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Mi'kmaw knowledge helps uncover a new area of interesting lichen biodiversity on the island of Newfoundland (Ktaqmkuk)

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Abstract. The island of Newfoundland, Canada, is known as an area with high lichen species richness; however, most of this diversity is known from coastal regions where the ocean creates a maritime climate. The central part of the island has a more continental climate and is also the part of the province with the highest levels of industrial forest harvest and mining activities. For these reasons, it has not been an area considered to have high lichen diversity. Here, we show how local Mi'kmaw knowledge in collaboration with western scientific expertise facilitated a two-eyed seeing approach (*Etuaptmumk*) that yielded the discovery of overlooked lichen diversity in Central Newfoundland. Surveys by the authors throughout 2023 yielded collections of 175 species of lichenized, lichenicolous and allied fungi from the area known as Charlie's Place. Of these, there is a high proportion of cyanolichens (13%) and calicioids (11%), indicating high ecological value and potential old growth/ancient forest status. In addition, we report 19 new species records for the province, two of which (*Chaenothecopsis vainioana* and *Myrionora albidula*) are new records for Canada. Overall, the survey work reported here suggests that Charlie's Place should be a priority area for protection within the context of Central Newfoundland. This work also illustrates the value of research under the framework of *Etuaptmumk* and the benefits of combining local Indigenous and western scientific knowledge. The political, logistical, and financial support of Qalipu First Nation was key to the success of this work.

Keywords. Indigenous-led conservation, two-eyed seeing, forest ecology, old-growth, Cyanolichens, calicioids, lichen diversity.

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Ecological understanding comes from multiple areas and ways of knowing. Western scientific knowledge has one approach to understanding ecology that can be (broadly) characterized as quantitative, reductive and with an emphasis on hypothesis testing. Holders of Traditional Indigenous Knowledge, known variously as Traditional Ecological Knowledge (TEK) or Indigenous Ecological Knowledge (IEK) (Ens et al. 2015), view ecological systems more holistically, and understand ecology to be infused with culture, language and spirituality (Jessen et al. 2022; Menzies 2006; Nelson & Shilling 2018). In Mi'kmaw tradition, use of resources from the natural world was governed by *netukulimk* (pronounced "neh-DU-guh-limk") – the set of customs and rituals that informed stewardship of lands, waters, animals and plants (McMillan & Prosper 2016). In the face of trying to reconcile Mi'kmaw worldviews and the colonizing influences that have had often devastating impacts on Indigenous lives, language and culture, Elders Albert Marshall and Murdena Marshall co-created the concept of *Etuaptmumk*

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(pronounced "Ed-do-up-dim-moomk"), or two-eyed seeing, with Cape Breton University professor Cheryl Bartlett. *Etuaptmumk* facilitates reconciliation between the worldviews of the Mi'kmaq and of western science (Bartlett et al. 2012; McMillan & Prosper 2016) and has been applied to understanding of long-term changes in river systems (Abu et al. 2019), salmon governance (Denny & Fanning 2016) and biodiversity conservation (Marshall et al. 2021).

The island portion of the province of Newfoundland and Labrador (*Ktaqmkuk*, pronounced "ook-da-hum-gook") has a history of Indigenous relations that is unique from the rest of Canada. The Europeans drove the first group they came in contact with, the Beothuk, into cultural extinction in 1829. When Newfoundland joined Canada in 1949, premier Joey Smallwood declared that there were no Indigenous people in the province, despite the fact that the Atlantic provinces had been home to the Mi'kmaw, a culture with strong ties to the sea, since time immemorial (McMillan & Prosper 2016). Decades of political activism by Indigenous people throughout the 20th and early 21st century led to the recognition of two Mi'kmaw groups, the Miawpukek ("mi-aw-pukek") First Nation (MFN) in 1984, and the Qalipu ("hal-lay-boo") First Nation (QFN) in 2011. The Miawpukek First Nation was granted a reserve (Conne River) in 1987. While the Qalipu First Nation does not have a reserve base, its accepted traditional territory spans the island of Newfoundland except for the Avalon Peninsula and the traditional Territory of the MFN. After years of interaction with Europeans, the legacy of colonial schools and churches, and isolation from other Mi'kmaw communities in the Maritimes, few people in Newfoundland speak Mi'kmaw. In the last few decades, however, people are striving to promote and revive Mi'kmaw cultural traditions while continuing to work with western systems of science, government and economy. For example, on the south coast of the island of Newfoundland, researchers in the federal government, academia and Indigenous Forest Guardians from Miawpukek have applied two-eyed seeing to the monitoring of rare lichens (Arsenault et al. in prep.).

Indigenous leaders and conservation activists around the world have highlighted the value of weaving together Indigenous and western perspectives to advance conservation, particularly as applied to place-based conservation (i.e., protected areas) (Fa et al. 2020; Marshall et al. 2021; Norman 2017; The Indigenous Circle of Experts 2018). In this paper, we describe a case where Mi'kmaw perspectives and local knowledge facilitated documentation of a biodiversity-rich area for lichens in a region within the context of a wider degraded forest landscape. The first three authors are Mi'kmaq, with the third (FS) straddling both worlds as a forester trained in western scientific management for over four decades. The remaining authors are all trained in western scientific perspectives. To illustrate the two-eyed seeing approach in this study, we begin by individually summarizing Indigenous and western science perspectives about the study area, specifically with regards to forest and lichen diversity, before describing how this group came together to collaborate.

