NOVA SCOTIA
Natural Resources and Renewables

RECOVERY PLAN FOR THE BLACK FOAM LICHEN *(ANZIA COLPODES)* IN NOVA SCOTIA

A recovery plan adopted by the Nova Scotia Department of Natural Resources and Renewables

2024 - 2029

Recommended citation:

Nova Scotia Department of Natural Resources and Renewables. 2024. Recovery Plan for the Black Foam Lichen (*Anzia colpodes*) in Nova Scotia [Final]. *Nova Scotia Endangered Species Act Recovery Plan Series*.

Cover illustration: Black Foam Lichen — Photo by Frances Anderson

NOVA SCOTIA
Natural Resources and Renewables

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

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Species:

Black Foam Lichen (*Anzia colpodes)*

Reference:

Environment and Climate Change Canada. 2023. Recovery Strategy for the Black-foam Lichen (*Anzia colpodes*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. vii + 37 pp.

Whereas a Species at Risk Act Recovery Strategy has been prepared for this species by Environment and Climate Change Canada (ECCC), and that plan has been reviewed by members of the applicable Nova Scotia Recovery Team and determined to fulfil the requirements of Section 15(4) of the Endangered Species Act as they pertain to Nova Scotia, the above-named recovery strategy shall be adopted in lieu of a Nova Scotia Recovery Plan subject to the following:

Date of Adoption: 5 February 2024

Expiry/renewal Date: 5 February 2029

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:

   Environment and Climate Change Canada (2023). Species description (3.1), Species population and distribution (3.2), Needs of the Black-foam Lichen (3.3), Threat assessment (4.1), Description of threats (4.2), Population and distribution

objectives (5), Conservation approach (6.2), Narrative to support the conservation approach (6.3), Identification of the species' critical habitat (7.1), Activities likely to result in the destruction of critical habitat (7.2), Measuring progress (8), Maps and locations of critical habitat (Appendix B).

3. Nova Scotia explicitly adopts critical habitat as outlined in ECCC (2023) in lieu of core habitat.

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

Approved: **Date:**

5 February 2024

Appendix A:

Environment and Climate Change Canada. 2023. Recovery Strategy for the Black-foam Lichen (*Anzia colpodes*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. vii + 37 pp.

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Black-foam Lichen (*Anzia colpodes)* in Canada

Black-foam Lichen

2023

Government of Canada
Gouvernement du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2023. Recovery Strategy for the Black-foam Lichen (*Anzia colpodes*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. vii + 37 pp.

Official version
The official version of the recovery documents is the one published in PDF. All hyperlinks were valid as of date of publication.

Non-official version
The non-official version of the recovery documents is published in HTML format and all hyperlinks were valid as of date of publication.

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: Black-foam Lichen at Barren Brook, Shelburne County (January 2021) © Mersey Tobeatic Research Institute 2021.

Également disponible en français sous le titre
« Programme de rétablissement de l'anzie mousse-noire (*Anzia colpodes*) au Canada »

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[1] www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

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 and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Black-foam Lichen and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with Natural Resources Canada, the provinces of Ontario, Quebec, New Brunswick and Nova Scotia. It was developed in cooperation and consultation with the Nova Scotia Lichens Recovery Team, non-governmental organizations and other stakeholders as per sections 39(1) of SARA.

It was determined that the recovery of the Black-foam Lichen in Canada is not technically or biologically feasible. The species still may benefit from general conservation programs in the same geographic area and will receive protection through SARA and other federal, and provincial or territorial, legislation, policies, and programs.

The feasibility determination will be re-evaluated as part of the report on implementation of the recovery strategy, or as warranted in response to changing conditions and/or knowledge.

The recovery strategy sets the strategic direction to support survival 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 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*.

[2] www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

[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.

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 Julie McKnight (Environment and Climate Change Canada, Canadian Wildlife Service – Atlantic Region (ECCC – ATL)). Acknowledgement and thanks are extended to parties that provided invaluable advice, unpublished reports, and personal communications to help inform the development of this document including Individuals, provincial governments, the Nova Scotia Lichens Recovery Team and other stakeholders. Special thanks are extended to members of the Nova Scotia Lichen Recovery Team: Rob Cameron (Nova Scotia Environment), Sean Haughian (Nova Scotia Museum of Natural History), Tom Neily, David Richardson (COSEWIC, Dean Emeritus – Saint Mary's University) and Brad Toms (Mersey Tobeatic Research Institute). Thanks are also extended to Frances Anderson (independent researcher), Alain Belliveau (Acadia University), Sam Brinker (Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry), James Churchill (Atlantic Canada Conservation Data Centre – AC CDC), Carling Dewar (Ministry of Northern Development, Mines, Natural Resources and Forestry), Lucy Ellis (Ministry of the Environment, Conservation and Parks), Jean Gagnon, (Ministère des Forêts, de la Faune et des Parcs), Marianne Gagnon, Emmanuelle Fay and Burke Korol (ECCC – CWS), Adam Hadley, Leanne Jennings (Ministry of the Environment, Conservation and Parks), David Mazerolle (Parks Canada Agency), Troy McMullin (Canadian Museum of Nature), Maureen Toner (New Brunswick Natural Resources and Energy Development), Donald Sam (Nova Scotia Natural Resources and Renewables), and Matt Smith (Parks Canada Agency), Eric Snyder (Ontario Ministry of the Environment, Conservation and Parks) and Erin Whidden (New Brunswick Natural Resources and Energy Development). Thanks are also extended to Ryan Kim (ECCC – ATL) and Chris Lauzon (ECCC – NCR) for preparing the critical habitat maps. Finally, the contribution made by the Committee on the Status of Endangered Wildlife in Canada in preparing the Status Report for Black-foam Lichen, which served as a basis for this document, is gratefully acknowledged.

Executive Summary

Black-foam Lichen (*Anzia colpodes*) is a greenish grey leafy lichen that grows on the trunks of deciduous trees. The species gets its common name from the thick spongy black tissue that lies under its body.

Once thought to be endemic to North America, the species was recently reported from Sakhalin Island (Russia). In the United States, Black-foam Lichen is rare in Maine and Michigan and possibly more common in warmer States (e.g., Alabama, Arkansas, Georgia, North Carolina, South Carolina and Tennessee). In Canada, Black-foam Lichen is known historically from four provinces: Ontario, Quebec, New Brunswick and Nova Scotia and is currently known to be extant in Nova Scotia and New Brunswick. The historical and current occurrences in Canada represent about half of the known global total.

Black-foam Lichen was assessed by COSEWIC as Threatened in May 2015 and listed on Schedule 1 SARA in February 2019. The species is considered Data Deficient in Ontario and is listed as Threatened under the *Nova Scotia Endangered Species Act*.

Based on the three questions Environment and Climate Change Canada uses to establish recovery feasibility, recovery of the Black-foam Lichen in Canada is determined to be not biologically or technically feasible at this time. This will be re-evaluated in response to changing conditions and/or knowledge.

Factors which directly threaten the survival of Black-foam lichen include logging and wood harvesting (high–medium impact), climate change including severe weather (high–low impact), air-borne pollutants (and resulting acid precipitation) (low impact), roads and railroads (low impact) and invasive non-native/alien species (gastropods) (unknown impacts).

It is not biologically or technically feasible to improve the species' condition such that it would be assessed as a status more favourable than threatened. The one-generation (17 years) objective is to slow the decline of Black-foam Lichen in Canada. While it is possible to mitigate one of the two known major threats (logging and wood harvesting), this alone is unlikely to stop the species' decline.

The conservation approach to support the population and distribution objectives and address threats to Black-foam Lichen are presented section 6.2.

Section 41(2) of SARA requires that the recovery strategy include an identification of the species' critical habitat, to the extent possible. Critical habitat is identified for Black-foam Lichen in this document to the extent possible given the best available information.

Recovery Feasibility Summary

Based on the following three questions Environment and Climate Change Canada uses to establish recovery feasibility, recovery of the Black-foam Lichen in Canada is determined to be not biologically or technically feasible at this time. This recovery strategy has been prepared as per section 41(2) of SARA and includes a description of the species and its needs, an identification of the species' critical habitat to the extent possible, and the unknowns surrounding the feasibility of recovery.

Survival (Characteristics)
Can survival characteristics be addressed to the extent the species is no longer at significant risk of extinction or extirpation as a result of human activity?

Yes with uncertainties. Detailed historical population information does not exist for this species, but it was probably not at significant risk of extirpation prior to human activity (i.e., logging and wood harvesting, climate change and potentially introduced gastropods). Though likely never common, it was much more widespread than it is today (Figure 1). It is not considered as sensitive as cyanolichens[4] to the direct effects of air pollution, but this species seemingly requires a very specific set of attributes including host tree's age and appropriate microclimate conditions (e.g., sufficient moisture, suitable temperature, moderately rough-barked deciduous trees). The species is considered "possibly extirpated" by NatureServe in Ontario and Quebec (NatureServe 2020) and was recently rediscovered in Fundy National Park, New Brunswick. It does not seem possible to stabilize the population within three generations. While losses due to logging and wood harvesting can be minimized, losses will still occur (as evidenced by losses at seemingly intact sites (COSEWIC 2015). The reasons for these losses are unclear but may be because of changing climate conditions.

Independence
Is the species currently able to persist in Canada independent of deliberate human interventions, and/or will it eventually be able to achieve and maintain independence in the state where condition (1) is met, such that it is **not reliant on significant, direct, ongoing human intervention?**

Yes with uncertainties. Losses are occurring (COSEWIC 2015) in the absence of logging and wood harvesting. The other potential threats affecting the lichen's possibility of persistence are gastropod grazing and climate change. If non-native gastropods are determined to be a significant threat, they could be removed from host trees using established control methods. However, climate predictions suggest significant change in the area occupied by Black-foam Lichen and if a changing climate is the primary driver of losses at intact sites, the lichen may be extirpated from Canada regardless of human interventions.

[4] A cyanolichen is a close association of fungi and cyanobacteria (also known as blue-green algae).

Improvement
Can the species' condition be improved over when it was assessed at risk?

No. There is substantial uncertainty due to climate change, which is predicted to significantly alter the amount of suitable habitat for this lichen in the future. Results of climate modelling in COSEWIC (2015) suggest that, by 2099 (within four to five generations), there will be no optimal climate for this lichen in Canada. Climate change and habitat succession will likely continue to cause population decline, even if the threat of logging and wood harvesting can be lessened. It is unlikely this species will ever be re-assessed as less at-risk than threatened C2a(i) (i.e., <10,000 individuals, decline (due to e.g., climate change) and no population containing > 1,000 individuals).

However, formal and informal partnerships with industry, scientists, municipal governments, federal/provincial governments, conservation organizations, landowners, and the public may promote persistence (survival) of this lichen in Nova Scotia, at least in the short-term. Some sites are protected under legislation (e.g., *Canada National Parks Act, Nova Scotia Special Places Act, and Wilderness Areas Protection Act*). The species is listed under the *Nova Scotia Endangered Species Act*, which protects both listed individuals and their dwellings. Forest management tools are under development. International agreements, national commitments, forest certification initiatives, and legislation may all contribute to sustainable forestry practices and the conservation of lichen species at risk through threat reduction/mitigation. In Nova Scotia, Special Management Practices (SMPs) were released for at-risk lichens and apply to provincial Crown lands (Nova Scotia Department of Natural Resources 2018).

Feasibility Determination
Based on answers to the above three questions, recovery in Canada is determined to be not feasible.

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1. COSEWIC* Species Assessment Information

Date of Assessment: May 2015

Common Name (population): Black-foam Lichen

Scientific Name: *Anzia colpodes*

COSEWIC Status: Threatened

Reason for Designation: In Canada, this lichen is at the northern edge of its range, and is known from Ontario, Québec, New Brunswick and Nova Scotia. It appears to be extirpated from Ontario and Quebec and has not been seen in New Brunswick for about a decade. It occurs on sites dominated by mature deciduous trees with high humidity and moderate light. In Nova Scotia, this lichen is widespread but not common. The reasons for its decline are not clear. The main current threat is deforestation. Additional threats may include grazing by molluscs and climate change.

Canadian Occurrence: Ontario, Quebec, New Brunswick, Nova Scotia

COSEWIC Status History: Designated threatened in May 2015.

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

2. Species Status Information

Black-foam Lichen (*Anzia colpodes*) was assessed by COSEWIC as Threatened in May 2015 and listed on Schedule 1 of the *Species at Risk Act* (SARA) in February 2019. The species was assessed by the Committee on the Status of Species at Risk in Ontario as Data Deficient (COSSARO 2016). The species is listed in Nova Scotia as Threatened. Global, national and sub-national ranks are in Table 1.

