

**RECOVERY PLAN FOR THE
*SABLE ISLAND SWEAT BEE (LASIOGLOSSUM
SABLENSE)* IN NOVA SCOTIA**



**A recovery plan adopted by the Nova Scotia Department of Lands and
Forestry**

2020 - 2025

FINAL

Recommended citation:

Nova Scotia Department of Lands and Forestry. 2020. Recovery Plan for the Sable Island Sweat Bee (*Lasioglossum sablense*) in Nova Scotia [Final]. *Nova Scotia Endangered Species Act Recovery Plan Series*.

Cover illustration: Sable Island Sweat Bee. Photo credit: Jason Gibbs

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

Adoption of a Recovery Plan per Section 15(9) of the Endangered Species Act

Species:

Sable Island Sweat Bee (*Lasioglossum sablense*)

Reference:

Parks Canada Agency (PCA). 2020. Recovery Strategy and Action Plan for the Sable Island Sweat Bee (*Lasioglossum sablense*) in Canada. *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency, Ottawa.

Whereas a Species at Risk Act Recovery Strategy has been prepared for this species by Environment Canada, and that plan has been reviewed by members of the applicable Nova Scotia Recovery Team and determined to fulfil the requirements of Section 15(9) of the Endangered Species Act as they pertain to Nova Scotia, the above-named recovery plan shall be adopted in lieu of a Nova Scotia Recovery Plan subject to the following:

Date of Adoption: 30 May 2020

Expiry/renewal Date: 30 May 2025

Conditions:

1. Adoption of this recovery plan will be reviewed 5 years from the Date of Adoption.
2. Only elements of this plan that are relevant to Nova Scotia and are in accordance with the Endangered Species Act (Nova Scotia) shall be used. This includes the following sections of the reports:

Parks Canada Agency (2020): 3. Species Information, 4. Threats, 5. Population and Distribution Objectives, 6.0 Broad Strategies and General Approaches to Meet Objectives, 8. Evaluation of the Socio-economic Costs and Benefits, 9.0 Measuring progress, 10.0 References, Appendix A.

3. The description of Critical habitat provided in Section 7.0 (PCA 2020) was not considered for adoption in lieu of core habitat. Sable Island Sweat Bee, although

located within the geographic boundaries of Nova Scotia and listed on the *Categorized List of Species at Risk made under Section 12 of the Endangered Species Act*, occurs exclusively on federal lands.

4. Should any additional requirements be identified, the Nova Scotia Department of Lands and Forestry may prepare an addendum to this plan under the Endangered Species Act.

Approved:



Date:

30 May 2020

Appendix A:

Parks Canada Agency (PCA). 2020. Recovery Strategy and Action Plan for the Sable Island Sweat Bee (*Lasioglossum sablense*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency, Ottawa.

Recovery Strategy and Action Plan for the Sable Island Sweat Bee (*Lasioglossum sablense*) in Canada

Sable Island Sweat Bee



2020



Recommended citation:

Parks Canada Agency. 2020. Recovery Strategy and Action Plan for the Sable Island Sweat Bee (*Lasioglossum sablense*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency, Ottawa. viii + 26 pp.

For copies of the recovery strategy and action plan, 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](https://www.sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1)¹.

Cover illustration: *Lasioglossum sablense*. Photo: John Klymko, 2019.

Également disponible en français sous le titre :
«Programme de rétablissement et plan d'action visant l'halicte de l'île de Sable (*Lasioglossum sablense*) au Canada [Proposition]»

© Her Majesty the Queen in Right of Canada, represented by the Minister of Environment and Climate Change, 2020. All rights reserved.

ISBN ISBN to come

Catalogue no. Catalogue no. to come

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](https://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1)

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 and action plans (for species for which recovery has been deemed feasible) for listed Extirpated, Endangered, and Threatened species. They are also required to report on progress within five years after the publication of the final document on the Species at Risk Public Registry.

This document has been prepared to meet the requirements under SARA of both a recovery strategy and an action plan. As such, it provides both the strategic direction for the recovery of the species, including the population and distribution objectives for the species, as well as the more detailed recovery measures to support this strategic direction, outlining what is required to achieve objectives. SARA requires that an action plan also include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation. It is important to note that the setting of population and distribution objectives and the identification of critical habitat are science-based exercises and socio-economic factors were not considered in their development. The socio-economic evaluation only applies to the more detailed recovery measures. The recovery strategy and action plan are considered part of a series of documents that are linked and should be taken into consideration together, along with the COSEWIC status report.

The Minister responsible for the Parks Canada Agency (PCA) is the competent minister under SARA for the Sable Island Sweat Bee and has prepared this combined recovery strategy and action plan, as per sections 37 and 47 of SARA. To the extent possible, it has been prepared in cooperation with Environment and Climate Change Canada and the Province of Nova Scotia (Department of Lands and Forestry). It was developed in cooperation and consultation with Indigenous governments and organizations, technical experts, non-governmental organizations, and other stakeholders, as per sections 39(1) and 48(1) of SARA.

Success in the recovery of this species depends on the commitment and cooperation of different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by the Parks Canada Agency alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Sable Island Sweat Bee and Canadian society as a whole. Implementation of this recovery strategy and action plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

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

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.

In the case of critical habitat identified for terrestrial species, including migratory birds, SARA requires that critical habitat identified in a federally protected area³ 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 section 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.

Acknowledgments

This recovery document was prepared by Darien Ure and Dan Kehler (Parks Canada). Acknowledgement and thanks are extended to the parties that provided invaluable advice and expertise to help inform the development of this document, including Environment and Climate Change Canada and the Province of Nova Scotia. Special thanks are extended to Julie McKnight (Environment and Climate Change Canada, Canadian Wildlife Service – Atlantic Region), Donna Hurlburt (Province of Nova Scotia, Department of Lands and Forestry), Jason Gibbs (University of Manitoba), Cory Sheffield (Royal Saskatchewan Museum), John Klymko (Atlantic Canada Conservation Data Centre), Miriam Richards (Brock University), David McCorquodale (Cape Breton University), Cody Chapman (The Confederacy of Mainland Mi'kmaq), Tamara Young (Kwilmu'kw Maw-Klusuaqn Negotiation Office) and Zoe Lucas (Sable Island Institute).

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 Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

Additional thanks are extended to Melissa Ristow and Jennifer Keeney (Parks Canada) for support in mapping critical habitat. Finally, the contribution made by the Committee on the Status of Endangered Wildlife in Canada in preparing the status report on the Sable Island Sweat Bee, which served as a basis for this document, is gratefully acknowledged.

Executive Summary

Sable Island Sweat Bee (*Lasioglossum sablense*) is a small (5–6 mm), dull-metallic sweat bee in the family Halictidae, which is globally endemic to Sable Island, Nova Scotia. The species was first described in 2010 (Gibbs 2010), assessed by COSEWIC as Threatened in 2014 (COSEWIC 2014) and listed under the *Species at Risk Act* (SARA) in 2018. The rationale for an assessment as Threatened was its occurrence as one isolated population with a very small range and no possibility of rescue.

There are unknowns regarding the feasibility of recovery of Sable Island Sweat Bee as presented in the recovery feasibility summary section. In keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible.

Although many knowledge gaps exist for this species, the primary threats to the Sable Island Sweat Bee have been identified to include habitat shifting and alteration associated with large scale processes of climate change and stemming primarily from increased severity and frequency of storms, sea level rise and flooding in addition to potential invasive species introductions and influences of non-native species. Recreational activities, vehicle use and collections for research may also have an influence on individuals, residences and suitable habitat.

This document has been prepared to meet the requirements under SARA of both a recovery strategy and an action plan. As such, it provides both the strategic direction for the recovery of the species as well as the more detailed recovery measures to support this strategic direction, outlining what is required to achieve the objectives. The population and distribution objective is to maintain a stable population of Sable Island Sweat Bee distributed across its current area of occupancy (2019). Meeting this objective will involve: (i) addressing key knowledge gaps (e.g., species' needs, biology, abundance, distribution and threats) so that suitable habitat can be described and subsequently protected habitat by 2025; and (ii) reducing and preventing key threats (e.g., ensuring no invasive species are introduced to the island; ensuring no suitable habitat is disturbed or permanently lost due to human activity, which may include restoration of suitable habitat where required).

In order to achieve the population and distribution objectives for the Sable Island Sweat Bee, the immediate focus of recovery and conservation efforts will be to prevent and reduce threats to the extent possible and maintain habitat at known sites while addressing knowledge gaps to better understand and protect the species and its habitat in the future. Specific recovery measures involving site stewardship and management, impact assessment and mitigation, development and implementation of best management practices, education and awareness initiatives, restoration activities and research and monitoring have been identified as high priorities over the next five years.