Indigenous knowledge perspectives. The first three authors of this paper are all members of Qalipu First Nation who can attest to the challenges of reconciling settler and Indigenous worldviews. They remember conversations with grandparents, mostly about wildlife and hunting, but occasionally about traditional uses of plants. JH had an aunt who knew about traditional medicines and he learned from her to recognize and harvest chaga (*Inonotus obliquus*) and other mushrooms (e.g., *Trametes versicolor* or "turkey tail") for tinctures and teas. All three note that much inter-generational knowledge has been lost due to forces of colonization. FS points out some irony of the disconnect between Mi'kmaw values and settler values. In the 18th and 19th centuries, European settlers mostly inhabited coastal communities and made their living fishing, while the Mi'kmaq were skilled in the woods, and were later hired as guides to developers who wanted to exploit forest resources. The resulting industrialization of forestry, and development of other extractive industries in Central Newfoundland has led to disconnection for the Mi'kmaq from their land and culture.

JH and DG are lifetime residents of the area known as "Charlie's Place," which is named for their ancestor, Charlie Francis, a Mi'kmaw trapper who was active in the area from 1821 until his death (at age 106) in 1915. JH refers to Charlie's Place as his family's "larder" where they obtained food and fuel along with furs to trade with the settler economy. He describes his grandfather Grant Francis managing the land on his own after early European foresters (in

the first half of the 20th century) harvested areas of Charlie's Place and then left. Grant Francis talked about how he left town to work in the woods when the "snow was knee-deep" and not returning until the "grass was knee-high." Grant's only source of income was hunting and trapping, and he shared many stories about wildlife and their habitats, as well as using roots for rope and other resources from the bush to sustain himself for months on end. JH says that for him, the trigger about the uniqueness of Charlie's Place came about 25 years ago, when he and DG were looking through photographs of their ancestors and reflecting on how hard they worked. JH remembers visiting some of these sites with them as a youth and noting how contented and peaceful they felt when they were in the woods, despite that it had been hard work to make a living there.

FS also notes the emotional and spiritual connections that people feel with Charlie's Place. He has observed that when local people visit, they exhibit behaviors and emotions "like what a religious person does when they visit an old cathedral."

The name "Qalipu" means "caribou" in the Mi'kmaw language and all three Mi'kmaw authors have always understood that lichens are important for sustaining caribou. JH remembers his grandfather telling him stories about abundant caribou in the area and of lichens "dripping off the trees." Recent ecological changes have interacted in complex ways to change caribou distribution (Dekelaita et al. 2022; Webber et al. 2020; Webber & Vander Wal 2021), movement (Laforge et al. 2021), and calf survival (Ellington et al. 2020; Mumma et al. 2019). Similarly, pine marten had declined since DG's father's and grandfather's time. This has prompted concerns among the new generation about how to conserve the area they and their family and ancestors have relied on since time immemorial.

In recent years, the Mi'kmaq began to notice that the forest in and around Charlie's Place looked different from other areas of central Newfoundland that they also frequented. When the first two authors showed photos of trees with the branches covered with lung lichen (*Lobaria pulmonaria*) to FS—who had done forestry work across the island for decades—he reflects that his reaction was, "I didn't know what I was looking at, but I knew I had not seen diversity like that anywhere in Newfoundland, except the Avalon Peninsula [another known lichen hotspot]." Based on his noticing this lichen diversity (but not knowing the species names), and his observations in his capacity as a professional forester of high numbers of black bears and caribou in the area, he started to refer to Charlie's Place as "the Amazon of Central Newfoundland."

Western scientific perspectives. The island of Newfoundland (108,860 km^2) is the insular portion of Canada's easternmost province, Newfoundland and Labrador. The island is part of the Appalachian physiographic region and contains a mix of boreal forest, tundra-like heaths (known locally as "barrens"), rocky outcrops, and abundant wetlands, lakes and rivers (South 1983). The eastern and southern coastal portions of the island are heavily influenced by their proximity to the North Atlantic Ocean, the Labrador current and the Gulf Stream (South 1983), and consequently have a humid, temperate/maritime climate. The combination of climate and lack of air pollution mean that the remnants of intact coastal forests of the island are highly suitable habitat for many lichens, including a number of rare species (Ahti & Jørgensen 1971). Early surveys for lichens by Europeans were tied to colonial activities of exploration, collecting and religious activities (Arnold 1896; Brassard 1980; de la Pylaie 1826; Eckfeldt 1895; Macoun 1902). These surveys focused on coastal communities, in line with patterns of human settlement. For example, Jean Bachelot de la Pylaie was a French plant collector based at the colony of St. Pierre-Miquelon who made two collecting trips to Newfoundland, facilitated by travelling with the French fishing fleet. Arthur Waghorne was an itinerant priest and amateur naturalist who botanized while travelling between the coastal communities under his commission (see details of his life in Brassard (1980) and summaries of his collections in Arnold (1896), Eckfeldt (1895) and Hulting (1896)). Of the early collectors, only John Macoun (1902) ventured away from the coast, and then only to Deer Lake and Grand Lake. In the latter half of the 20th century, Finnish lichenologist Teuvo Ahti made several surveys of Newfoundland in 1956 and again in 1977–79 (Ahti 1974, 1983). Unlike the earlier surveyors, he did venture into Central Newfoundland. The amateur mycological group, Foray NL, began including lichens in their annual collection reports in 2012. Foray NL had surveys in Central Newfoundland in Terra Nova