Table 1. Conservation Status Ranks for Black-foam Lichen (*Anzia colpodes*) (NatureServe 2020, GBIF 2021)

Global (G) Rank[a]	National (N) Rank[a]	Subnational (S) Rank[a]	
G4	Canada: N3	Ontario: SH Quebec: SH	New Brunswick: S1S2 Nova Scotia: S3
	United States: NNR	Michigan: SNR New York: SNR North Carolina: SNR Pennsylvania: SNR Wisconsin: SX	States with occurrences (1970–2021 (GBIF 2021)) not reviewed by NatureServe: Alabama, Arkansas, Georgia, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Missouri, Ohio, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia

[a]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

Black-foam Lichen is a leafy lichen that grows as greenish grey rosettes[5] up to 20 cm across on the trunks of deciduous trees. The species gets its common name from the thick spongy black tissue that lies under its body.

3.2 Species Population and Distribution

Once thought to be endemic to North America, Black-foam Lichen was recently reported from Sakhalin Island (Russia) (Skirina *et al.* 2016, COSEWIC 2015). Historically, the species was widespread in eastern North America from the Great Lakes to New England to the Southern United States. Black-foam Lichen is becoming increasingly rare (COSEWIC 2015). In the United States, it is restricted to a handful of sites in Maine, likely extirpated from Ohio and Wisconsin (NatureServe 2020, COSEWIC 2015) and critically imperiled in Michigan. It may be more common in the south (e.g., Alabama, Arkansas, Georgia, Louisiana, North Carolina, Oklahoma, South Carolina, Texas and Tennessee (GBIF 2021).

COSEWIC (2015) provides an estimate of 1,584–3,696 individuals[6] of Black-foam Lichen in Canada. The species was designated Threatened based on an inferred (at least) 30% decline. The historical and current occurrences in Canada represent about half of the known global total (COSEWIC 2015). In Canada, Black-foam Lichen was historically found in four provinces: Ontario, Quebec, New Brunswick and Nova Scotia and is currently known from Nova Scotia (Figure 1). Observations of the species in 2022 from Fundy National Park (N. Vinson, personal communication) confirm the species is present in New Brunswick but is likely quite rare.

The species has only been observed in New Brunswick and Nova Scotia since the 1970s (COSEWIC 2015). Between 1995 and 2020, 97 records of Black-foam Lichen were known from Nova Scotia (61 occurrences; 1995–2020) (Atlantic Canada Conservation Data Centre (AC CDC) unpublished data, COSEWIC 2015, F. Anderson unpublished data and T. McMullin unpublished data). Recent searches in Fundy National Park confirm the species is still present in New Brunswick.

[5] colonies form expanding circles; referred to as rosettes.
[6] an “individual” lichen here refers to a physically distinct thallus (i.e., “body” of the lichen).

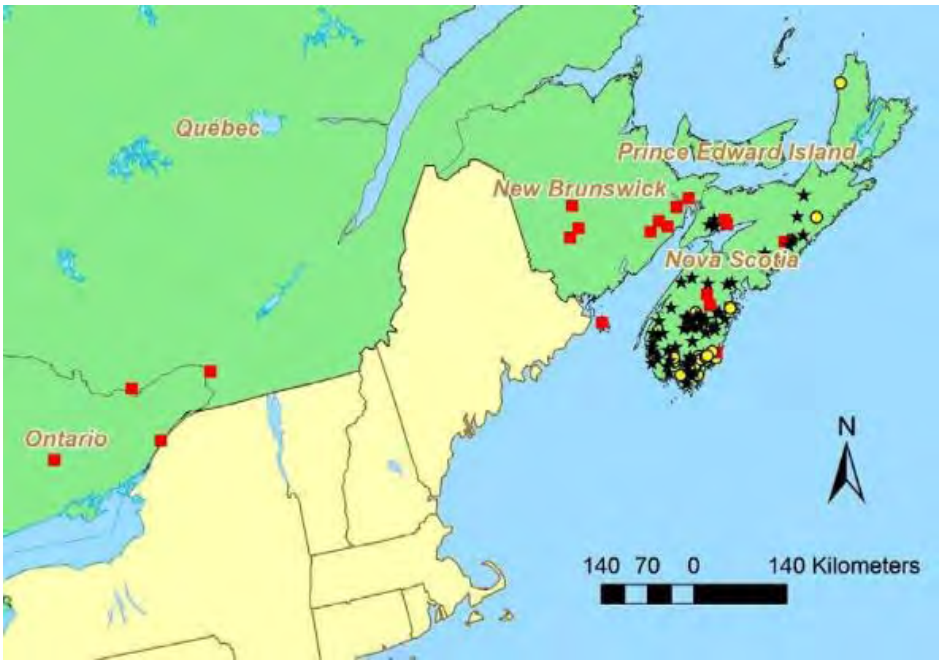

Figure 1. The distribution of Black-foam Lichen in Canada: extant occurrences (post-1995) are represented by yellow dots, black stars represent historical (pre-1995) occurrences not recently revisited and historical records revisited without finding the lichen are represented by red squares (COSEWIC 2015).

3.3 Needs of the Black-foam Lichen

Known Black-foam Lichen needs include:

- macro and microclimates with high humidity and high rainfall (annual precipitation > 1000 mm) throughout the year with cool summers and moderate winters (COSEWIC 2015)
    - large amounts of moisture in the form of fog and rain, often in excess of 1400 mm annually (COSEWIC 2015)
    - forests providing increased light levels during winter and protective shade during summer
    - host trees that are moderately rough-barked deciduous trees[7]
- favorable conditions of bark pH (not too acidified by air pollution or acid rain/precipitation)
- presence of suitable strains of green alga (on suitable tree trunks) (COSEWIC 2015)
- fairly open canopy (high light levels). At higher elevations (> 60 m above sea level: e.g., Cobequid Hills, NS) and at lower elevations with cooler mean summer temperatures (e.g., Eastern Shore NS), high crown closure seems to be tolerated.

[7] often Red Maple (*Acer rubrum*) but also found on Red Oak (*Quercus rubra*), White Ash (*Fraxinus americana*), Sugar Maple (*Acer saccharum*), and Shadbush (*Amelanchier* species). Single collections are known from Balsam Fir (*Abies balsamea*), Yellow Birch (*Betula alleghaniensis*), American Beech (*Fagus grandifolia*), and Eastern Hemlock (*Tsuga canadensis*).

4. Threats

4.1 Threat Assessment

Direct threats to Black-foam Lichen and its habitat were assessed in the species' COSEWIC status report – Appendix 1 (reproduced as Table 2 below) (COSEWIC 2015). Threats scored as "negligible" are not included in Table 2. The threat classification system used in COSEWIC status reports is based on the IUCN – CMP (World Conservation Union – Conservation Measures Partnership) unified threats classification system, which uses the same threat categories for all species (IUCN and CMP 2006 and Salafsky *et al.* 2008). 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) (Salafsky *et al.* 2008). Limiting factors are not considered during this assessment process. For purposes of threat assessment, only present and future threats are considered. 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 2. Threat Calculator Assessment

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
1	Residential & commercial development	Low	Small	Extreme	High
1.1	Housing & urban areas	Low	Small	Moderate	High
4	Transportation & service corridors	Low	Small	Moderate	High
4.1	Roads & railroads	Low	Small	Moderate	High
5	Biological resource use	High–Medium	Large– Restricted	Serious	High
5.3	Logging & wood harvesting	High–Medium	Large–Restricted	Serious	High
8	Invasive & other problematic species & genes	Unknown	Pervasive	Unknown	High
8.1	Invasive non-native/alien species	Unknown	Pervasive	Unknown	High
9	Pollution	Low	Restricted	Slight	High
9.5	Air-borne pollutants	Low	Restricted	Slight	High

11	Climate change & severe weather	High–Low	Pervasive–Large	Serious–Slight	Moderate
11.1	Habitat shifting & alteration	Unknown	Pervasive–Large	Unknown	Moderate
11.4	Storms & flooding	High–Low	Pervasive– Large	Serious–Slight	Moderate

[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 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 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.

[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%; Negligible < 1%).

[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 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%).

[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

Threats with low to high impact and unknown impact are listed as above in the threat calculator assessment table (Table 2) and are described in more detail below.

1.1 Housing & urban areas (low impact)
The historical occurrences in Ontario and Quebec were located in places that have undergone landscape changes because of urban spread (COSEWIC 2015) including development of recreational trails. The occurrences in New Brunswick and Nova Scotia were not historically subject to similar levels of development but lakeshores, especially, are facing increased pressures of development in Nova Scotia.

4.1 Roads & railroads (low impact)
New road development can affect the microclimate (e.g., increase light, wind and temperature, and reduce moisture) of nearby forests by removing trees and other vegetation and concentrating water flow and diverting natural water drainage systems (Cameron 2006). New roads also provide access to remote areas that may foster further development (Maass and Yetman 2002).

5.3 Logging & wood harvesting (high–medium impact)
The harvest of host trees (and nearby trees suitable for colonization and that protect suitable microclimate) is the greatest threat to this lichen in Canada. Forestry practices such as clear cutting or harvesting on a large scale may cause fragmentation and would temporarily (decades) alter biodiversity and age class structure of potential habitat. Adjacent harvesting can increase the lichen's exposure to wind and the drying and heating effects of the sun (Hunter 1990, Cameron *et al.* 2013); greatly reduce the ability of a forest stand to buffer against periods of low humidity (Maass and Yetman 2002) and reduce a lichen's ability to disperse (Rheault *et al.* 2003). Significant decreases in old hardwood forest habitat have occurred in both New Brunswick and Nova Scotia due to increased hardwood harvest (COSEWIC 2015, Nova Scotia Department of Natural Resources 2008).

Forest harvesting in Nova Scotia has expanded to include harvesting for biomass production and woodchips, which has increased the amount of deciduous tree harvesting (COSEWIC 2016). In Nova Scotia, a biomass plant in Port Hawkesbury use "low grade" hardwood not suitable for higher end usage (generally small, crooked, knotty or diseased wood) and secondary forest biomass such as bark as a source of energy (S. Walsh, personal communication). Emera also owns and operates a biomass-fueled steam plant in Brooklyn, Nova Scotia. Other small-scale wood initiatives are underway in Nova Scotia (e.g., heating public buildings) to create a new market for locally-sourced "low-grade" wood from private woodlots (Government of Nova Scotia 2020). This increased commercial interest may result in the removal of potential host trees in upland hardwood slopes and mixed Red Maple Swamps (COSEWIC 2015).

8.1 Invasive non-native/alien species (unknown impact)

Black-foam Lichen seems to be susceptible to grazing by gastropods (COSEWIC 2015, Asplund pers. comm. 2014 *in* COSEWIC 2015). Grazing can be a serious threat to epiphytic[8] lichens and can limit their growth, development and distribution (Vatne *et al.* 2010, Asplund and Gauslaa 2008, Gauslaa 2008); grazing contributed to the reported extirpation of Yellow Specklebelly Lichen (*Pseudocyphellaria crocata*) from southwest Norway (Gauslaa 2008). The Maritimes are now faced with two large and aggressive invasive slugs (*Arion species* and Milky Slug (*Deroceras reticulatum))* which were observed feeding on several rare cyanolichens[9] in Nova Scotia (Cameron 2009). Additional monitoring of Black-foam Lichen occurrences is required to understand the severity and impact of this threat.

9.5 Air-borne pollutants (low impact)

Lichens, growing without vascular systems, are entirely dependent on atmospheric sources for both water and nutrients and are thus sensitive to air pollution (and resulting acid precipitation) (Nash 2008, Richardson and Cameron 2004, Henderson 2000). Air pollution may have contributed to the disappearance of Black-foam Lichen from Ontario and Quebec and possibly from occurrences near Saint John, New Brunswick (COSEWIC 2015). Lichens may be indirectly affected by pollution's effect on the pH and buffering capacity of tree bark (Batty *et al.* 2003, Grodzińska 1977) and pollution may negatively affect a lichen's growth (COSEWIC 2015). A long history of exposure to air pollution and acid precipitation results in tree bark that is too acidic for epiphytic lichens, especially for very young lichen, to colonize and/or thrive (Batty *et al.* 2003, Nieboer *et al.*1984).