Section 41(1)(c) of SARA requires that the recovery strategy 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. There are presently numerous knowledge gaps surrounding critical habitat requirements for Sable Island Sweat Bee; critical habitat has been identified to the extent possible at this time. A schedule of studies has been developed to provide the information necessary to identify the critical habitat that will be sufficient to meet the population and distribution objectives. As more information becomes available, additional critical habitat may be identified.

Measures proposed in this recovery strategy and action plan will have limited socio-economic impact and place no restrictions on land use outside of Sable Island National Park Reserve. Direct costs of implementing this plan will be borne by Parks Canada. Indirect costs are expected to be minimal, while benefits will include positive impacts on ecological integrity, greater awareness and appreciation of the value of biodiversity to Canadians, and opportunities for engagement of partners and visitors.

Recovery Feasibility Summary

Based on the following four criteria that the Government of Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Sable Island Sweat Bee. In keeping with the precautionary principle, this recovery strategy and action plan has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible. Accordingly, this plan prioritizes filling knowledge gaps in order to address the unknowns surrounding the feasibility of recovery.

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

Yes. Although information on total abundance is not available, individuals have been observed annually over several consecutive years of surveys (2013–2019), indicating that a breeding population presently exists.

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

Yes. The Sable Island Sweat Bee is a generalist forager and has been found throughout vegetated areas on Sable Island, which comprise approximately 14.6 km² (Colville et al. 2016). Many knowledge gaps exist surrounding suitable nesting habitat, however it appears that nest sites require stable, bare to sparsely vegetated, sand substrate, which is also widely distributed across the island (Parks Canada 2019a). Although information on habitat requirements is relatively limited, the continued presence of the species on Sable Island suggests that sufficient suitable habitat is available to support maintenance of the current population.

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

Unknown. Although several knowledge gaps still exist, the primary threats to the Sable Island Sweat Bee are identified to be habitat shifting and alteration associated with climate change (stemming primarily from increased severity and frequency of storms, sea level rise, and salt water intrusion/flooding) in addition to potential invasive species introductions and interactions with non-native species (COSEWIC 2014). The influence of these threats on the Sable Island Sweat Bee population is poorly understood and it is unknown whether threats associated with climate change can be avoided or mitigated.

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

Yes. Notwithstanding unknowns associated with the species' historic condition, it is considered to be biologically and technically feasible to mitigate some key threats to increase the likelihood that the species will maintain a stable population across its known range. The Sable Island Sweat Bee is intrinsically rare in Canada and naturally precarious due to its small range confined within an isolated location. It is therefore

recognized that the recovered condition of this species may continue to be associated with an assessed status of Threatened (D criterion – Restricted population).

Table of Contents

Preface.....	i
Acknowledgments	ii
Executive Summary	iv
Recovery Feasibility Summary	vi
Table of Contents	viii
1. COSEWIC* Species Assessment Information	1
2. Species Status Information	1
3. Species Information	2
3.1 Species Description	2
3.2 Species Population and Distribution.....	2
3.3 Needs of the Sable Island Sweat Bee	3
4. Threats.....	4
4.1 Threat Assessment	4
4.2 Description of Threats	5
5. Population and Distribution Objectives.....	9
6. Broad Strategies and General Approaches to Meet Objectives	10
6.1 Actions Already Completed or Currently Underway	10
6.2 Strategic Direction for Recovery.....	12
6.3 Narrative to Support the Recovery Planning Table	16
6.4 Monitoring	16
7. Critical Habitat.....	16
7.1 Identification of the Species' Critical Habitat	17
7.1.1 Information and Methods Used to Identify Critical Habitat.....	18
7.2 Schedule of Studies to Identify Critical Habitat.....	18
7.3 Activities Likely to Result in the Destruction of Critical Habitat.....	19
7.4 Proposed Measures to Protect Critical Habitat.....	20
7.4.1 Measures Proposed to Protect Critical Habitat on Federal Lands	20
8. Evaluation of Socio-economic Costs and Benefits.....	20
8.1 Costs.....	21
8.2 Benefits	21
9. Measuring Progress	22
10. References	23
Appendix A: Effects on the Environment and Other Species	26

1. COSEWIC* Species Assessment Information

Date of Assessment: November 2014

Common Name (population): Sable Island Sweat Bee

Scientific Name: *Lasioglossum sablense*

COSEWIC Status: Threatened

Reason for Designation:

The species is globally endemic to Sable Island, Nova Scotia, and occurs as one isolated population with a very small range and no possibility of rescue. The island has only about 13 km² of vegetated area that provides foraging/nesting sites for this bee. Nesting likely occurs near or within this vegetated area and sweat bees are not known to travel large distances (i.e., >200 m) for forage. Increased frequency and severity of storms, in addition to climate change and related sea level rise, are expected to drive change which will further decrease the quality and quantity of bee habitat on the island. Eco-tourism is also a potential future threat, which may also increase the introduction and spread of invasive species. Habitat on the island is also susceptible to invasive plant species, introduced horses, and seawater flooding.

Canadian Occurrence:

Nova Scotia

COSEWIC Status History:

Designated Threatened in November 2014

* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

2. Species Status Information

Sable Island Sweat Bee (*Lasioglossum sablense* Gibbs) was assessed as Threatened by COSEWIC in 2014 and listed as Threatened in Schedule 1 of the *Species at Risk Act* in May 2018. The species was also listed as Threatened under the Nova Scotia *Endangered Species Act* in 2017. Since the Sable Island Sweat Bee is currently known to be endemic to Sable Island, the percentage of the global population that is located in Canada is 100% (Table 1).

Table 1. Conservation status ranks for Sable Island Sweat Bee (NatureServe 2019).

Global (G) Rank ¹	National (N) Rank	Subnational (S) Rank
G1	Canada N1	Nova Scotia S1

¹ Conservation Status Rank: 1– critically imperiled; 2– imperiled; 3– vulnerable to extirpation or extinction; 4– apparently secure; 5– secure; X – presumed extirpated; H – historical/possibly extirpated; NR – status not ranked; U – unrankable

3. Species Information

3.1 Species Description

The Sable Island Sweat Bee is a small (5–6 mm), dull-metallic sweat bee in the family Halictidae (COSEWIC 2014). It was first described in a revision of the *Lasioglossum* subgenus *Dialictus* for Canada (Gibbs 2010) based on specimens collected from Sable Island in 1966 and 1967 (Howden et al. 1970) and 2008 (Catling et al. 2009).

There are five bee species that occur on Sable Island, including two *Lasioglossum* species: the Sable Island Sweat Bee and the Nova Scotia Sweat Bee (*Lasioglossum novascotiae*; Lucas 2017). The Nova Scotia Sweat Bee can be distinguished by the sparse punctures on the dorsal surface of the thorax adjacent to the wing bases. Additionally, the dense pale hairs on the end of the female's abdomen can be used to distinguish Sable Island Sweat Bee females from the more sparsely pubescent Nova Scotia Sweat Bee (COSEWIC 2014).

3.2 Species Population and Distribution

The Sable Island Sweat Bee is endemic to Canada and known to occur only on Sable Island, Nova Scotia (COSEWIC 2014). Located at the edge of the continental shelf, 290 kilometers southeast of Halifax and 150 kilometers from the closest landfall, Sable Island is a 42-kilometre-long crescent shaped island in the Atlantic Ocean. Extensive search effort and examination of thousands of *Lasioglossum* specimens from throughout Atlantic Canada during the species revision process (Gibbs 2010, COSEWIC 2014) as well as subsequent field surveys targeting dune ecosystems in mainland Nova Scotia and Cape Breton Island (Klymko and Robinson 2019) have not resulted in discovery of any occurrences of the Sable Island Sweat Bee outside of Sable Island.

On Sable Island, the Sable Island Sweat Bee has been found throughout the vegetated portion of the island and confirmed to occur at 27 sites, each separated by a distance of more than 300 m from another location (Lucas 2017, 2018; Figure 1). The areal extent of vegetated communities on Sable Island is approximately 14.6 km² (as of 2014) (Colville et al. 2016).

The population size for the Sable Island Sweat Bee is currently unknown and there is no information on historic populations, trends in abundance or whether current levels are within the range of historic natural variability (COSEWIC 2014). From collections and observations between 2014 and 2018, the Sable Island Sweat Bee has been found to be less abundant than the Nova Scotia Sweat Bee, with a relative proportion of occurrences of approximately 3:1 (COSEWIC 2014, Lucas 2017) but occurring across a wider distribution (Lucas 2017).

