PROPOSED

Species at Risk Act
Recovery Strategy Series
Adopted under Section 44 of SARA

Recovery Strategy for the Small-flowered Lipocarpha (*Lipocarpha micrantha*) in Canada

Small-flowered Lipocarpha



2017

Government of Canada
Gouvernement du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2017. Recovery Strategy for the Small-flowered Lipocarpha (*Lipocarpha micrantha*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. 2 parts, 34 pp. + 17 pp.

For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

Cover illustration: © Terry T. McIntosh

Également disponible en français sous le titre
« Programme de rétablissement du lipocarphe à petites fleurs (*Lipocarpha micrantha*) au Canada [Proposition] »

© Her Majesty the Queen in Right of Canada, represented by the Minister of Environment and Climate Change, 2017. All rights reserved.
ISBN
Catalogue no.

Content (excluding the illustrations) may be used without permission, with appropriate credit to the source.

[1] http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

RECOVERY STRATEGY FOR THE SMALL-FLOWERED LIPOCARPHA (*Lipocarpha micrantha*) IN CANADA

2017

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the *Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia* (Part 2) under Section 44 of the *Species at Risk Act* (SARA). Environment and Climate Change Canada has included a federal addition (Part 1) which completes the SARA requirements for this recovery strategy.

The federal recovery strategy for the Small-flowered Lipocarpha in Canada consists of two parts:

Part 1 – Federal Addition to the *Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia*, prepared by Environment and Climate Change Canada.

Part 2 – *Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia*, prepared by the Ministry of Environment.

Table of Contents

Part 1 – Federal Addition to the *Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia*, prepared by Environment and Climate Change Canada.

Preface 2
Acknowledgements 4
Additions and Modifications to the Adopted Document 5
Executive Summary 6
Recovery Feasibility Summary 7
1. Species Status Information 8
2. Species Information 9
2.1 Species Population and Distribution 9
3. Threats 10
3.1 Description of Threats 12
4. Population and Distribution Objectives 14
5. Broad Strategies and General Approaches to Meet Objectives 15
5.1 Actions Already Completed or Currently Underway 15
5.2 Strategic Direction for Recovery 16
5.3 Narrative to Support the Recovery Planning Table 18
6. Critical Habitat 19
6.1 Identification of the Species' Critical Habitat 19
6.2 Schedule of Studies to Identify Critical Habitat 30
6.3 Activities Likely to Result in the Destruction of Critical Habitat 30
7. Measuring Progress 32
8. Statement on Action Plans 32
9. Effects on the Environment and Other Species 32
10. References 33

Part 2 – *Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia*, prepared by the Ministry of Environment.

Part 1 – Federal Addition to the *Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia*, prepared by Environment and Climate Change Canada

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), 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 after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change is the competent minister under SARA for the Small-flowered Lipocarpha and has prepared the federal component of this recovery strategy (Part 1), as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Province of British Columbia (BC) and the Province of Ontario (ON), as per section 39(1) of SARA. SARA section 44 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for content (sub-sections 41(1) or (2)). The Province of British Columbia provided the attached recovery strategy for Small-flowered Lipocarpha (Part 2) as science advice to the jurisdictions responsible for managing the species in British Columbia. It was prepared in cooperation with Environment and Climate Change Canada.

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 and Climate Change Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Small-flowered Lipocarpha 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 and Climate Change Canada 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.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area[3] be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

[3] These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Bird Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

Acknowledgements

Development of this recovery strategy was coordinated by Kella Sadler and Matt Huntley (Environment and Climate Change Canada, Canadian Wildlife Service – Pacific Region (ECCC CWS-PAC). Substantial input and collaborative support was provided by Lauren Strybos and Justine Mannion (ECCC CWS - Ontario Region). Marie-Andrée Carrière and Andres De Vleeschauwer (ECCC CWS – National Capital Region), Ken Corcoran and Lesley Dunn (ECCC CWS - Ontario Region), Brenda Costanzo and Peter Fielder (British Columbia (BC) Ministry of Environment), Louise Blight, Rob Dinwoodie, Gordon Humphrey, and Lora Nield (BC Ministry of Forests, Lands and Natural Resource Operations), Terry McIntosh, and Jay Fitzsimmons, Eric Snyder, Leanne Jennings, Glenn Desy, and Vivian Brownell (OMNRF Species Conservation Policy Branch), and members of the Protected Areas Section (OMNRF Natural Resource Conservation Policy Branch) contributed useful feedback and/or supporting information. Danielle Yu (ECCC CWS-PAC) provided additional assistance with mapping and figure preparation.

Additions and Modifications to the Adopted Document

The following sections have been included to address specific requirements of the federal *Species at Risk Act* (SARA) that are not addressed in the *Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia* (Part 2 of this document, referred to henceforth as “the BC recovery strategy”) and/or to provide updated and additional information. The adopted BC recovery strategy does not provide information for Small-flowered Lipocarpha in Ontario or the historic population in Quebec; therefore the updated/additional species information provided in this federal recovery strategy is predominantly of that nature.

Under SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Therefore, statements in the BC recovery strategy referring to protection of survival/recovery habitat may not directly correspond to federal requirements. Recovery measures dealing with the protection of habitat are adopted; however, whether particular measures or actions will result in protection of critical habitat under SARA will be assessed following publication of the final federal recovery strategy.

Executive Summary

This section replaces the "Executive Summary" section in the BC recovery strategy.

The Small-flowered Lipocarpha (*Lipocarpha micrantha*) is a small (2 to 20 cm tall), annual herbaceous sedge. Its leaves and stems are clustered in small tufts and it produces green flowers arranged in dense, oval spikes, each 2–6 mm long. Small-flowered Lipocarpha was designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Threatened in 1992 then re-examined and designated Endangered in 2002 before being listed on Schedule 1 of the *Species at Risk Act* in 2005.

In Canada, the Small-flowered Lipocarpha reaches its North American northern limit in British Columbia (BC), Ontario and historically into Quebec. In BC, populations occur around Lake Osoyoos and Lake Okanagan in the south Okanagan Valley, while in Ontario, populations are present in Lake of the Woods, Rainy Lake and Tide Lake areas of northwestern Ontario. Populations have been extirpated in BC (east shore of Osoyoos Lake; last seen 1985), Ontario (Holiday Beach and Detroit River; last seen 1987 and 1901 respectively) and Quebec (Missisquoi Bay; last seen 1957). Small-flowered Lipocarpha grows on wet, sandy, exposed shorelines in areas prone to flooding. It prefers open areas, avoiding competition from other plants and does not tolerate the presence of organic sediments.

The greatest threat to the Small-flowered Lipocarpha is water management/use, which due to changes in seasonal water levels can affect the reproduction of this annual species. Other threats to this species are tourism and recreation development, livestock farming and ranching, recreational activities, and invasive non-native species.

The population and distribution objective for the Small-flowered Lipocarpha is to maintain the distribution, and to maintain or increase the abundance of all known extant populations in BC and Ontario, including any new or re-discovered populations that may be found in the future.

One or more recovery action plans will be completed by 2022.

Recovery Feasibility Summary

This section replaces the "Recovery Feasibility Summary" section in the BC recovery strategy.

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, recovery of the Small-flowered Lipocarpha has been deemed technically and biologically feasible.

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. Reproductively capable individuals are available at all extant[4] sites. This species is an annual plant, and reproduces from seed. Seeds that are produced in the fall (and banked within the surrounding substrate) will germinate the next time appropriate conditions occur. This may happen in the same location the next summer, or if conditions are unfavourable for growth, the seeds may not germinate for several years or even decades. The species is therefore subject to fluctuating population size from year to year. The maximum longevity of Small-flowered Lipocarpha seeds that are banked within the substrate is currently unknown.

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

   Yes. The Small-flowered Lipocarpha is mainly found on sandy beaches that are subject to seasonal flooding, therefore availability of habitat fluctuates with water levels. Although there is currently sufficient suitable habitat to support the species at occupied sites, extant populations in Ontario and BC are particularly susceptible to habitat loss from development, local destruction and/or deleterious water level management due to their small size. However, it is possible that more suitable habitat for the species might also be made available through habitat management or restoration.

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

   Yes. The primary threats to the species are loss and degradation of habitat due to development, controlled water level regimes, and invasive species. Stewardship efforts and cooperation with landowners and land managers can prevent or mitigate primary threats through conservation methods including habitat protection, inventory and monitoring, and habitat restoration/rehabilitation.

[4] An "extant" site is one which is considered or presumed to be still in existence, i.e., not destroyed or lost (extirpated).

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

   Yes. General habitat restoration methods/techniques are known. Standard seed propagation techniques exist for re-introduction and/or augmentation efforts, should these activities be deemed necessary for conservation efforts.

1. Species Status Information

This section replaces the "Species Status Information" (Section 2) in the BC recovery strategy.

Legal Designation: SARA Schedule 1 (Endangered) (2005).

Table 1. Conservation Status of the Small-flowered Lipocarpha (from NatureServe 2015, BC Conservation Framework 2015, and Ontario Natural Heritage Information Centre 2015).

Global (G) Rank*	National (N) Rank*	Sub-national (S) Rank*	COSEWIC Status	BC List	BC Conservation Framework	Ontario Status - SARO[5]
G5	Canada (N2) United States(NNR)	Canada: British Columbia (S1), Ontario (S2), Quebec (SX) United States: multiple states**	Endangered (2002)	Red List (Extirpated, Endangered, or Threatened)	Highest priority: 1, under Goal 3***	Threatened (2008)

*Rank 1– critically imperiled; 2– imperiled; 3- vulnerable to extirpation or extinction; 4- apparently secure; 5– secure; H– possibly extirpated; NR – status not ranked

** Alabama (SNR), Arizona (SNR), Arkansas (SNR), California (SNR), Connecticut (S1S2), District of Columbia (S1), Florida (SNR), Georgia (S3?), Idaho (SNR), Illinois (S3S4), Indiana (SNR), Iowa (S4), Kansas (S2), Kentucky (S4?), Louisiana (S1), Maine (S1), Maryland (S1), Massachusetts (S2), Michigan (S3), Minnesota (SNR), Mississippi (S4), Missouri (SNR), Nebraska (SNR), New Hampshire (SH), New Jersey (S1), New Mexico (SNR), New York (S1), North Carolina (SH), North Dakota (S1?), Ohio (S2), Oklahoma (SNR), Oregon (SH), Pennsylvania (S1), Rhode Island (S1), South Carolina (S2), Tennessee (SNR), Texas (SNR), Virginia (S2), Washington (SNR), Wisconsin (SNR)

*** The three goals of the BC Conservation Framework are: 1. Contribute to global efforts for species and ecosystem conservation; 2. Prevent species and ecosystems from becoming at risk; 3. Maintain the diversity of native species and ecosystems

It is estimated that the percent of the global range and population of this species in Canada is less than 1% (Smith et al. 2001).

[5] The Species at Risk in Ontario (SARO) List is a regulation under Ontario's *Endangered Species Act, 2007* similar in context to Schedule 1 of the *Species at Risk Act*.

2. Species Information

2.1 Species Population and Distribution

Table 2 (below) replaces the table in Section 3.2 “Population and distribution" subsection in the BC recovery strategy, to provide an updated summary of the distribution and abundance of recorded Small-flowered Lipocarpha populations throughout Canada. Of the 18 known populations, 14 are currently considered extant: 3 in BC and 11 in Ontario. The BC populations occur at Osoyoos Lake (2 populations) and Okanagan Lake (1 population), in the southern interior of the province. The Ontario populations occur at Rainy Lake (9 populations), at Sable Islands – Lake of the Woods (1 population) and at Tide Lake – English River (1 population), in the northwestern part of the province.

Four populations are considered extirpated[6]: 1 population in BC (Osoyoos Lake – east shore), 2 populations in Ontario (Holiday Beach; Detroit River), and 1 population in Quebec (Missisquoi Bay, Lake Champlain). The extirpated Osoyoos Lake - east shore population has not been observed since 1985, and was likely lost to shoreline development. The Holiday Beach population has not been observed since 1987, despite thorough searches in 2001, and the beach habitat has been seriously degraded (Smith et al. 2004). The Detroit River population has not been observed since 1901 and the habitat has presumably been destroyed by shoreline development. The Quebec population at Missisquoi Bay has not been observed since the 1950s, despite intensive search efforts between 1989 and 2002 and habitat is thought to be degraded as a result of water quality issues (Smith et al. 2004).

[6] An “extirpated” population is one which was previously known to occur (i.e., for which there is historical record), but that no longer exists

Table 2. Summary of Small-flowered Lipocarpha locations in Canada, as of 2016; with population number (Pop. #), year of last survey or observation (Last Survey/Obs.), estimated number of plants and status shown for each site.

Pop. #	Site name	Last Survey/Obs.	Estimated number of plants	Status
British Columbia				
1	Osoyoos Lake	2001	30,000-50,000	Extant
2	Osoyoos Lake – east shore	1985	0	Extirpated
3	Osoyoos Lake – Willow Beach (northwest shore)	2016	>1,000	Extant
4	Okanagan Lake - Sun-Oka Beach	2015	“1,000s”	Extant
Ontario				
5	Sandpoint Island, Rainy Lake	2003	800	Extant
6	Goose Portage, Rainy Lake	2003	1	Extant
7	Swell Bay, Rainy Lake	2003	2	Extant
8	Redgut Bay 1, Rainy Lake	2003	“rare”	Extant
9	Redgut Bay 2, Rainy Lake	2003	25-35	Extant
10	Redgut Bay 3, Rainy Lake	2003	20,000	Extant
11	Redgut Bay 4, Rainy Lake	2003	5	Extant
12	Redgut Bay 5, Rainy Lake	2003	100-200	Extant
13	Poundnet Bay, Rainy Lake	2000	75	Extant
14	Sable Islands	2003	~100,000	Extant
15	Tide Lake	2003	20+	Extant
16	Holiday Beach	1987	0	Extirpated
17	Detroit River	1901	0	Extirpated
Quebec				
18	Missisquoi Bay, Lake Champlain	1957	0	Extirpated

3. Threats

Table 3 (below) replaces Table 2 of the “Threats Assessment" (section 4.1) in the BC recovery strategy, to provide information on the threats to all known Small-flowered Lipocarpha populations in Canada.

The Small-flowered Lipocarpha threat assessment is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system. Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the Description of Threats section.

Table 3. Threat classification table for Small-flowered Lipocarpha in Canada. IUCN Threat numbers are in accordance with the IUCN-CMP (International Union for Conservation of Nature –Conservation Measures Partnership) unified threats classification system (CMP 2010).

Threat #[a]	Threat description	Impact[b]	Scope[c]	Severity[d]	Timing[e]	Population(s) or location(s) or site(s)
1	Residential & commercial development	Medium	Pervasive	Moderate	Moderate	
1.3	Tourism & recreation areas	Medium	Pervasive	Moderate	Moderate	**BC:** Osoyoos Lake (#1), Osoyoos Lake – Willow Beach (#3)
2	Agriculture & aquaculture	Low	Pervasive	Slight	High	
2.3	Livestock farming & ranching	Low	Pervasive	Slight	High	**BC:** Osoyoos Lake (#1)
6	Human intrusions & disturbance	Low	Pervasive	Slight	High	
6.1	Recreational activities	Low	Pervasive	Slight	High	**BC:** Osoyoos Lake (#1), Osoyoos Lake – Willow Beach (#3), Sun-Oka Beach (#4) **ON:** Sandpoint Island, Rainy Lake (#5), Goose Portage, Rainy Lake (#6)
7	Natural system modifications	Very high	Pervasive	Extreme	High	
7.2	Dams & water management/use	Very high	Pervasive	Extreme	High	**BC:** Osoyoos Lake (#1), Osoyoos Lake – Willow Beach (#3) **ON:** Sandpoint Island, Goose Portage, Swell Bay, Redgut Bay 1-5, Poundnet Bay, Rainy Lake (#5-13), Sable Islands (#14), Tide Lake (#15)
8	Invasive & other problematic species & genes	Unknown	Large-Restricted	Unknown	High	
8.1	Invasive non-native/alien species	Unknown	Large-Restricted	Unknown	High	**BC:** Osoyoos Lake (#1) **ON:** Poundnet Bay, Rainy Lake (#13), Sable Islands (#14)
8.2	Problematic native species	Unknown	Large-Restricted	Unknown	High	**BC:** Osoyoos Lake (#1) **ON:** Poundnet Bay, Rainy Lake (#13), Sable Islands (#14)

[a] Threat numbers are provided for Level 1 threats (i.e., whole numbers) and Level 2 threats (i.e., numbers with decimals).
[b] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment time frame (e.g., timing is insignificant/negligible [past threat] or low [possible threat in long term]); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.
[c] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).
[d] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. For this species a generation time of 2-3 years was used resulting in severity being scored over a 10-year timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit $\geq$ 0%).
[e] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

3.1 Description of Threats

Threat descriptions are provided in decreasing order of Threat Impact levels, as per classification in Table 3 above.