Epiphytic lichens may benefit from pollution prevention campaigns and industrial technologies that reduce emissions and a number of these are underway (Environment and Climate Change Canada 2018). However, despite such initiatives, many areas in eastern Canada continue to be exposed to concentrations of acidifying pollutants in excess of critical loads[10] (Environment and Climate Change Canada 2018).

11.1 Habitat shifting & alteration (unknown impact) and 11.4 Storms and flooding (high–low impact)

Climate change is predicted to significantly alter the extent of occurrence[11] that is suitable for this lichen (because of predicted drier summers). Results of climate modelling in COSEWIC (2015) suggest that, by 2099 (within four to five generations), there may be no optimal climate remaining for this lichen in Canada. Shifts in habitat were scored as unknown impact but it is hypothesized that milder winters may increase the population and distribution of introduced gastropods that graze on Black-foam Lichen (COSEWIC 2015).

[8] an epiphytic lichen grows on the surface of a tree but does not feed from it.
[9] a close association of fungi and cyanobacteria (also known as blue-green algae).
[10] the amount of acid deposition that an area can tolerate.
[11] the area contained within the shortest continuous imaginary polygon which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a species. Synonymous with geographic distribution/ species' range.

Increases in storms and severe weather events are also predicted. Small amounts of blowdown (due to storms) may increase suitability of forest stands for Black-foam Lichen growth and colonization (because of increased light levels) in the short-term, but the long-term (≥ 100 years) impact of changing weather patterns is unknown.

5. Population and Distribution Objectives

The one-generation (17 years) objective is to slow the decline of Black-foam Lichen in Canada. While it is possible to mitigate one of the two known major threats (logging and wood harvesting), this alone is unlikely to stop the species' decline.

Black-foam Lichen was assessed by COSEWIC in May 2015 and listed as Threatened on Schedule 1 SARA in February 2019. The species was designated as threatened because of historical and anticipated declines due to anthropogenic threats but also because of uncertainty around the reasons for decline. This lichen is particularly sensitive to human activities (logging and wood harvesting and climate change) and the results of recent climate modelling suggest there will be no optimal habitat remaining for this lichen in Canada in less than 80 years (i.e., by 2099; COSEWIC 2015). The lichen may no longer be present in Ontario and Quebec and this might be irreversible damage. The species is still present in New Brunswick, albeit in small numbers. The species is also rare in Nova Scotia, likely due to its specific habitat needs, limited dispersal range and patchy distribution of suitable habitat.

Ambitious population and distribution objectives are not possible for this species at this time. It is not biologically or technically feasible to improve the species' condition such that it would be assessed as a status more favourable than threatened because, while losses due to logging and wood harvesting can be minimised, declines will still occur (as evidenced by losses at seemingly intact sites in New Brunswick and Nova Scotia (COSEWIC 2015)). These losses may be attributable to a changing climate. The species' risk of extirpation may be improved through formal and informal partnerships, legislative protection and the implementation of beneficial management practices but it is likely the species will continue to decline in the long-term (≥ 100 years) and may ultimately face extirpation from Canada. Preventing extirpation will require mitigating losses due to logging and wood harvesting within the species' range in Nova Scotia and filling knowledge gaps to understand reasons for losses at undisturbed sites.

Should the recovery feasibility be re-evaluated in response to changing conditions or knowledge, the population and distribution objectives may be re-examined.

6. Conservation Approach

6.1 Actions Already Completed or Currently Underway

Measures targeting Black-foam Lichen and/or its habitat are currently underway[12]:

3. Awareness Raising
   - Lichens Nova Scotia website. www.lichensns.com
   - Wild Flora Society website – General lichens resources. http://nswildflora.ca/links/taxonomy-ecology-and-image-databases/bryophytes-lichens/ and http://nswildflora.ca/publications/reference-literature/lichens/
   - Common Lichens field guides (McMullin and Anderson 2015 and Haughian 2020)
   - Peer mentoring (general lichens): S. Haughian, A. Belliveau, B.Toms, F. Anderson and T. McMullin have all created resources or hosted public talks, presentations, guest lectures and/or guided nature walks about lichens in the last couple of years. S. Haughian, A. Belliveau, and T. McMullin also work with students and volunteers through their institutions, training them to ID, curate, and/or survey lichens.
   - Presentations
     - Identifying lichens in the Halifax area of Nova Scotia: the basics of identification guides, optics, and techniques. 2019. Concluding workshop for the City Nature Challenge. April 29, 2019. Halifax, NS, Canada.
     - Hiding in plain sight: lichens and liverworts in Atlantic Canada. 2019. Invited lecture by the Nova Scotia Wild Flora Society. November 25, 2019. Halifax, NS, Canada.
     - Lichens: Can I pick/eat/squish/crumble/throw/poke them? 2019. Invited discussion about basic types of lichen, what they do, and what they are –followed by a lichen hunt and terrarium creation activity – for the Young Naturalists Club of Nova Scotia as part of the Celebration of Nature Conference, May 25, 2019. Liscombe, NS, Canada.
     - Lichens in Nova Scotia: a brief overview of lichen biology, classification, diversity, conservation, current research, and techniques. 2019. Invited lecture for Nova Scotia Celebration of Nature Conference, May 25, 2019. Liscombe, NS, Canada.

5. Livelihood, Economic & Moral Incentives
   - In Nova Scotia, Special Management Practices (SMPs) were released for at-risk lichens and apply to provincial Crown lands (Nova Scotia Department of Natural

[12] Refer to the CMP Conservation Actions Classification v 2.0 for more details on action classification nomenclature: https://docs.google.com/spreadsheets/d/1i25GTaEA80HwMvsTiYkdOoXRPWiVPZ5l6KioWx9g2zM/edit#gid=1144804238

Resources 2018). These SMPs require expert-conducted surveys prior to proposed land use activities for all areas on Crown Land within modelled Boreal Felt Lichen (*Erioderma pedicellatum*) habitat and affords Black-foam Lichen a 100 m radius with minimal disturbance (e.g., no active clearing, removal or disturbance of trees, soil or wetlands) around the record.

6. Conservation Designation & Planning
   - Protected areas designated because of at-risk lichens:
     - Approximately 24% of the extant Black-foam Lichen occurrences are in areas managed for conservation (e.g., Kejimkujik National Park and National Historic Site, Provincial Parks, Provincial Nature Reserves, Provincial Wilderness Areas and other conservation areas)
     - Ghost Antler Park in NS https://novascotia.ca/nse/protectedareas/nr_ghostantler.asp,
     - St. Esprit portion of Forchu https://novascotia.ca/nse/protectedareas/wa_fourchucoast.asp
     - Goodfellow Brook Protected Natural Area and
     - Clark Point Protected Natural Area in Nova Scotia.
   - Identifying Lichen-Rich Areas in Nova Scotia (Cameron and Bayne 2020): decision support for securement and protection
   - Conservation easements for at-risk lichens:
     - NCCC property at Round Bay and the Hectanooga Cedar swamp (with NSNT and Nova Scotia Environment).
   - Monitoring plan for at-risk lichens under development by Mersey Tobeatic Research Institute.

7. Legal & Policy Frameworks
   - At-risk lichens are considered and surveyed for as part of the Environmental Impact Assessment process when a Boreal Felt Lichen polygon is encountered, or records of rare lichens are known within scope of (or adjacent to) the project.
   - A review of forestry practices in Nova Scotia was completed in 2018 and resulted in a series of recommendations (Lahey 2018). The Province of Nova Scotia agreed to adopt these recommendations including an ecological forestry model, which introduces precautionary measures to conserve biodiversity and to restore forests by emulating natural disturbances (Taylor *et al.* 2020).
   - Under the Nova Scotia *Biodiversity Act*, the Minister may enter into an agreement with landowners to support the conservation of valued biodiversity on private land and may provide compensation if the use of private lands is restricted in some way. The Minister may also initiate educational and interpretive programs respecting the conservation of biodiversity.
   - NS old forest policy: current lands under conservation contain six Black-foam Lichen occurrences in NS (MTRI personal communication).

- Implementing recovery and conservation measures set out in recovery documents for other SARA-listed tree lichens that are found in similar habitats (e.g., Vole Ears Lichen (*Erioderma mollissimum*) (Environment and Climate Change Canada 2020b, Environment Canada 2014) and Blue Felt Lichen (*Degelia plumbea*) in Canada (Environment and Climate Change Canada 2020a)) may contribute to the conservation and management of Black-foam Lichen and/or its habitats.

8. Research & Monitoring
   - Non-targeted surveys/ targeted surveys:
     - Several inventories completed in recent years in Ontario, Quebec, New Brunswick and Nova Scotia.
     - Pre-activity surveys for lichens in Boreal Felt Lichen polygons in Nova Scotia.
     - Formal and Impromptu bio-blitzes (5+)
     - Surveys of Nova Scotia Museum-owned nature properties by S. Haughian
     - Lichen inventories and monitoring conducted at Kejimkujik National Park and National Historic Site and Fundy National Park.
     - Workshops: annual myco-forays in Newfoundland and Labrador, Crum workshop in New Brunswick in 2019
   - Through AC CDC, data requests and data subscriptions/memberships, records are/have been available to inform research, planning, conservation prioritization, impact mitigation and management decisions throughout its known range.

9. Education & Training
   - Lichen training incorporated in Nova Scotia Community College Environmental Technician courses (2020).
   - Nova Scotia Natural Resources and Renewables includes at-risk lichen training into sessions for Crown Land contractors and contractors are provided with species at risk identification cards.

6.2 Conservation Approach

Table 3. Conservation Approach and Implementation Schedule

Conservation Actions Classification[a]	Recovery Measures[a]	Priority[b]	Threats or Concern Addressed	Timeline
B. Behavioral Change/ Threat Reduction Actions				
3. Awareness Raising				
3.1 Outreach and Communications	Raise awareness of SAR lichens (e.g., species needs, sites, direct threats) with relevant government agencies, landowners and land managers, forestry and mining industry, recreational users. • Provide at-risk lichen identification workshops for interested individuals and organizations.	Medium	all threats in Table 2 except 9. Pollution and 11. Climate Change & Severe Weather	2023 – 2026
5. Livelihood, Economic & Moral Incentives				
5.2 Better Products & Management Practices	Change behaviours by developing and promoting better management practices for sensitive and rare lichens and provide training and/or technical assistance to land managers so practices are adopted (e.g., pre-activity surveys for at-risk lichens required on all Crown land in Nova Scotia).	High	all threats in Table 2 except 9. Pollution and 11. Climate Change & Severe Weather	ongoing
C. Enabling Condition Actions				
6. Conservation Designation & Planning				
6.1 Protected Area Designation &/or Acquisition	Establish or demarcate Government protected areas, private conservation areas or other types of conservation areas for the species and its habitat (e.g., especially where it is possible to increase connectivity between subpopulations).	High	all threats in Table 2	2023-2028
6.2 Easements & Resource Rights	Promote conservation easements with landowners.	Medium	all threats in Table 2	as needed
6.4 Conservation Planning	Plan for conserving and managing Black-foam Lichen at occupied sites (e.g., develop an at-risk lichen monitoring plan and protocols, include the species in pre-activity plans, forest resource extraction planning exercises and strategies).	High	all threats in Table 2	2023-2025

Conservation Actions Classification[a]	Recovery Measures[a]	Priority[b]	Threats or Concern Addressed	Timeline
7. Legal & Policy Frameworks				
7.1 Laws, Regulations & Codes	Create, amend, or influence laws, regulations and codes regarding the release of air-borne pollutants such that environmental levels do not exceed what sensitive lichens can tolerate.	Medium	9. Pollution and 11. Climate Change & Severe Weather	as needed
7.2 Policies & Guidelines	Create, amend, or influence existing management policies and/or guidelines regarding logging and wood harvesting to ensure the survival of Black-foam Lichen.	High	all threats in Table 2 except 9. Pollution and 11. Climate Change & Severe weather	2023 – 2026
8. Research & Monitoring				
8.1 Basic Research & Status Monitoring	Conduct research on Black-foam Lichen (to address knowledge gaps): • inventory potentially suitable habitat within the species' range (current and historic), • investigate macrohabitat and microhabitat needs (e.g., importance of watercourse, especially distance to watercourse and crown closure requirements), investigate impacts of harvest regimes on species survival, • refine species-specific suitable habitat models and monitor the population (e.g., distribution, threats and their distribution and cumulative effects), • monitor threats to the species, • investigate genetic diversity, • investigate impacts of harvest regimes on species survival • anticipate climate change impacts, identify potential climate refugia[13] and identify and prioritize effective potential adaptation actions (e.g., increase forest extent and connectivity, protect topographic features that could foster survival in changing landscapes (e.g., watercourses)), • determine feasibility of assisting Black-foam Lichen in-situ via transplantation (e.g., when a tree falls due to age or storms), • determine if providing ex-situ protection to the species (artificial propagation) is feasible.	Very High	knowledge gaps	2023 – 2028

[13] areas that remain relatively free from climate change habitat impacts and enable persistence of the lichen.