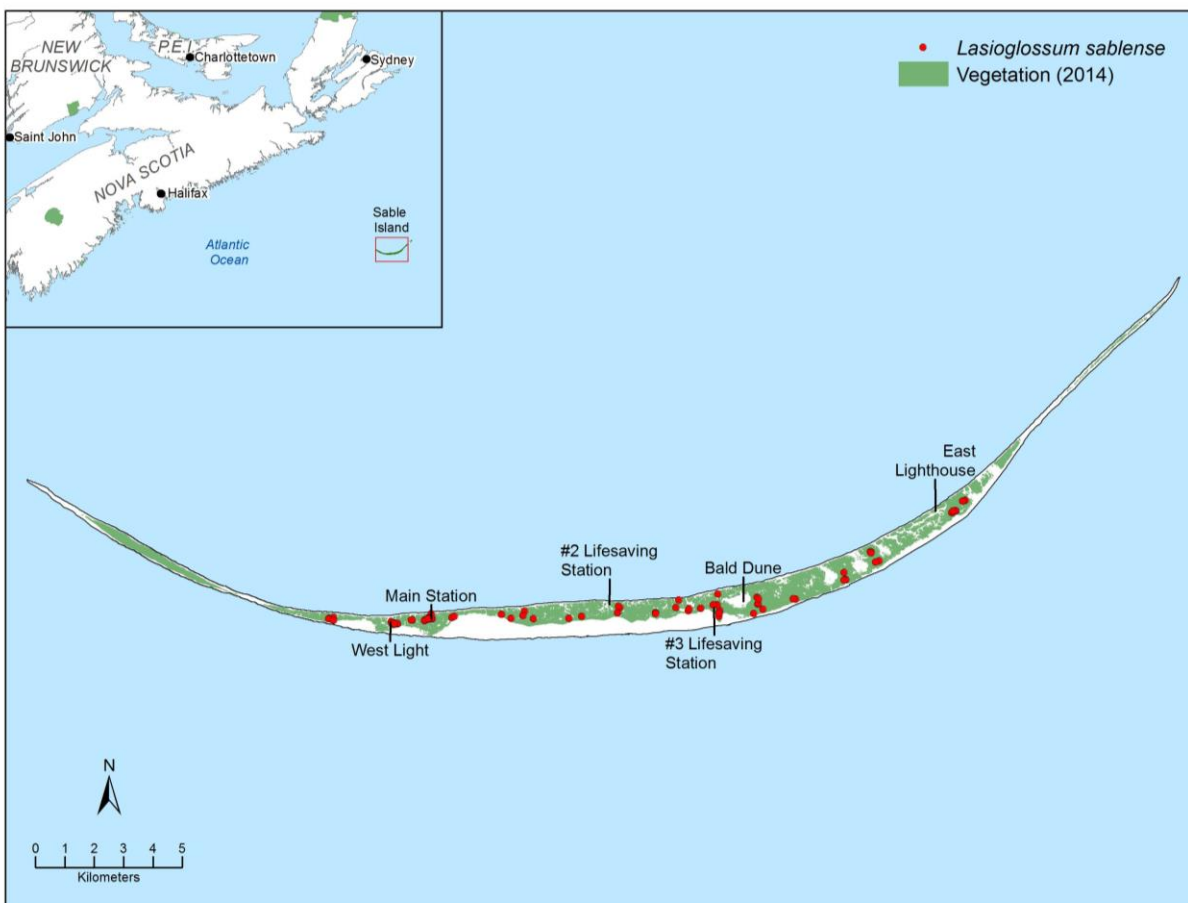


Figure 1. Distribution of occurrence records for Sable Island Sweat Bee on Sable Island, NS, Canada. Data from Lucas (2017, 2018).

3.3 Needs of the Sable Island Sweat Bee

The Sable Island Sweat Bee is a ground-nesting species and a generalist forager on flowering plants (COSEWIC 2014). In temperate regions, *Lasioglossum* typically have an annual life cycle (Michener 1974) where inseminated adult females overwinter and emerge in spring to form new nests. Reproductive males and females are produced and emerge in late summer (COSEWIC 2014). The Sable Island Sweat Bee has an active flight period from at least mid-May to mid-October (Lucas 2017, 2018). During this period, the species has been found foraging most often in heath vegetation communities but has also been found foraging in sparse and dense grassland (Lucas 2017).

The Sable Island Sweat Bee requires pollen and nectar throughout its active period and it uses a wide variety of plant species for this food source (Lucas 2017). An examination of floral associations identified the key forage species as: *Rosa virginiana*, *Trifolium pratense*, *Achillea millefolium*, *Anaphalis margaritacea*, *Hieracium* sp., *Scorzoneroide autumnalis*, *Solidago sempervirens*, *Sonchus arvensis*, *Taraxacum officinale*, *Vaccinium*

macrocarpon, *Rubus x biformispinus*, *Sibbaldia tridentata*, *Calystegia sepium* and *Leucanthemum vulgare* (Lucas 2017, 2018).

The foraging range for a bee of similar size to the Sable Island Sweat Bee is likely a distance of less than 1 km from its nest site (Greenleaf et al. 2007) and considering the windy climate on Sable Island, the nest sites are likely in close proximity to the vegetation communities required for foraging (COSEWIC 2014).

Relatively little is known about the nesting biology and requirements of the Sable Island Sweat Bee. They have been confirmed to nest underground, as with most other species of *Lasioglossum*, and evidence of eusociality has been detected. In Summer 2019, four nest sites, with aggregations of up to 80 nests at a given site, were found in and around Main Station on Sable Island (Parks Canada 2019a). Almost all nest sites were found in stable, sparsely vegetated heath habitat, with greater than 50% bare sand. Note that search effort was largely confined to this habitat within the fenced area of the Main Station. A small search effort outside of Main Station led to the identification of a single nest in a patch of bare sand, in the lee of the dominant winds. It is presumed that overwintering likely occurs at or near the nest sites, as with other species of *Lasioglossum* (COSEWIC 2014).

4. Threats

4.1 Threat Assessment

The threat assessment for Sable Island Sweat Bee (Table 2) is based on the unified threats classification system developed by the International Union for the Conservation of Nature–Conservation Measures Partnership (IUCN-CMP 2006). The threat assessment conducted for the species' status report (COSEWIC 2014) was used as the basis for this assessment and updated to reflect current and potential threats, taking into account activities and operations consistent with legislation and regulations governing Sable Island National Park Reserve. 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. For the purposes of threat assessment, only present and future threats are considered and a 10-year window is used as the period of assessment. 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 4.2.

The following description of the species location is provided as context for this assessment: Sable Island became a National Park Reserve under the Canada National Parks Act in 2013. Prior to that, there had been a continuous human presence since 1801, first as the Humane Establishment (lifesaving stations) then as a weather station

maintained by the Meteorological Service of Canada. During this time, various buildings were built and maintained, and species of plants and animals were introduced to the island. Currently, the remaining infrastructure is centered on three locations: the Main Station and research camps at West Light and East Light. There are between 3 and 20 contractors, staff and researchers on the island depending upon the time of year. Sable Island National Park Reserve (SINPR) receives about 450 visitors a year, the majority arriving by small expedition cruise vessel, and spending approximately four hours on the island. The remaining visitors arrive by air charter or by private vessel and can spend up to ten hours on the island. There is no overnight accommodation for visitors, nor is there any permanent infrastructure to support visitation. Parks Canada and various researchers maintain a fleet of vehicles, including small ATVs, 2–6 seat UTVs, tracked skid steers, and 4-wheel drive passenger vehicles. The first ten-year park management plan was approved in 2019 (Parks Canada 2019b).

Table 2. Threat Assessment Summary Table

Threat #	Threat¹ description	Impact²	Scope³	Severity⁴	Timing⁵
1	Residential & commercial development	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
1.3	Tourism & recreation areas	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
3	Energy production & mining	Not a Threat (in the assessed timeframe)	Restricted (11-30%)	Slight (1-10%)	Low (Possibly in the long term, >10 yrs)
3.1	Oil & gas drilling	Not a Threat (in the assessed timeframe)	Restricted (11-30%)	Slight (1-10%)	Low (Possibly in the long term, >10 yrs)
4	Transportation & service corridors	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
4.1	Roads & railroads	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
5	Biological resource use	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
5.1	Hunting & collecting terrestrial animals	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
6	Human intrusions & disturbance	Negligible	Negligible (<1%)	Slight (1-10%)	High (Continuing)
6.1	Recreational activities	Negligible	Negligible (<1%)	Slight (1-10%)	High (Continuing)
8	Invasive & other problematic species	Low	Large - Small (31-70%)	Slight (1-10%)	High (Continuing)
8.1	Invasive non-native/alien species	Low	Large - Small (1-70%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)
8.2	Problematic native species	Unknown	Large (31-70%)	Unknown	High (Continuing)
11	Climate change & severe weather	Low	Restricted (11-30%)	Moderate (11-30%)	Moderate (Possibly in the short term, < 10 yrs)
11.1	Habitat shifting & alteration	Low	Restricted (11-30%)	Moderate (11-30%)	High (Continuing)

Threat #	Threat¹ description	Impact²	Scope³	Severity⁴	Timing⁵
11.2	Droughts	Not a Threat (in the assessed timeframe)	Large (31-70%)	Moderate (11-30%)	Low (Possibly in the long term, >10 yrs)
11.3	Temperature extremes	Not a Threat (in the assessed timeframe)	Restricted (11-30%)	Moderate (11-30%)	Low (Possibly in the long term, >10 yrs)
11.4	Storms & flooding	Low	Small (1-10%)	Moderate (11-30%)	High (Continuing)

¹ Classification of Threats adopted from IUCN-CMP (Salafsky et al. 2008).