IUCN #7. Natural system modification (7.2 Dams and water management/use)

British Columbia

Information on this threat is available in the adopted BC recovery strategy (section 4.2).

Ontario

Water levels at the Rainy Lake and Lake of the Woods populations are tightly regulated for economic, recreational and environmental purposes (COSEWIC 2002; Harris et al. 2004). On Rainy Lake, water level limits are set through a rule curve[7] established by extensive consultation and scientific studies. Rainy Lake and Lake of the Woods are on the Canada – United States border, thus changes to water level regulation require the full involvement and approval of the International Lake of the Woods Control Board, the International Rainy Lake Board of Control, or the International Joint Commission (Harris et al. 2004).

As with the BC population at Osoyoos Lake, disruption of the natural cycle of flooding and draw-down can degrade habitat for the Small-flowered Lipocarpha and lead to long-term habitat loss at both of the northwestern Ontario populations. High water levels may flood suitable habitat on sandy shorelines, which prevents germination of Small-flowered Lipocarpha as the seed bank would be inundated. The species is highly sensitive to habitat conditions, thus minor alterations could render an area unsuitable (COSEWIC 2002). The maintenance of unnaturally low water levels over several years can also result in degradation of Small-flowered Lipocarpha habitat as shrubs and other highly competitive species may flourish in the absence of disturbance. Further research is required to determine the effects of the current water management regime on the Small-flowered Lipocarpha habitat at these locations.

Additionally, water levels at the extirpated Holiday Beach population are manipulated to enhance duck habitat, resulting in the loss of much of the habitat where Small-flowered Lipocarpha formerly occurred (Smith et al. 2001). Dredged materials and mounds of rotting vegetation have been deposited in other nearby areas, covering up the suitable flat, moist sand habitat for the species.

[7] The compilation of operating criteria, guidelines, and specifications that govern the storage and release function of a reservoir.

IUCN #1. Residential and commercial development (1.3 Tourism and recreation areas)

British Columbia

Information on this threat is available in the adopted BC recovery strategy (section 4.2).

Ontario

Development pressure is a historical threat at current sites in Ontario. The extirpated Ontario populations and habitat at Holiday Beach and Detroit River were directly affected by shoreline development. Shoreline development can replace sand beaches with artificial substrates and disrupt natural sand erosion and deposition processes, thereby degrading Small-flowered Lipocarpha habitat (Harris et al. 2004). Since Small-flowered Lipocarpha populations at Sandpoint Island, Goose Portage, Poundnet Bay, Sable Islands, and Tide Lake in Ontario are secured within provincial parks or conservation reserves, currently these populations are not considered to be under threat from development. Several sites (Swell Bay, Redgut Bay 1, 2, 4, 5) occur on Crown Land, while the remaining site (Redgut Bay 3) occurs on Rainy Lake Indian Reserve 26B (Harris et al. 2004).

IUCN #6.1 Recreational activities

British Columbia

Recreational activities such as all-terrain vehicle use, or by people using the beaches for swimming or boating, results in the threat of direct trampling of plants and/or habitat degradation via disturbance and/or compaction of soils at all locations. The population at Sun-Oka Beach is located within a highly used Provincial Park, though provincial parks staff currently limit access during the growing season (Safford, K. and M. Weston, pers. comm. 2016). A residential development is proposed at the northwest end of Osoyoos Lake that, if approved, may increase recreational use of the beach habitat at the Osoyoos Lake – Willow Beach population.

Ontario

The remaining extant Ontario populations are relatively small, both in number of individuals and area, and are therefore vulnerable to environmental disturbance such as excessive recreational use of shorelines which could alter habitat (COSEWIC 2002; Harris et al. 2004). At the Sandpoint Island and Goose Portage populations on Rainy Lake, which occur in Sandpoint Island Provincial Park, recreational activities are likely to occur and may result in damage to plants (e.g., trampling).

IUCN #2.3 Livestock farming & ranching

British Columbia

Livestock ranching is a threat at the Osoyoos Lake population (#1) that can result in direct trampling of plants and/or habitat degradation via disturbance and/or compaction of soils.

Ontario

Livestock farming and ranching is not a known threat to Small-flowered Lipocarpha populations in Ontario.

IUCN #8. Invasive and other problematic species and genes (8.1 Invasive and non-native/alien species; 8.2 Problematic native species)

British Columbia

Information on this threat is available in the adopted BC recovery strategy (section 4.2).

Ontario

Invasive species may pose a threat to Small-flowered Lipocarpha populations in Ontario. Details on the extent of this threat are currently unknown; however, Small-flowered Lipocarpha is known to be intolerant of competition from other plant species (COSEWIC 2002). Many Ontario populations occur on lakes where water levels are unnaturally regulated. This can allow shrubs, grasses, and other highly competitive and invasive vegetation (e.g., Reed Canarygrass (*Phalaris arundinacea)*, European Common Reed (*Phragmites australis australis*)) to overtake sandy shorelines which provide habitat for Small-flowered Lipocarpha (COSEWIC 2002; Catling and Mitrow 2011; Catling et al 2014).

4. Population and Distribution Objectives

This section replaces “Recovery Goal and Objectives” (section 5) in the BC recovery strategy.

Environment and Climate Change Canada has determined the population and distribution objective for the Small-flowered Lipocarpha to be:

To maintain the distribution, and to maintain or increase the abundance of all known extant populations in BC and Ontario, including any new or re-discovered populations that may be found in the future.

Rationale:

Canadian populations of the Small-flowered Lipocarpha represent the northern distribution limit for this species in North America; occurring in both the southern interior

of BC and in northwestern Ontario. Current recovery efforts focus on maintaining the 14 known extant populations, as it is deemed unlikely that restoration and/or re-introduction at extirpated sites where shoreline developments and/or severe degradation has occurred is biologically or technically feasible. However if additional naturally-occurring populations are discovered or re-discovered, these should also be maintained.

The Small-flowered Lipocarpha was likely always naturally rare within its historical range in Canada. Although threat mitigation may address many of the threats to the species, considering the species' historical distribution, and the limited amount of suitable habitat remaining, it is likely that the species will remain at risk in Canada.

The trend in population size (including direction, rate of change) for all extant populations is unknown; and it is important to note for future monitoring and/or trend estimation purposes that the population size of this annual species may characteristically fluctuate among survey years (Harris et al. 2004), depending on habitat suitability. Banked seeds may persist in the substrate for years, and the current abundance and potential viability of seeds at extant and extirpated sites is unknown. Specific targets for sustainable population numbers are therefore difficult to identify reliably. Where the best available information and/or long-term monitoring indicates overall population decline, deliberate attempts to increase abundance (e.g., through seeding, translocation of plants or change in land use management) should be considered. Additionally, a regular assessment of threats (e.g., water level management, shoreline development) and potential mitigation measures will be important in evaluating the recovery of this species.

5. Broad Strategies and General Approaches to Meet Objectives

5.1 Actions Already Completed or Currently Underway

The BC recovery strategy (section 6.1) provides detailed information on recovery actions that were completed or underway at the time publication (2011). Since that time, additional inventory/monitoring work has been completed by Terry McIntosh at Osoyoos Lake and Okanagan Lake (i.e., surveys of known sites and suitable habitat, in 2015-2016).

Information on actions completed in Ontario for the purpose of meeting recovery objectives identified in this recovery strategy is provided below (Table 4).

Table 4. Recovery-related Small-flowered Lipocarpha work completed in Ontario, as of 2016.

Purpose	Project	Recovery-related Action(s)
Inventory & monitoring	Harris et al. (2004)	The Sable Islands site was surveyed informally in 1998, 2002, 2003, and the Poundnet Bay site was surveyed in 1999 and 2000. Additional surveys for the Small-flowered Lipocarpha were conducted in 2003 during exceptionally low water levels at sites in Lake of the Woods and Rainy Lake.
Habitat Protection	Ontario Parks (2012)	Sandpoint Island, Goose Portage, Poundnet Bay, Sable Islands, Tide Lake in Ontario are secured within provincial parks or conservation reserves. The remaining populations are currently secured through stewardship by private landowners or management agencies. The Interim Park Management Statement for Sandpoint Island Provincial Park (2012) states that the use of all-terrain vehicles will not be permitted, park development will not be considered until park management plan is complete, and invasive species management will be implemented as necessary. This will potentially reduce threats to the Small-flowered Lipocarpha. Additionally, Small-flowered Lipocarpha is specifically mentioned in the statement and will be protected within the park.
Threat Mitigation	Harris et al. (2004)	Rule curve changes were implemented in 2000 on the Rainy Lake – Namakan Reservoir system toward restoring a more natural water level regime, addressing one of the significant threats to the Small-flowered Lipocarpha.
Inventory & monitoring	Smith (2016)	An identification key to the Cyperaceae of Ontario has been developed, which should facilitate broader survey and monitoring work as species in the sedge family are often difficult for non-experts to identify.
Research	International Joint Commision (ongoing)	The International Joint Commision is currently evaluating whether changes are needed to the current (2000) rule curves for the Rainy-Namakan chain of lakes. A study board has been appointed to complete the evaluation and is expected to submit its final report by March 31 2017. Over 20 studies have been completed to assess environmental and economic impacts of changing the current rule curve. These studies may assist in assessing the impacts of water level management on Small-flowered Lipocarpha as detailed bathymetric data has been collected, and hydrodynamic models have been developed for the system.

5.2 Strategic Direction for Recovery

The BC recovery strategy provides a recovery planning table for British Columbia (section 6.2, Table 3 of that document). Table 5 (below) is included to provide strategic direction for recovery planning in Ontario.

Table 5. Recovery planning table for the Small-flowered Lipocarpha in Ontario. Threats are according to the IUCN-CMP classification (refer to Table 3).

Threat or Limitation	Priority[a]	Broad Strategy to Recovery	General Description of Research and Management Approaches
1.3, 6.1, 7.2, 8.1, 8.2, Knowledge Gaps	Essential	Survey and monitor habitat and populations; Protect, manage, and where appropriate restore habitat	• Confirm the distribution of the Small-flowered Lipocarpha in Ontario by revisiting known sites during low water level years to determine number of occupied sites, number of plants and area of occupancy; as well as search for new sites • Determine physical habitat attributes of known sites with regard to substrate and moisture conditions; monitor any changes in habitat • Assess and mitigate the extent of the main threats (shoreline development, dams and water management/use, invasive non-native species, recreational use of habitat) to all Ontario populations • Identify sites suitable for restoration and determine feasibility of restoration; implement restoration activities, if deemed appropriate • If changes are made to the current (2000) rule curves following the evaluation of the Rainy-Namakan chain of lakes, monitor for any positive or negative impacts on the species.
7.2, Knowledge Gaps	Necessary	Conduct research activities	• Investigate seed production, seed bank germination rates and longevity, seed dispersal mechanisms, and seedling and juvenile development • Conduct research on the hydrologic processes and optimum water regime necessary for the Small-flowered Lipocarpha, particularly the frequency, duration, and degree of low water level events required to sustain habitat and populations • Further understanding of Small-flowered Lipocarpha metapopulation dynamics
1.3, 6.1, 7.2, Knowledge Gaps	Necessary	Conduct stewardship activities	• Continue to work with Ontario Parks to steward and manage lands for persistence of the species • Ensure Small-flowered Lipocarpha is considered in water level planning on Lake of the Woods and Rainy Lake • Work with the appropriate organizations (e.g., Lake of the Woods Control Board, International Rainy Lake Board of Control, International Joint Commission, local hydropower operators) to provide input to water management plans on waterbodies with known Small-flowered Lipocarpha populations in Ontario and to restore a more natural flow regime to Rainy Lake, Lake of the Woods, and the English River

[a] "Priority" reflects the degree to which the approach contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species. Priority is characterized as essential (urgent and important, needs to start immediately), necessary (important but not urgent, action can start in 2-5 years), or beneficial (action would be beneficial at any time that it was feasible to start).

5.3 Narrative to Support the Recovery Planning Table

The BC recovery strategy (section 6.3 of that document) provides a narrative to support the recovery planning table for British Columbia. The information below provides narrative to support the recovery planning table for Ontario.

As the species has not been surveyed in Ontario in over a decade, monitoring of Small-flowered Lipocarpha population trends and habitat status, including water level monitoring, should be completed at extant populations. Successful monitoring will depend on surveying the populations at the right times of year as well as during low water levels (e.g., late summer to early fall), at appropriate intervals of time (e.g., over 2-3 years, as the number of plants can be highly variable depending on annual survey timing as well as between years), and taking regular water level readings at each occurrence. Monitoring should also be conducted to determine the habitat requirements (e.g., soil texture, substrate, moisture), and suitable water level regime for Small-flowered Lipocarpha. Additionally, monitoring is required to assess the extent and effects of known threats such as water management/use, invasive species encroachment, recreational use of habitat, and shoreline development.

Research is required to determine if/when restoration is needed at extant populations. This includes conducting research on the physical habitat requirements of Small-flowered Lipocarpha, seed production, seed bank germination rates and longevity, seed dispersal mechanisms, and seedling and juvenile development.

It is important to secure long-term protection for all known populations of Small-flowered Lipocarpha in Ontario. The populations occurring at Sandpoint Island, Goose Portage, Poundnet Bay, Sable Islands, and Tide Lake are located within provincial parks or conservation reserves, and continued collaboration with Ontario Parks is needed to manage lands containing Small-flowered Lipocarpha. With respect to the remaining populations, stewardship initiatives have been initiated with private landowners or management agencies. As the use of dams and water level management is one of the main threats to the species, collaboration among organizations such as the Lake of the Woods Control Board, International Rainy Lake Board of Control, International Joint Commission, and local hydropower operators is required to provide input on water level planning, and to work towards restoring a more natural flow regime to waterbodies on which Small-flowered Lipocarpha occurs. Communication among these organizations is necessary to ensure that the species' needs are considered with respect to lake level management changes. Additionally, research and monitoring should be undertaken to investigate the optimum water regime necessary for the Small-flowered Lipocarpha to persist, prior to recommending any potential changes to existing rule curves and water level management practices at several populations if required.

6. Critical Habitat

This section replaces “Information on Habitat Needed to Meet Recovery Goal” (section 7.0) in the BC recovery strategy.

6.1 Identification of the Species’ Critical Habitat

Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species’ critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. The BC recovery strategy for Small-flowered Lipocarpha includes a description of the species’ habitat requirements. This science advice was used to inform the following critical habitat sections in this federal recovery strategy.

Critical habitat for the Small-flowered Lipocarpha is identified in this document to the extent possible; as responsible jurisdictions and/or other interested parties conduct research to address knowledge gaps, the existing critical habitat methodology and identification may be modified and/or refined to reflect new knowledge.

Critical habitat is partially identified in this recovery strategy. A schedule of studies (Section 6.2) has been established to provide the information necessary to complete the identification of critical habitat needed to meet the population and distribution objectives. The identification of critical habitat will be updated when the information becomes available, either in a revised recovery strategy or action plan(s).

Geospatial location of areas containing critical habitat

Critical habitat for the Small-flowered Lipocarpha is identified for 13 extant populations: 2 in British Columbia (Figures 1-2) and 11 in Ontario (Figures 3-8; Table 6).