Conservation Actions Classification[a]	Recovery Measures[a]	Priority[b]	Threats or Concern Addressed	Timeline
8.2 Evaluation, Effectiveness Measures and Learning	Collect information about conservation work (e.g., collate data collected by lichen experts, store data with AC CDC, evaluate effectiveness of management policies, evaluate recovery efforts and adapt based on progress).	Medium	knowledge gaps	annually; evaluate every five years
9. Education & Training				
9.2 Training & Individual Capacity Development	Provide conservation capacity development through hands-on coaching & technical assistance and workshops & professional development training courses.	Low	all threats in Table 2 except 9. Pollution and 11. Climate Change & Severe weather	2023 – 2028

[a] Refer to the CMP Conservation Actions Classification v 2.0 for more details: https://docs.google.com/spreadsheets/d/1i25GTaEA80HwMvsTiYkdOoXRPWiVPZ5l6KioWx9g2zM/edit#gid=1144804238

[b] "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.

6.3 Narrative to Support the Conservation Approach

Brief rationales for C. Enabling Condition Actions are provided below to detail why they are necessary for other conservation efforts to succeed.

6. Conservation Designation & Planning
Protected Areas, including Indigenous Protected and Conserved Areas, as well as private lands conserved through private land conservation mechanisms, can contribute significantly to the conservation of lichen species at risk, and their establishment should be pursued wherever possible. The valuable insights and expertise of all stakeholders, including Indigenous Ecological Knowledge and stewardship practices, must be considered while making management decisions regarding both public and private lands.

A monitoring plan and protocol for all epiphytic at-risk lichens, including the collection of ecological indices and information on threats, must be developed and implemented. Permanent monitoring plots could be set up in Nova Scotia to monitor trees for the persistence of mature lichen and the establishment of juveniles. Microclimate measurements (e.g., humidity, forest composition, forest age structure, and indicator species[14]) could be undertaken before and after treatments to assess the impact of edge effects[15] and nearby forestry activity.

7. Legal & Policy Frameworks
In Nova Scotia, SMPs were developed for at-risk lichens and apply to provincial Crown lands. These SMPs require expert-conducted pre-activity surveys for all areas that intersect modelled Boreal Felt Lichen habitat.

Black-foam Lichen may benefit from reductions in air pollutants such as Sulphur dioxide and resulting acid precipitation. It is not reasonable to initiate a massive campaign solely to reduce local and transboundary sources of pollution for the benefit of lichens. Instead, partnerships should be strengthened with Industry and governments to encourage compliance with the *Canadian Environmental Protection Act* and to continue implementing the Canada-Wide Acid Rain Strategy for Post-2000, the Nova Scotia Energy Strategy, the Nova Scotia Climate Change Action Plan and the New Brunswick Climate Change Action Plan.

[14] a species whose presence provides information on the condition of an ecosystem
[15] changes resulting from ecological alterations along an abrupt boundary of a habitat.

8. Research & Monitoring
Data (e.g., inventories, survey effort, monitoring health, threats, persistence) and other information about conservation outcomes should be collated, stored, and made available for landscape and resource planning purposes, and updated as new information becomes available. Finally, previously un-surveyed potential habitat within the species range should be prioritised for inventory given previous surveys for at-risk lichens may have concentrated on slightly different habitat and missed this lichen (C. Pepper, personal communication 2020). Studying the feasibility of transplanting this lichen to nearby host trees when a host tree is threatened by uncontrollable factors (e.g., death of host tree, storms, blow-downs) may be necessary for the maintenance of this lichen at some sites. Studying whether ex-situ methods of protection are feasible for this species may be necessary to prevent its extirpation from Canada in the long-term.

9. Education & training
Stakeholders (especially forest sector) and other relevant individuals (e.g., landowners, land managers) should be provided with information and tips to identify the lichen in the field. Improving lichen identification skills can support effective management and conservation of forest ecosystems.

7. Critical Habitat

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.

Critical habitat for Black-foam Lichen is based on habitat occupancy and habitat suitability and identified in this document, 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 5) 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 new information becomes available, either in a revised recovery strategy or action plan(s).

7.1 Identification of the Species' Critical Habitat

Critical habitat for Black-foam Lichen is identified as all areas with suitable habitat within the yellow polygons in Figures 2–15 (see Appendix B). Suitable habitat relates to areas possessing a specific set of biophysical attributes required for the species' life processes as summarized in Table 4.

Areas within the polygons that clearly do not contain the biophysical attributes (e.g., existing cleared areas including road) are not identified as critical habitat under SARA.

Table 4. The Area and Associated Biophysical Attributes Necessary for Black-foam Lichen (*Anzia colpodes*)

Life Stage	Life Process[a]	Area or Type of Site[b]	Biophysical Attributes[c]
All	All	Mature forests	• Mature, moderately rough-barked, deciduous trees, • Mean annual precipitation > 1000 mm

[a] Life Process: The life-cycle process of the listed species taking place in critical habitat. This function informs the rationale for its protection. The identification of critical habitat must describe how the functions support a life process necessary for the survival or recovery of species at risk.

[b] Area or type of site: The area or type of site where the listed species naturally occurs or depends on in order to carry out its life processes.

[c] Biophysical attributes: measureable properties or characteristics of the area or type of site. In essence, biophysical attributes provide the greatest level of information about the area or type of site required to support the life process requirements of the species.

7.1.1 Information and methods used to identify critical habitat

Occurrence data were received from the AC CDC for New Brunswick and Nova Scotia and additional records were received from F. Anderson and T. McMullin for Nova Scotia. There are no recent occurrences in Ontario and Quebec. COSEWIC (2015) suggests 1995 as a logical point to separate historical occurrences from presumably and confirmed extant occurrences. Only recent records (1995–2020) with errors ≤ 50 m were included in the data set used to create the yellow polygons in Figures 2–15 (See Appendix B). Two records from New Brunswick were not included in the analysis because more recent surveys determined the species was lost. A 100 m radius circle was drawn around each record. If another record occurred within 500 m, the records were joined by a 200 m-wide “corridor” considered critical to this species’ survival (Scheidegger and Werth 2009: sub-populations consisting of 10 or more occupied trees may be more robust to disturbance). Providing an undisturbed “corridor” may allow for colonization and for increases in the number of occupied trees, making the subpopulation more likely to survive. The 500 m distance was based on the species’ suspected dispersal distance (in woodlands, dispersal distance is thought to be only a few hundred meters COSEWIC 2015) (see Table 4).

7.2 Schedule of Studies to Identify Critical Habitat

Table 5. Schedule of Studies to Identify Critical Habitat

Description of Activity	Rationale	Timeline
Re-visit previously occupied sites (since 1995) where suitable mature forest habitat remains and occurrences have not been reconfirmed (COSEWIC 2015. Table 2: part 2).	Confirms sites where critical habitat criteria are met.	2027

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 or from the cumulative effects of one or more activities over time. Activities described in Table 6 include those likely to cause destruction of critical habitat for the species; however, destructive activities are not limited to those listed.

Table 6. Examples of Activities Likely to Result in the Destruction of Critical Habitat of Black-foam Lichen in Canada

Description of Activity	Description of Effect	Details of Effect
Development or land conversion (e.g., energy production & mining, transportation & service corridors, biological resource use: logging and wood harvesting) that result in the removal of host trees and occupied forest stands	• Host trees and potential suitable host trees are removed. • Habitat and/or the function of a site may be physically destroyed or altered. • Macroclimate and microclimate attributes including temperature, humidity, wind speeds and bark pH may be altered (e.g., through increased edge effects) such that habitat becomes unsuitable.	Related IUCN – CMP Threats: 1.1 Housing and urban areas 3.1 Oil & gas drilling, 3.2 Mining & quarrying, 4.1 Roads & railroads 4.2 Utility & service lines and 5.3 Logging & wood harvesting. This activity may likely result in the destruction of critical habitat if it occurred within the bounds of, or within hundreds of meters of, critical habitat. This activity could cause destruction all times of the year.

8. Measuring Progress

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

Over the next one generation (17 years):

- The species is not lost from Canada.
- Extant sites are not lost due to logging and wood harvesting.
- Research is completed to understand the reasons for losses at intact sites.

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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*[16]. 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[17] (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 and are summarized below.

Implementing this recovery strategy will benefit the environment. At a regional level, any progress in reducing air-borne pollutants will benefit not only lichens, but also most (if not all) of the flora and fauna of the Atlantic forest region as well. Protection of wet forest habitat will also benefit forest-dwelling species at risk (e.g., landbirds and reptiles). The potential for the strategy to inadvertently lead to adverse effects on other species was considered and the SEA concluded this strategy will not entail any significant adverse effects.

[16] www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html
[17] www.fsds-sfdd.ca/index.html#/en/goals/

Appendix B: Maps and Locations of Critical Habitat.

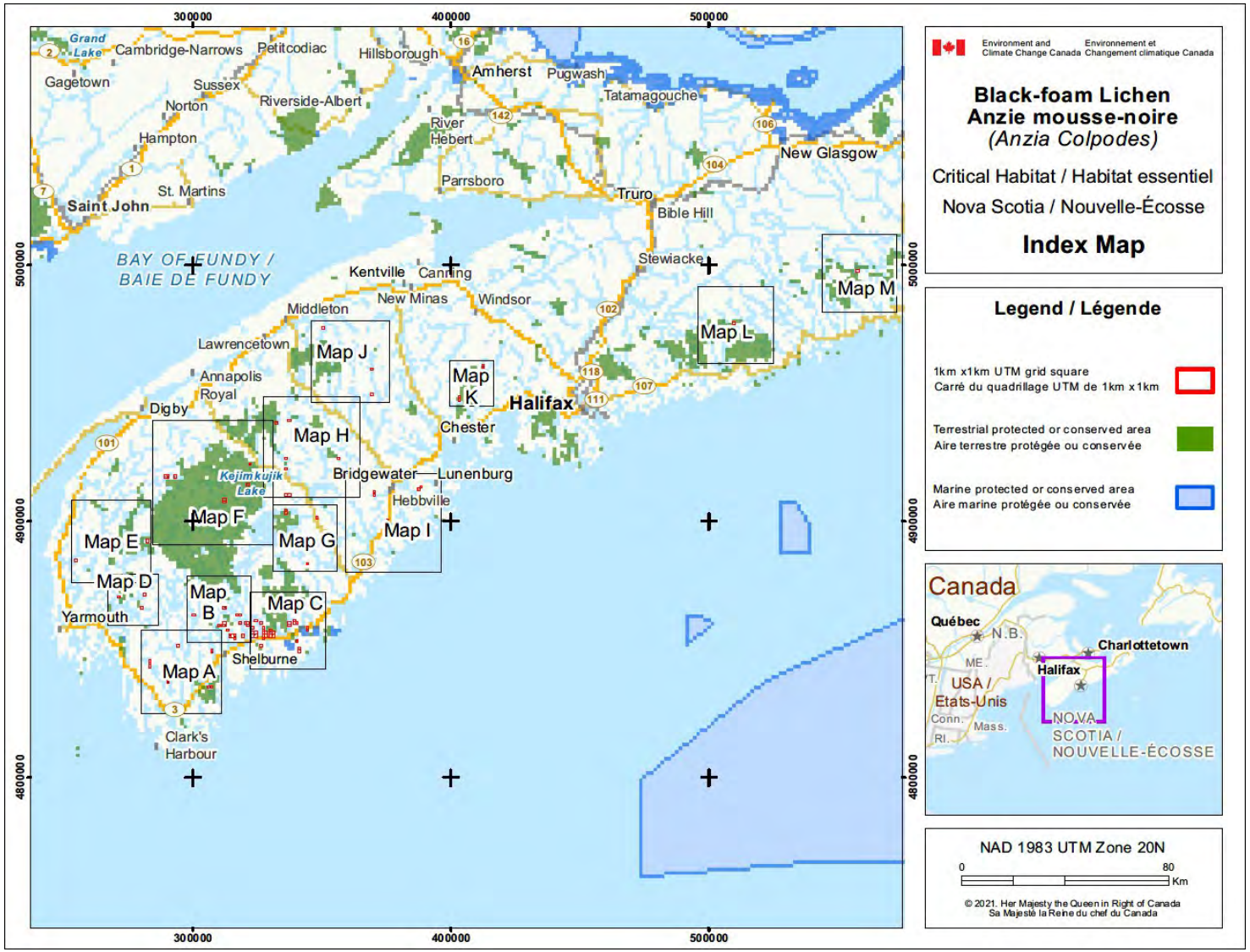

Figure 2. Overview map of Critical habitat for Black-foam Lichen in Nova Scotia.