National Park (Wissink, 2012) and in Bishop's Falls in 2022/2023 (Jenkins, 2024) Recent scientific research on lichens has been focused on the central Avalon Peninsula (McCarthy et al. 2015; McMullin & Arsenault 2019; McMullin & Wiersma 2017; Wigle et al. 2021) and along the south coast (McCarthy et al. 2015) as well as the Northern Peninsula (unpublished surveys by Ahti in 2000, James Lendemer in 2007, and Andre Arsenault, 2010–present). In addition, there have been recent unique discoveries in Terra Nova National Park on the east coast (Padgett et al. 2020) and south coast (Paquette et al. 2024).

The interior of the island, the Central Newfoundland Forest Ecoregion (hereafter "Central Newfoundland"), has a more continental climate compared to the other regions of the Island and has had relatively less survey work for lichens than the Avalon Peninsula and west coast regions of the Island (J. McCarthy pers. comm). Ahti (1974, 1983) describes a few survey locations near Grand Falls and Gander from the 1970s. More recent lichen research projects that have occurred in Central Newfoundland have focused on specific targets. For example, McMullin & Arsenault (2016) visited two sites in Central Newfoundland in their survey of calicioids across the island, and Padgett & Wiersma (2020) surveyed macrolichens growing on black spruce in forested wetlands at 18 sites in Central Newfoundland. When it comes to lichen diversity, large parts of Central Newfoundland are still unexplored.

Central Newfoundland has the most extensive human footprint of any ecoregion in the province (Government of Newfoundland and Labrador and Nature Conservancy of Canada 2013), largely as a result of industrial forestry and mineral activities. It is also in this area where the highest number of fires (both natural and anthropogenic) and spruce budworm infestations have occurred (Arsenault et al. 2016). Nonetheless it has been identified as an important target for conservation and is currently under-represented by protected areas (WERAC 2020). The last six authors of this paper, all with scientific familiarity with the forests and lichen habitats in other parts of the province, admit that they had not prioritized this part of Central Newfoundland for surveys of lichen biodiversity.

Two-eyed seeing. In January 2023, the first three authors, who had learned from their parents and grandparents that the lichens in this area provided important food for caribou, started to notice unusual-looking lichens in Charlie's Place compared to other parts of Central Newfoundland. They alerted local lichen experts to the presence of a variety of cyanolichens (*Lobaria pulmonaria*, *Lobarina scrobiculata*, *Peltigera* spp., and *Ricasolia quercizans* in Charlie's Place. Although Charlie's Place is not far in linear distance from settlements, it takes effort (boat and/or 4-wheel drive vehicles) to access. The first three authors facilitated five unique visits by the remaining authors to the area between June and October 2023. They guided the western scientists to areas they knew had unique diversity of one sort or another (e.g., places they had foraged for mushrooms, medicinal plants, or areas that were productive for hunting or fishing) or where they knew from oral history that there had been little to no forest harvest. DG and JH carried out ongoing surveys through the fall of 2023 using knowledge about species identification learned through the summer from working with the western scientists. As a result of these surveys, Charlie's Place is quickly becoming recognized as a biodiversity-rich area for lichenized, lichenicolous and allied fungi within the context of Central Newfoundland. This paper represents a summary of our collective findings, to date, and highlights the conservation value of this area. This account also serves to highlight the value of taking a two-eyed seeing approach to ecological research.

Methods

Charlie's Place is the name of a region about 120 km^2 in area, bordered on the north by Gander Lake, and to the east and west by the Northwest and Southwest Gander Rivers, respectively. It is an area of mostly upland boreal forest, with a mix of stand types, ranging from pure conifer, one or both of balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*), to mixedwood of fir and/or spruce with trembling aspen (*Populus tremuloides*), white birch (*Betula papyrifera*), mountain maple (*Acer spicatum*) and red maple (*Acer rubrum*). Stand age ranges from ~20 years to over 140 years and includes stands with impressively large hardwoods for this region. In addition to the two rivers, a smaller watercourse ("Joe's Feeder") flows roughly down the middle, and there are several medium to large ponds and some bogs throughout the area (**Fig. 1**) and a variety of habitat types (**Table 1**).