The area containing critical habitat for the Small-flowered Lipocarpha is based on three additive components: (1) the areas occupied by individual plants or patches of plants within the past 25 years[8], including the associated potential location error from Global Positioning System (GPS) units (ranging up to 100 m uncertainty distance) around observations; and, (2) a 50 m distance (i.e., critical function zone distance[9]) to encompass immediately adjacent areas required for the persistence of local populations; and (3) the entire portion of distinct ecological features[10] which are

[8] Where habitat retains the potential to support an occurrence (either currently and/or through restoration efforts). “Areas occupied” are determined by best available point and/or occurrence polygon information (e.g., provincial element occurrence data and other reports).
[9] Critical function zone distance has been defined as the threshold habitat fragment size required for maintaining constituent microhabitat properties for a species (e.g., critical light, moisture, humidity levels necessary for survival). Existing research provides a logical basis for suggesting a minimum critical function zone distance of 50 m for rare plant species occurrences (see: http://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=6A845288-1%20-%20_Toc285808423#_Toc285808423; Appendix 1).
[10] “Distinct” ecological, or landscape features are here referred to as those that are distinguishable at a landscape scale (through use of detailed ecosystem mapping or aerial photos), which, at that scale, appear as ecologically

associated with, and are integral to, Small-flowered Lipocarpha individual plants or patches of plants.

Biophysical attributes of critical habitat

Habitat needs for Small-flowered Lipocarpha are known only generally. Habitat types that are known to support the species include low dunes, swales, and shorelines of lakes and waterways that have natural flooding regimes, and soil of either mud, or coarse sand. These general habitat types are comprised by a suite of ecological properties that overlap to provide suitable habitat for Small-flowered Lipocarpha. The biophysical attributes of critical habitat for the Small-flowered Lipocarpha therefore include all of the vegetation (composition and abundance of plant species), substrates, and related hydrological properties that comprise the habitat types described above, within the geospatial areas identified as containing critical habitat.

The areas containing critical habitat for the Small-flowered Lipocarpha are presented in Figures 1-8. The shaded yellow polygons (units) shown on maps represent identified critical habitat, excepting only those features that clearly do not meet the needs of the species. These include: (i) existing anthropogenic features (e.g. paved roads, dock structures), (ii) submerged areas below the lowest recorded water level of waterbodies, and (iii) areas dominated by woody vegetation (trees, shrubs) and/or large perennials. These features do not possess the biophysical attributes required by the Small-flowered Lipocarpha and they are not identified as critical habitat.

The 1 km x 1 km UTM grid overlay shown on maps is a standardized national grid system that highlights the general geographic area containing critical habitat, for land use planning and/or environmental assessment purposes. More detailed information on the location of critical habitat to support protection of the species and its habitat in Ontario (Figures 3-8, Table 6) may be requested by contacting Environment and Climate Change Canada's Recovery Planning section at: ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

contiguous features with relatively distinct boundaries, and which comprise the context for a species occurrence. Distinct ecological features identified as critical habitat for Small-flowered Lipocarpha include: open, sandy, freshwater seasonally-flooded shorelines (down to the lowest documented water level), as well as the associated draw-down zone (area between maximum and minimum seasonal water levels) adjacent to shorelines. Small-flowered Lipocarpha has been identified at a “site” level scale (1:15,000 scale of reference).

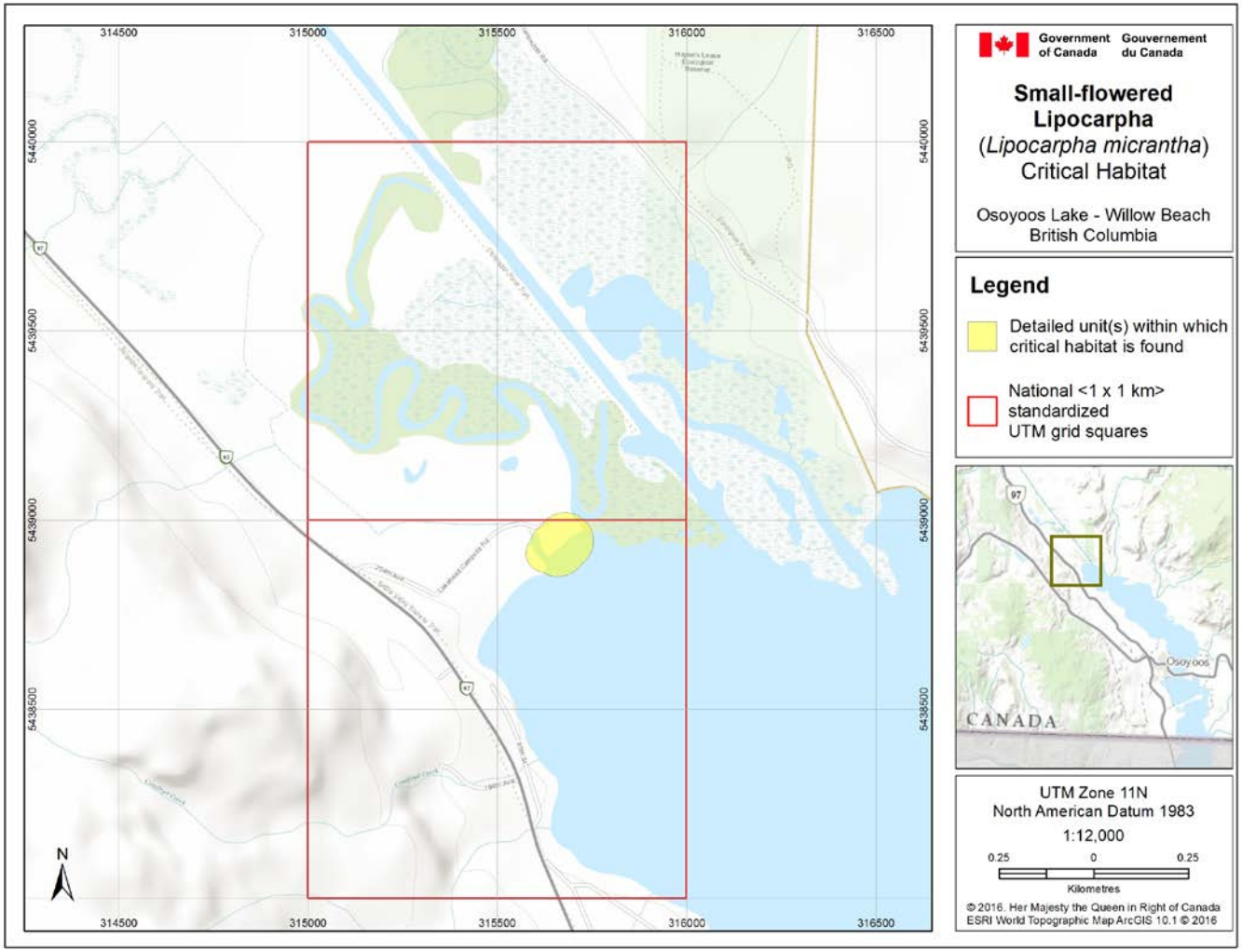


Figure 1. Critical habitat for the Small-flowered Lipocarpha at Osoyoos Lake - Willow Beach, BC is represented by the yellow shaded polygons, except where clearly unsuitable habitats (as described in Section 6.1) occur. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygons do not contain critical habitat.

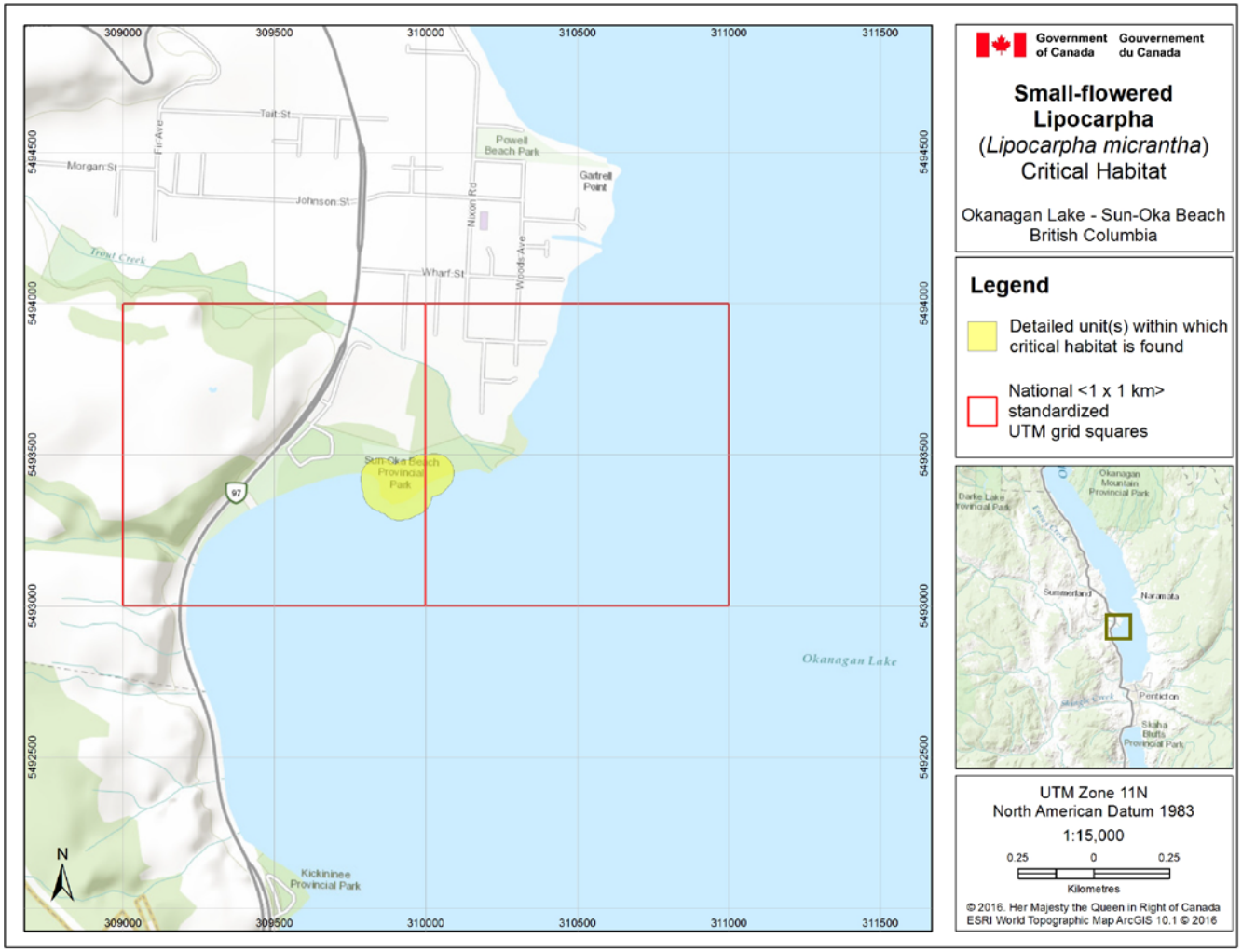


Figure 2. Critical habitat for the Small-flowered Lipocarpha at Okanagan Lake - Sun Oka Beach, BC is represented by the yellow shaded polygons, except where clearly unsuitable habitats (as described in Section 6.1) occur. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygons do not contain

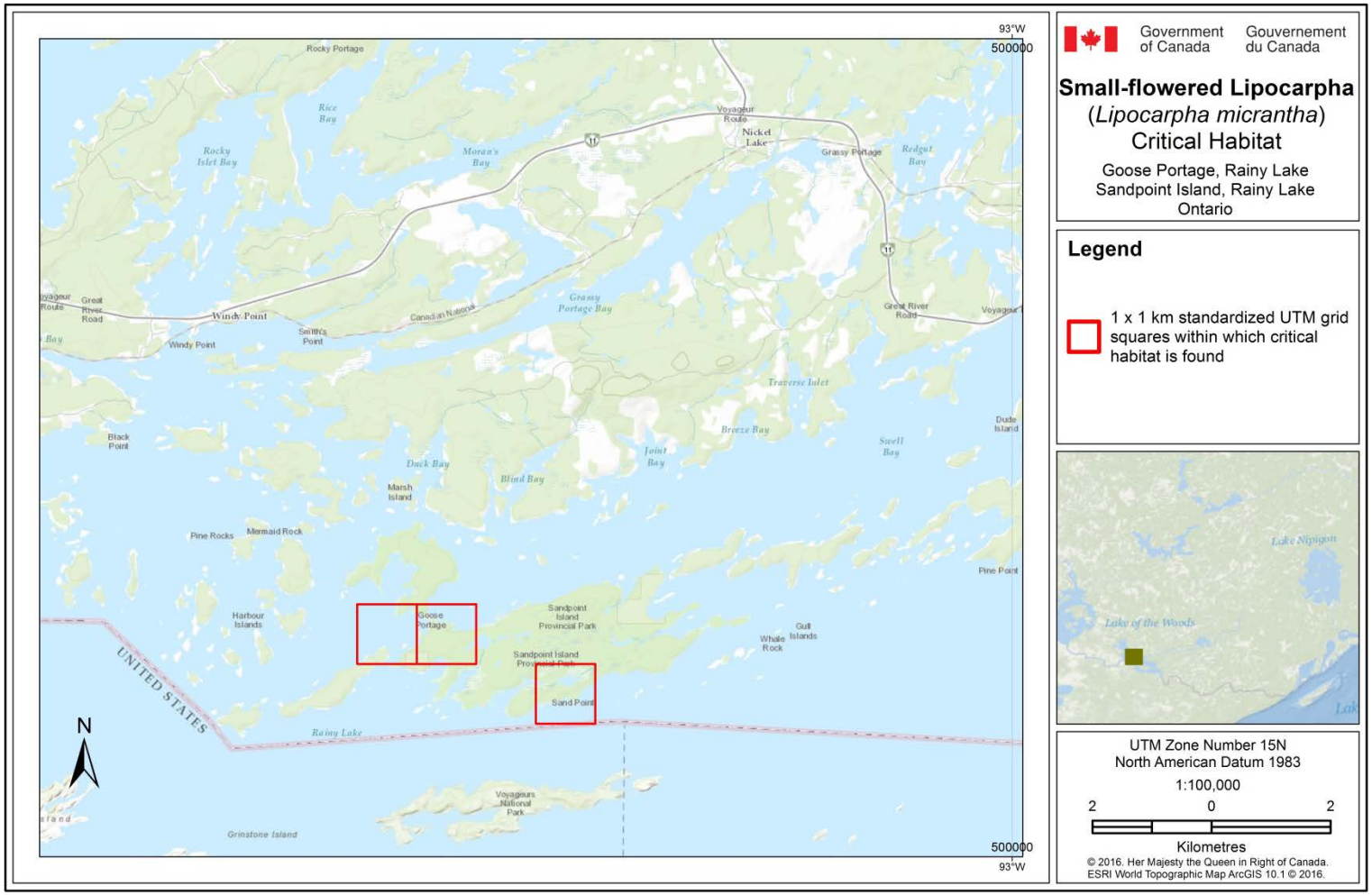


Figure 3. Critical habitat for the Small-flowered Lipocarpha at Goose Portage and Sandpoint Island, Rainy Lake ON occurs within the 1 x 1 km standardized UTM grid squares where the criteria described in section 6.1 are met. This standardized national grid system indicates the general geographic area within which critical habitat is found; detailed critical habitat mapping is not shown.