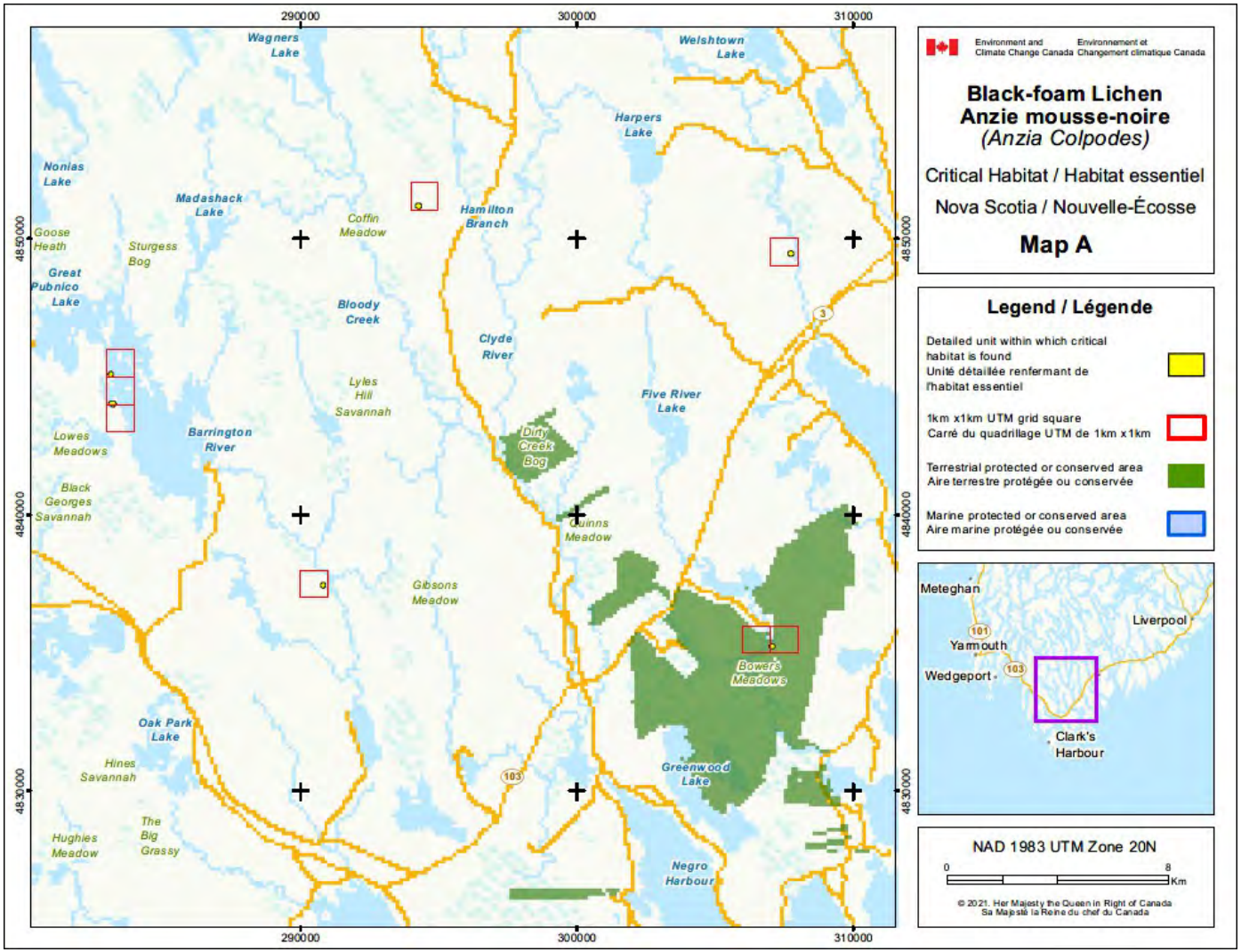

Figure 3. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

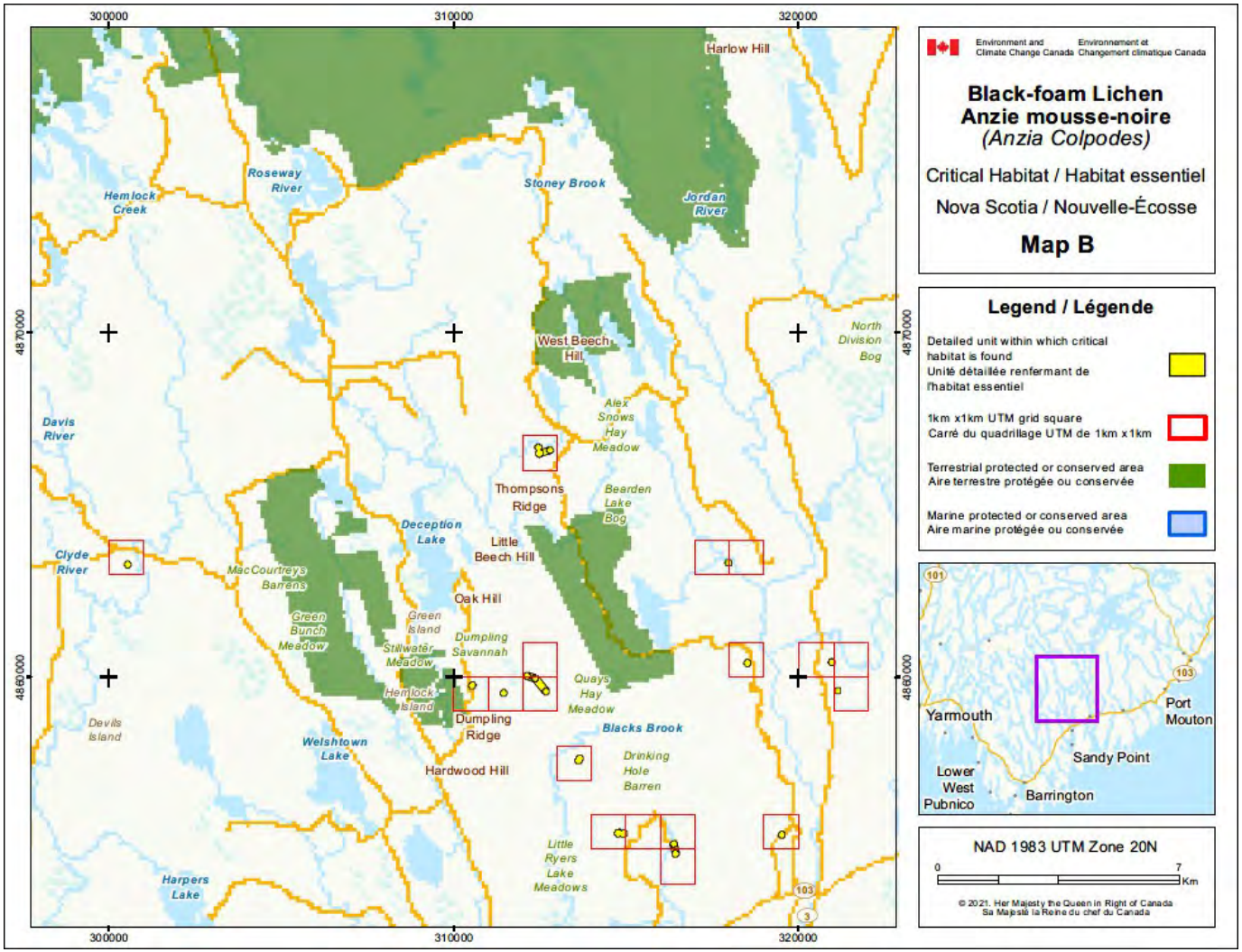

Figure 4. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

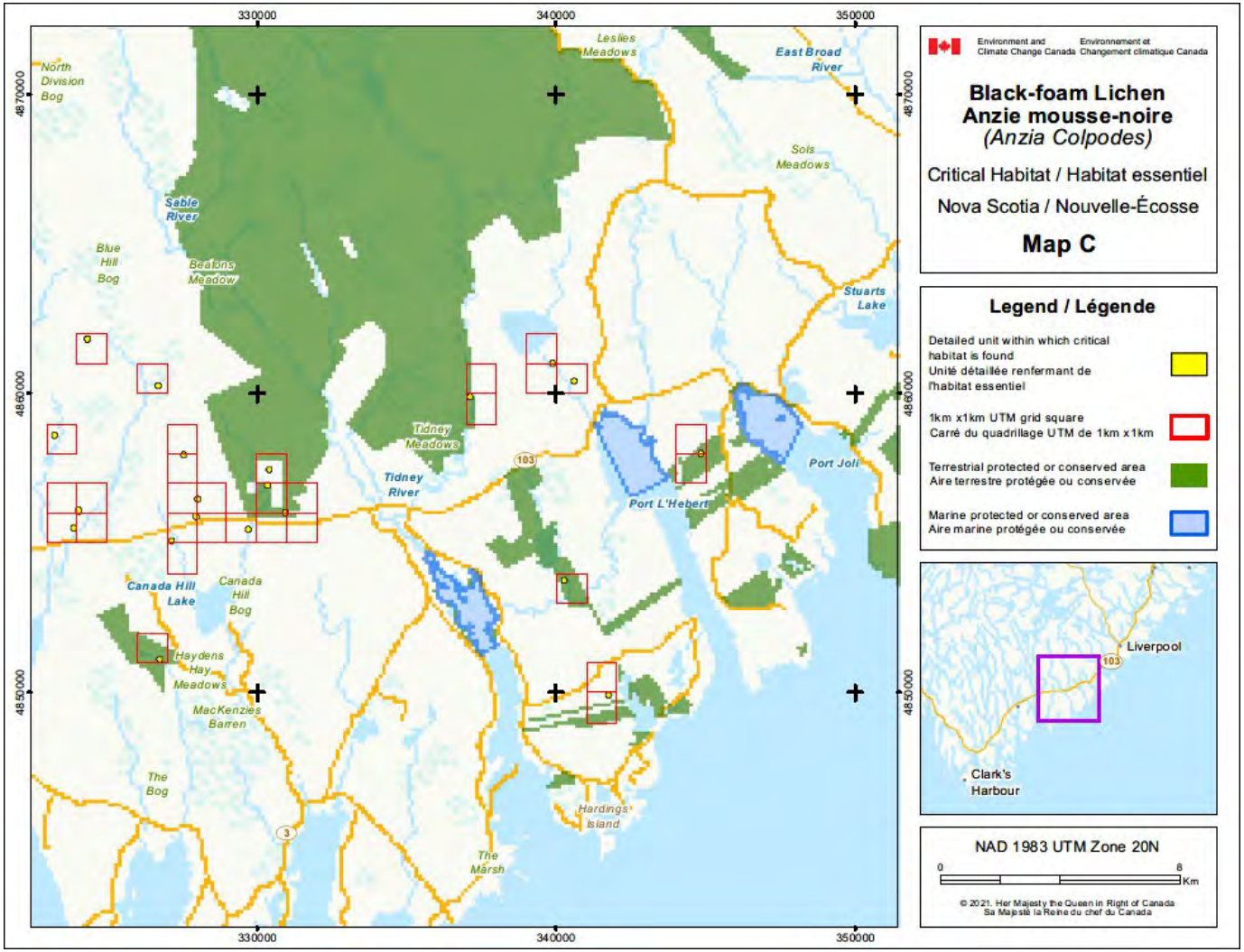

Figure 5. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

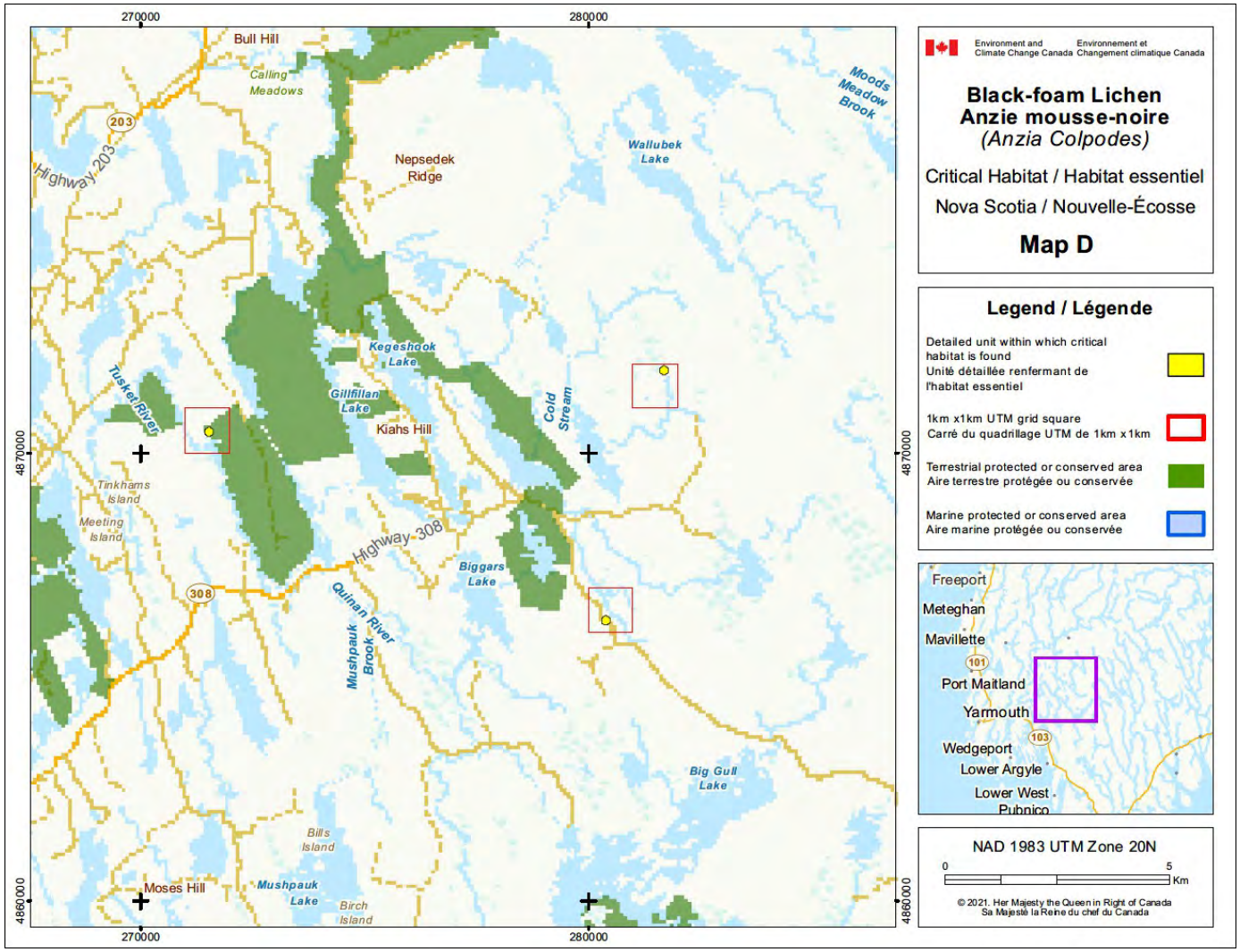