² 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% decline), 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 timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

³ 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%).

⁴ 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. 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 ≥ 0%).

⁵ Timing – High = continuing; Moderate = only in the future (could take place in the short term [< 10 years or 3 generations]) or now suspended (could return 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 Sable Island Sweat Bee was assessed as Threatened by COSEWIC in 2014 because of its occurrence as one isolated population with a small range and no possibility of rescue. In addition to this natural precariousness, current and anticipated issues and activities that could threaten the survival of the Sable Island Sweat Bee are detailed below. As described in the status report for the species (COSEWIC 2014), habitat shifting and alteration (e.g., saltwater intrusion, sea level rise), storms and flooding and invasive non-native/alien species are likely the greatest threats to the Sable Island Sweat Bee and its habitat. Droughts and temperature extremes and oil and gas activities may also have an impact in the future. Recreational activities, vehicle use and collections for research may have a slight influence on the species and its habitat. Overall, the level of impact of these threats was determined to be either low or unknown and many knowledge gaps remain. Threats are listed as above in the threat assessment summary table (Table 2) and are described in more detail below.

1.3 Tourism and recreational areas; 6.1 Recreational activities

Visitation on Sable Island is carefully managed and currently very low (i.e., <500 visitors/year in 2017 and 2018 (Parks Canada 2019b)) with no overnight stays and hence is not likely to be a significant threat to sweat bees or their habitat. All visitation is managed by Parks Canada through a visitor registration process. The majority of visitors arrive by expedition vessels (guided in small groups on the island), with the remainder arriving by chartered aircraft or private vessels (Parks Canada 2019b). Human foot traffic on Sable Island could potentially increase erosion on dune slopes and vegetated areas and trample sensitive bee habitat, however the impact of this activity is considered to be negligible. Visitor activities are managed in a way to minimise disturbance to vegetation and potential bee habitat through avoiding travel in sensitive areas (i.e., heath and freshwater ponds) and using existing horse paths as much as possible. Procedures are currently in place to minimise the risks of introducing invasive species associated with visits to the island, however increases in visitation will also increase the probability of introduction of invasive species.

3.1 Oil and gas drilling

Current regulations prevent oil or gas drilling within one nautical mile of Sable Island however low impact surficial exploration activities and sub-surface horizontal drilling beneath the island are permitted under the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* although not currently underway (Parks Canada 2019b). The Canada-Nova Scotia Offshore Petroleum Board regulates offshore activities and has a responsibility to consult with Parks Canada in review of resource exploration activities. It is unclear what effect sub-surface drilling would have on the island, but any disturbance or collapse of material beneath the island could have a significant impact on ecosystems. Low impact seismic exploration on Sable Island may also affect bee habitat through trampling and disturbance to vegetation associated with vehicle and equipment use (Lucas 2015).

4.1 Roads and vehicle use

Vehicle use at Sable Island National Park Reserve is restricted to barren beaches, limited roads near the island's station and other predefined locations as outlined in Parks Canada's Best Management Practice for the management of permitted motor vehicle use (Parks Canada 2014). Driving on vegetation, dune slopes and sensitive ecosystems (including heath and freshwater ponds) is prohibited, which should limit direct impact on floral hosts and nesting sites of Sable Island Sweat Bee. The only exception to this is the use of ATVs in non-heath vegetated areas during the winter for the grey seal research program, however this seasonal use is not expected to significantly affect sweat bee habitat, overwintering sites or individuals since the ground is frozen, vegetation is dormant and disruption of substrate is minimal.

5.1/5.2 Collecting terrestrial animals & gathering terrestrial plants

Collection of insects on Sable Island is limited to permitted research activities and generally confined to voucher specimens to assist with identification. Although this may involve removal of a very small number of Sable Island Sweat Bee individuals, it is not considered to be a significant threat to the population. Collection of individuals is only permitted for research related to the conservation of the species. Protocols for in-situ, non-lethal identification have been developed (i.e., macro photography, capture/release using specimen identification tubes). Collection of plants on Sable Island is also limited to permitted research activities and generally confined to voucher specimens. Although this may involve removal of a very small number of plants that may be food for Sable Island Sweat Bee, it is not considered to be a significant threat to the species.

8.1 Invasive non-native/alien species

There are currently no known invasive, alien species that are a significant threat to the Sable Island Sweat Bee. *Sphecodes* bees that are cleptoparasitic on other species of *Lasioglossum* have not been recorded on Sable Island. If other bee species were introduced to the island, then they could potentially impact the Sable Island Sweat Bee through increased competition or introduced disease. Nest sites for cavity-nesting bees would be limited to areas near buildings or other structures, which would minimize the impact and likelihood of establishment of these bees. Transportation of ground-nesting species is unlikely but could be possible (e.g., nests in potted plants)(COSEWIC 2014). The broad floral host range of Sable Island Sweat Bee also may help it escape competition from other species. Other invasive insects, such as ants or bee-attacking insects, could also potentially impact Sable Island Sweat Bee if accidentally introduced. Mutillid wasps, which parasite bee nests, are not currently known to occur on Sable Island (Majka 2014).

Introduction of an invasive plant species could also be problematic to the Sable Island Sweat Bee and its habitat. The harsh conditions on Sable Island (e.g., high winds, frequent storms, cool summer climate, high sand content, and heavy inundation of salt water) are likely to limit the number of invasive species that could become successfully established. Nevertheless, any invasive plant that interferes with the natural ecosystem could be potentially harmful to Sable Island Sweat Bee. Protocols are currently being

developed and implemented to minimize the probability of transporting invasive, alien species to Sable Island National Park Reserve.

Sable Island has a resident population of naturalized horses, which are protected as wildlife under the *Canada National Parks Act*. The impact of the horse population on the Sable Island Sweat Bee is unknown and requires additional study. Trampling of vegetation by the horses is potentially damaging either directly or through increased erosion (Freedman et al. 2011). Horses also preferentially consume Marram grass (*Ammophila breviligulata*), which is the primary sand-binding plant species responsible for preventing erosion. This large herbivore has the potential to also consume valuable floral hosts of the bee. However, horses play a role in nutrient cycling, soil formation, and plant productivity on Sable Island (McLoughlin et al. 2016). The horse population has been increasing since it was protected by legislation in 1960 from 180 in 1961 (Welch 1975) to 559 individuals in 2018 (P. McLoughlin, pers. comm.). Research on the potential effect of horses on the Sable Island Sweat Bee and its floral hosts using horse exclosures is required (Freedman et al. 2011).

8.2 Problematic native species

Grey seals (*Halichoerus grypus*) also have the potential to damage vegetated areas during the winter months when they come inland on Sable Island. Grey seal populations increased exponentially over several decades during the late 20th century, although this population growth has declined in recent years (Bowen et al. 2003, Bowen 2014). During winter months, the seals move inland and occupy the lowland terrestrial areas of the island. The presence of large numbers of grey seals in these areas may contribute to erosion, which could influence Sable Island Sweat Bee overwintering sites and dormant floral resources however further research is required to address this knowledge gap. In summer months, Grey seal movement and digging may also disturb or damage individuals and/or nest sites.

11.1 Habitat shifting and alteration

Habitat loss and alteration, resulting from natural geomorphological processes, which are being affected by climate change and associated increases in severity and frequency of storms, sea level rise, and salt water intrusion/flooding has been identified as a key threat to the Sable Island Sweat Bee. Through natural processes, Sable Island is continually shifting as wind and wave action reduces material from one end of the island and replaces it on the opposite side of the island (Byrne et al. 2014). The island is highly susceptible to erosion by wind and water because of its low topography, unstable sand substrate, and large areas of unvegetated terrain (Freedman 2001). Predictions for Sable Island are for a continued 1 cm/year increase in sea level as a result of climate change (Manson et al. 2019). It is anticipated that Sable Island will continue to build upward with the regional rise in sea level, building new dunes as long as the regional oceanic patterns are not greatly altered and as long as there is an abundant supply of sand available for this regional system (Duck et al. 2014). However, Sable Island has a low elevation and sea level rise may affect some vegetated areas and alter available habitat for the Sable Island Sweat Bee. Increased rates of erosion and dune instability would affect availability of habitat for Sable Island Sweat Bee; however, this is

not expected to be a significant threat in the short-term. An analysis of vegetation cover between 1963 and 2014 found that the total areal extent of early and late vegetation communities on Sable Island had been relatively consistent over this period (Colville et al. 2016).