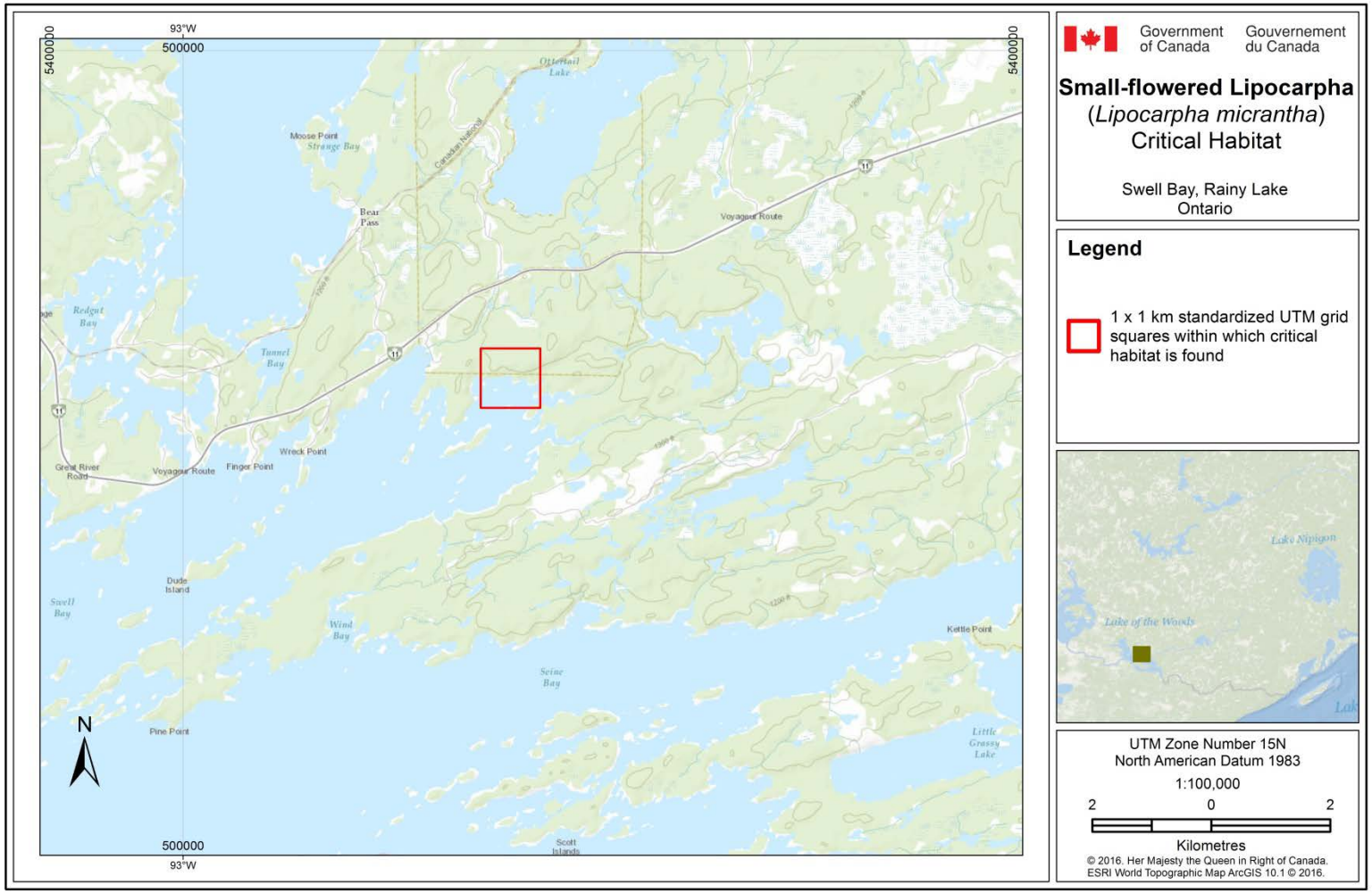


Figure 4. Critical habitat for the Small-flowered Lipocarpha at Swell Bay, Rainy Lake ON occurs within the 1 x 1 km standardized UTM grid squares where the criteria described in section 6.1 are met. This standardized national grid system indicates the general geographic area within which critical habitat is found; detailed critical habitat mapping is not shown.

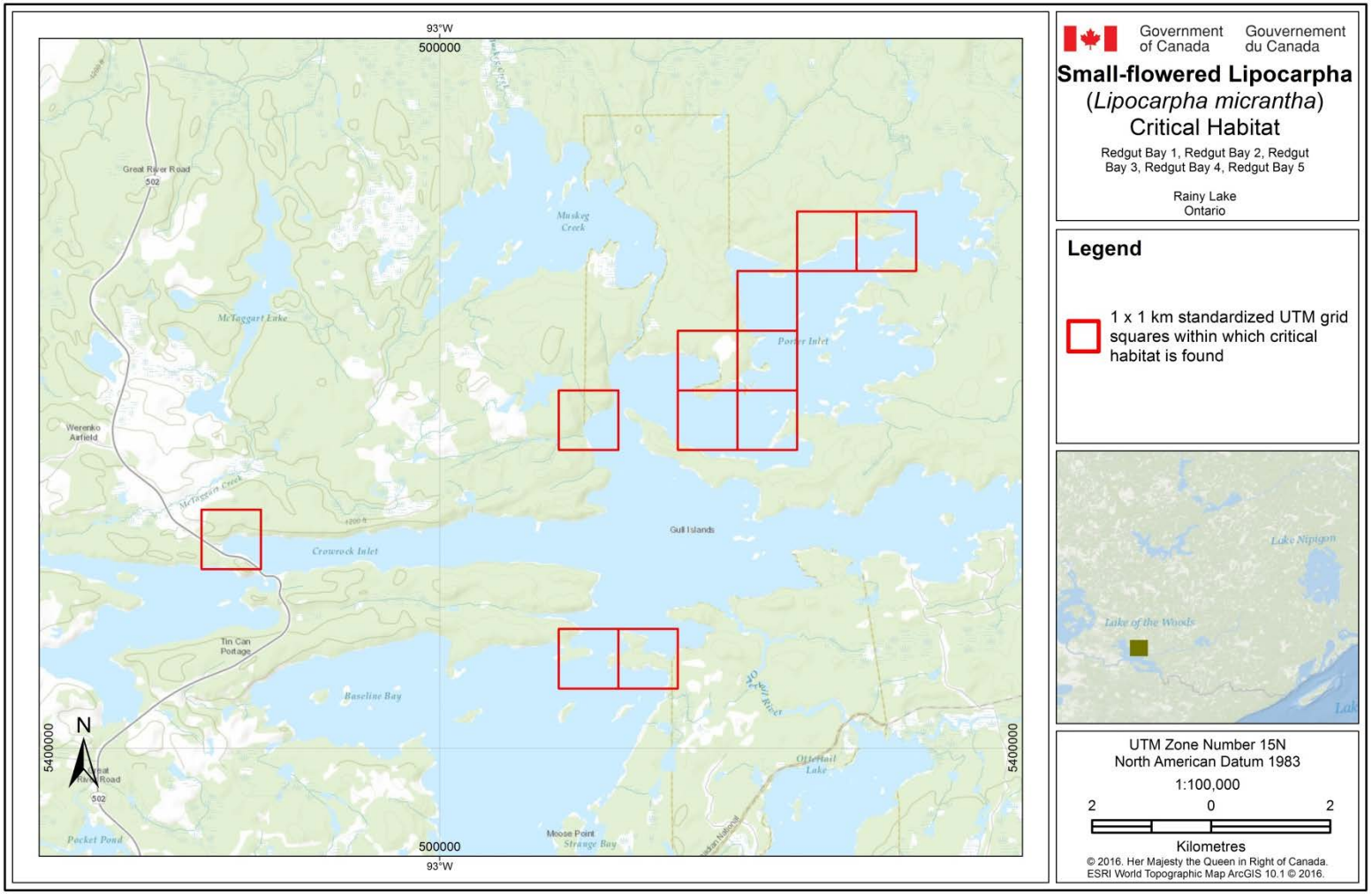


Figure 5. Critical habitat for the Small-flowered Lipocarpha at Redgut Bay 1, Redgut Bay 2, Redgut Bay 3, Redgut Bay 4, and Redgut Bay 5, Rainy Lake ON occurs within the 1 x 1 km standardized UTM grid squares where the criteria described in section 6.1 are met. This standardized national grid system indicates the general geographic area within which critical habitat is found; detailed critical habitat mapping is not shown.

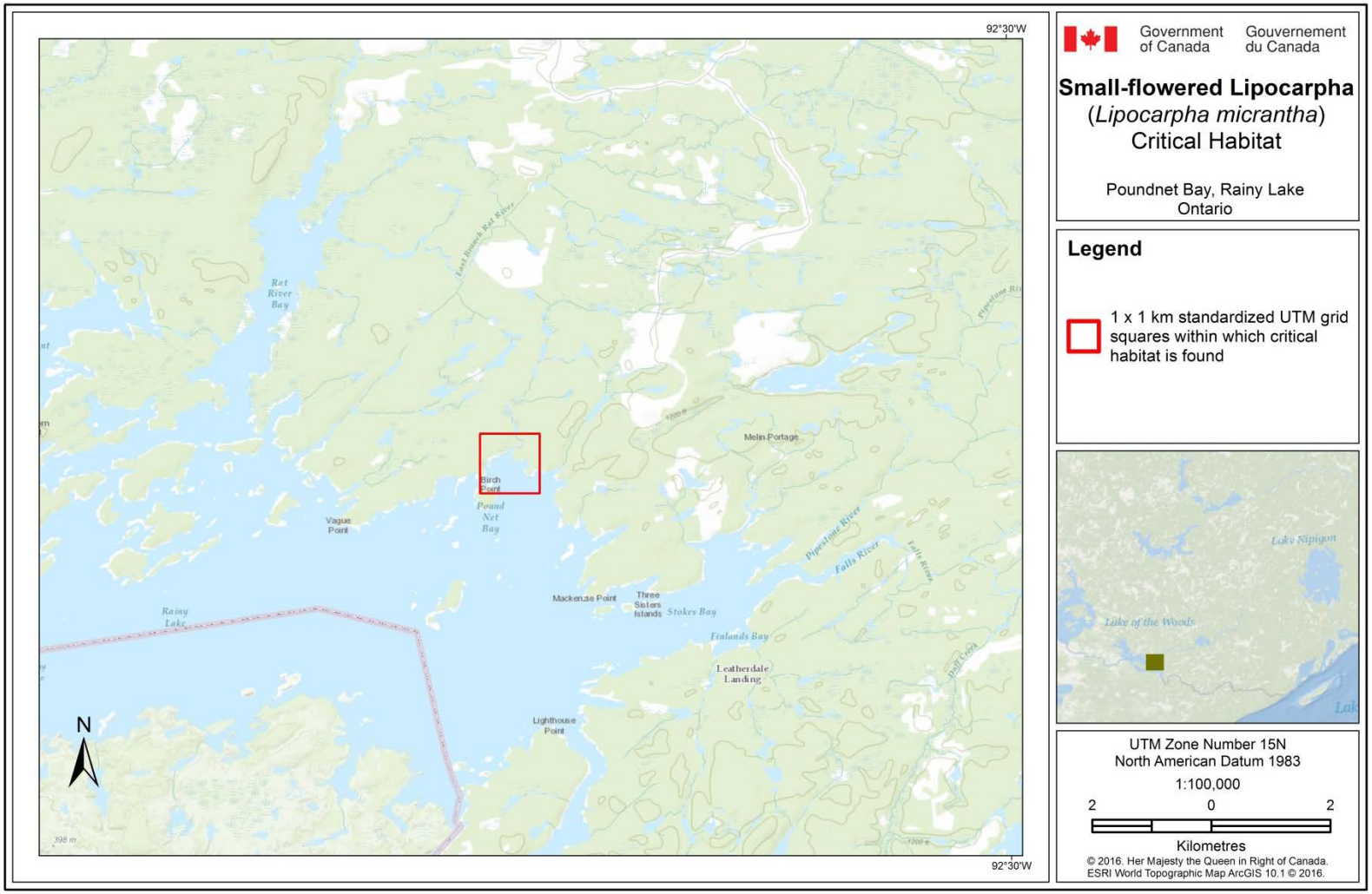


Figure 6. Critical habitat for the Small-flowered Lipocarpha at Poundnet Bay, Rainy Lake ON occurs within the 1 x 1 km standardized UTM grid squares where the criteria described in section 6.1 are met. This standardized national grid system indicates the general geographic area within which critical habitat is found; detailed critical habitat mapping is not shown.

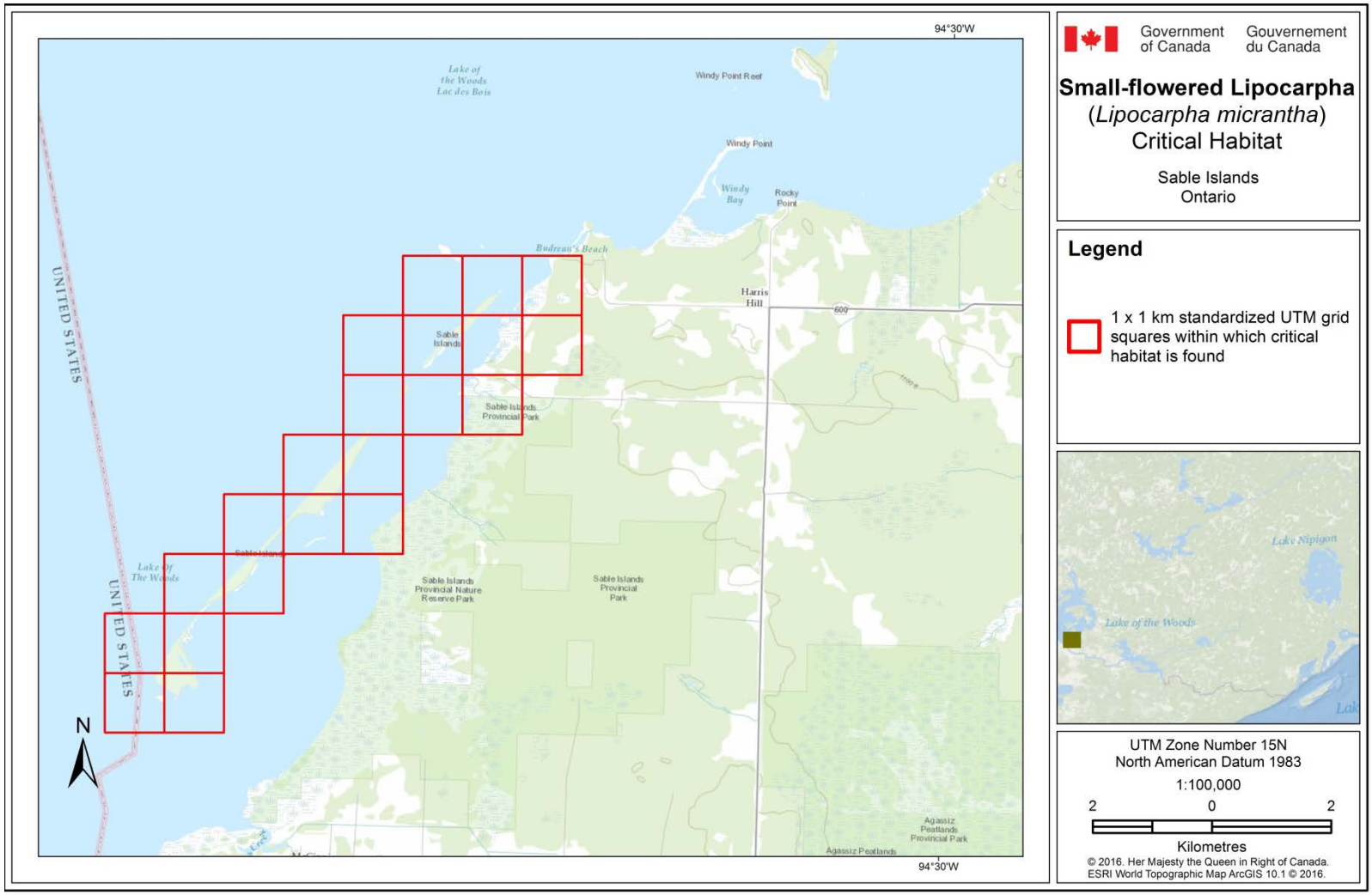


Figure 7. Critical habitat for the Small-flowered Lipocarpha at Sable Islands, ON occurs within the 1 x 1 km standardized UTM grid squares where the criteria described in section 6.1 are met. This standardized national grid system indicates the general geographic area within which critical habitat is found; detailed critical habitat mapping is not shown.