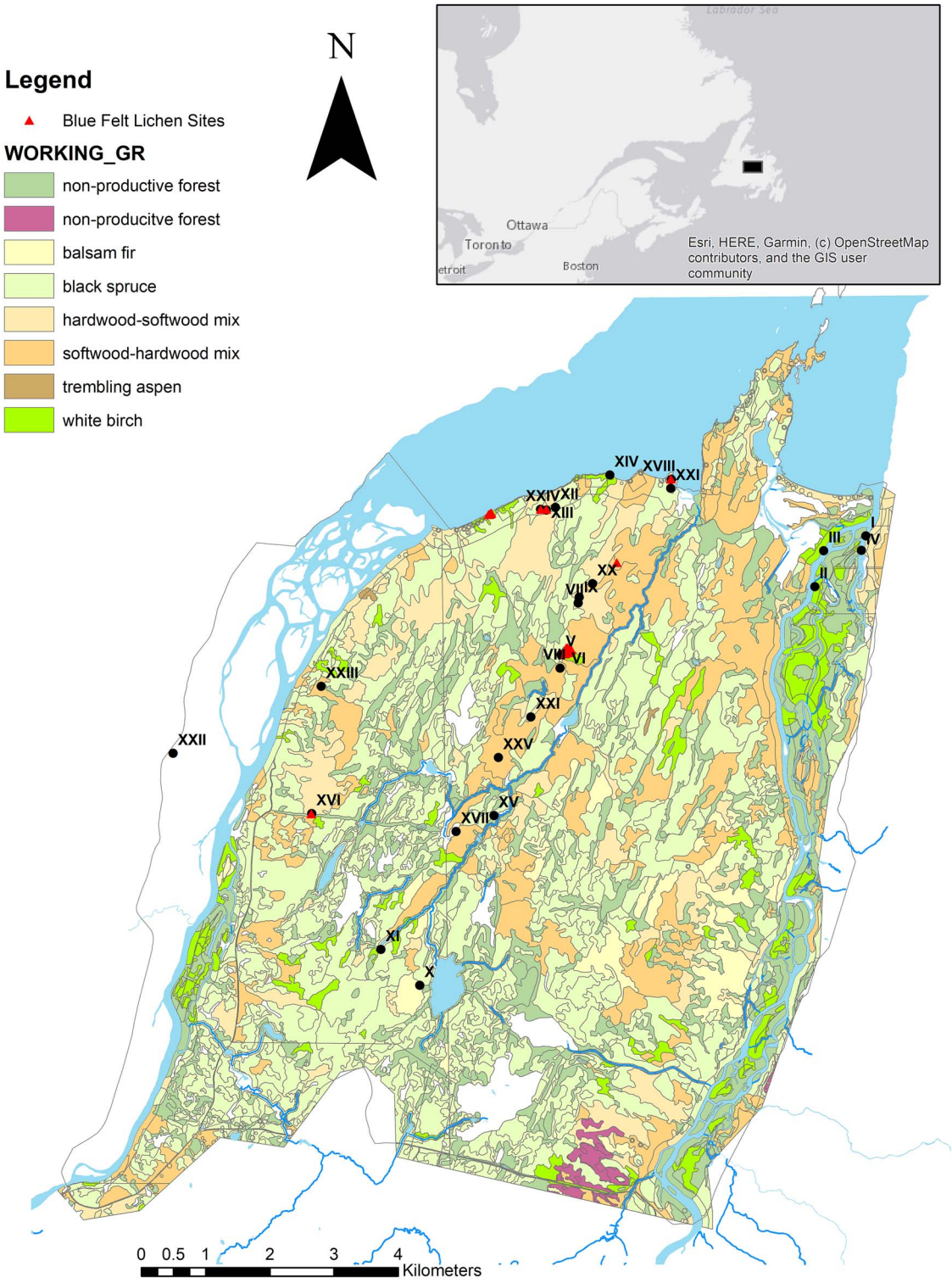

Figure 1. Map of the study area known as Charlie's Place (~120 km^2). Roman numerals correspond to survey locations as listed in the annotated species list, and habitat descriptions for these areas are found in Table 1. Red triangles are new discoveries of blue felt lichen (*Pectenia plumbea*). Black rectangle in the inset map shows the approximate location of Charlie's Place within the island of Newfoundland, within the context of eastern North America. Forest cover data in the main map is from the Fisheries, Forestry and Agriculture (FFA) GeoHub and is licensed under the Open Government License – Newfoundland and Labrador (https://geohub-gnl.hub.arcgis.com/pages/terms-of-use).

Table 1. Habitat descriptions of the survey sites labelled on Figure 1.