11.2 Droughts

A freshwater lens, persisting in a delicate balance with the island's surface topography and vegetative cover, climate patterns, and the surrounding ocean, sustains life on Sable Island (Hennigar 1976). The freshwater lens extends under the entire length of the island, surrounded on either side and from below by saltwater and exposed at the surface in the form of several freshwater ponds across the island. These freshwater ponds have shown a decreasing trend in extent across the island due to erosion, sand deposition and saltwater incursion during storm events (Freedman et al. 2014). An extended period of drought could impact the freshwater lens and availability of freshwater on the island, consequently affecting vegetation communities and habitat and food availability for the Sable Island Sweat Bee. Total amounts of seasonal precipitation have increased (spring, summer) or remained stable (winter, fall) over the past century on Sable Island (Duck et al. 2014, PCA 2017). Groundwater monitoring wells show a slight increase in chloride concentration and decrease in water level over the past 30 years (Kennedy et al. 2014). Overall, significant, extended periods of drought are not perceived to be a significant threat in the assessed timeframe.

11.3 Temperature extremes

Sable Island has experienced a slightly warming climate, with surface air temperature increasing at an average rate of about 0.11°C per decade over the past century (Duck et al. 2014, PCA 2017). This increase is consistent with and slightly higher than what is being observed globally as a result of climate change during the past century or so, the causes of which are anthropogenic. Extended extreme hot or cold temperatures could potentially impact the Sable Island Sweat Bee directly or indirectly by damaging floral hosts. Examination of climate data from the past century indicate that temperatures on Sable Island are becoming more variable (Duck et al. 2014) however this is not anticipated to be a significant threat to the Sable Island Sweat Bee or its habitat in the short-term. Climate projections estimate that temperatures could increase by up to 5 degrees Celsius over the next century (PCA 2017).

11.4 Storms and flooding

Sable Island is an emergent sand bank in a remote oceanic location and as such is exposed to maritime weather of the northwest Atlantic and affected by fog, wind and heavy seas (Robichaud and Mullock 2011). As noted above, climate change is expected to increase storm frequency and severity in the region (Loder et al. 2013). Blow-outs and wash-overs are prevalent along both the north and south sides of the island and more frequent towards the east and west tips (Byrne et al. 2014). The effect of this flooding on vegetation or the impact of submersion of Sable Island Sweat Bee nests is largely unknown, however there are likely to be some impacts to the species associated with loss of habitat. In particular, freshwater ponds are decreasing in extent across the island due to erosion, sand deposition and saltwater incursion during storm

events (Freedman et al. 2014). This inundation by saltwater and infilling by sand of freshwater ponds leads to loss of vegetation and biodiversity, which has the potential to affect Sable Island Sweat Bee habitat.

5. Population and Distribution Objectives

The population and distribution objective is:

To maintain a stable population of Sable Island Sweat Bee distributed across its current area of occupancy⁴ (2019).

Meeting this objective will involve:

Addressing key knowledge gaps (e.g., species' needs, biology, abundance, distribution and threats) so that suitable habitat can be described and subsequently protected by 2025.

Reducing and preventing key threats (e.g., take measures to prevent the introduction of invasive species; ensuring no suitable habitat is disturbed or permanently lost due to human activity, which may include restoration of suitable habitat where required).

The Sable Island Sweat Bee is intrinsically rare in Canada and naturally precarious due to its small range confined within an isolated location. It is therefore recognized that the approaches to recovery outlined in this document may never result in de-listing of the species and that the recovered condition of this species may still be associated with an assessed status of Threatened (D criterion – Restricted population).

Due to a lack of information on abundance and habitat needs, quantitative targets for population and distribution objectives are not possible at this time. Accordingly, the immediate focus of conservation efforts for the Sable Island Sweat Bee will be to prevent and reduce threats (i.e., invasive species introductions, habitat loss and disturbance associated with human activity) to the extent possible and maintain habitat at known sites while addressing knowledge gaps. As key knowledge gaps regarding habitat, population abundance and trends, and threats to the species are addressed, conservation efforts may be refined and the population and distribution objectives may be revised.

⁴ Area of occupancy is defined as the occupied habitat within a species range. Sable Island Sweat Bee is known to occupy the vegetated portion of Sable Island, estimated to be approximately 14.6 km² in 2014 (Colville et al. 2016), which is the most recent assessment.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

The following inventories and research activities have contributed to the current understanding of the Sable Island Sweat Bee and its distribution, habitat preferences and seasonality on Sable Island, Nova Scotia:

- Specimen collections stemming from faunal surveys on Sable Island in the late 1960s (Howden et al. 1970) and 1980s (Wright 1989) included *Lasioglossum* (sp).
- Gibbs (2010) described the species in a revision of the *Lasioglossum* subgenus *Dialictus* for Canada based on specimens collected from Sable Island in 1966 and 1967 (Howden et al. 1970) and 2008 (Catling et al. 2009).
- During development of the COSEWIC status assessment led by Jason Gibbs (COSEWIC 2014), field sampling and specimen led to 38 confirmed occurrences in four general areas on Sable Island (West Light, East Light, Main Station and Calapogon Pond).
- From 2016 to 2018, Zoe Lucas, in collaboration with Parks Canada, conducted field inventories to better understand the distribution, seasonality and habitat preferences of bees on Sable Island. This work identified the flight season for the Sable Island Sweat Bee to be from at least May 13–Oct 18. The species was found to be widely distributed on Sable Island and confirmed to occur at 27 locations, each separated by a distance of more than 300m from another location. Foraging habitat and 15 associated plant species were identified through confirmed foraging records (Lucas 2017, 2018, 2019).
- In 2018, Atlantic Canada Conservation Data Centre (ACCDC) led surveys in dune habitat along the Atlantic coast of Nova Scotia to search for the Sable Island Sweat Bee in order to further test whether it is endemic to Sable Island. Twenty sites were surveyed in August and September and 174 metallic sweat bees were collected, none of which were identified as the Sable Island Sweat Bee (Klymko and Robinson 2019).
- In 2019, Parks Canada, in partnership with the ACCDC and Miriam Richards (Brock University), led a partial survey of nesting sites at the Main Station on Sable Island. Four nesting sites (consisting of 90, 14, 3, and 1 individual nests) were discovered, but the area was not exhaustively searched (Parks Canada 2019a). Extremely limited search effort outside Main Station (2 hours) led to the discovery of one nest, approximately 300 m east of the Main Station enclosure. Observations strongly suggest eusociality at least in some nests.

- Parks Canada is currently working with Miriam Richards (Brock University) to sequence and assemble the complete genome of the Sable Island Sweat Bee using next generation techniques for two main purposes: (i) to establish phylogenetic relationships to closely related species in the *Viridatum* species group, including the Nova Scotia Sweat Bee; and (ii) to assess genetic variation among individuals. The combination of these two types of data will provide information on the biogeographic origins of the Sable Island Sweat Bee, to estimate the age of the species and the time since speciation, and most importantly, to estimate the effective population size and extent of inbreeding in the population.

6.2 Strategic Direction for Recovery

The recovery measures outlined below are arranged by both the broad strategies required to recover the species and the general descriptions of research and management approaches that will be taken (Table 3). The classification of broad strategies is based on the conservation actions classification developed by the International Union for the Conservation of Nature–Conservation Measures Partnership (v.2.0). For each recovery measure, desired outcomes and anticipated timelines for implementation and delivery are indicated. Identified threats that will be addressed by each recovery measure relate to those described in Section 4.

Table 3. Recovery planning table and Implementation Schedule

General description of research and management approaches	#	Recovery measure	Desired outcome	Priority ¹	Threats or concerns addressed	Timeline
Broad Strategy ² : Land/Water management – Site/area stewardship						
Mitigate threats and protect Sable Island Sweat Bee and its habitat through site-level stewardship and management	1	Develop and implement standard operating procedures and evaluate projects through impact assessment and research permitting processes to mitigate human-caused threats to the species and its habitat (i.e., human use and access, including biosecurity procedures; vehicle use; infrastructure)	Standard operating procedures (i.e., Best management practices) are developed by 2021 and implemented annually and impact assessments are completed as required to ensure that human-caused threats to sweat bees are mitigated.	High	1.3 Tourism and recreation areas; 4.1 Roads and vehicle use; 5.1 Collecting terrestrial animals; 6.1 Recreational activities; 8.1 Invasive non-native/alien species	Annually
Restore targets and mitigate stresses via active management	2	Mitigate stresses (e.g., erosion, vegetation changes, wind flow changes) associated with infrastructure development/decommissioning through re-vegetation and site restoration.	Impact assessments are completed as required to ensure that there is no new erosion created from building or removing infrastructure and that the total area of suitable habitat for Sable Island Sweat Bee is maintained.	High	1.3 Tourism and recreation areas; 4.1 Roads & rail roads; 6.1 Recreational activities	Annually