Figure 6. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

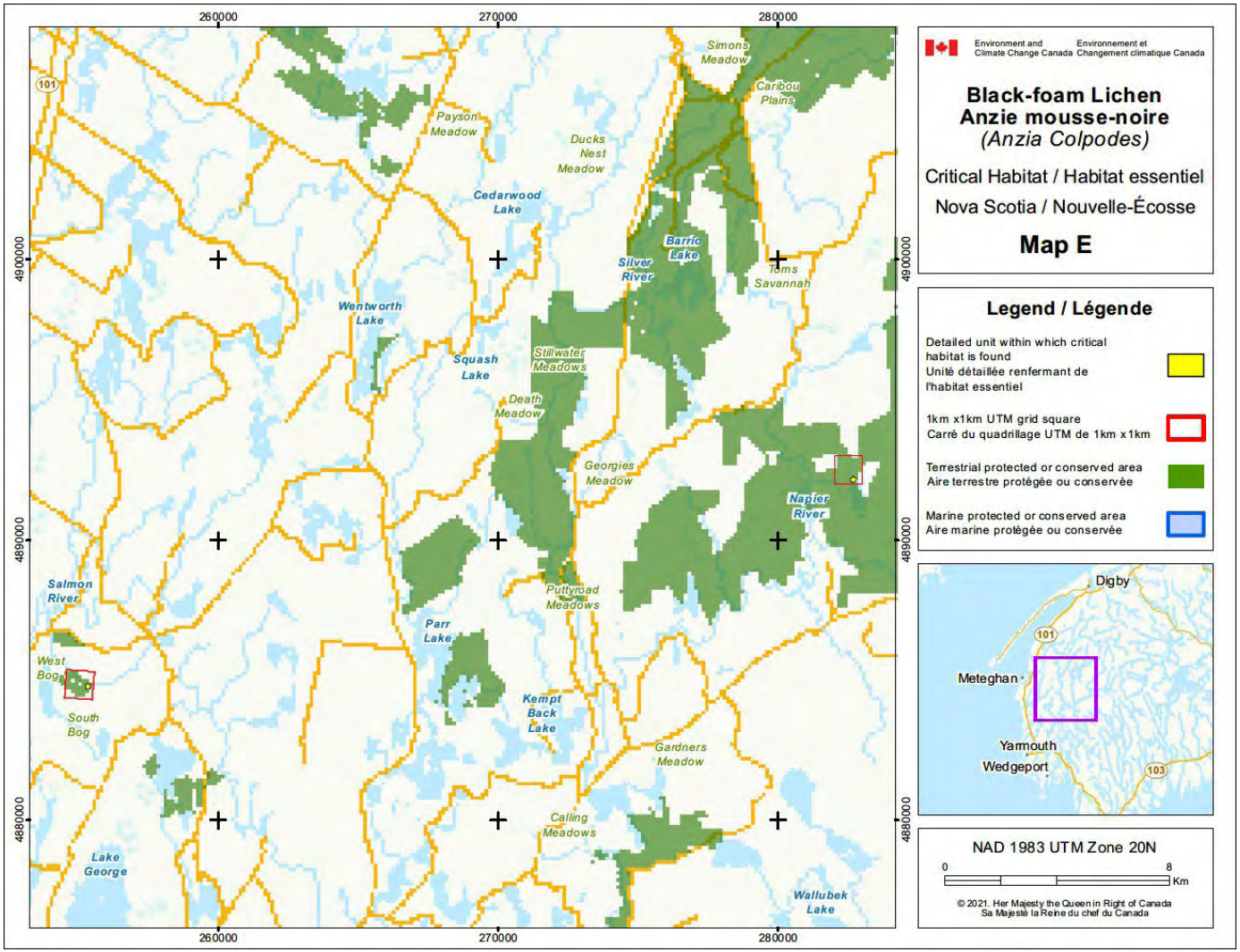

Figure 7. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

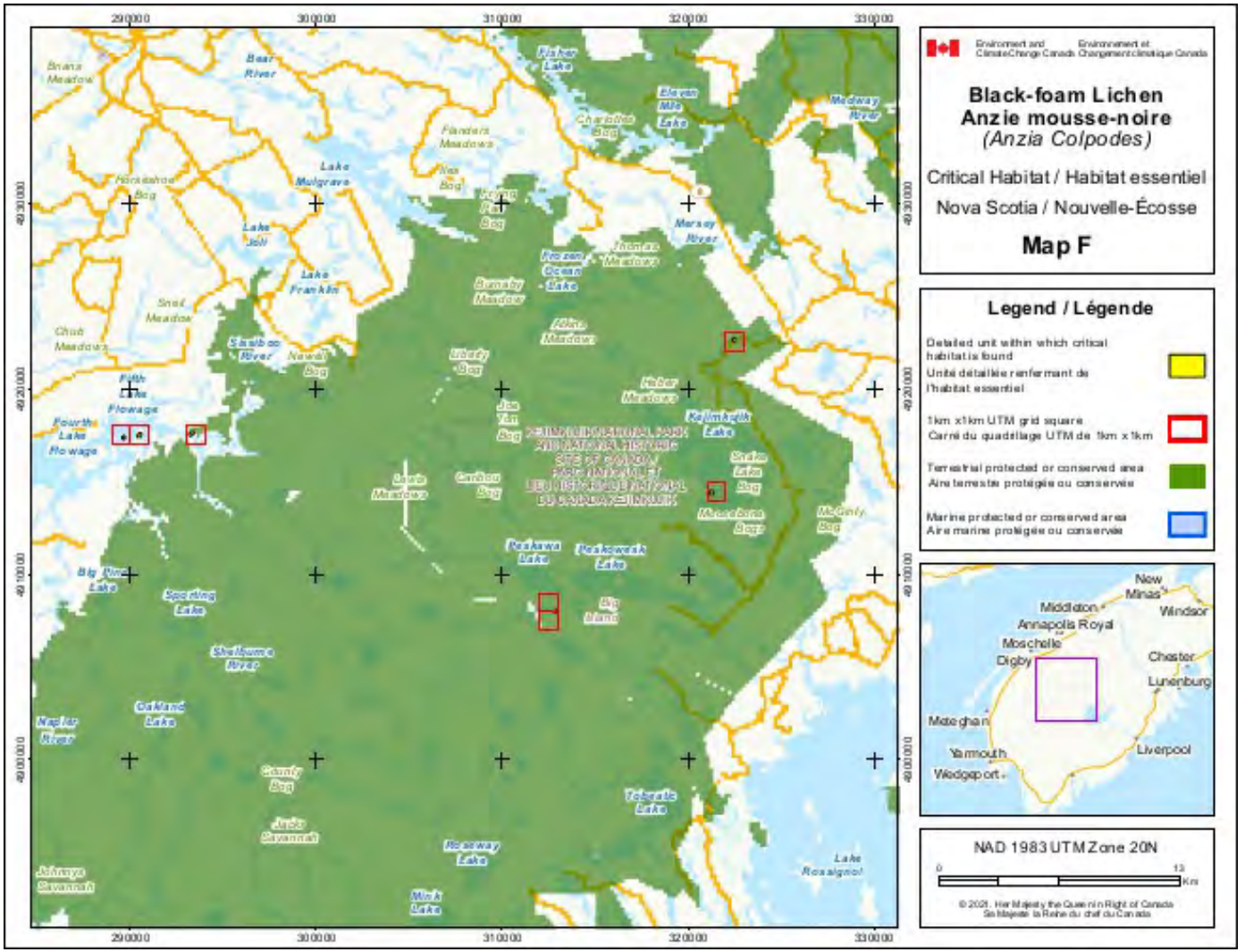

Figure 8. Critical habitat for Black-foam Lichen in and near Kejimkujik National Park and National Historic Site, NS is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