Site number	Habitat description
I	Open habitat on an island in the SW Gander River, scattered red maple and white birch
II	Open habitat of large red maples perched on old white pine stumps
III	Open site with red maple and white birch; herbaceous understory, high moose herbivory
IV	Open site with red maple and white birch; understory bracken fern
V	Closed canopy forest of large trembling aspens and red maple
VI	Closed canopy forest; mix of balsam fir and trembling aspen
VII	Closed canopy forest; mix of white birch and trembling aspen
VIII	Rocky outcrop
IX	Closed canopy forest; mix of black spruce and balsam fir
X	Balsam fir dominated stand
XI	Mixed forest of white birch, trembling aspen, balsam fir; herbaceous understory
XII	Mixed stand of white birch and trembling aspen with regenerating balsam fir, a few large red maples
XIII	Brook-side habitat; herbaceous
XIV	Rocky beach
XV	Young forest with alder and young balsam fir; a few mature black spruce
XVI	Older forest with mix of trembling aspen, white birch, balsam fir
XVII	Open disturbed field
XVIII	Large trembling aspens on edge of a clearing
XIX	Large trembling aspens at base of a cliff; open areas with herbaceous vegetation; high moose herbivory
XX	Mature red maples at edge of an alder/white birch swamp
XXI	Edge of a mixedwood forest with smaller trembling aspen and alder-covered wet area
XXII	Floodplain of a brook; dry boulders with herbaceous vegetation
XXIII	Mixed forest of white birch, trembling aspen and balsam fir
XXIV	Mixed forest of white birch, trembling aspen and balsam fir
XXV	Mixed forest of white birch, trembling aspen and balsam fir

Different sub-groups of the group of authors visited Charlie's Place at different times, guided in all instances by the two lead authors. FS & CH visited 12–14 June 2023 and CH visited again 19–20 October 2023; FS & YFW visited 14–16 July 2023; FS, AA, KD and HP made a day trip on 27 September 2023 as part of a Foray NL trip; YFW & RTM visited between 2–6 October 2023. Visits in June, July and September focused on several older stands where some of the more charismatic species and large cyanolichens were initially found (points V, VII, VIII and XVIII in **Fig. 1**). The visits in October focused on sampling as wide a variety of habitat types as possible, including older and younger stands, open rock outcrops, disturbed sites and beaches along Gander Lake as well as sites of traditional ecological and cultural value (**Fig. 1**). These were identified and located by the first two authors. Field work was carried out under a permit issued to DG, JH and YFW by the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture–Wildlife Division (Doc/2023/00436). In terms of dedicated lichen survey effort, we estimate it to be 17 total person-days by the collective group. The time spent surveying with various lichen experts gave DG and JH the confidence to recognize significant lichen species. They continued to explore Charlie's Place throughout October and November 2023, sending the other members of the team photographs and samples of interesting finds.

In each survey area, we used the "intelligent meander" approach (Newmaster et al. 2005; Selva 2003) and focused on surveying as many microhabitats as possible, such as different types of soil and rocks, trees (boles and branches) of all species and age classes, snags, rotten logs and stumps, tip-ups, and cracks and crevices in tree boles. KD's survey work focused on lichenicolous fungi. We identified species using stereo and compound microscopy along with spot tests (K, C, PD and I) and thin layer chromatography (Culberson & Kristinsson 1970), and followed various keys (e.g., Brodo et al. 2001; Brodo 2016).

The full database of specimens collected has been deposited in FigShare (doi: 10.6084/m9.figshare.25840936).

Results

The total number of lichenized, lichenicolous and allied fungi known to date from Charlie's Place is 175. Of these, 23 (13%) are cyanolichens, 108 (61%) are chlorolichens, 24 (14%) are non-lichenized fungi traditionally treated with lichens and 20 (11%) are calicioids. Nineteen species are reported here for the first time for the province (**Fig. 2 & 3**), and one (*Ochrolechia gowardii*) is a new report for the island of Newfoundland (previously reported from Labrador, Deduke et al. 2016; **Fig. 2I**). Another of these "new" species, *Chaenothecopsis vainioana* (**Fig. 2G**), is a new record for Canada, and a first record for eastern North America (Hardman et al. 2017). One other, *Myrionora albidula* (syn. *Biatora albidula*; **Fig. 3F & G**), is known from other parts of Canada, but is reported formally for the first time here. Nine species are considered to be of conservation concern (**Table 2**). There are multiple thalli of the blue felt lichen, *Pectenia plumbea* (syn. *Degelia plumbea*) in several locations. Eight locations of this species, indicated by red triangle on **Fig. 1**, were identified by DG and JH through the late fall and winter of 2023 after working with the other authors through the summer and early fall. Other notable finds include two species that have not been documented in over a century: *Calicium viride* (**Fig. 2D**), last reported by Macoun (1902), and *Stictis radiata*, collected by Waghorne in the late 1800s (confirmed by Sherwood 1977) and only rarely reported. When we compare total species detected from this survey to other floristic surveys in Newfoundland, Charlie's Place has the second-highest estimated number of species among the localities previously surveyed in the province (**Table 3**).

Annotated List

The annotated list below details the cumulation of our finds, along with collection numbers (CH– Claudia Hanel; CMS – Foray NL collection, collected by AA, HP and KD; all other numbers are from RTM). The list is in alphabetical order by genus and species. Roman numerals correspond to survey locations of **Fig. 1** and **Table 1**, and nomenclature follows Esslinger (2021). Species authors prior to 1996 are from Brummitt & Powell (1996); remaining authors are based on Esslinger (2021). Species new to the province of Newfoundland and Labrador are indicated with an asterisk (*), species new to Canada with two asterisks (**), and non-lichenized fungi by a dagger (†). Specimens for which we confirmed identity with TLC are indicated with "TLC" in superscript and notes indicate what lichen substances were detected.