	3	If mitigation is not feasible or unsuccessful, restore habitat lost or degraded because of human activity.	Area of suitable habitat for Sable Island Sweat Bee is maintained.	High	1.3 Tourism and recreation areas; 4.1 Roads & rail roads; 6.1 Recreational activities	As necessary
Broad Strategy: Awareness Raising – Outreach & Communications						
Raise awareness of Sable Island Sweat Bee	4	Design and implement awareness program and information materials to provide to all visitors and researchers to increase understanding of the species, its critical habitat and best management practices to ensure its protection.	Awareness program is developed by 2021 and implemented annually.	High	1.3 Tourism and recreation areas; 4.1 Roads and vehicle use; 5.1 Collecting terrestrial animals; 6.1 Recreational activities; 8.1 Invasive non-native/alien species	Annually
Broad Strategy: Research & Monitoring – Basic Research & Status Monitoring						
Conduct research and analyses on Sable Island Sweat Bee	5	Develop a standardized monitoring protocol to assess Sable Island Sweat Bee absolute or relative abundance and distribution.	Monitoring protocol for estimating abundance is developed and implemented by 2022.	High	Knowledge Gaps	2022
	6	Monitor the species at known sites and inventory for new occurrences in priority areas.	Population status and trend is determined by 2025.	High		2025
	7	Complete taxonomic and genetic analyses for Sable Island Sweat Bee.	Genome is sequenced and analyzed in relation to other species and effective population size is estimated by 2022.	High		2022

	8	Collaborate with academic institutions and researchers to understand the species' life cycle and social structure.	Life cycle and social structure are better understood by 2025.	High		2025
Conduct research and analyses on threats to the species and its habitats	9	Collaborate with academic institutions and researchers to understand the effects of horses and grey seals on Sable Island Sweat Bee and its habitat.	Exclosure study completed and ecological role and influence of horses and grey seals are better understood by 2025.	High		2025
	10	Collaborate with academic institutions and researchers to understand effects of invasive species and whether the Sable Island Sweat Bee has any predators and/or parasites and diseases.	Mortality factors are understood by 2025.	Medium		2025
	12	Collaborate with academic institutions and researchers to better understand the role of human disturbance on Sable Island Sweat Bee nesting habitat and identify potential habitat enhancement strategies.	Influences to nesting habitat and potential enhancement strategies are understood by 2025.	Medium		2025
Broad Strategy: Species Management – Ex-situ Conservation						
Provide <i>ex-situ</i> protection for Sable Island Sweat Bee via captive breeding (if required to meet population and distribution objectives)	13	Assess feasibility and develop methodology for captive rearing Sable Island Sweat Bees and determine criteria for implementation.	Captive rearing plan and methodology is developed by 2030.	Low	11.1 Habitat shifting and alteration; 11.2 Drought; 11.3 Temperature extremes; 11.4 Storms and flooding	2030

¹ "Priority" reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species. High priority measures are considered those most likely to have an immediate and/or direct influence on attaining the

population and distribution objectives for the species. Medium priority measures may have a less immediate or less direct influence on reaching the population and distribution objectives, but are still important for the recovery of the population. Low priority recovery measures will likely have an indirect or gradual influence on reaching the population and distribution objectives, but are considered important contributions to the knowledge base and/or public involvement and acceptance of the species.

² Classification of broad strategies and approaches is adopted from IUCN Conservation Measures Partnership Conservation Actions Classification v. 2.0.

6.3 Narrative to Support the Recovery Planning Table

In order to achieve the population and distribution objectives for the Sable Island Sweat Bee, the immediate focus of recovery and conservation efforts will be to prevent and reduce threats to the extent possible and maintain habitat at known sites while addressing knowledge gaps to better understand and protect the species and its habitat in the future. Given the uncertainty around whether threats to the species and its habitat associated with climate change (i.e., habitat shifting and alteration, storms and flooding, drought, temperature extremes) can be avoided or mitigated, priority has been placed on reducing those threats that can be addressed through site stewardship and management, impact assessment and mitigation, development and implementation of standard operating procedures (i.e., best management practices), education and awareness initiatives, and restoration activities where required (i.e., habitat loss and disturbance associated human activity, invasive species introductions).

Research and monitoring will focus on working with experts to fill knowledge gaps related to status and trends in population abundance, genetic composition and effective population size, nesting biology, life cycle and social structure of the species, influences of other species and threats, and mortality factors for the Sable Island Sweat Bee.

Finally, given that the species occurs as one isolated population with a very small range and no possibility of rescue, a methodology for captive rearing will be assessed for feasibility and developed, along with criteria for implementation. This is a precautionary measure to have prepared in the unlikely event that the species is not able to sustain itself independently and as such, is identified as a low priority measure at this time.

6.4 Monitoring

Monitoring activities will be put in place to assess the results of implementation of the identified recovery measures and track progress towards achieving the population and distribution objectives for the Sable Island Sweat Bee. A monitoring protocol to estimate relative abundance and track distribution of the population will be developed and implemented by 2022. Trends in these measures will be examined to determine if a stable population abundance is maintained across its current area of occupancy (2019).

7. Critical Habitat

SARA defines critical habitat as "...the habitat that is necessary for the survival or recovery of a listed wildlife species...". Section 41(1)(c) of SARA requires that a recovery strategy 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.

Critical habitat for Sable Island Sweat Bee is based on habitat occupancy and is identified, to the extent possible, based on the best available information. Additional

critical habitat may be added in the future if new information supports the inclusion of areas beyond what is currently identified.

A schedule of studies (Table 4) has been developed to provide the information necessary to complete the identification of critical habitat that will be sufficient 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).

7.1 Identification of the Species' Critical Habitat

Critical habitat for Sable Island Sweat Bee is identified as all areas within the yellow polygons in Figure 2. These detailed polygons represent habitat patches containing at least one confirmed Sable Island Sweat Bee nest as of November 2019. Additional critical habitat is required to meet the species' population and distribution objectives.

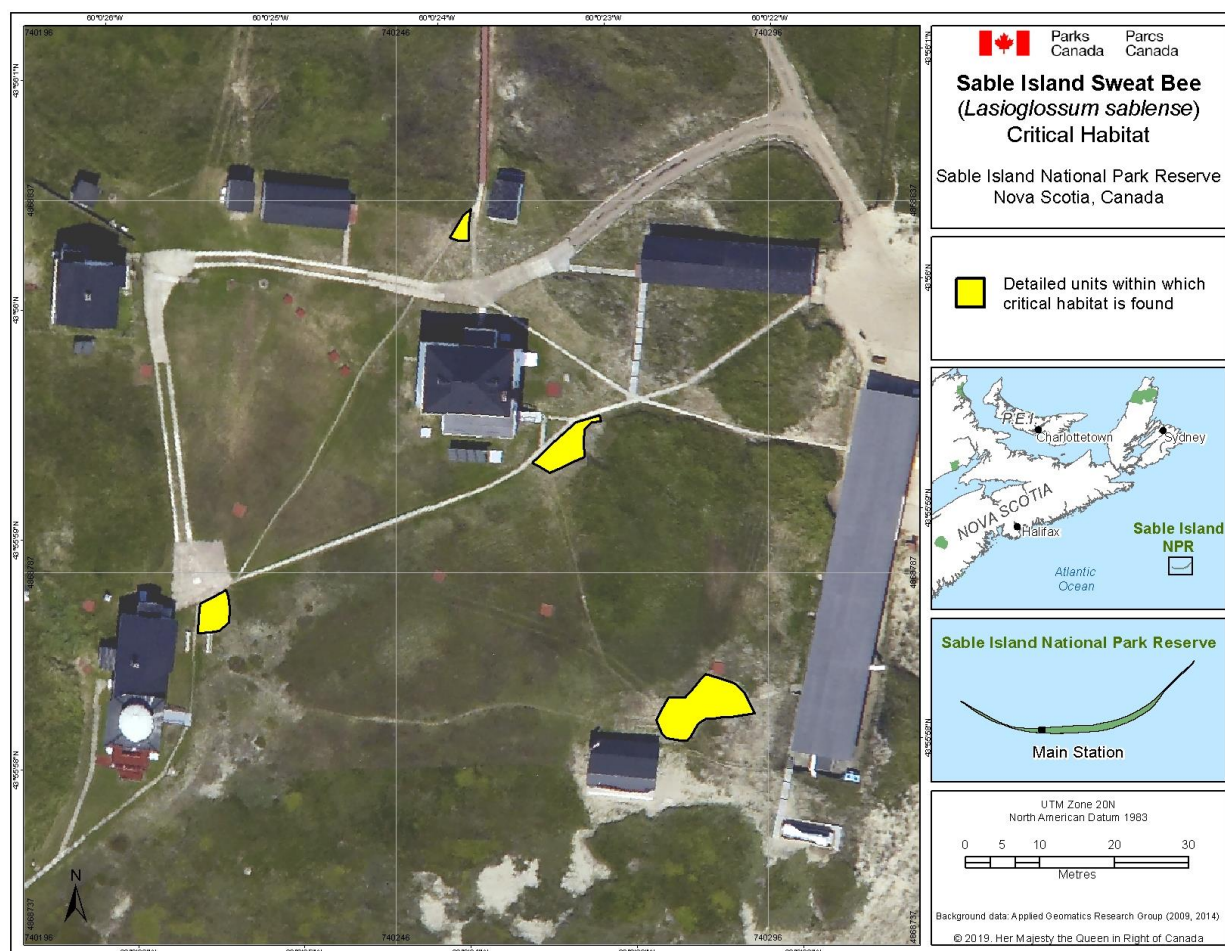


Figure 2. Critical habitat for Sable Island Sweat Bee is represented by the yellow shaded polygons where the habitat occupancy criteria for nesting is met.