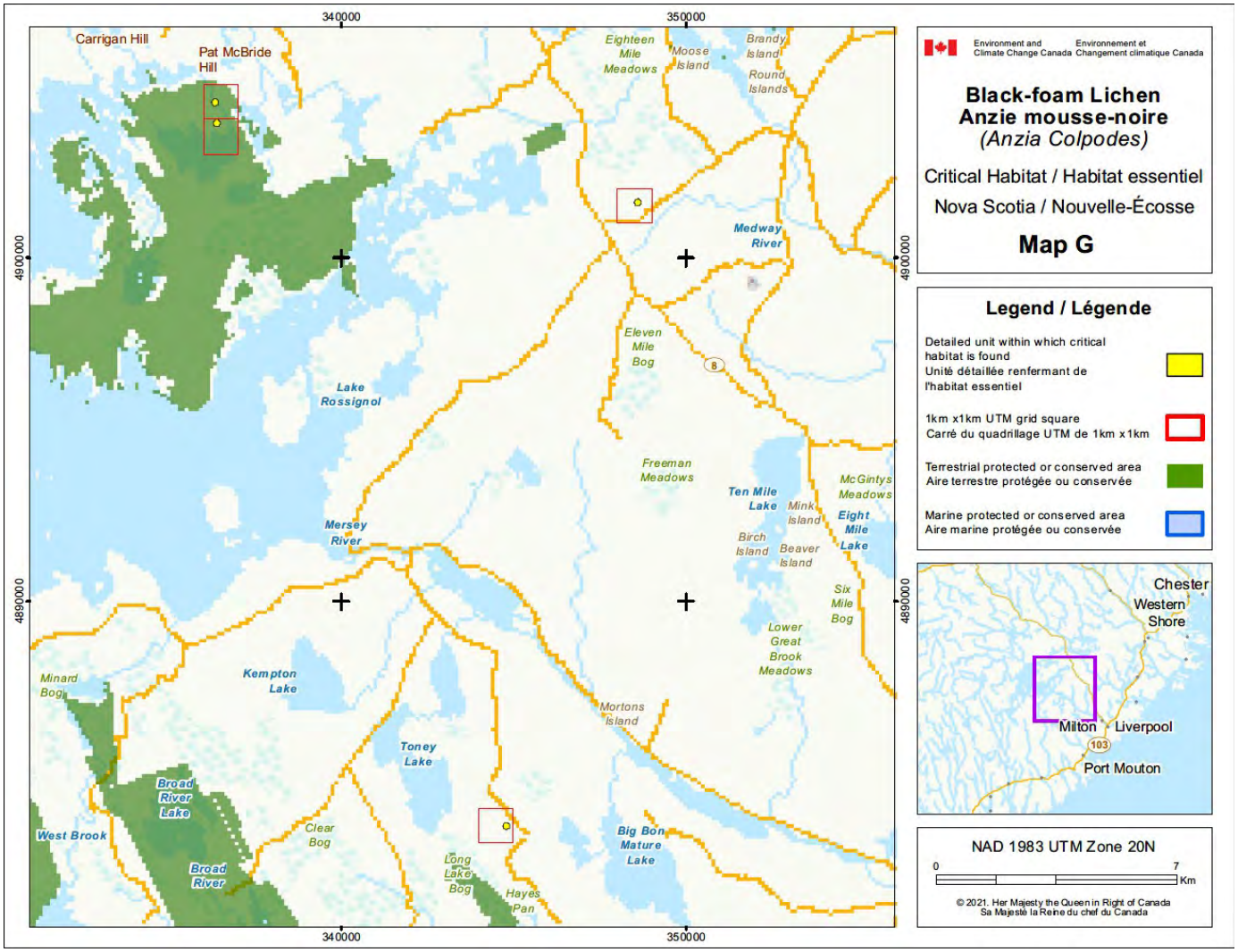

Figure 9. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

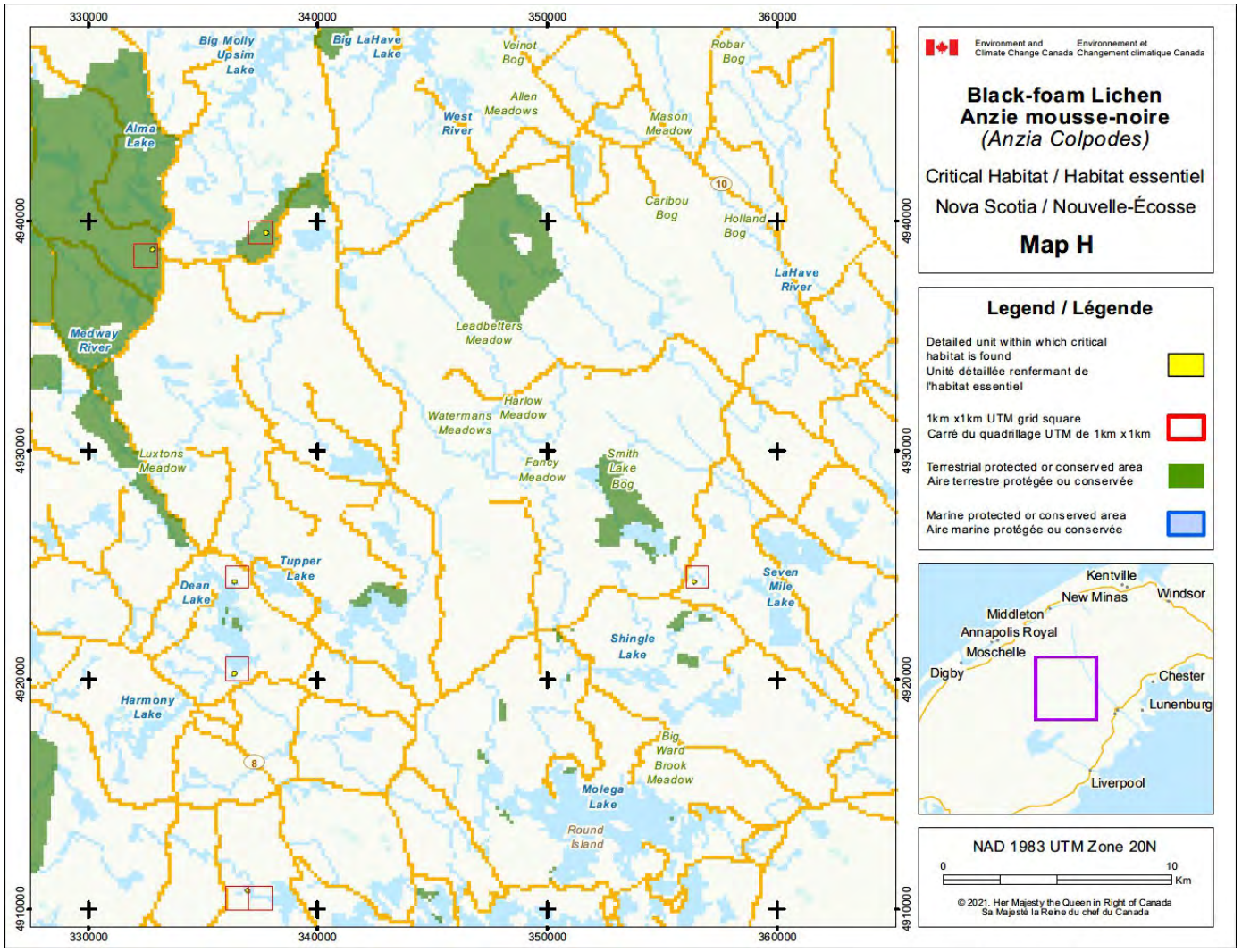

Figure 10. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

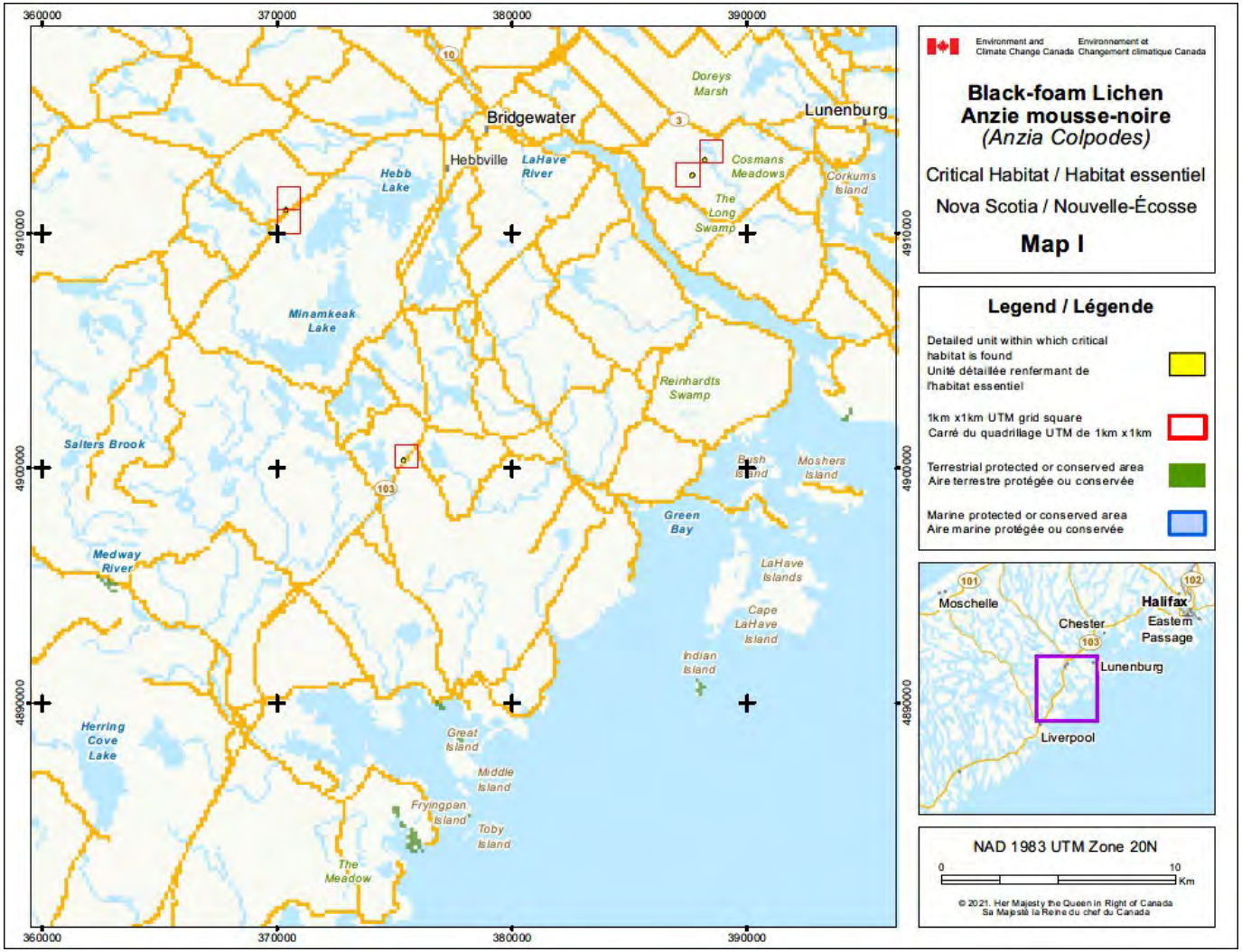

Figure 11. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

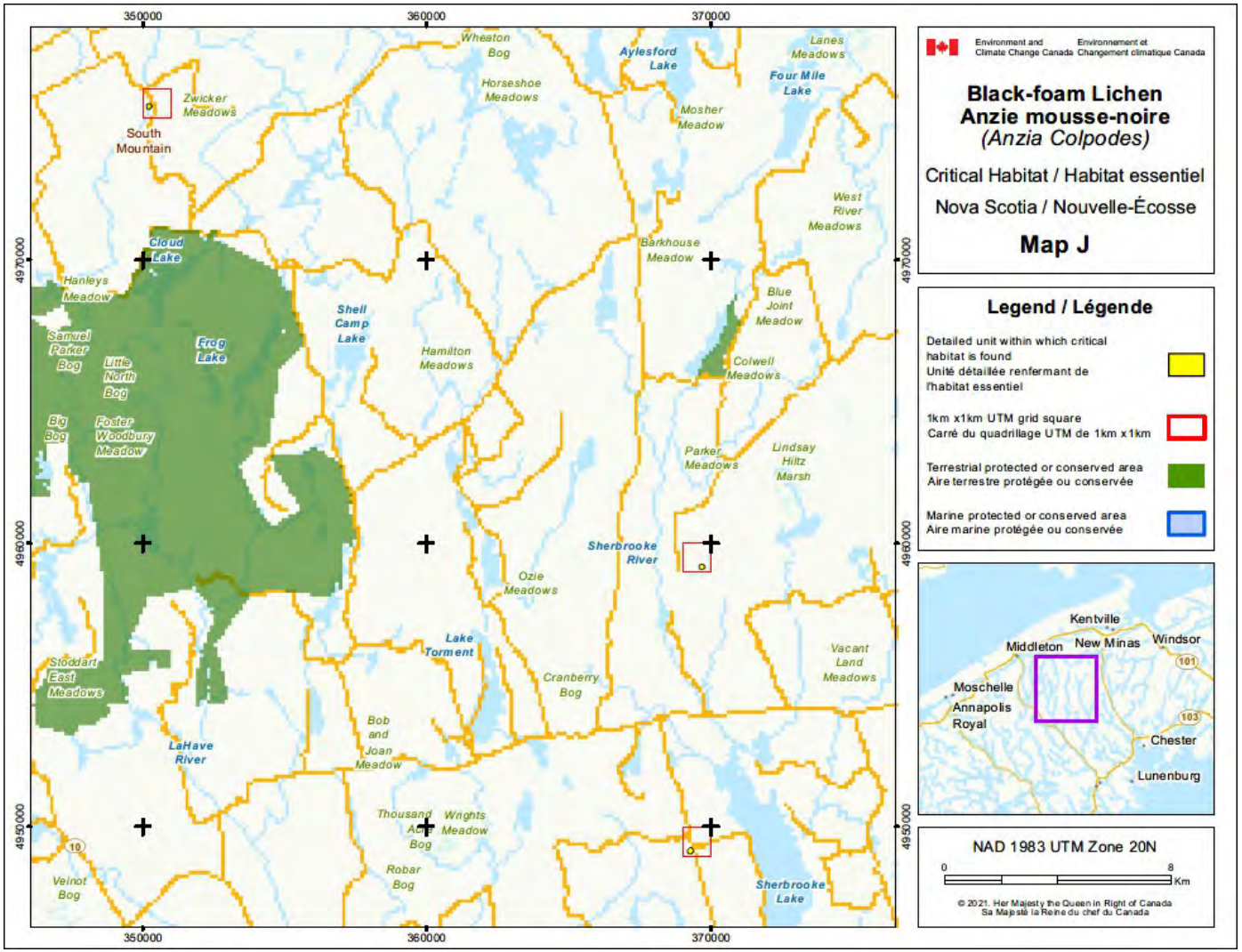

Figure 12. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

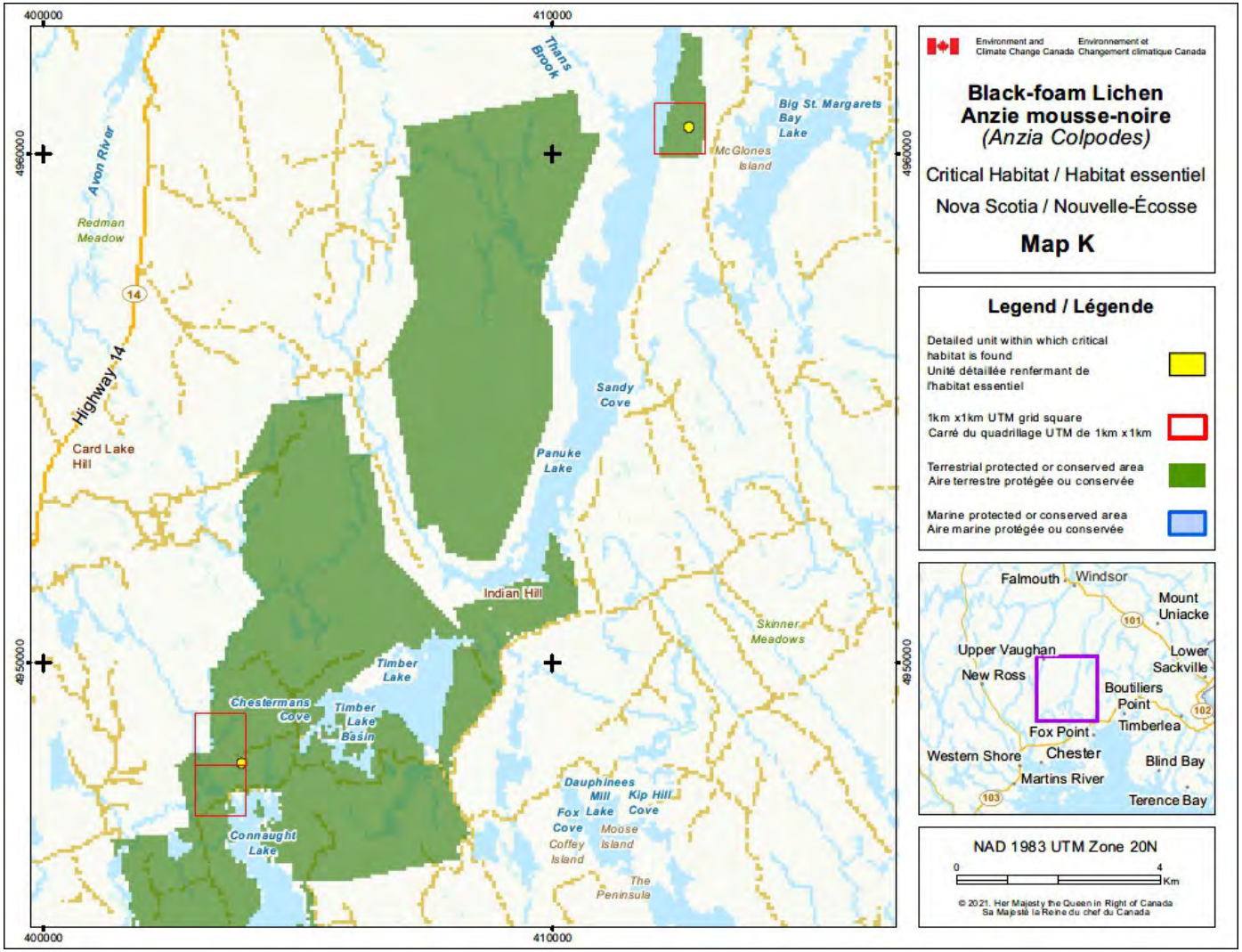

Figure 13. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