†***Abrothallus santessonii* (D.Hawksw.) Suija, D. Hawksw. & Pérez-Ort.** – Lichenicolous on *Platismatia glauca* on dead *Picea*, CMS23B-244 (V).

***Agryrium rufum* (Pers.) Fr.** – Lichenicolous on a snag, 25267 (II).

***Alectoria sarmentosa* (Ach.) Ach.** – Corticolous on *Abies balsamea*, CMS23B-529, CMS23B-236, 25345, 25358 (V), 25290 (IX), 25427 (XV), 25421 (XVI).

***Alyxoria varia* (Pers.) Ertz & Tehler** – Corticolous on *Acer rubrum*, 25240 (I).

***Arthonia vinosa* Leighton** – Corticolous on *Betula papyrifera*, 25258 (III). Corticolous on a conifer snag, 25204 (IV). Lignicolous on a *Pinus strobus* snag, 25450 (II).

*†***Arthopyrenia fallaciosa* (Stizenb. *ex* Arnold) Thiyagaraja, Ertz, Lücking, Coppins & K.D.Hyde** – Corticolous on *Betula papyrifera*, 25287 (VII), 25405 (XI).

***Bacidia schweinitzii* (Fr. *ex* E.Michener) A.Schneid.** – Corticolous on *Populus tremuloides*, 25348 (V).

***Baeomyces rufus* (Huds.) Rebent.** – Saxicolous, 25394 (V). Terricolous, 25404 (X).

Biatora pontica* Printzen & Tønsberg – Corticolous on *Acer rubrum*, 25224 (I).

***Biatora pycnidiata* Printzen & Tønsberg** – Corticolous on *Acer rubrum*, 25232 (I) Corticolous on *Abies balsamea*, 25330, 25352 (V).

***Biatora terrae-novae* Printzen & J.W.McCarthy** – Bryicolous, 25393 (X).

***Biatora vernalis* (L.) Fr.** – Corticolous on *Abies balsamea*, 25346 (V). Bryicolous at the base of a *Populus tremuloides*, 25374 (XI).

***Bryoria furcellata* (Fr.) Brodo & D.Hawksw.** – Corticolous on *Larix laricina*, 25432 (XV).

***Bryoria fuscescens* (Gyeln.) Brodo & D.Hawksw.** – Corticolous on *Picea*, CMS23A-332 (XVIII). Lignicolous on a snag, 25434 (XV).