7.1.1 Information and Methods Used to Identify Critical Habitat

The first Sable Island Sweat Bee nests were found on Sable Island in July 2019 (Parks Canada 2019a). Information on necessary nesting biophysical attributes is limited. Four nest sites were found (including two aggregations of nests) during a 1-2 week survey but searches were not exhaustive, were largely confined to the operational fenced area around Main Station area, and covered only a very small proportion of potential habitat. The yellow polygons in Figure 2 include habitat patches containing at least one confirmed Sable Island Sweat Bee nest as of November 2019. The extent of the contiguous habitat patch within which one or more nests were found was delineated based on air photos (ground sampling distance of 10 cm) without any buffer.

The Main Station area has a unique substrate, vegetation type and human use pattern compared with other areas on Sable Island, and as a result, characteristics of nest habitat in this area may not be applicable to other areas on the island. Additionally, with the first few nests found only recently, there are many basic questions about nesting biology that need to be addressed in order to better understand nest site requirements and habitat use (e.g., nest site fidelity, dispersal distance from nest sites, key attributes of aggregation sites, relative importance of human-modified habitat at Main Station, tolerance to or benefit from disturbance).

7.2 Schedule of Studies to Identify Critical Habitat

Table 4. Schedule of Studies to Identify Critical Habitat for Sable Island Sweat Bee

Description of Activity	Rationale	Timeline
Surveys to better understand nesting habitat requirements	There is a need to understand if nesting habitat is limiting and can be usefully described and mapped. This would involve additional nest surveys in a range of habitat types across Sable Island (beyond Main Station where nest surveys have focused to date) and a finer-scale analysis of distinguishing characteristics of nest sites (i.e., biophysical attributes).	2020-2022
Research to better understand nesting biology, life history and social structure	There is a need to understand: (i) how often and under what conditions nests are aggregated; (ii) whether the species shows fidelity to nesting sites and if so, how long they are used; (iii) flight distance from nests to foraging habitat; (iv) dispersal distance of females from overwintering site to form new nests; and (v) the relative importance of human-modified habitat at Main Station.	2020-2025

Map distribution of floral resources	There is a need to determine if areas and timing of high density floral resources could be used to inform additional critical habitat identification for key foraging areas; for example, certain areas or species may be an important forage resource at key times in the season. Discerning pollen foraging from nectar foraging would also help to better describe floral resource requirements.	2020-2025
Develop a habitat selection model using presence/absence data to better characterize foraging/nesting habitat requirements (i.e., examine biophysical attributes of occurrence or nesting sites)	This model would be used to refine the definition of foraging and nesting habitat to inform finer-scale critical habitat identification	2020-2025
Identify areas of population aggregates	This information would be used to describe and identify areas of high quality habitat (if specific foraging and nesting habitat requirements outlined above cannot be defined)	2020-2025 (if required)

7.3 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 the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects from one or more activities over time. Activities described in Table 5 include those likely to cause destruction to critical habitat for the Sable Island Sweat Bee; however destructive activities are not limited to those listed.

Table 5. Activities likely to result in the destruction of critical habitat for Sable Island Sweat Bee

Description of Activity	Description of Effect	Details of Effect
Infrastructure development or land conversion	Physically replaces suitable habitat such that an area is no longer available for nesting activity.	Related to IUCN-CMP Threats: 1.3 Tourism and recreation areas; 3.1. Oil & gas drilling; 4.1 Roads & rail roads; 6.1 Recreational activities. This activity may result in destruction of critical habitat if it occurs within the identified polygons. This activity may result in destruction at all times of the year.

Excavation or alteration of substrate that results in a permanent change in condition (e.g., digging, vegetation removal, deposition of sand or other material on surface)	Vegetation cover and physical characteristics of substrate (e.g., stability, moisture, temperature) become altered such that substrate may become unsuitable as nesting habitat.	Related to IUCN-CMP Threats: 1.3 Tourism and recreation areas; 3.1. Oil & gas drilling; 4.1 Roads & rail roads; 6.1 Recreational activities. This activity may result in destruction of critical habitat if it occurs within the identified polygons. This activity may result in destruction at all times of the year.
Re-vegetation of open areas	Vegetation cover and physical characteristics of substrate (e.g., stability, moisture, temperature) become altered such that substrate may become unsuitable as nesting habitat.	Related to IUCN-CMP Threats: 1.3 Tourism and recreation areas; 3.1. Oil & gas drilling; 4.1 Roads & rail roads; 6.1 Recreational activities 11.1 Habitat shifting & alteration. This activity may result in destruction of critical habitat if it occurs within the identified polygons. This activity may result in destruction at all times of the year.

7.4 Proposed Measures to Protect Critical Habitat

The information below outlines the measures proposed to be taken to protect critical habitat for Sable Island Sweat Bee.

7.4.1 Measures Proposed to Protect Critical Habitat on Federal Lands

Critical habitat for Sable Island Sweat Bee occurs only in Sable Island National Park Reserve of Canada, a federal protected area. Sable Island National Park Reserve was listed on Schedule 2 to the *Canada National Parks Act* on December 1, 2013. As required under SARA (s.58), a protection statement including a description of the critical habitat for Sable Island Sweat Bee as well as a description of how critical habitat will be legally protected on federal land will be published on the Species at Risk Public Registry within 180 days of the publication of the final recovery strategy and action plan.

8. Evaluation of Socio-economic Costs and Benefits

SARA requires that an action plan include an evaluation of the socio economic costs of the action plan and the benefits to be derived from its implementation (SARA 49(1)(e), 2002). This evaluation addresses only the incremental socio-economic costs of implementing this action plan from a national perspective as well as the social and environmental benefits that would occur if the action plan were implemented in its entirety. It does not address cumulative costs of species recovery in general nor does it

attempt a cost-benefit analysis. Its intent is to inform the public and to guide decision making on implementation of the action plan by partners.

The protection and recovery of species at risk can result in both benefits and costs. SARA recognizes that “wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons” (SARA 2002). Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians. A review of the literature confirms that Canadians value the preservation and conservation of species in and of themselves. Actions taken to preserve a species, such as habitat protection and restoration, are also valued. In addition, the more an action contributes to the recovery of a species, the higher the value the public places on such actions (Loomis and White 1996; DFO 2008). Furthermore, the conservation of species at risk is an important component of the Government of Canada’s commitment to conserving biological diversity under the International Convention on Biological Diversity. The Government of Canada has also made a commitment to protect and recover species at risk through the Accord for the Protection of Species at Risk. The specific costs and benefits associated with this action plan are described below.

8.1 Costs

The total cost to implement this action plan will be borne by Parks Canada. These costs to the government will be covered by prioritization of existing funds and thereby will not result in additional costs to society. Many of the proposed measures will be integrated into the operational management of Sable Island National Park Reserve. This includes any incremental salary costs, materials, equipment, and contracting of professional services for measures outlined in Table 3. No major socio-economic costs to park visitors, partners, stakeholders or Indigenous groups are expected as a result of this action plan.

The action plan applies only to Sable Island National Park Reserve, the only known location for the Sable Island Sweat Bee, and does not bring any restrictions to land use outside the park. As such, this action plan will place no socio-economic costs on the Canadian public. However, some restrictions may be placed on research and visitor activities on park lands in order to protect and recover the species.

8.2 Benefits

Measures presented in this recovery strategy and action plan will contribute to meeting the population and distribution objectives for the Sable Island Sweat Bee. These measures are expected to have an overall positive impact on co-located species, ecological processes and overall ecological integrity of Sable Island National Park Reserve. Additionally, these measures are expected to enhance opportunities for appreciation of the site and the species by partners, visitors and the general public. These include opportunities to learn about and take part in conservation activities and

opportunities for visitors and partners to be involved in the protection and recovery of species at risk.

9. Measuring Progress

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

No significant observed or inferred decline in the species' occupied habitat (area of occupancy)(from 2019 baseline) by 2025.

The competent minister must monitor and report on the implementation of the recovery strategy (section 46 of SARA) and action plan (section 55 of SARA) and the progress towards meeting its objectives within five years.

