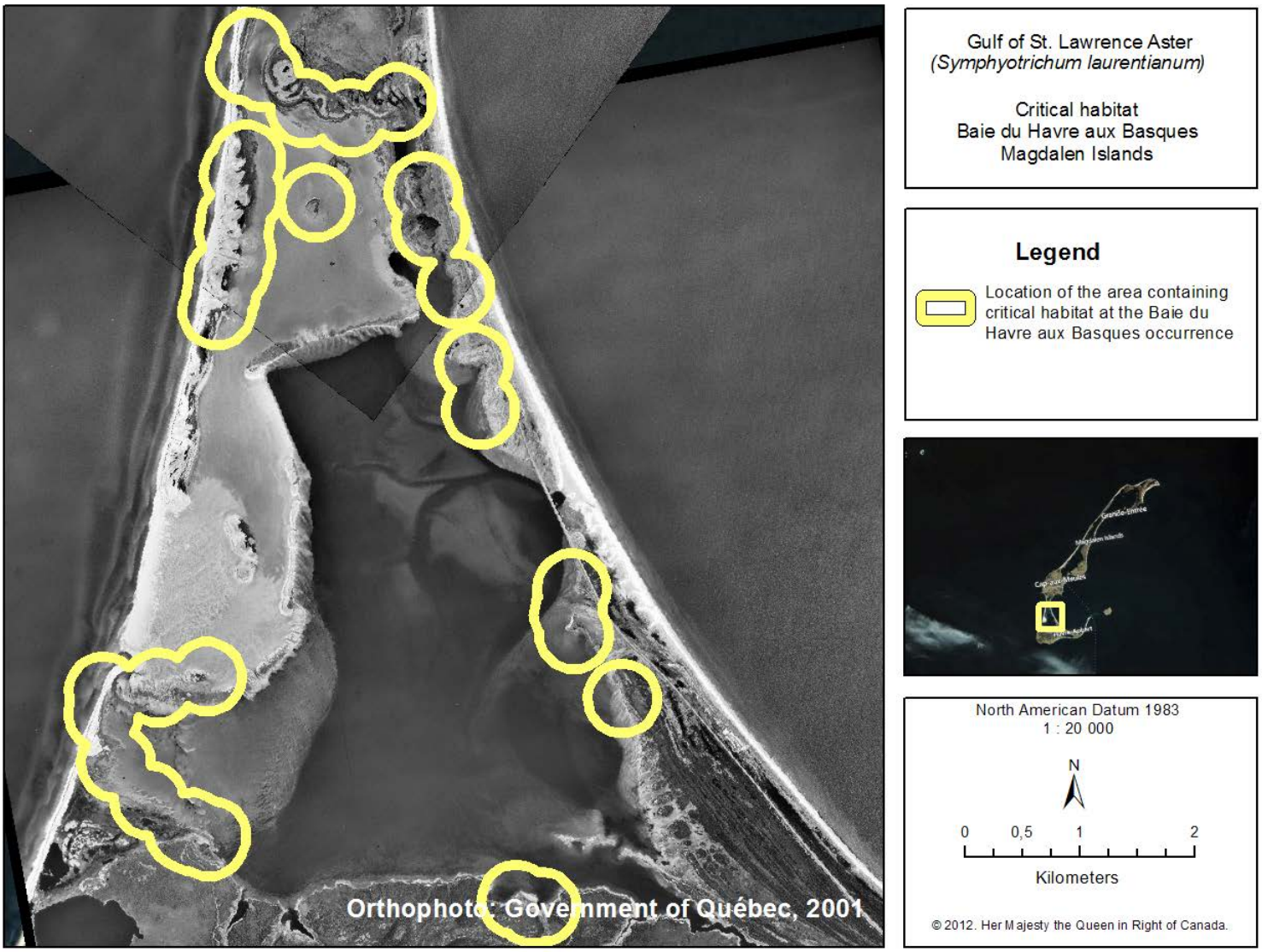

Figure A-3. Area containing critical habitat at the Baie du Havre aux Basques occurrence in Quebec.