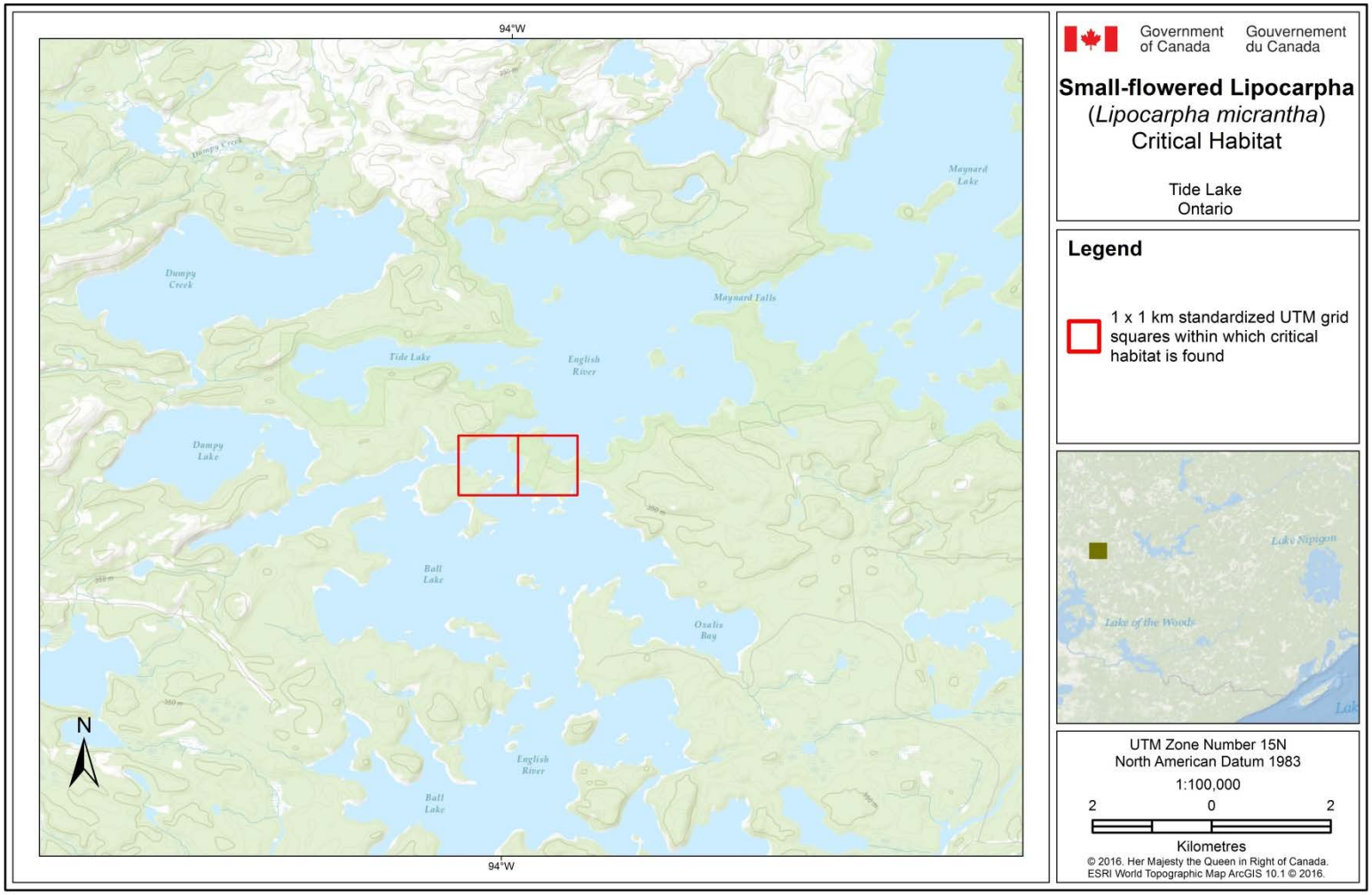


Figure 8. Critical habitat for the Small-flowered Lipocarpha at Tide Lake, ON occurs within the 1 x 1 km standardized UTM grid squares where the criteria described in section 6.1 are met. This standardized national grid system indicates the general geographic area within which critical habitat is found; detailed critical habitat mapping is not shown.

Table 6. Grid squares that contain critical habitat for the Small-flowered Lipocarpha in Ontario. Critical habitat for the Small-flowered Lipocarpha occurs within these 1 x1 km UTM grid squares where the criteria described in section 6.1 are met.

Population	1 x 1 km Standardized UTM grid square ID[1]	UTM Grid Square Coordinates[2]		Land Tenure[3]
		Easting	Northing	
Sable Islands	15UUQ7165	376000	5415000	Non-Federal land
	15UUQ7166	376000	5416000	Non-Federal land
	15UUQ7175	377000	5415000	Non-Federal land
	15UUQ7176	377000	5416000	Non-Federal land
	15UUQ7177	377000	5417000	Non-Federal land
	15UUQ7187	378000	5417000	Non-Federal land
	15UUQ7188	378000	5418000	Non-Federal land
	15UUQ7198	379000	5418000	Non-Federal land
	15UUQ7199	379000	5419000	Non-Federal land
	15UUQ8108	380000	5418000	Non-Federal land
	15UUQ8109	380000	5419000	Non-Federal land
	15UUQ8200	380000	5420000	Non-Federal land
	15UUQ8201	380000	5421000	Non-Federal land
	15UUQ8210	381000	5420000	Non-Federal land
	15UUQ8211	381000	5421000	Non-Federal land
	15UUQ8212	381000	5422000	Non-Federal land
	15UUQ8220	382000	5420000	Non-Federal land
	15UUQ8221	382000	5421000	Non-Federal land
	15UUQ8222	382000	5422000	Non-Federal land
	15UUQ8231	383000	5421000	Non-Federal land
	15UUQ8232	383000	5422000	Non-Federal land
Goose Portage	15UVP8897	489000	5387000	Non-Federal land
	15UVP9807	490000	5387000	Non-Federal land
Sandpoint Island, Rainy Lake	15UVP9826	492000	5386000	Non-Federal land
Redgut Bay 1, Rainy Lake	15UVQ9063	496000	5403000	Non-Federal land
Tide Lake	15UVR2784	428000	5574000	Non-Federal land
	15UVR2794	429000	5574000	Non-Federal land
Swell Bay, Rainy Lake	15UWP0954	505000	5394000	Federal Land
Poundnet Bay	15UWP2789	528000	5379000	Non-Federal land
Redgut Bay 2, Rainy Lake	15UWQ0025	502000	5405000	Federal Land
Redgut Bay 5, Rainy Lake	15UWQ0021	502000	5401000	Non-Federal land
	15UWQ0031	503000	5401000	Non-Federal land
Redgut Bay 3, Rainy Lake	15UWQ0045	504000	5405000	Federal Land
	15UWQ0046	504000	5406000	Federal Land
	15UWQ0055	505000	5405000	Federal Land
	15UWQ0056	505000	5406000	Federal Land
	15UWQ0057	505000	5407000	Federal Land
Redgut Bay 4, Rainy Lake	15UWQ0068	506000	5408000	Non-Federal land
	15UWQ0078	507000	5408000	Non-Federal land

[1] Based on the standard UTM Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789), where the first 2 digits and letter represent the UTM Zone, the following 2 letters indicate the 100 x 100 km standardized UTM grid followed by 2 digits to represent the 10 x 10 km standardized UTM grid. The last 2 digits represent the 1 x 1 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See http://www.bsc-eoc.org/ for more information on breeding bird atlases).

[2] The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 1 x 1 km standardized UTM grid square containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.

[3] Land tenure is provided as an approximation of the types of land ownership that exist at the critical habitat units and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

6.2 Schedule of Studies to Identify Critical Habitat

This section replaces Section 7.2 “Studies Needed to Describe Survival/Recovery Habitat” in the BC recovery strategy.

The following schedule of studies (Table 7) outlines the activities required to complete the identification of critical habitat for the Small-flowered Lipocarpha in Canada.

Table 7. Schedule of studies to identify critical habitat.

Description of Activity	Outcome/Rationale	Timeline
Work with applicable organizations to complete identification of Small-flowered Lipocarpha occurring at Osoyoos Lake (#1), BC.	Further work is required to identify critical habitat for a this population. This activity is required such that sufficient critical habitat is identified to meet the population and distribution objectives.	2017 - 2022

6.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by Small-flowered Lipocarpha. Destruction may result from a single or multiple activities at one point in time, or from the cumulative effects of one or more activities over time. Activities described in Table 8 include those likely to cause destruction of critical habitat for Small-flowered Lipocarpha, however, destructive activities are not limited to those listed.

The BC recovery strategy contains a section describing specific human activities likely to damage survival/recovery habitat. This science advice was used to inform the description of activities likely to result in the destruction of critical habitat in this federal recovery strategy.

Table 8. Activities likely to result in the destruction of critical habitat for the Small-flowered Lipocarpha. IUCN Threat numbers are in accordance with the IUCN-CMP (International Union for Conservation of Nature –Conservation Measures Partnership) unified threats classification system (CMP 2010).

Description of Activity	Description of effect (biophysical attribute or other) in relation to habitat function loss	Details and relationship to identified threats
Destruction of natural shoreline, including: − Shoreline development (e.g., building docks, boat houses, sheds, or the installation or construction of any other type of infrastructure) − Beach maintenance (e.g., infilling with foreign substrates, raking) or the deliberate introduction of plants (e.g., lawn or garden creation) − Agricultural activities (livestock use)	Results in habitat loss by removal, compaction, and/or covering of seed bank and natural substratum required for growth, or changing other required components of habitat (such as hydrology/drainage) to the extent that it is unsuitable for Small-flowered Lipocarpha.	Related IUCN-CMP threat #1.3, 2.3, 8.1, 8.2 **BC:** Many portions of the shoreline along Osoyoos Lake are threatened by further development and/or trampling from cattle grazing. These activities can result in direct destruction of critical habitat individually, or can act cumulatively to destroy critical habitat.
Recreational use of the landscape that results in significant adverse effects[a], including the use of motorized vehicles (all-terrain vehicles) at any time, intensive foot traffic, and/or boat dragging	Causes destruction of critical habitat via disturbance and/or compaction of soils to the extent that it is no longer suitable for Small-flowered Lipocarpha (growing plants and/or seed germination). May also cause destruction by increasing invasive plant introduction/encroachment.	Related IUCN-CMP threat #6.1, 8.1 **BC:** Recreational use at beaches is a threat at all locations in BC. **ON:** Sandpoint Island, Rainy Lake (#5), Goose Portage, Rainy Lake (#6) Significant adverse effects are more likely if these activities occur during the growing season (early summer to late fall).
Inappropriate water level control (e.g., via human management of outlet dams) for flood control, drinking water or irrigation purposes, causing water level stabilization and/or abnormal fluctuations	Results in suppression of natural flood/drought cycles and water level regimes such that hydrological patterns and processes are beyond the biological tolerance range of Small-flowered Lipocarpha. If water levels are artificially maintained at too-high or too-low levels, or are prevented from fluctuating the required amounts at appropriate times, this will prevent successful completion of one or more life history stages, i.e., germination, growth, and/or flowering. Also, changes in natural flood/drought cycles can result in an altered disturbance regime such that ecological succession is facilitated (e.g., the area becomes grown-in with woody plants), to the extent that habitat is no longer suitable for Small-flowered Lipocarpha.	Related IUCN-CMP threat #7.2 **BC:** Osoyoos Lake water levels are controlled by a downstream dam in the United States and water levels are set by the International Osoyoos Lake Board of Control established by Order of the International Joint Commission. Okanagan Lake water levels are also managed. **ON:** Unnatural water level management is a threat at all locations in Ontario.

[a] Significant adverse effects are those that negatively impact the species' survival and recovery. Success of the species' survival and recovery will be assessed by the population and distribution objective, and the associated performance measures set out in this document, that: the distribution and abundance of Small-flowered Lipocarpha has been maintained, i.e., population size and extent of occurrence or area of occupancy at each site is stable and/or increasing.

7. Measuring Progress

This section replaces “Performance Measures” (section 8) in the BC recovery strategy.

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives:

- The distribution of the Small-flowered Lipocarpha in Canada has been maintained (i.e., extent of occurrence has not decreased); and,
- The abundance of the Small-flowered Lipocarpha in Canada has been maintained (i.e., population sizes have not decreased).

Measurements of population size (as measured during peak flowering times) should allow for annual variation in numbers of flowering plants and related variation in annual monitoring results, i.e., trends in annual estimates are to be evaluated over the course of a longer time period, for example, over a five year interval.

8. Statement on Action Plans

One or more action plans for Small-flowered Lipocarpha will be posted on the Species at Risk Public Registry by 2022.

9. Effects on the Environment and Other Species

This section replaces “Effects on Other Species” (section 9) in the BC recovery strategy.

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*[11]. 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 and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy’s[12] (FSDS) goals and targets.

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 in this statement.

[11] www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[12] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1

The Small-flowered Lipocarpha occurs in the southern interior of BC, and the critical habitat identified for the species here is known to overlap with occurrences of other shoreline plants in the area that are characterized as species at risk. For example, the SARA Schedule 1 plant species Scarlet Ammannia (*Ammannia robusta*), Toothcup (*Rotala ramosior*), Short-rayed Alkali Aster (*Symphyotrichum frondosum)* and Bent Spike-rush (*Eleocharis geniculata*) also occur at Osoyoos Lake in the Okanagan Valley. The provincially listed (BC) rare plants Awned Cyperus (*Cyperus squarrosus*), Thyme-leaved Spurge (*Chamaesyce serpyllifolia* ssp. *serpyllifolia*), and Beaked Spike-rush (*Eleocharis rostellata*) are known to co-occur in these areas as well. In Ontario, Western Silvery Aster (*Symphyotrichum sericeum)*, a designated Threatened plant species on Schedule 1 of SARA also occurs at Lake of the Woods. Additionally, the endangered Piping Plover (*Charadrius melodus circumcinctus*) is known to breed along shores in the Lake of the Woods area, and other federally-listed species at risk such as Golden-winged Warbler (*Vermivora chrysoptera*), Wood Thrush (*Hylocichla mustelina)*, Eastern Meadowlark (*Sturnella magna*) are known to occur in the area as well. Holiday Beach is also known as a breeding area for the Prothonotary Warbler (*Protonotaria citrea*) which is listed as Endangered on Schedule 1 of SARA and provides habitat for several raptor species including the Peregrine Falcon (*Falco peregrinus*) and Red-shouldered Hawk (*Buteo lineatus*).

The proposed recovery approaches are not expected to negatively affect any other native species of concern. The recommended habitat protection will indirectly benefit other species, including species at risk in the area. Increased public education and awareness may limit harmful recreational activities at these locations, and proper management of invasive species may restore habitat for other plant species at risk. In acknowledgement of the high potential for shared habitat among local species at risk, large-scale management actions, such as invasive species removal or the use of herbicides, should be planned and implemented carefully. All on-site activities (surveys, research, and management) to aid recovery of the Small-flowered Lipocarpha may potentially pose a threat to co-occurring species at risk (e.g., via trampling, increased herbivory as a consequence of animals using human-made trails, or inadvertent dispersal of alien species during disposal), unless care is taken to avoid damage.

10. References

BC Conservation Framework. 2015. Conservation Framework Summary: *Lipocarpha micrantha*. BC Ministry of the Environment. Available: http://a100.gov.bc.ca/pub/eswp/. [Accessed December, 2015]

Catling, P.M. and G. Mitrow. 2011. Major invasive alien plants of natural habitats in Canada. 1. European Common Reed, *Phragmites australis* (Cav.) Trin. Ex Steud. Subsp. *australis*., Canadian Botanical Association Bulletin, 44(2): 52-61.

Catling, P.M., G., Mitrow, and A. Ward. 2014. Major invasive alien plants of natural habitats in Canada, 9. Reed Canarygrass, Phalaris Roseau: *Phalaris arundinacea* L. Canadian Botanical Association Bulletin, 47(1): 25-34.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2002. COSEWIC assessment and update status report on the small-flowered lipocarpha Lipocarpha micrantha in Canada. Ottawa, ON. vi + 16 pp.

CMP (Conservation Measures Partnership). 2010. Threats Taxonomy. Available: http://www.conservationmeasures.org/initiatives/threats-actions-taxonomies/threats-taxonomy.

Harris, A.G. R. F. Foster, G.W. Douglas and S.J. Smith. 2004. National recovery strategy for small-flowered lipocarpha (*Lipocarpha micrantha*) in Canada. Report prepared for the Ontario Ministry of Natural Resources, Northwest Region, Thunder Bay and British Columbia Ministry of Water, Lands and Air Protection, Biodiversity Branch. 25 pp.

NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available: http://www.natureserve.org/explorer. [Accessed December 2015].

Ontario Natural Heritage Information Centre. 2016. Element Summary Report for *Lipocarpha micrantha* Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario. Available: http://www.biodiversityexplorer.mnr.gov.on.ca/nhicWEB/nhicIndex.jsp [accessed January 2016].

Ontario Parks. 2012. Sandpoint Island Provincial Park (P2589) Interim Management Statement. Available:http://files.ontario.ca/environment-and-energy/parks-and-protected-areas/mnr_bpp0131.pdf [Accessed May 2016]

Safford, K. and M. Weston, pers. comm. 2016. B.C. Parks. Personal communication with Kella Sadler.