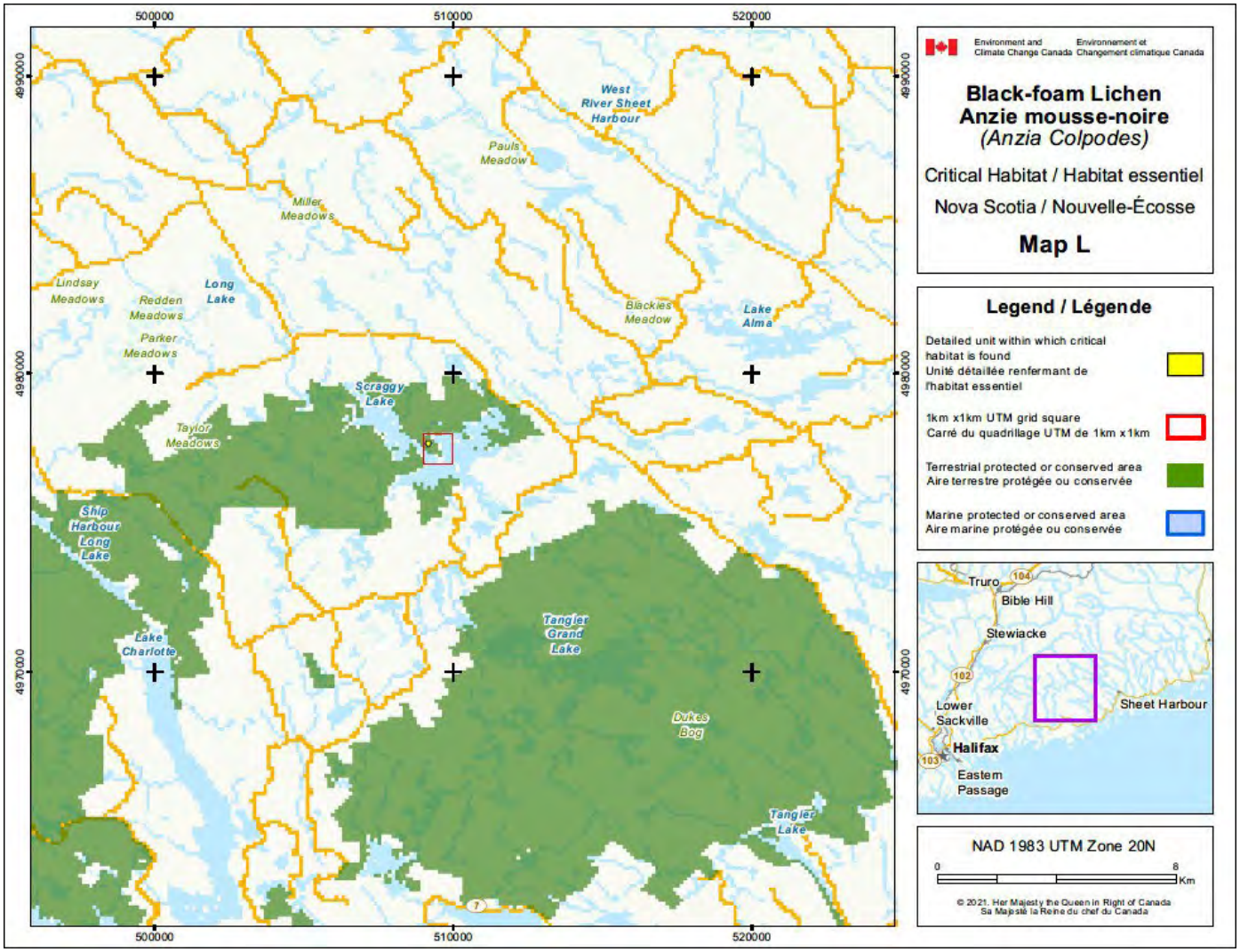

Figure 14. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

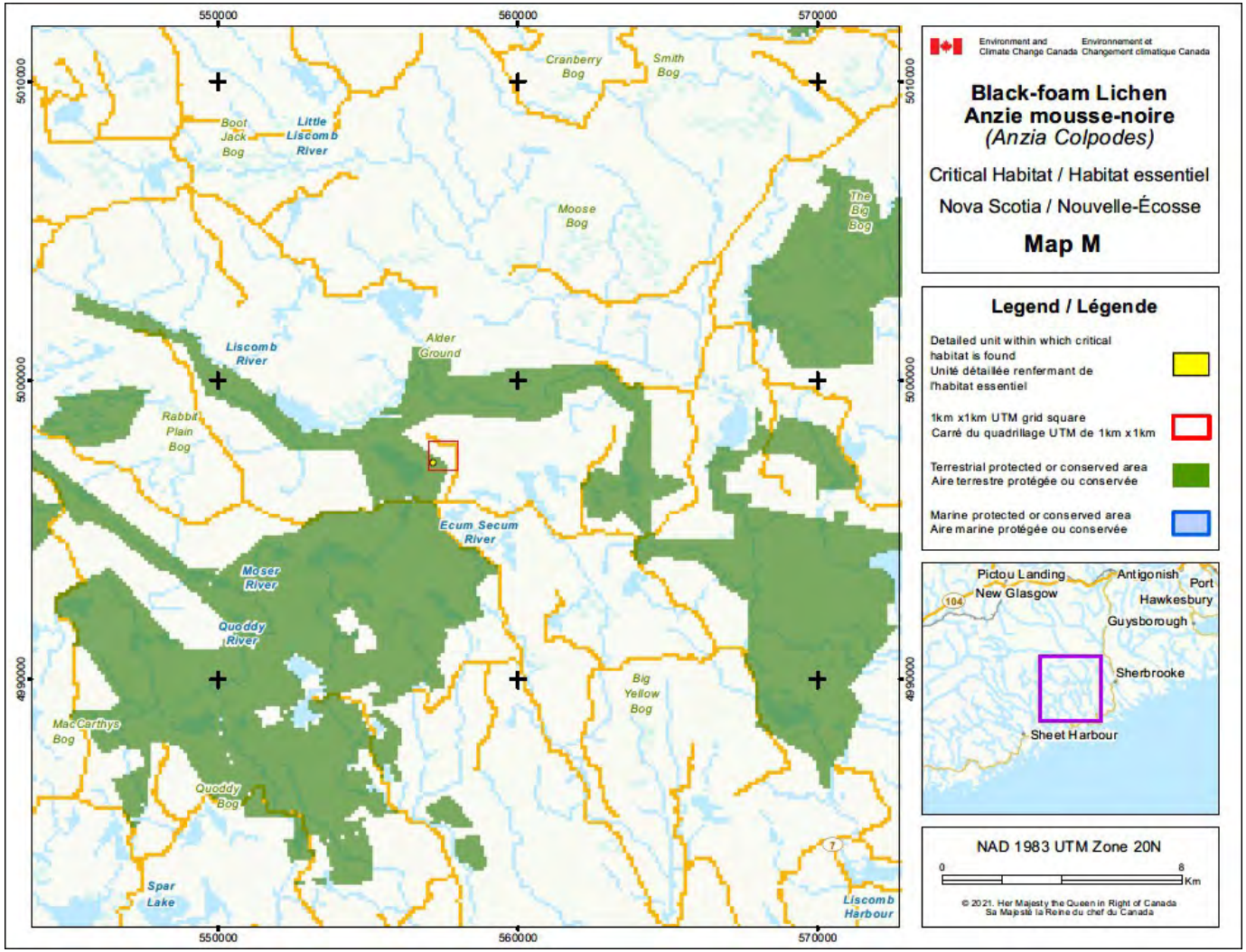

Figure 15. Critical habitat for Black-foam Lichen in Nova Scotia is represented by the yellow shaded polygons where the habitat occupancy and biophysical attributes criteria and methodology set out in the recovery strategy (section 7) are met. The 1 x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid system used to indicate the general geographic area within which critical habitat is found.