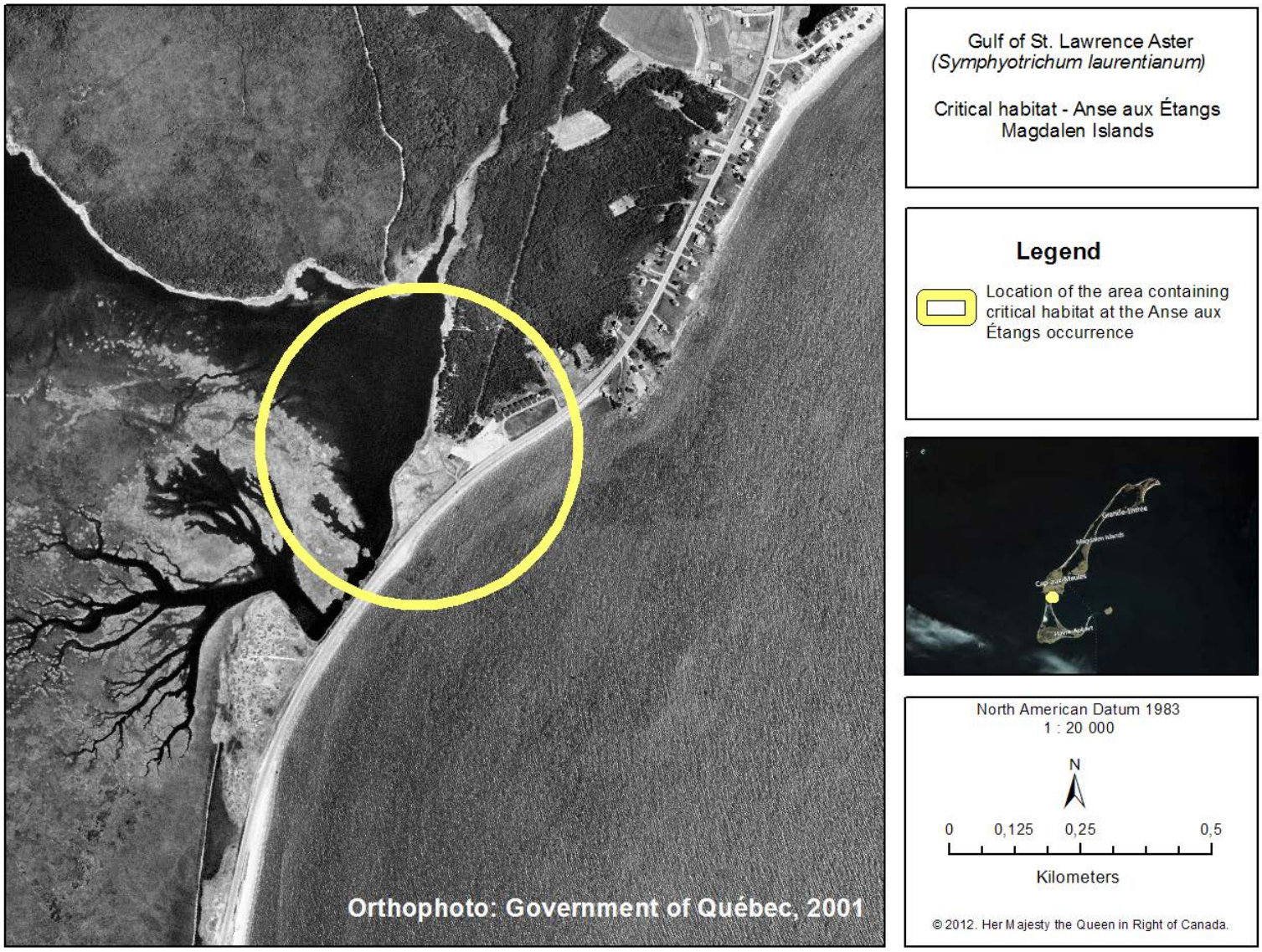

Figure A-4. Area containing critical habitat at the Anse aux Étangs occurrence in Quebec.

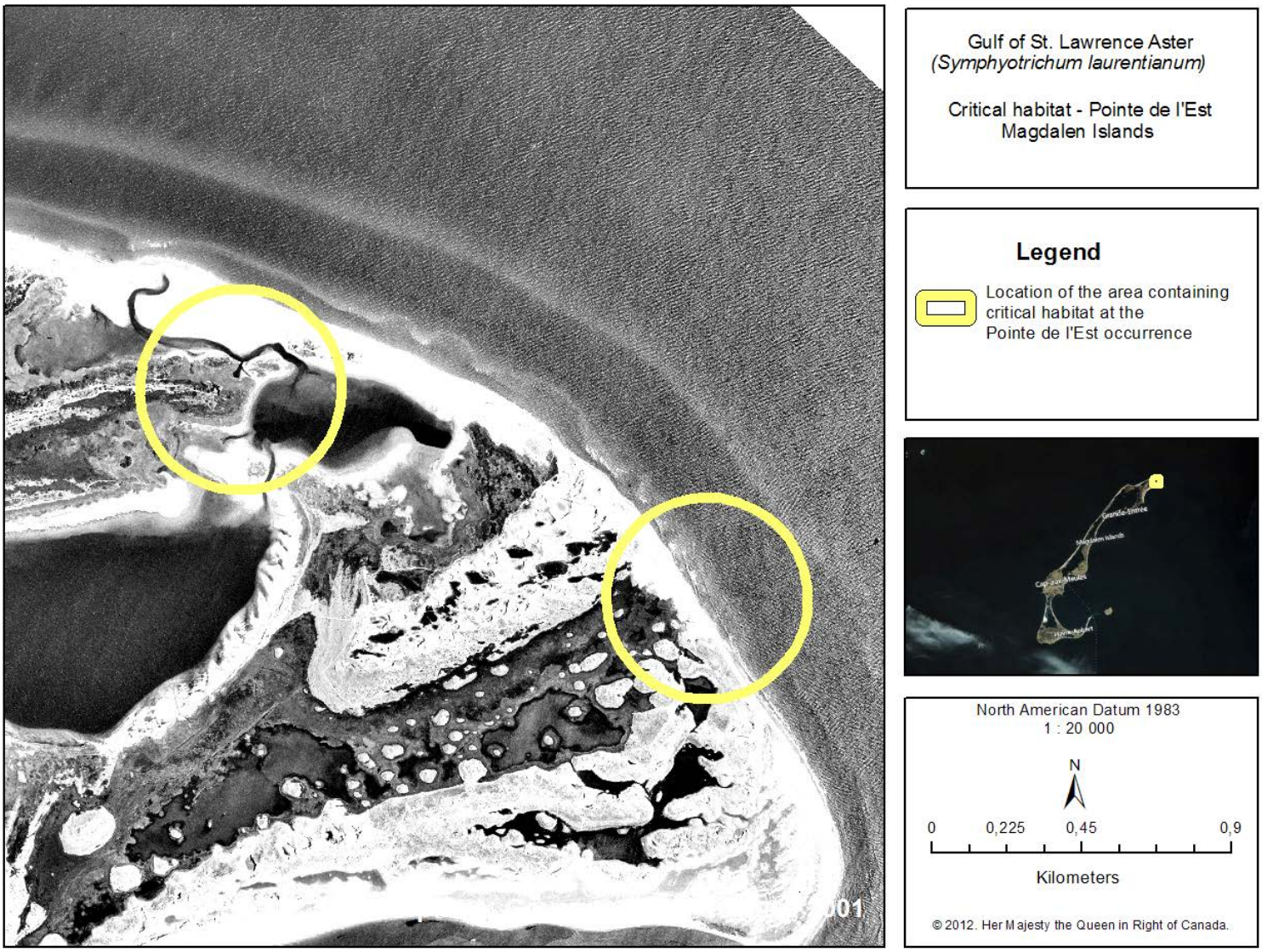

Figure A-5. Area containing critical habitat at the Pointe de l'Est occurrence in Quebec.