Reporting on implementation of the action plan (under s. 55 of SARA) will be done by assessing progress towards implementing the broad strategies. Reporting on the ecological and socio-economic impacts of the action plan (under s. 55 of SARA) will be done by assessing the results of monitoring the recovery of the species and its long term viability and by assessing the implementation of the action plan.

10. References

- Applied Geomatics Research Group. 2015. Sable Island, Nova Scotia 2014 Topography and Land Cover Atlas. Middleton, Nova Scotia. 124 pp.
- Bowen, W.D., McMillan, J.I. and R. Mohn. 2003. Sustained exponential population growth of the grey seal on Sable Island. *ICES Journal of Marine Science*, 60: 1265-1274.
- Bowen, W.D. 2014. Marine mammals. In Freedman, B. (ed), An ecological and biodiversity assessment of Sable Island. Report prepared for Parks Canada.
- Byrne, M., Freedman, B. and D. Colville. 2014. The geology of Sable Island and evolution of the Sable Island bank. In Freedman, B. (ed), An ecological and biodiversity assessment of Sable Island. Report prepared for Parks Canada.
- Cameron, H.L. 1965. The shifting sands of Sable Island. *Geographical Review*, 55: 463-476.
- Catling P., Lucas, Z. and B. Freedman. 2009. Plants and insects new to Sable Island, Nova Scotia. *The Canadian Field-Naturalist* 123:141–145.
- Colville, D., Reeves, B., Ure, D., Livingstone, B. and H. Stewart. 2016. Mapping the topography and land cover of Sable Island. *Proceedings of the Nova Scotian Institute of Science*, 48(2):285-307.
- COSEWIC. 2014. COSEWIC Assessment and Status Report on the Sable Island Sweat Bee (*Lasioglossum sablense*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 38 pp.
- Duck, T., Freedman, B., Thomas, B. and D. Worthy. 2014. Climate of Sable Island. In Freedman, B. (ed), An ecological and biodiversity assessment of Sable Island. Report prepared for Parks Canada.
- Fisheries and Oceans Canada (DFO). 2008. Estimation of the Economic Benefits of Marine Mammal Recovery in the St. Lawrence Estuary. Policy and Economics Regional Branch, Quebec.
- Frasier, T., Lucas, Z., MacLeod, B. and P. McLoughlin. 2014. The Horses of Sable Island. In Freedman, B. (ed), An ecological and biodiversity assessment of Sable Island. Report prepared for Parks Canada.
- Freedman, B. 2001. Air photo assessment of changes in plant cover on Sable Island, Nova Scotia. Report produced for Canadian Wildlife Service, Atlantic Region, Sackville, NB.
- Freedman, B., Catling, P.M. and Z. Lucas. 2011. Effects of feral horses on vegetation of Sable Island, Nova Scotia. *Canadian Field-Naturalist*, 125: 200-212.
- Freedman, B. 2014. An ecological and biodiversity assessment of Sable Island. Report prepared for Parks Canada.

- Freedman, B., Lucas, Z. and S. Blaney. 2016. Vascular plants. *In* Freedman, B. (Ed.) 2016. Sable Island, the Ecology and Biodiversity of Sable Island (pp. 115-129). Fitzhenry and Whiteside, Markham ON.
- Greenleaf, S.S., Williams, N.M., Winfree, R. and C. Kremen. 2007. Bee foraging ranges and their relationship to body size. *Oecologia*, 153:589-596.
- Gibbs, J. 2010. Revision of the metallic *Lasioglossum* (*Dialictus*) of eastern Canada (Hymenoptera: Halictidae: Halictini). *Zootaxa*, 2591:1-382.
- Hennigar, T.W. 1976. Water Resources and Environmental Geology of Sable Island, Nova Scotia. Report No. 76-1, Nova Scotia Department of Environment, Halifax, NS.
- Howden H.F., Martin, J.E.H., Bousfield, E.L. and D.E. McAllister. 1970. Fauna of Sable Island and its zoogeographic affinities – a compendium. National Museum of Natural Sciences Publications in Zoology, No. 4. Queen's Printer for Canada, Ottawa, pp. vi + 45.
- Kennedy, G., Drage, J. and T.W. Hennigar. 2014. Groundwater resources of Sable Island. In Freedman, B. (ed), An ecological and biodiversity assessment of Sable Island. Report prepared for Parks Canada.
- Klymko, J. and S. Robinson. 2019. Sable Island Sweat Bee surveys on mainland Nova Scotia and Cape Breton Island. Report prepared by Atlantic Canada Conservation Data Centre for the Nova Scotia Species at Risk Conservation Fund.
- Loder, J. W., Han, G., Galbraith, P. S., Chassé, J. and A. van der Baaren. 2013. Aspects of Climate Change in the Northwest Atlantic off Canada. Bedford Institute of Oceanography, Dartmouth, Nova Scotia: Fisheries and Oceans Canada.
http://publications.gc.ca/collections/collection_2014/mpo-dfo/Fs97-6-3045-eng.pdf.
- Loomis, J.B. and D.S. White. 1996. Economic benefits of rare and endangered species: Summary and meta-analysis. *Ecological economics*, 18(1996): 197-206.
- Lucas, Z. 2015. Assessment of low-impact petroleum exploration on Sable Island. Report prepared for the Canada-Nova Scotia Offshore Petroleum Board. Halifax, NS.
- Lucas, Z. 2017. 2016 Bee Inventory and Distribution, Sable Island. Report prepared for Parks Canada. Halifax, NS.
- Lucas, Z. 2018. Additional notes on distribution and foraging activity of *Lasioglossum* species on Sable Island, Summer 2017. Report prepared for Parks Canada. Halifax, NS.
- Lucas, Z. 2019. Sable Island Sweat Bee distribution, Sable Island National Park Reserve, Summer 2018. Report prepared for Parks Canada. Halifax, NS.
- Majka, C. 2014. The invertebrate fauna of Sable Island. In Freedman, B. (ed), An ecological and biodiversity assessment of Sable Island. Report prepared for Parks Canada.
- Manson, G.K., Couture, N.J., and T.S. James. 2019. CanCoast 2.0: Data and indices to describe the sensitivity of Canada's marine coasts to changing climate. Geological Survey of Canada, Open File 8551, <https://doi.org/10.4095/314669> (Open Access).

Michener, C.D. 1974. The social behavior of the bees: A comparative study. Harvard University Press. 404 pp.

McLoughlin, P., Lysak, K., Debeffe, L., Perry, T. and K.A. Hobson. 2016. Density-dependant resource selection by a terrestrial herbivore in response to sea-to-land nutrient transfer by seals. *Ecology*, 97(8): 1929-1937.

Parks Canada. 2014. Parks Canada Best Management Practices for management of permitted motor vehicle use, Sable Island National Park Reserve, Parks Canada, Halifax, NS.

Parks Canada. 2017. Let's talk about climate change: Atlantic region. Parks Canada Agency, Ottawa, ON.

Parks Canada. 2019a. Field report on 2019 sweat bee survey. Unpublished report. Halifax, NS.

Parks Canada. 2019b. Sable Island National Park Reserve of Canada Management Plan. Parks Canada Agency, Ottawa, ON.

Robichaud, B. and J. Mullock. 2011. The Weather of Atlantic Canada and Eastern Quebec. Nav Canada, Natural Resources Canada. Ottawa, ON.

Salafsky, N., Salzer, D., Stattersfield, A.J., Hilton-Taylor, C., Neugarten, R., Butchart, S.H.M., Collen, B., Cox, N., Master, L., O'Connor, S. and D. Wilkie. 2008. A standard lexicon for biodiversity conservation: unified classifications of threats and actions. *Conservation Biology* 22:897-911.

Appendix A: Effects on the Environment and Other Species

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*](#)⁵. 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*](#)'s⁶ (FSDS) goals and targets.

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

Overall, it is anticipated that implementation of this recovery strategy and action plan will have a beneficial impact on non-target species, ecological processes, and the environment in Sable Island National Park Reserve and will not result in any significant adverse ecological, social or cultural effects. In particular, measures outlined in this plan may contribute to enhanced understanding and protection of other species and ecosystem processes that co-exist with the Sable Island Sweat Bee, including the Ipswich Sparrow (SARA-listed as Species Concern) and other rare plants and invertebrates. Recovery measures for the Sable Island Sweat Bee will be implemented with consideration of all co-occurring species at risk, such that there are no negative impacts to these species or their habitats. This plan aims to address key management priorities aimed at maintaining or improving the broader ecological integrity of Sable Island National Park Reserve (Parks Canada 2019b). Additionally, this plan outlines stewardship measures, educational programs, and awareness initiatives involving park visitors, partners and the general public. This could contribute to greater appreciation, understanding and action towards the conservation and recovery of species at risk in general.

⁵ www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1

⁶ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1