***Bryoria nadvornikiana* (Gyeln.) Brodo & D. Hawksw.** – Corticolous on *Abies balsamea*, 25367 (VII).

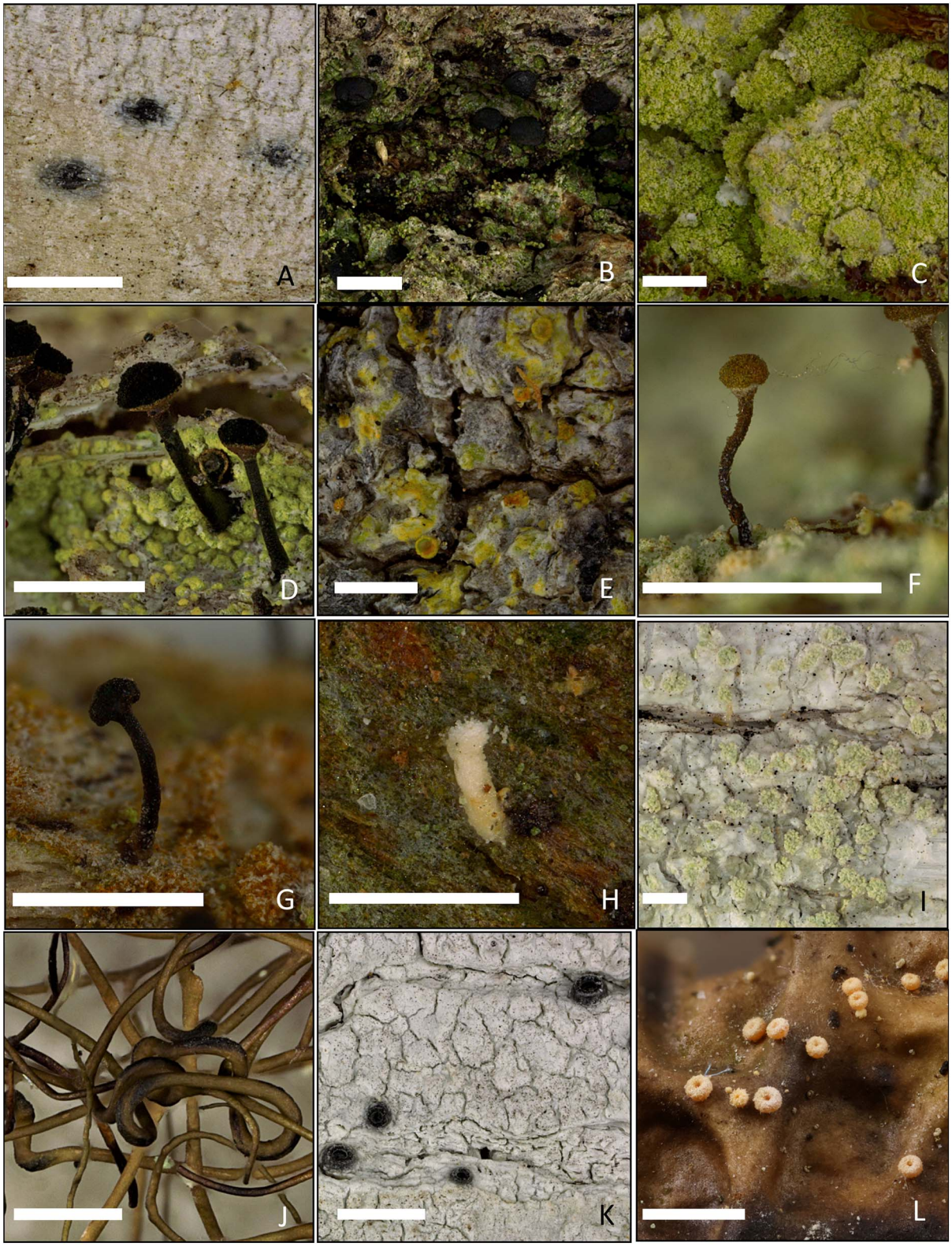

Figure 2. New and notable species to the province of Newfoundland and Labrador found in Charlie's Place. **A.** *Arthopyrenia fallaciosa,* **B.** *Bacidia schweinitzii,* **C.** *Biatora pontica,* **D.** *Calicium viride* (not seen in the province since the 1890s), **E.** *Caloplaca chrysophthalma,* **F.** *Chaenotheca stemonea,* **G.** *Chaenothecopsis vainioana* (first report for Canada), **H.** *Dictyocatenulata alba* **I.** *Ochrolechia gowardii* (first report for the island part of the province), **J.** *Raesaenenia huuskonenii,* **K.** *Stictis urceolatum,* **L.** *Nectriopsis lecanodes*. White bar in all images = 1 mm, except in H = 0.5 mm.