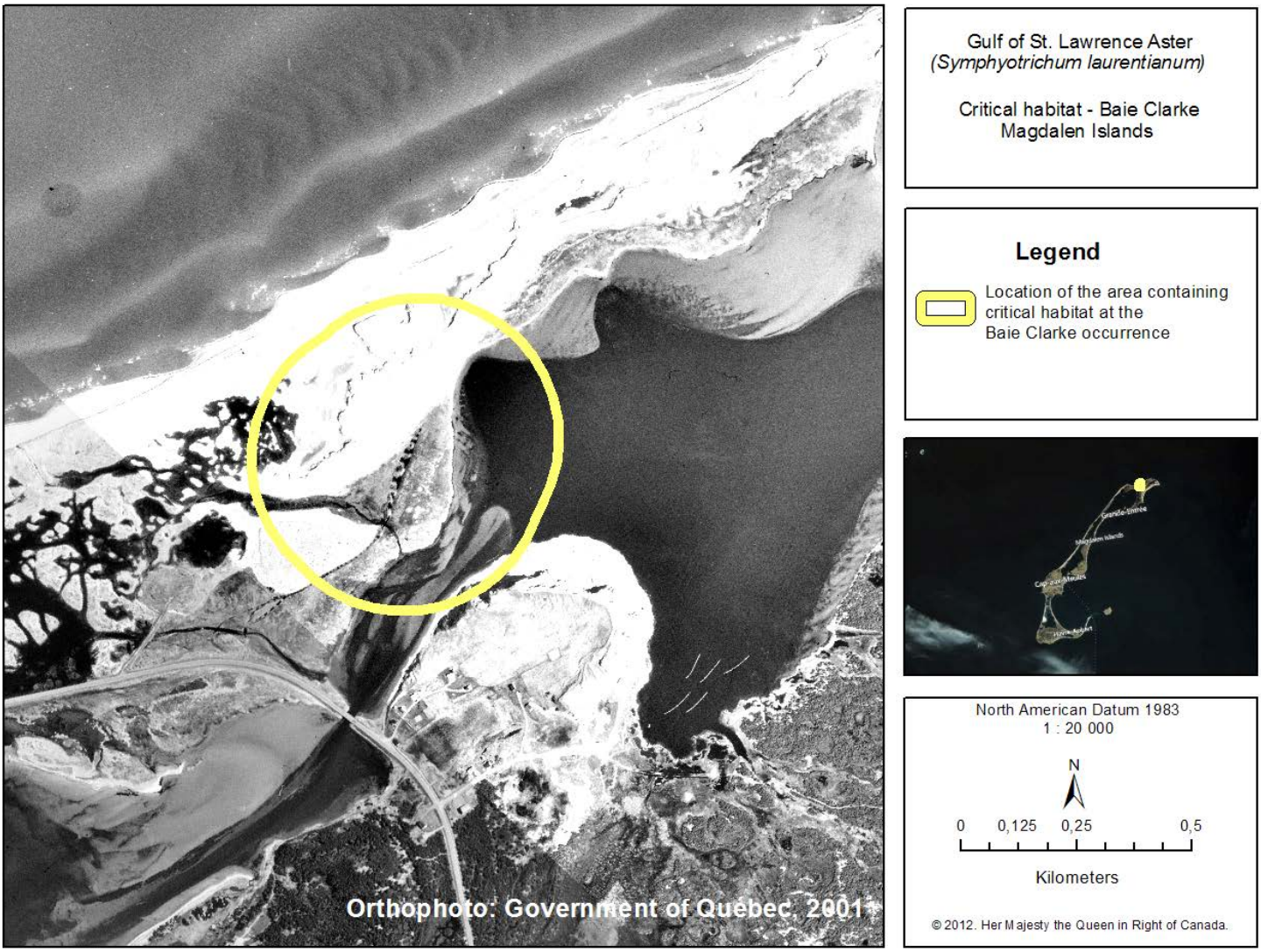

Figure A-6. Area containing critical habitat at the Baie Clarke occurrence in Quebec.