Smith, T. W., G. Douglas and A. Harris. 2001. Update COSEWIC Status Report on Small-Flowered Lipocarpha *Lipocarpha micrantha.* Interim report, submitted Sept. 2001. Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa, Ontario. 24 pp.

Smith, T. W., G. W. Douglas and A. G. Harris. 2004. Conservation Evaluation of Small-flowered Lipocarpha, *Lipocarpha micrantha* (Cyperaceae) in Canada. Canadian Field-Naturalist 118:179-184.

Smith, T. 2016. Keys to the Cyperaceae of Ontario. [PDF file] Available: http://plantarum.ca/assets/docs/OntarioCyperaceae.pdf [Accessed December 2016].

Part 2 – *Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia*, prepared by the Ministry of Environment

Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia



Prepared by Ministry of Environment

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

July 2011

About the British Columbia Recovery Strategy Series

This series presents the recovery strategies that are prepared as advice to the Province of British Columbia on the general strategic approach required to recover species at risk. Recovery strategies are prepared in accordance with the priorities and management actions assigned under the British Columbia Conservation Framework. The Province prepares recovery strategies to ensure coordinated conservation actions and meet its commitments to recover species at risk under the *Accord for the Protection of Species at Risk in Canada*, and the *Canada – British Columbia Agreement on Species at Risk.*

What is recovery?

Species at risk recovery is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a recovery strategy?

A recovery strategy summarizes the best available science-based knowledge of a species or ecosystem to identify goals, objectives, and strategic approaches that provide a coordinated direction for recovery. These documents outline what is and what is not known about a species or ecosystem, identify threats to the species or ecosystem, and what should be done to mitigate those threats.

Recovery strategies are usually prepared by a recovery team with members from agencies responsible for the management of the species or ecosystem, experts from other agencies, universities, conservation groups, aboriginal groups, and stakeholder groups as appropriate.

For more information

To learn more about species at risk recovery in British Columbia, please visit the Ministry of Environment Recovery Planning webpage at:
<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

To learn more about the British Columbia Conservation Framework, please visit the Ministry of Environment Conservation Framework webpage at:
< http://www.env.gov.bc.ca/conservationframework/>

Recovery Strategy for Small-flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia

Prepared by Ministry of Environment

July 2011

Recommended citation

Ministry of Environment. 2011. Recovery strategy for small-flowered lipocarpha (*Lipocarpha micrantha*) in British Columbia. B.C. Ministry of Environment, Victoria, BC. 17 pp.

Cover illustration/photograph

Photograph by Terry McIntosh (with permission)

Additional copies

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

Publication information

Library and Archives Canada Cataloguing in Publication

Recovery strategy for Small-Flowered Lipocarpha (*Lipocarpha micrantha*) in British Columbia [electronic resource]

(British Columbia Recovery Strategy Series)

Electronic monograph in PDF format.
ISBN 978-0-7726-6516-4

1. Cyperaceae--Conservation--British Columbia. 2. Endangered plants--British Columbia. I. British Columbia. Ministry of Environment II. Series: British Columbia Recovery Strategy Series

333.95'321609711 C2011-909042-2 QL84.24 R4 2011

Content (excluding illustrations) may be used without permission, with appropriate credit to the source.

Disclaimer

This recovery strategy has been prepared by the B.C. Ministry of Environment as advice to the responsible jurisdictions and organizations that may be involved in recovering the species. The B.C. Ministry of Environment presents this document as part of fulfilling its commitments under the *Accord for the Protection of Species at Risk in Canada,* and the *Canada –British Columbia Agreement on Species at Risk.*

This document identifies the recovery strategies that are deemed necessary, based on the best available scientific and traditional information, to recover small-flowered lipocarpha populations in British Columbia. Recovery actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and recovery approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all reviewers.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this strategy. The B.C. Ministry of Environment encourages all British Columbians to participate in the recovery of small-flowered lipocarpha.

RESPONSIBLE JURISDICTIONS

The British Columbia Ministry of Environment is responsible for producing a recovery strategy for small-flowered lipocarpha under the *Accord for the Protection of Species at Risk in Canada*. Environment Canada's Canadian Wildlife Service (EC-CWS) participated in the preparation of this recovery strategy.

ACKNOWLEDGEMENTS

This strategy is based on a previous draft prepared by George W. Douglas and Shyanne J. Smith (British Columbia) in cooperation with the members of small-flowered Lipocarpha Recovery Team: Harold Baumbrough (botanist), Brenda Costanzo (co-chair, B.C. Ministry of Environment), George Douglas (botanist, deceased), Orville Dyer (co-chair, B.C. Ministry of Environment), Pam Krannitz (retired, EC-CWS), Ted Lea (past co-chair, retired, B.C. Ministry of Environment), Alex McLean (B.C. Ministry of Forests and Range), and Dennis St. John (botanist). In addition, for earlier drafts, Ron Hall (Osoyoos Indian Band) contributed technical assistance. Brenda Costanzo and Terry McIntosh both provided additional comments and review, which lead to substantial updates to this strategy. Leah Westereng reformatted this document (Ministry of Environment 2010a).

EXECUTIVE SUMMARY

Small-flowered lipocarpha (*Lipocarpha micrantha*) was designated as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) due to the species being disjunct in Canada, with only three extant populations in British Columbia (B.C.) and two extant populations in Ontario. It was listed as Endangered in Canada on Schedule 1 of the *Species at Risk Act* (SARA) in 2005 due to being imperiled in Canada.

This recovery strategy only addresses the portion of the Canadian range for this species that occurs in B.C.

In B.C., small-flowered lipocarpha is ranked S1 (critically imperiled) by the Conservation Data Centre and is on the provincial Red list. The B.C. Conservation Framework ranks the small-flowered lipocarpha as a priority 1 under goal 3 (maintain the diversity of native species and ecosystems).

The greatest threat to small-flowered lipocarpha is water management/use, which due to changes in seasonal water levels can affect the reproduction of this annual species. Other threats to this species are tourism and recreation development, livestock farming and ranching, recreational activities, and invasive non-native species.

The population and distribution goal is to maintain the distribution and to maintain or improve the abundance, of the three extant populations in B.C., as well as any other extant populations that may be identified or established.

The following are the recovery objectives:
1. To establish habitat protection for all known extant sites in B.C., with no loss or degradation of currently occupied habitat.
2. To assess and mitigate the extent of the main threats (tourism and recreation development, dams and water management/use, invasive non-native species) to the three populations in B.C.
3. To confirm the distribution of small-flowered lipocarpha in B.C. (existing and new locations), and update recovery objectives as needed.
4. To investigate the feasibility of establishing one new population in B.C. where there is suitable habitat, to compensate for the population extirpated in the province.

RECOVERY FEASIBILITY SUMMARY

The recovery of small-flowered lipocarpha in B.C. is considered technically and biologically feasible based on the criteria outlined by the Government of Canada (2009):

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, there are three extant populations in B.C., with approximately 30,000–50,000 individuals present in an optimal year.

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

   Yes, there is habitat to support the existing populations in British Columbia, and additional suitable habitat might also be made available through habitat management or restoration.

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

   Yes, recovery actions such as stewardship and cooperation with landowners and land managers can prevent major threats.

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

   Yes, standard propagation techniques exist for raising new stock for translocation; also, general restoration methods/techniques are known.

TABLE OF CONTENTS

RESPONSIBLE JURISDICTIONS....III
ACKNOWLEDGEMENTS....III
EXECUTIVE SUMMARY....IV
RECOVERY FEASIBILITY SUMMARY....IV
1 COSEWIC* SPECIES ASSESSMENT INFORMATION....1
2 SPECIES STATUS INFORMATION....1
3 SPECIES INFORMATION....2
3.1 Species Description....2
3.2 Populations and Distribution....2
3.3 Needs of small-flowered Lipocarpha....4
3.3.1 Habitat and Biological Needs....4
3.3.2 Limiting Factors....5
4 THREATS....5
4.1 Threat Assessment....6
4.2 Description of Threats....8
5 RECOVERY GOAL AND OBJECTIVES....9
5.1 Population and Distribution Goal....9
5.2 Rationale for the Population and Distribution Goal....10
5.3 Recovery Objectives....10
6 APPROACHES TO MEET OBJECTIVES....10
6.1 Actions Already Completed or Underway....10
6.2 Recovery Planning Table....11
6.3 Narrative to Support Recovery Planning Table....12
6.3.1 Habitat Protection and Private Land Stewardship....12
6.3.2 Monitor Trends....13
6.3.3 Species and Population Management....13
7 INFORMATION ON HABITAT NEEDED TO MEET RECOVERY GOAL....14
7.1 Description of Survival/Recovery Habitat....14
7.2 Studies Needed to Describe Survival/Recovery Habitat....14
8 MEASURING PROGRESS....15
9 EFFECTS ON OTHER SPECIES....15
10 REFERENCES....16

LIST OF TABLES

Table 1. Small-flowered lipocarpha populations in British Columbia. Refer to Figure 2 for locations....3
Table 2. Threat classification table for small-flowered lipocarpha....6
Table 3. Recovery planning table for small-flowered lipocarpha....11
Table 4. Studies needed to describe survival/recovery habitat to meet the recovery goal for small-flowered lipocarpha....14

LIST OF FIGURES

Figure 1. North American range of small-flowered lipocarpha (COSEWIC 2002). 3
Figure 2. Distribution in 2002 (stars) of small-flowered lipocarpha in British Columbia. 4

1 COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: November 2002
Common Name: Small-flowered Lipocarpha
Scientific Name: *Lipocarpha micrantha*
COSEWIC Status: Endangered
Reason for Designation: A disjunct species occurring in only three sites with the largest population at risk from potentially significant habitat and population losses.
Canadian Occurrence: British Columbia and Ontario
Status History: Designated Threatened in April 1992. Status re-examined and designated Endangered in November 2002. Last assessment based on an update status report.

*Committee on the Status of Endangered Wildlife in Canada.

2 SPECIES STATUS INFORMATION

Small-flowered lipocarpha[a]

Legal Designation

Identified Wildlife:[b] No B.C. *Wildlife Act*:[c] No SARA Schedule: 1 (2005)

Conservation Status[d]

B.C. List: Red B.C. Rank: S1 (2000) National Rank: N2 Global Rank: G5 (2002)

Subnational Ranks:[e]

United States	Alabama (SNR), Arizona (SNR), Arkansas (SNR), California (SNR), Connecticut (S1S2), District of Columbia (S1), Florida (SNR), Georgia (S3?), Idaho (SNR), Illinois (S3S4), Indiana (SNR), Iowa (S4), Kansas (S2), Kentucky (S4?), Louisiana (SH), Maine (S1), Maryland (S1), Massachusetts (S2), Michigan (S3), Minnesota (SNR), Mississippi (S4), Missouri (SNR), Nebraska (SNR), New Hampshire (SH), New Jersey (S1), New Mexico (SNR), New York (S1), North Carolina (SH), North Dakota (S1?), Ohio (S2), Oklahoma (SNR), Oregon (SH), Pennsylvania (S1), Rhode Island (S1), South Carolina (S2), Tennessee (SNR), Texas (SNR), Virginia (S1), Washington (SNR), Wisconsin (SNR)
Canada	ON (S2), QC (SX)

B.C. Conservation Framework[f]

Goal 1: Contribute to global efforts for species and ecosystem conservation.	Priority:[g] 4 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk.	Priority: 6 (2009)
Goal 3: Maintain the diversity of native species and ecosystems.	Priority: 1 (2009)

Action Groups: Compile Status Report; Monitor Trends; Planning; List under *Wildlife Act*; Send to COSEWIC; Habitat Protection; Habitat Restoration; Private Land Stewardship; Species and Population Management

[a] Data source: B.C. Conservation Data Centre (2010) unless otherwise noted.
[b] Identified Wildlife under the *Forest and Range Practices Act*, which includes the categories of species at risk, ungulates, and regionally important wildlife (Province of British Columbia 2002).
[c] Listed as Endangered or Threatened under the *Wildlife Act* (Province of British Columbia 1982).
[d] S = Subnational; N = National; G = Global; B = Breeding; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure; NA = not applicable; NR = unranked; U = unrankable.
[e] Data source: NatureServe (2009).
[f] Data source: Ministry of Environment (2010b).
[g] Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3 SPECIES INFORMATION

3.1 Species Description

Small-flowered lipocarpha is a small annual sedge. The stems and leaves are usually less than 10 cm long and are about 0.5 mm wide. The flowers are arranged in dense, oval spikes, each 2–6 mm long. There are 1–3 spikes on each stem, which are subtended by 1–3 leafy bracts. Each spike has numerous inconspicuous flowers. The reproductive structures are concealed by 1–2 mm long, short-tipped scales (Gleason and Cronquist 1991; Douglas and Ceska 2001).

3.2 Populations and Distribution

Globally, small-flowered lipocarpha is found in South and Central America, and in Mexico. From Mexico northward, small-flowered lipocarpha is found in various states in the United States, with the main range being from Texas north to northwestern Ontario and to the east coast of the United States. There are disjunct populations in Florida, California, and British Columbia. The species is also known from the Galapagos Islands and Africa (COSEWIC 2002). In North America,[1] small-flowered lipocarpha is extant in 21 states and is also found in Ontario (two extant and two extirpated populations) and B.C (three extant and one extirpated population; Figure 1). Less than 1% of the global range of this species is found in B.C. (Smith *et al.* 2004).

In B.C., small-flowered lipocarpha is only known from Okanagan and Osoyoos Lakes (Table 1; Figure 2), where there are three extant populations: one on the Osoyoos Indian Reserve along Osoyoos Lake (Smith *et al.* 2004), one on private land on the northwest shore of Osoyoos Lake (Willow Beach) discovered in 2007 (BC Conservation Data Centre 2010), and one on Okanagan Lake (in Sun-Oka Beach Provincial Park) discovered in 2002 (Smith *et al.* 2004). One population on the eastern shore of Osoyoos Lake (Smith *et al.* 2004) has been extirpated since 1985[2] (COSEWIC 2002; Smith *et al.* 2004).

A foreshore survey of Osoyoos Lake in 2009 (BC CDC 2011) identified nine high potential foreshore habitats where small-flowered lipocarpha could occur, although it was not observed in 2009 when the survey took place.

[1] This recovery strategy only addresses the portion of the Canadian range for this species that occurs in British Columbia.

[2] Originally discovered in 1978 but reported to have been extirpated by 1985 (Sabourin *et al.* 1992). CDC ranks this as extirpated. The population was destroyed by infilling of the lagoon and public toilets were built on the site (BC CDC 2010).