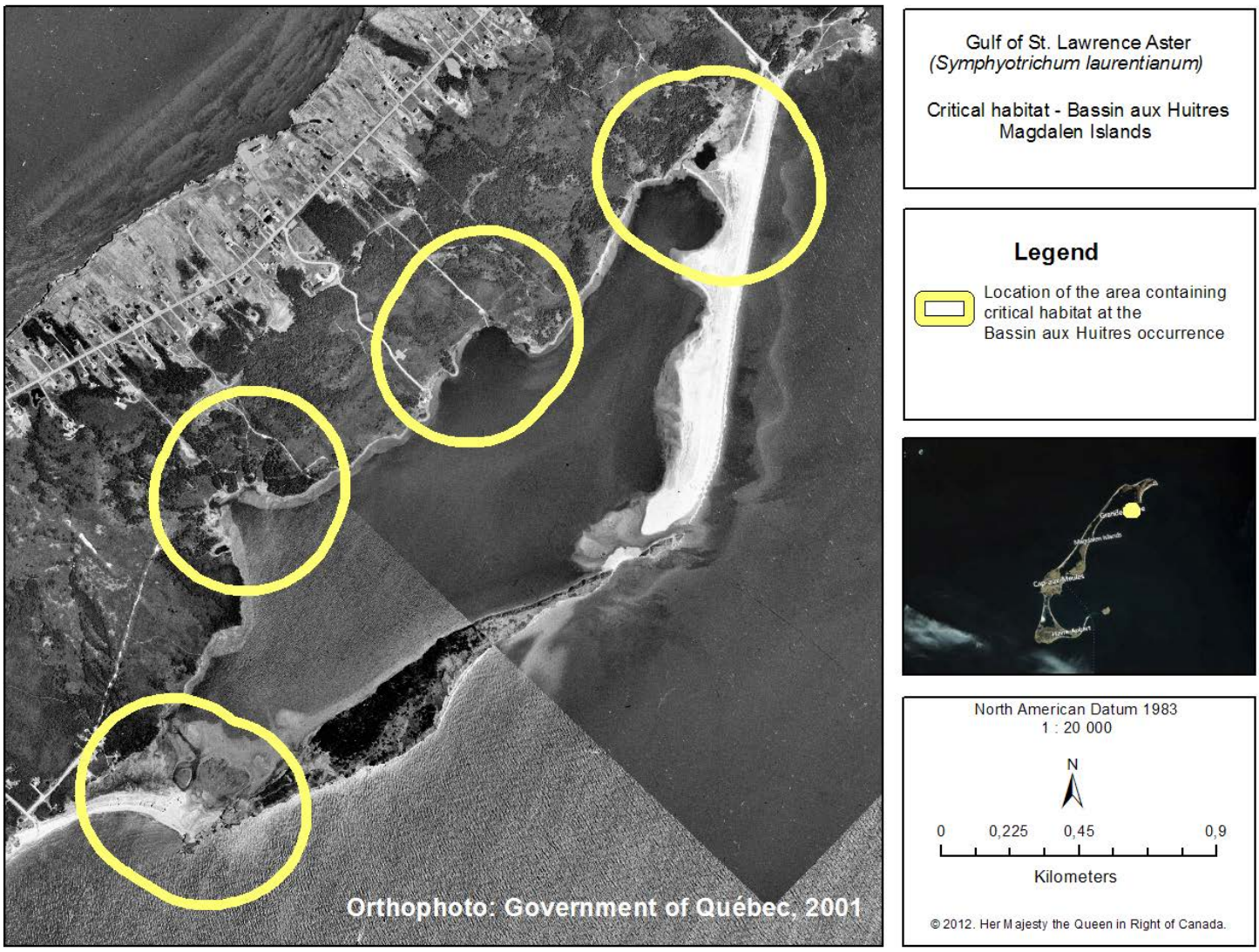

Figure A-7. Area containing critical habitat at the Bassin aux Huîtres occurrence in Quebec.

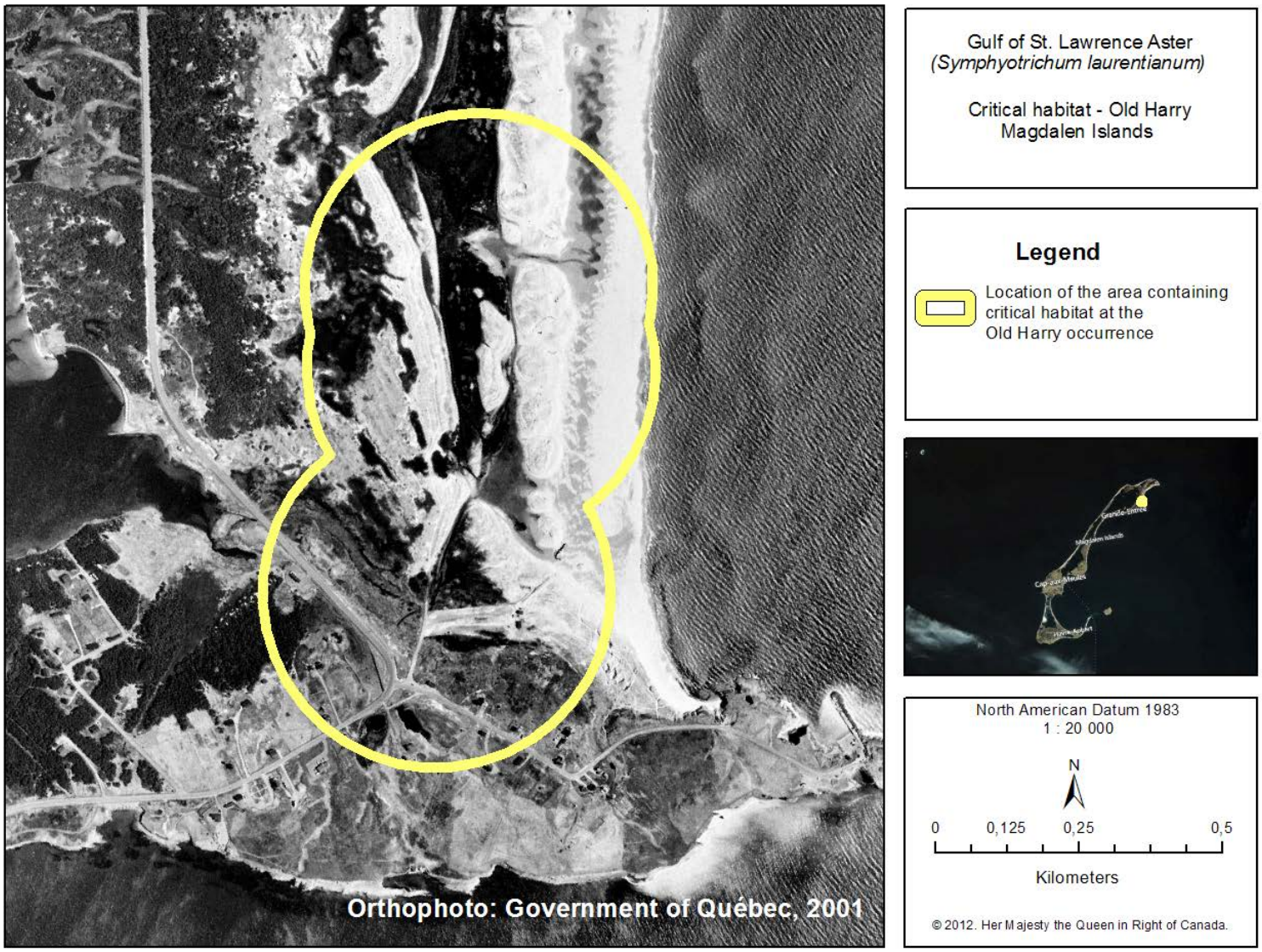

Figure A-8. Area containing critical habitat at the Old Harry occurrence in Quebec.

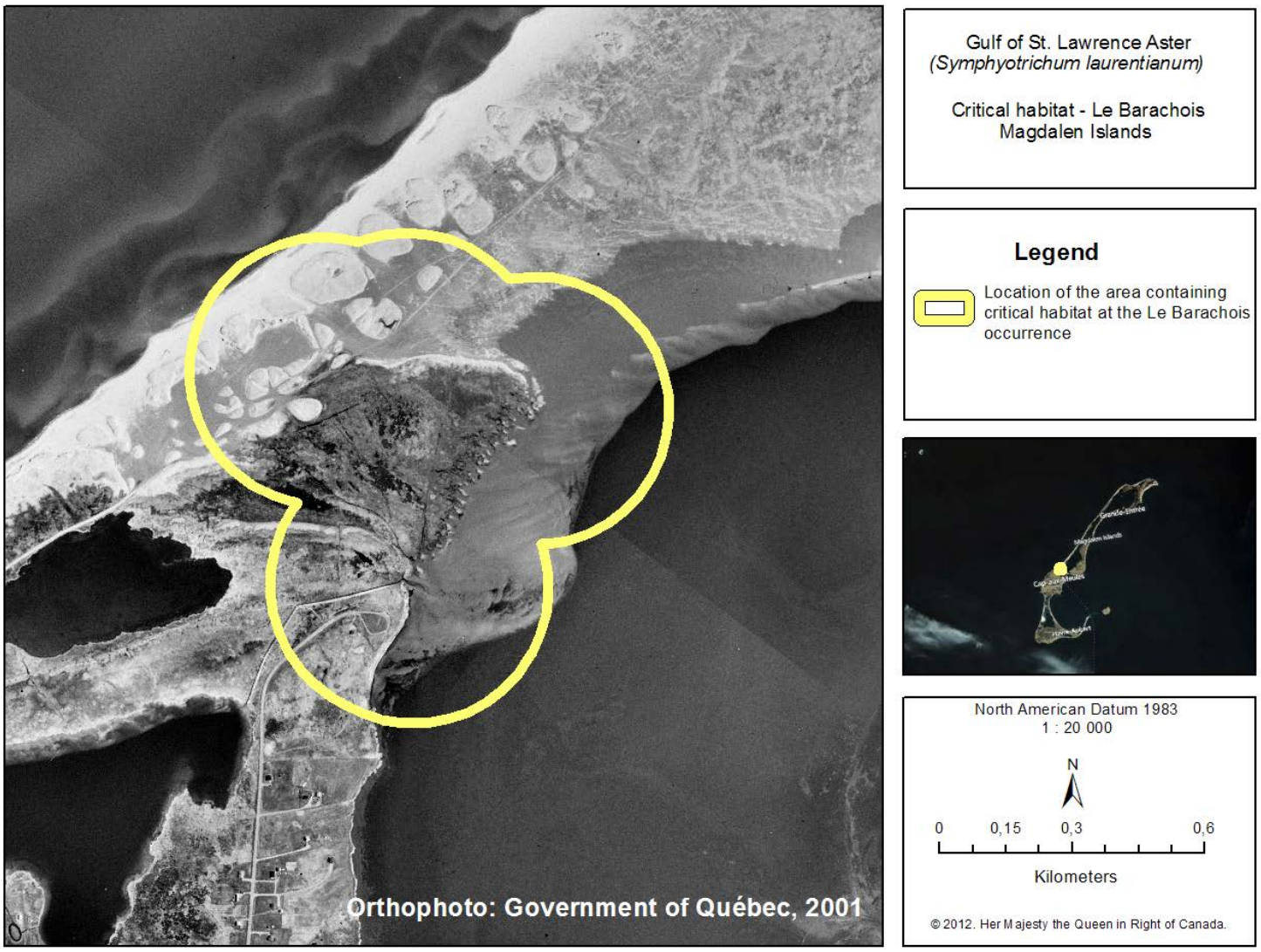

Figure A-9. Area containing critical habitat at Le Barachois occurrence in Quebec.