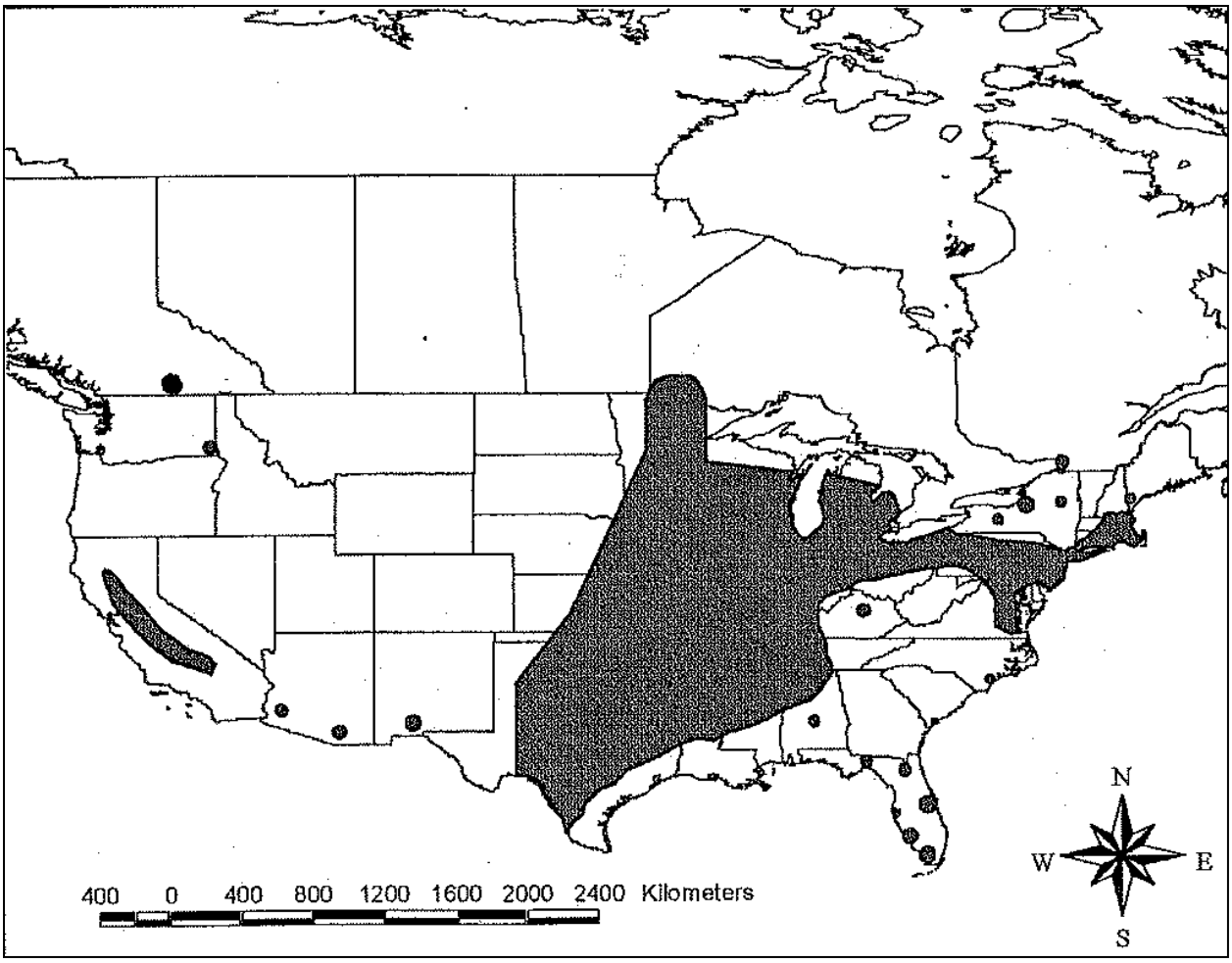


Figure 1. North American range of small-flowered lipocarpha (COSEWIC 2002). Note: now extirpated from Quebec.

Table 1. Small-flowered lipocarpha populations in British Columbia. Refer to Figure 2 for locations.

Population[a]	Number of plants	Last observation	Surveyor	Land tenure
Osoyoos Lake, several subpopulations[b]	30,000–50,000	2001	G. Douglas	Osoyoos Indian Reserve
Osoyoos Lake (east shore)	Extirpated	1985	A. Ceska	Municipal park
Osoyoos Lake (Willow Beach on northwest shore)	3	2007	T. McIntosh	Private
Sun-Oka Beach, Okanagan Lake	~200	2006[c]	T. McIntosh	Sun-Oka Beach Provincial Park

[a] Populations are separated by at least 2 km from one another as defined by NatureServe (2004).
[b] Subpopulations as defined by the Conservation Data Centre (CDC) are within 1 km of each other.
[c] Observations of the plants previous year's growth in May 2011 confirmed that this population was present in the summer of 2010 (K. Sadler, pers. comm. 2011).

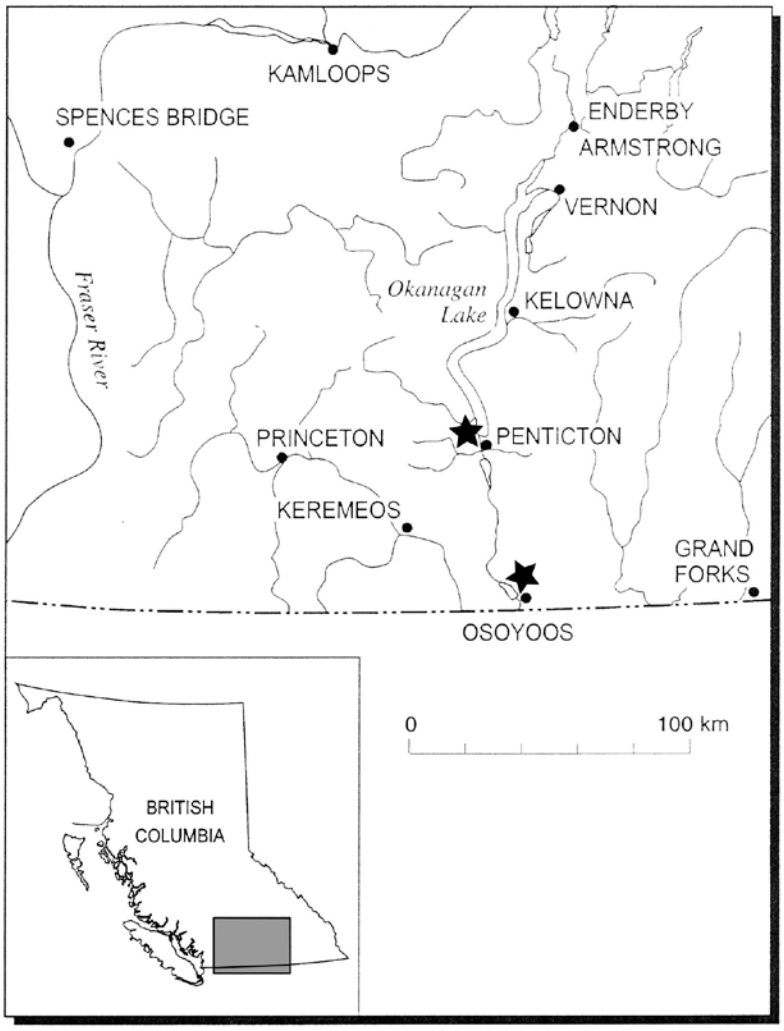


Figure 2. Distribution in 2001 (stars) of small-flowered lipocarpha in British Columbia.

3.3 Needs of small-flowered Lipocarpha

3.3.1 Habitat and Biological Needs

In B.C., small-flowered lipocarpha is found in the south Okanagan Valley in two biogeoclimatic zones: the Bunchgrass very dry hot subzone (BGxh1) and the Ponderosa Pine very dry hot subzone (PPxh1). Climate in the Bunchgrass zone is warm to hot with dry summers and moderately cold winters, and the Ponderosa Pine zone is the driest and warmest forested zone in B.C. (Meidinger and Pojar 1991).

In the south Okanagan, small-flowered lipocarpha inhabits moderately wave-washed sandy shores as well as interdunal swales that have seasonal flooding but are protected from high waves and strong currents (Smith *et al.* 2004). This species requires fluctuating water levels, germinating only during low water periods. As well, this species is not a strong competitor, and

it requires open, sandy areas (Sabourin *et al.* 1992). The fluctuation of water levels helps to maintain the open nature of the sites that small-flowered lipocarpha inhabits (Smith *et al.* 2004).

On Osoyoos Lake, small-flowered lipocarpha habitat is either a narrow (usually < 2 m wide) strip along the lakeshore or in interdunal swales. Originally, most of the open, sandy shoreline of the lake would have been suitable habitat but has been lost to development (McIntosh 2010). Plants occur on almost level ground (1–2% slope) on medium to coarse sand and exposure ranges from west to south–southeast. Although small-flowered lipocarpha is found within the low dune habitats on the east side of Osoyoos Lake, it has not been found on the dunes along the northwest shore of this lake (McIntosh 2010).

The Sun-Oka Beach population on Okanagan Lake is found in a moist, sandy swale behind the main beach area near the tip of a sandspit. Here, most of the plants occur along the drier edges of the trail that runs through this depression. Awned cyperus (*Cyperus squarrosus*), a sedge on the provincial Blue list (B.C. Conservation Data Centre 2010), is found here alongside small-flowered lipocarpha, as well as at Osoyoos Lake.

3.3.2 Limiting Factors

Small-flowered lipocarpha requires a narrow habitat niche that includes seasonally wet, sandy beaches or swales that are maintained by a fluctuating water regime (COSEWIC 2002; Smith *et al.* 2004). Fluctuating water levels are required to expose the seed bank allowing germination as the substrate dries out. As small-flowered lipocarpha does not thrive when subject to competition from other plants, it requires fairly open habitats as well as protection from strong waves (Smith *et al.* 2004).

4 THREATS

Threats are defined as proximate (human) activities or processes that have caused, are causing, or may cause the destruction, degradation, and/or impairment of biodiversity and natural processes. Threats can be historical, ongoing, and/or likely to occur in the future. Threats do not include intrinsic biological features of the species or population such as inbreeding depression, small population size, and genetic isolation, which are considered limiting factors.

4.1 Threat Assessment

The threat classification below is based on the IUCN-CMP (World Conservation Union-Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre and the Conservation Framework. For a detailed description of the threat classification system, see the CMP website (CMP 2010). For information on how the values are assigned or overall impact is calculated, see Master *et al.* (2009) and table footnotes for details. Threats for small-flowered lipocarpha were assessed for the entire province (Table 2).

Table 2. Threat classification table for small-flowered lipocarpha.

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Site(s) or population(s)	Stress
1	Residential & commercial development	Medium	Pervasive	Moderate	Moderate		
1.3	Tourism & recreation areas	Medium	Pervasive	Moderate	Moderate	Osoyoos Lake	Indirect or accidental mortality
2	Agriculture & aquaculture	Low	Pervasive	Slight	Moderate		
2.3	Livestock farming & ranching	Low	Pervasive	Slight	High	Osoyoos Lake	Indirect or accidental mortality
6	Human intrusions & disturbance	Low	Pervasive	Slight	High		
6.1	Recreational activities	Low	Pervasive	Slight	High	Osoyoos Lake; Sun-Oka Beach	Indirect or accidental mortality
7	Natural system modifications	Very high	Pervasive	Extreme	High		
7.2	Dams & water management/use	Very high	Pervasive	Extreme	High	Osoyoos Lake	Indirect or accidental mortality; reduced productivity; reduced fitness
8	Invasive & other problematic species & genes	Unknown	Large - Restricted	Unknown	High		
8.1	Invasive non-native/alien species	Unknown	Large - Restricted	Unknown	High	Osoyoos Lake	Indirect or accidental mortality; reduced productivity; reduced fitness
8.2	Problematic native species	Unknown	Large - Restricted	Unknown	High	Osoyoos Lake	Indirect or accidental mortality; reduced productivity; reduced fitness

[a] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each stress is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very high (75% declines), High (40%), Medium (15%), and Low (3%).
[b] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%).

[c] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population: Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%.
[d] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of Threats

The overall province-wide Threat Impact for this species is Very High[3]. The greatest threat is water management/use, which due to changes in seasonal water levels can affect the reproduction of this annual species (Table 2). Details are discussed under the IUCN level 1 headings.

IUCN #7. Natural system modification (7.2 Dams and water management/use)
For over half a century, Osoyoos Lake water levels have been controlled by a downstream dam in the United States. The water levels have been set by the International Osoyoos Lake Board of Control established by Order of the International Joint Commission (IJC). However, they depend entirely, within certain limits, on the economic needs of downstream users in the United States. The status reports for both scarlet ammannia (*Ammannia robusta*) and toothcup (*Rotala ramosior*), rare plant species that are also found along Osoyoos Lake, state that both species are under potential threat of rising lake levels (Douglas and Oldman 1998; COSEWIC 1999). As well, for small-flowered lipocarpha, Sabourin *et al.* (1992) state that "…alteration of natural water level cycles could result in the destruction of the habitat required by *Lipocarpha micrantha*." Further, COSEWIC (2002) says that "artificial manipulation of water levels also threatens viability of existing populations." The Osoyoos Indian Reserve location for small-flowered lipocarpha occurs on and around a lagoon, the water level of which is directly related to the managed lake water levels. Water level is also controlled on Okanagan Lake, where the Sun-Oka Beach population occurs, so natural system modification is a potential threat at this site.

Disrupting the natural cycle of flooding and draw-down can degrade small-flowered lipocarpha habitat and lead to long-term habitat loss. Too many consecutive years of low water levels may lead to the invasion of small-flowered lipocarpha habitat by shrubs (especially willows), grasses, and other highly competitive species (COSEWIC 2002; T. McIntosh, pers. comm., 2010). However, if water levels were maintained at a higher level for a longer period of time in late summer, the seed bank would not be exposed and small-flowered lipocarpha may not germinate (COSEWIC 2002). Conversely, if lake water levels were maintained at a lower than normal level, small-flowered lipocarpha would not have sufficient moisture to allow it to develop to a reproductive state. Additionally, if the lake levels do not fluctuate naturally, there is evidence that persistent lake levels cause wave action to be at a constant elevation over this period of time. Constant wave action then destroys the habitat for small-flowered lipocarpha by removing the gently sloping habitat that small-flowered lipocarpha requires. The resulting cutbanks and erosion that occur are evident along the east shore of Osoyoos Lake (C. Bjork, T. McIntosh, pers. comm., 2010).

IUCN #1. Residential and commercial development (1.3 Tourism and recreation areas)
The majority of the shoreline along Osoyoos lakeshore (total of 28.5 km) has been altered over time as a result of either total or continual removal of all vegetation along the beach to create swimming beaches. Shoreline found within the Osoyoos Indian Reserve #1 (approximately 12.2

[3] The overall threat impact was calculated following Master et al. (2009) using the number of Level 1 Threats assigned to this species: 1 Very High, 1 Medium, 2 Low, and 1 Unknown (Table 2).

km) remains potential habitat for small-flowered lipocarpha (BC Conservation Date Centre 2011). A recent survey of the Osoyoos Lake shoreline in 2009 found nine potential habitat locations for this species (McIntosh 2010), some which are on private lands, and one that was within a recent development footprint (BC Conservation Data Centre 2010). There has not been a survey of Okanagan Lake specifically for this species. However, it is suggested that Okanagan Lake could provide new collections (COSEWIC 2002).

Shoreline development presents a threat to small-flowered lipocarpha and its habitat in British Columbia. If significant development occurred, particularly near the subpopulation on Osoyoos Lake that is in a lagoon, such development may irreversibly alter lagoon hydrology, and affect small-flowered lipocarpha occurrences (COSEWIC 2002).

As the small-flowered lipocarpha populations at Sun-Oka Beach, Okanagan Lake are in a provincial park, and as such are legally protected through provisions of the *Parks Act*, these populations are not under threat from development..

IUCN #8. Invasive and other problematic species and genes (8.1 Invasive and non-native/alien species; 8.2 Problematic native species)
Invasive non-native plants, such as common burdock (*Arctium minus*), great mullein (*Verbascum thapsus*), silverberry (*Elaeagnus angustifolia*), willow species (*Salix* spp.), and Siberian elm (*Ulmus pumila*), potentially threaten small-flowered lipocarpha by reducing available habitat and competing for resources (Smith *et al.* 2004; T. McIntosh, pers. comm., 2006). However, we do not know the severity of this threat. As well, efforts to control invasive plants through mechanical or chemical means may inadvertently harm extant and currently unknown populations or individuals of small-flowered lipocarpha. There have been removal efforts of invasive species on Osoyoos Indian Reserve lands at Osoyoos Lake in 2004–2007, but the program has been discontinued. It is not known whether this removal has had a positive effect on small-flowered lipocarpha populations. Fluctuating lake levels help restrict the encroachment by native plants into small-flowered lipocarpha habitat. However, if lake levels are kept at a constant height, there could be infill by native species (Smith *et al.* 2004).

Low impact threats
Other threats include trampling from cattle grazing at Osoyoos Lake (IUCN #2.3), and recreational activities (IUCN #6.1) such as all-terrain vehicle use, or by people using the beaches for swimming or boating, also resulting in trampling of plants at all locations..

5 RECOVERY GOAL AND OBJECTIVES

5.1 Population and Distribution Goal

The population and distribution goal for small-flowered lipocarpha is to maintain the distribution, and to maintain or improve the abundance of the three extant populations in B.C., as well as any other extant populations that may be identified or established.

5.2 Rationale for the Population and Distribution Goal

This species was likely always rare in B.C. and recovery, in this case, constitutes ensuring no further populations become extirpated and establishing one new population to replace the single known extirpated population. Although threat mitigation will address many of the threats to the species, the limited amount of suitable habitat remaining means that the species will likely remain critically imperiled (S1) in B.C. Small-flowered lipocarpha is an annual species, therefore germination success and microhabitat favorability can vary between years. Specific targets for population numbers are difficult to identify reliably, owing to natural fluctuation in population numbers from year to year. Long-term survey data could potentially be used to indicate the natural variability of the populations and then help to determine population targets, however, this data is not available.