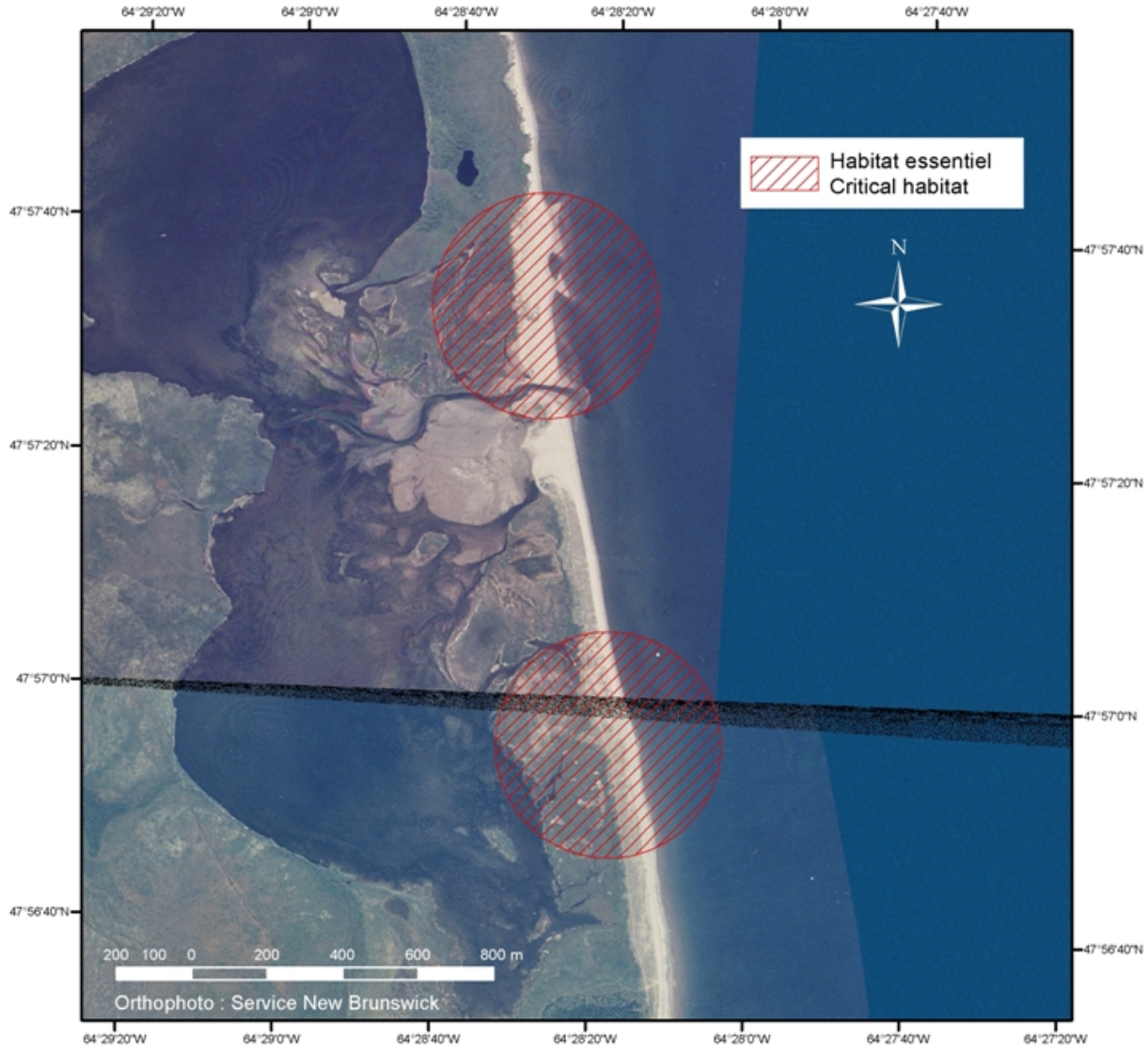

Figure A-10. Area containing critical habitat at the Windsors Malbaie occurrence in New Brunswick.

Figure A-11. Area containing critical habitat at the Kouchibouguac – Lac-à-Exilda occurrence in New Brunswick.

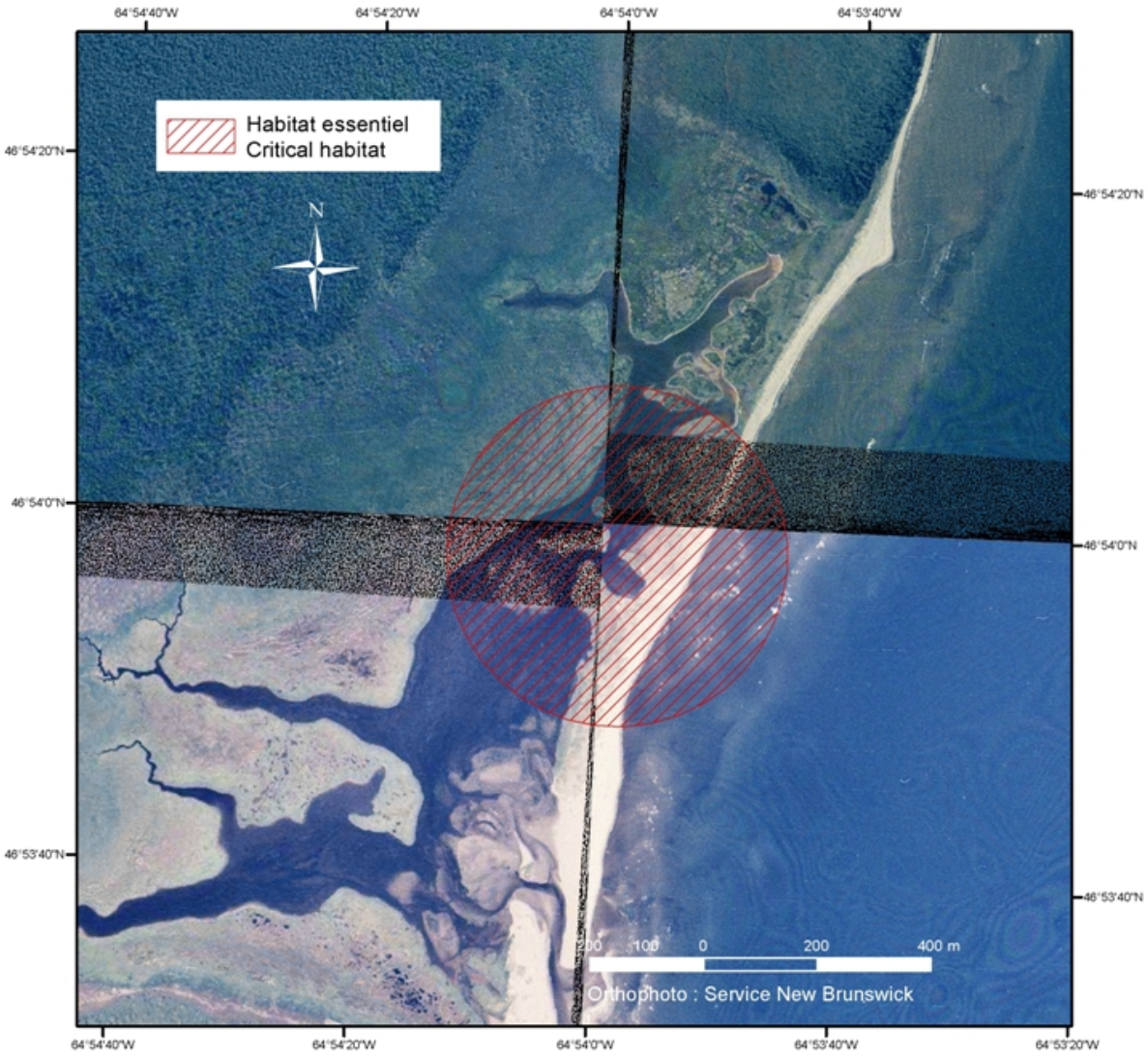

Figure A-12. Arera containing critical habitat at the Kouchibouguac – Barachois occurrence in New Brunswick.

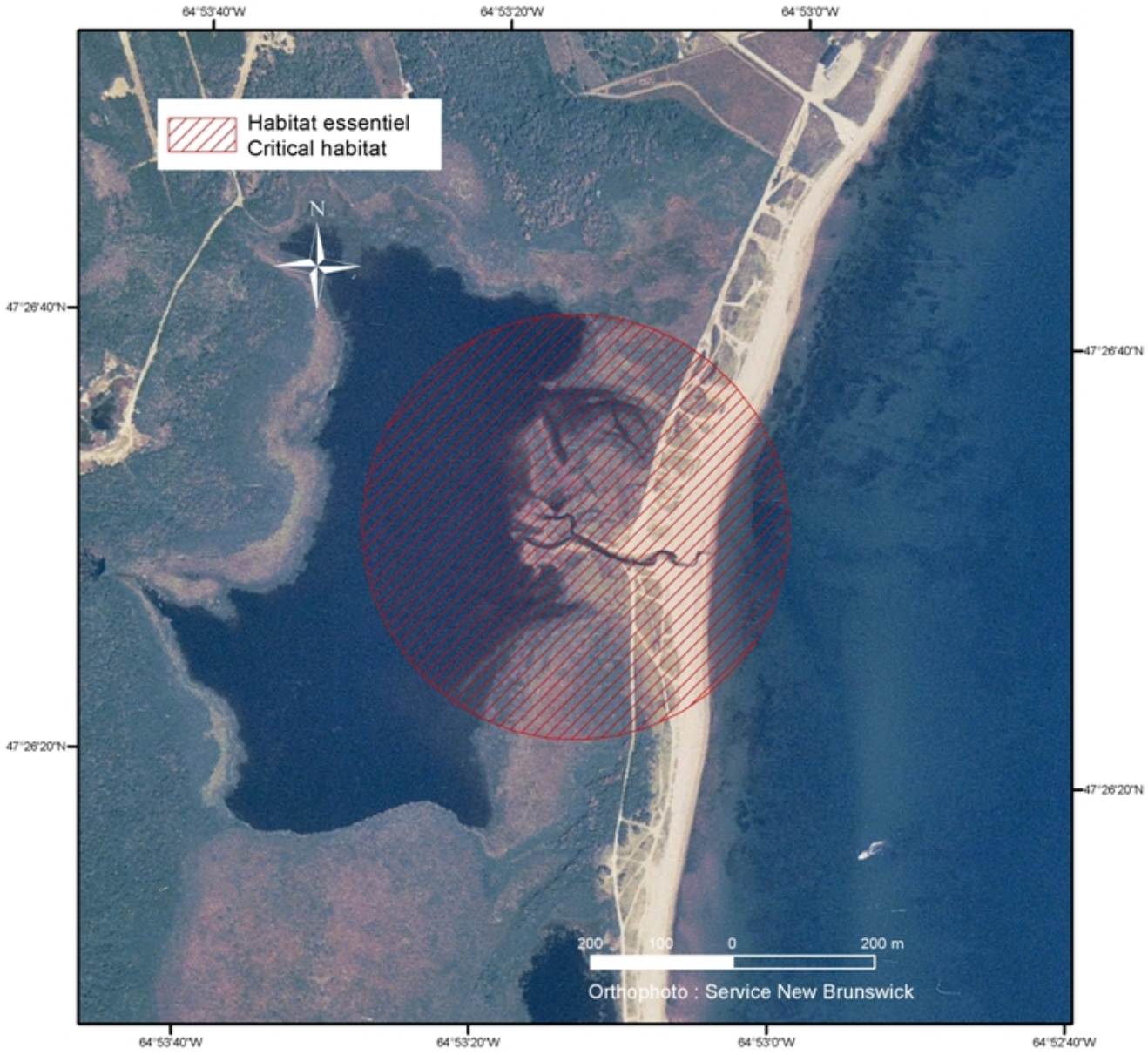

Figure A-13. Area containing critical habitat at the Tracadie- Val Comeau occurrence in New Brunswick.