5.3 Recovery Objectives

The recovery strategy has the following objectives:

1. To establish habitat protection for all known extant sites in B.C., with no loss or degradation of currently occupied habitat.
2. To assess and mitigate the extent of the main threats (tourism and recreation development, dams and water management/use, invasive non-native species) to the three populations in B.C.
3. To confirm the distribution of small-flowered lipocarpha in B.C. (existing and new locations), and update recovery objectives as needed.
4. To investigate the feasibility of establishing one new population in B.C. where there is suitable habitat, to compensate for the population extirpated in the province.

6 APPROACHES TO MEET OBJECTIVES

A multi-species recovery approach is recommended for small-flowered lipocarpha. This list includes toothcup (*Rotala ramosior*), scarlet ammannia (*Ammannia robusta*), and other provincially listed species in B.C. that share similar threats and have similar property ownership in the southern Okanagan Valley. Any activities for recovery could be done with the Southern Okanagan-Similkameen Conservation Program.

6.1 Actions Already Completed or Underway

Actions listed below have been categorized by the action groups of the Conservation Framework (Ministry of Environment 2010b). Status of the action group for this species is given in brackets.

Compile Status Report (complete)

- COSEWIC status report completed (COSEWIC 2002).

Send to COSEWIC (complete)
- Small-flowered lipocarpha assessed as Endangered (COSEWIC 2002).

Planning (complete)
- B.C. Recovery Strategy completed (this document, 2011).

Habitat Protection, Habitat Restoration, and Private Land Stewardship (in progress)
- The Sun-Oka Beach site on Okanagan Lake, which is found within Sun-Oka Provincial Park and is protected by provisions of the *Parks Act*, has a park management plan (2003) in place. Although small-flowered lipocarpha is not specifically mentioned in the park management plan, the species is listed in the B.C. Parks Annual Management Planning (AMP) review for that park. As well, the occurrence at Sun-Oka Beach is identified in the BC Parks Conservation Risk Assessment database and would be considered in the BC Parks impact assessment process for any proposed development or activity in the park.
- Survey of the majority of suitable habitat on Osoyoos Lake conducted in 2009 (McIntosh).
- Invasive species removal at Osoyoos Lake by the Osoyoos Indian Band (funded by the Habitat Stewardship Program) from 2004 to 2007. As we are unaware if monitoring has taken place, it is unknown whether this removal has had a positive effect on small-flowered lipocarpha populations.
- A fence has been erected at Osoyoos Lake population by the Osoyoos Indian Band to reduce access and thereby limiting invasive species dispersal by humans, horses, or cattle, and eliminate habitat and population destruction by motorized vehicles. It is not known whether this has made a positive impact on the species survival and recovery.
- Water levels: There have been discussions with the International Osoyoos Lake Board of Control and the small-flowered lipocarpha recovery team regarding potential research projects to determine the water-level requirements of the species during all life phases.

Monitor Trends (in progress)
- Local botanists continue to monitor known sites and survey for new populations. In B.C., casual surveys have been conducted regularly since 1991, and one intensive search was conducted in 2001 (Smith *et al.* 2004).
- Observations of the plants previous year's growth in May 2011 confirmed that this population was present in the summer of 2010 (K. Sadler, pers. comm. 2011).

6.2 Recovery Planning Table

Table 3. Recovery planning table for small-flowered lipocarpha.

Obj. #	Conservation Framework action group	Actions to meet objectives	Threat[a] or concern addressed	Priority[b]
1	Habitat Protection; Private Land Stewardship	• Provide BC Parks and First Nations with specific sites where the plants are found, conduct field trips to view these plants, and discuss stewardship of sites	1.3, 2.3, 6.1, 8.1	Essential
1		• BC Ministry of Forests, Lands and Natural Resource Operations will endeavor to work with BC Parks and First Nations to steward and manage lands for persistence of the species	1.3, 2.3, 6.1, 7.2, 8.1	Essential

Obj. #	Conservation Framework action group	Actions to meet objectives	Threat[a] or concern addressed	Priority[b]
1		• Work with the International Osoyoos Lake Board of Control to ensure that species needs are met with respect to the Osoyoos Lake dam	7.2	Essential
2		• Assess and mitigate the extent of the threat of shoreline development	1.3	Beneficial
3		• Search for new sites during low water level years	Knowledge Gaps	Essential
1	Monitor Trends	• Determine physical habitat attributes of known sites	Knowledge Gaps	Necessary
3		• Revisit known sites during low water level years to determine number of occupied sites, number of plants and area of occupancy	Knowledge Gaps	Necessary
2		• Investigate natural hydrologic processes necessary to maintain populations	7.2, Knowledge Gaps	Beneficial
2		• Investigate the impacts of invasive species and vegetation succession	8.1, Knowledge Gaps	Necessary
2		• Potential lakeshore development, both commercial and recreational, must be monitored with respect to small-flowered lipocarpha occurrences and habitat.	Knowledge Gaps	Necessary
4	Species and Population Management	• Determine feasibility of establishing one additional population	Knowledge Gaps	Necessary
		• Investigate seed production, seed bank germination rates and longevity, seed dispersal mechanisms, and seedling and juvenile development	Knowledge Gaps	Beneficial
4		• Identify sites suitable for restoration and establishment of one additional population	Knowledge Gaps	Beneficial
4		• Implement restoration activities and translocate plants if deemed appropriate	Limited Habitat and Small Population	Beneficial

[a] Threat numbers according to the IUCN-CMP classification (see Table 2 for details).
[b] Essential (urgent and important, needs to start immediately); Necessary (important but not urgent, action can start in 2–5 years); or Beneficial (action is beneficial and could start at any time that was feasible).

6.3 Narrative to Support Recovery Planning Table

Recommended actions have been categorized by the action groups of the Conservation Framework.

6.3.1 Habitat Protection and Private Land Stewardship

It is important to secure long-term protection for known populations of small-flowered lipocarpha. For the Osoyoos Lake populations on the Osoyoos Indian Reserve and private land, this could be achieved by establishing a stewardship program or stewardship agreement. The Sun-Oka Beach population is within a provincial park and so is provided protection under the

Parks Act and existing park management tools. BC Parks needs to be provided with location data so sites can be protected through management planning in provincial parks, and operational staff need to be educated annually to learn about the species and its habitat.

B.C. Ministry of Forests, Lands and Natural Resource Operations (FLMNRO) will endeavour to work with BC Parks and First Nations to identify and conserve this species and its habitat.

Communication with the International Osoyoos Lake Board of Control is necessary to ensure that the species' needs are considered with respect to lake levels changes. As well, the appropriate agency should undertake assessment and mitigation for the species with respect to shoreline development. Surveys for new locations of small-flowered lipocarpha should take place in low water level years around the shores of Okanagan Lake, and other lakes in the Okanagan Valley that have potential habitat.

Providing protection of the habitat alone will not be sufficient to support the population and distribution objectives for small-flowered lipocarpha. Research is required to help better understand small-flowered lipocarpha habitat requirements. A collaborative approach to research is encouraged, with the academic community and the hydropower industry as potential partners.

6.3.2 Monitor Trends

Monitoring small-flowered lipocarpha population trends and habitat status, including water level monitoring, should be completed at extant and any new occurrences. Successful monitoring will depend on surveying the populations at the right times of year as well as during times when the beaches are exposed (e.g., late summer to early fall, when water levels are low enough to allow seed germination, growth, flowering, and seed set), at reasonable intervals of time (perhaps covering the span of a growth season 2-3 years, as the number of plants can be highly variable depending on annual survey timing as well as between years), and taking regular water level readings at each occurrence.

Monitoring should also be designed to help determine the habitat requirements (e.g., soil texture, presence of organics), and suitable water level regime for small-flowered lipocarpha. As well, to determine the effect of competition by other plants, either native or invasive alien species encroachment, plot-based methods with cover estimates could be used to provide an indication of the tolerance of small-flowered lipocarpha.

Potential lakeshore development, both commercial and recreational, must be monitored with respect to small-flowered lipocarpha occurrences and habitat. Development may affect factors such as population numbers and distribution, adjacent hydrological dynamics, lakeshore water levels, invasive plant distribution, and available shoreline for small-flowered lipocarpha.

6.3.3 Species and Population Management

Research needs to be undertaken to determine if the extant populations require restoration and if an additional population can be re-established. If either is deemed appropriate, there needs to be

additional research conducted on physical habitat requirements of small-flowered lipocarpha, seed production, seed bank germination rates and longevity, seed dispersal mechanisms, and seedling and juvenile development. The information obtained from these studies will contribute to population translocation/re-establishment efforts.

7 INFORMATION ON HABITAT NEEDED TO MEET RECOVERY GOAL

Threats to small-flowered lipocarpha habitat have been identified and habitat appears to be limiting for this species. To meet the population and distribution goal for this species, it is recommended that specific habitat attributes be identified for small-flowered lipocarpha and locations of habitat are geospatially described on the landscape to facilitate management to mitigate habitat threats.

7.1 Description of Survival/Recovery Habitat

Currently only general habitat requirements are known for small-flowered lipocarpha (shorelines of lakes and waterways that have natural flooding regimes, and soil of either mud, coarse sand; see Section 3.3.1). Specific habitat requirements for the species and the relationship of fluctuation water levels (particularly with respect to controlled water levels on Osoyoos Lake) still need to be determined, in combination with the effects of minor anthropogenic disturbance (e.g. trailside growth pattern at Sun-Oka Beach). When this outstanding work has been completed, it would be beneficial if the habitat needed for survival/recovery of the species was spatially identified for small-flowered lipocarpha in B.C. (see Section 7.2). At minimum, survival/recovery habitat should include the known area of occupancy for this species.

7.2 Studies Needed to Describe Survival/Recovery Habitat

A schedule of studies outlining the work necessary to identify survival/recovery habitat is provided in Table 4.

Table 4. Studies needed to describe survival/recovery habitat to meet the recovery goal for small-flowered lipocarpha.

Description of activity	Outcome/rationale	Timeline
1. Describe and record condition of occupied habitat. • Delineate the habitat features within the current area of occupancy and site conditions including associated shoreline with respect to fluctuations in water levels (temporal and spatial). • Compile site-specific information on community composition, site characteristics, ecological condition (e.g., moisture regime, length of inundation and exposure, and landscape context, adjacent land use, water level, plant succession).	Determine the specific habitat required for the species both occupied and potential.	2018
2. Identify and map occupied and adjacent suitable habitat for small-flowered lipocarpha, including location for establishing one new population if feasible.	Range for potential habitat for the species.	2018

8 MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution goal and recovery objectives. Performance measures are listed below for each objective.

Objective 1: Area of occupancy has not decreased in any of the three known populations, and population monitoring indicates that, by 2021, the annual numbers of flowering individuals falls within an acceptable range required for long-term persistence at sites[4].

Objective 2: Impact of the three main threats (dams and water management use; tourism and recreation areas; invasive non-native species) to the populations has been investigated as well as mitigated by 2016.

Objective 3: Suitable habitat has been surveyed for new populations, and the status of existing and new locations has been confirmed by 2016.

Objective 4: Research has been conducted to determine feasibility of establishing one additional population by 2018.

9 EFFECTS ON OTHER SPECIES

Regulating water levels to promote small-flowered lipocarpha habitat and germination will also benefit other seed bank species. In B.C., toothcup and scarlet ammannia (both nationally endangered) occupy similar habitats that may benefit from changes to water levels that are made to meet small-flowered lipocarpha needs.

[4] The acceptable range in the numbers of individuals has yet to be determined. Long-term survey data will be required to determine this range, and possibly completing a minimum viable population analysis for the species.

10 REFERENCES

B.C. Conservation Data Centre. 2010. BC Species and Ecosystems Explorer. B.C. Min. Environ., Victoria, BC. <http://a100.gov.bc.ca/pub/eswp/> [Accessed Sept. 22, 2010]

B.C. Conservation Data Centre. 2011. Biodiversity Tracking and Conservation System (BIOTICS). Information requested and obtained on Jan. 10, 2011. B.C. Min. Environ., Victoria, BC.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 1999. COSEWIC assessment and status report on the toothcup *Rotala ramosior* in Canada. Ottawa, ON. vi + 19 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2002. COSEWIC assessment and update status report on the small-flowered lipocarpha *Lipocarpha micrantha* in Canada. Ottawa, ON. vi + 16 pp.

Conservation Measures Partnership. 2010. Threats taxonomy. <http://www.conservationmeasures.org/initiatives/threats-actions-taxonomies/threats-taxonomy> [Accessed <http://www.conservationmeasures.org/initiatives/threats-actions-taxonomies/threats-taxonomy> [Accessed Sept. 22, 2010]

Douglas, G.W. and A. Ceska. 2001. Cyperaceae. Pages 12–199 *in* G.W. Douglas, D. Meidinger, and J. Pojar, eds. Illustrated flora of British Columbia. Vol. 6. Monocotyledons (Acoraceae to Najadaceae). B.C. Min. Environ., Lands and Parks and B.C. Min. For., Victoria, BC. 361 p.

Douglas, G.W. and M.J. Oldham. 1998. Status report on scarlet ammannia (*Ammannia robusta* Heer & Regel). Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 19 pp.

Gleason, H.A. and A. Cronquist. 1991. Manual of vascular plants of northeastern United States and adjacent Canada. N.Y. Botanical Garden, Bronx, N.Y.

Government of Canada. 2009. Species at Risk Act policies, overarching policy framework – draft. Min. Environ., Ottawa, ON. 38 pp.<http://dsp-psd.pwgsc.gc.ca/collection_2009/ec/En4-113-2009-eng.pdf> [Accessed May 3, 2010]

Master, L., D. Faber-Langendoen, R. Bittman, G.A. Hammerson, B. Heidel, J. Nichols, L. Ramsay, and A. Tomaino. 2009. NatureServe conservation status assessments: factors for assessing extinction risk. NatureServe, Arlington, VA. <http://www.natureserve.org/publications/ConsStatusAssess_StatusFactors.pdf> [Accessed Sept. 22, 2010]

McIntosh, T. 2010. Foreshore plant species at risk inventory, Osoyoos Lake, BC. Report prepared for B.C. Min. Environ. <http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=18269> [Accessed Jan. 25, 2011]

Meidinger, D. and J. Pojar. 1991. Ecosystems of British Columbia. B.C. Min. For., Res. Branch, Victoria, BC.

Ministry of Environment. 2010a. British Columbia guide to recovery planning for species and ecosystems. B.C. Min. Environ., Victoria, BC. 32 pp. <http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm> [Accessed Oct. 9, 2010]

Ministry of Environment. 2010b. Conservation framework. B.C. Min. Environ., Victoria, BC. <http://www.env.gov.bc.ca/conservationframework/index.html> [Accessed Sept. 22, 2010]

NatureServe. 2004. NatureServe Explorer: an online encyclopedia of life [web applicaton]. Version 7.1. Arlington, VA. Habitat-based plant occurrence delimitation guidance. 1 October 2004. <http://www.natureserve.org/explorer/decision_tree.htm> [Accessed Oct. 25, 2010]

NatureServe. 2009. NatureServe explorer: an online encyclopedia of life [web application]. Version 7.1. Arlington, VA. <http://www.natureserve.org/explorer> [Accessed July 26, 2010]

Province of British Columbia. 1982. Wildlife Act [RSBC 1996] c. 488. Queen's Printer, Victoria, BC. <http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96488_01> [Accessed July 26, 2010]

Province of British Columbia. 2002. Forest and Range Practices Act [RSBC 2002] c. 69. Queen's Printer, Victoria, BC. <http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_02069_01> [Accessed July 26, 2010]

Sabourin, A., M.J. Oldham, and D. Paquette. 1992. Status report on the small-flowered lipocarpha *Lipocarpha micrantha* (syn. *Hemicarpha micrantha*) in Canada. COSEWIC, Ottawa, ON.

Smith, T.W., G.W. Douglas, and A.G. Harris. 2004. Conservation Evaluation of Small-flowered Lipocarpha, *Lipocarpha micrantha* (Cyperaceae) in Canada. Can. Field-Nat. 118(2):179–184.

Personal Communications

Curtis Bjork, Botanical consultant, Clearwater, BC.

Terry McIntosh, Botanical consultant, Vancouver, BC.

Kella Sadler, Senior Species at Risk Biologist, Canadian Wildlife Service, Delta, BC.