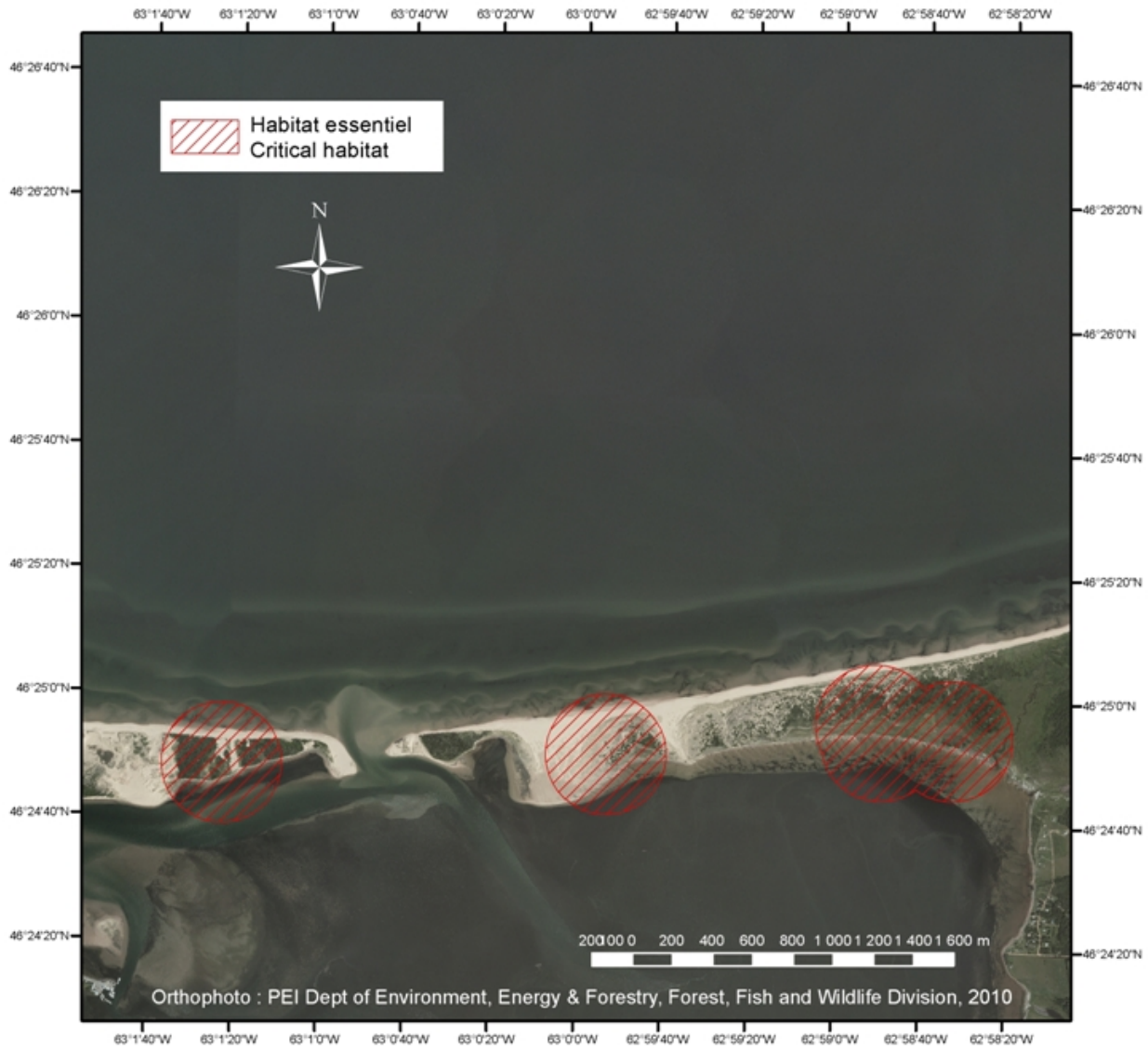

Figure A-14. Area containing critical habitat at the Blooming Point occurrence in Prince Edward Island.

Figure A-15. Area containing critical habitat at the Campbell's Pond occurrence in Prince Edward Island.

Figure A-16. Area containing critical habitat at the Covehead Pond occurrence in Prince Edward Island.

APPENDIX B: STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of the Gulf of St. Lawrence Aster. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects as recommended approaches to recovery focus on non-intrusive activities such as monitoring and public awareness.

The recovery activities proposed in this document should have positive effects on non-targeted species, natural communities or ecological processes. Other rare plant species are frequently associated with the Gulf of St. Lawrence Aster, including Marsh Feltwort (*Lomatogonium rotatum*: rare in New Brunswick according to Hinds, 1983), Golden Dock (*Rumex persicarioides:* rare in New Brunswick according to Hinds, 1983), Connecticut Beggarticks (*Bidens heterodoxa*: likely to be designated threatened or vulnerable in Quebec, according to Labrecque and Lavoie, 2002) and Gaspé Arrowgrass (*Triglochin gaspensis*: likely to be designated threatened or vulnerable in Quebec, according to Labrecque and Lavoie, 2002) (COSEWIC, 2004). These other rare species could therefore benefit from increased habitat protection.