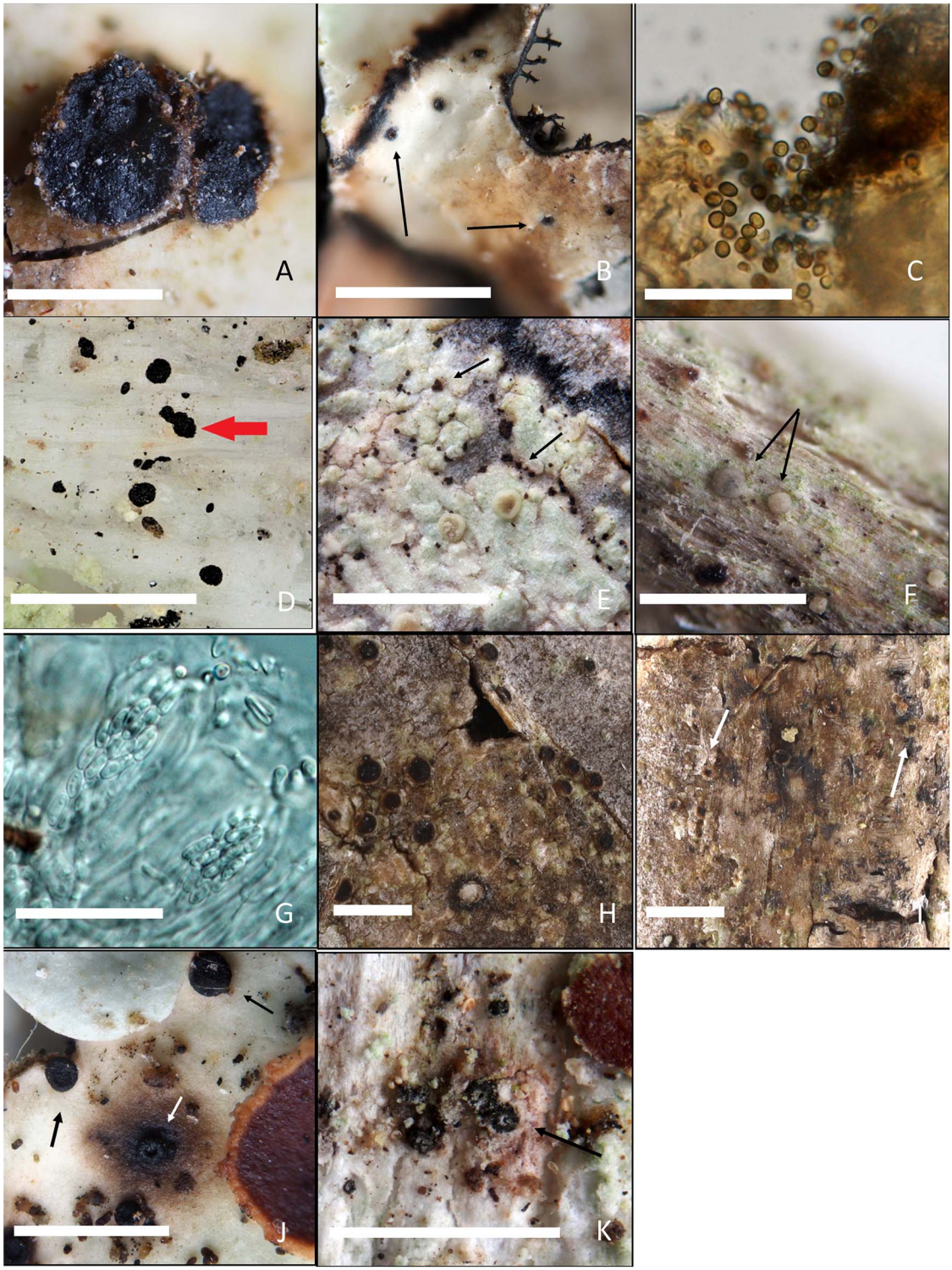

Figure 3. A. *Intralichen* sp. (growing in blackened apothecia of *Lobarina scrobiculata*). **B.** *Lichenoconium erodens* on *Parmelia squarrosa*. **C.** Conidia of *Lichenoconium erodens*. **D.** *Lichenostigma alpinum* on *Ochrolechia gowardii*. **E.** *Lichenostigma chlaroterae* on *Lecanora* cf. *symmicta*. **F.** *Myrionora albidula*. **G.** Polysporous asci and spores of *Myrionora albidula*. **H.** *Rinodina polyspora*. **I.** *Rinodina subminuta*. **J.** *Sclerococcum lobariellum* on *Ricasolia quercizans*. **K.** *Skyttea* on *Loxospora elatina*. White bar in all images = 1 mm, except in D, p = 0.5 mm and o, s = 25 μm.

Table 2. Table of rare species found in Charlie's Place, with notes about criteria for designating species of conservation concern. NL ESA: Newfoundland and Labrador Endangered Species Act; COSEWIC: Committee on the Status of Endangered Wildlife in Canada; SARA: Canadian Species-at-Risk Act; S-ranks refer to rankings from NatureServe.

Species	NL ESA	COSEWIC/ SARA rank	S-rank	Based on collections
Calicium viride			S2 (imperiled) in New Brunswick; S1 (critically imperiled) in Ontario	First report in the province in over 100 years
Chaenotheca gracillima			S3 (vulnerable) in New Brunswick	Limited records in the province
Chaenotheca stemonea				Only report in the province
Chaenothecopsis viridireagens				Limited records in Atlantic Canada
Heterodermia speciosa			S3 (vulnerable) in Atlantic provinces (Newfoundland & Labrador, Nova Scotia, New Brunswick, Prince Edward Island)	Very limited records in the province
Pannaria subrubiginosa in ed.				Very limited records in the province and in most of Atlantic Canada
Pectenia plumbea (syn. *Degelia plumbea*)	Vulnerable	Special concern COSEWIC & SARA	S2 (imperiled) on the island of Newfoundland as of 2015, likely S3 (vulnerable)	
Protopannaria pezizoides			S3 (vulnerable) in the province	
Ramboldia elabens				Very limited records in the province

***Bryoria pseudofuscescens* var. *pikei* (Brodo & D. Hawksw.) McCune** – Corticolous on *Abies balsamea*, 25366 (VII).

***Bryoria trichodes* subsp. *trichodes* (Michx.) Brodo & D.Hawksw.** –Corticolous on *Abies balsamea*, 25392 (X). Corticolous on *Picea*, 25381 (XII). Corticolous on *Picea mariana*, 25310 (VIII).

***Buellia disciformis* (Fr.) Mudd** – Corticolous on *Acer rubrum*, 25236 (I). Corticolous on *Alnus*, 25341 (II).

***Buellia schaereri* De Not.** – Corticolous on *Acer rubrum*, 25241 (I), 25243 (I).

***Buellia stillingiana* J.Steiner** – Corticolous on *Acer rubrum*, 25284 (II). Corticolous on smooth bark of low, dead branch of *Acer spicatum*, CMS23A-359 (V).

***Calicium glaucellum* Ach.** – Lignicolous on a snag, 25255 (III), 25336 (V).

***Calicium lenticulare* Ach.** – Lignicolous on a *Betula papyrifera* snag, 25422 (XVI).

***Calicium salicinum* Pers.** – Lignicolous on a snag, 25256 (III), 25325 (V), 25378 (XIII). Corticolous on *Betula papyrifera*, 25263 (IV).

***Calicium viride* Pers.** – Corticolous on an old *Betula papyrifera*, 25275 (II). Not reported in Newfoundland and Labrador since Macoun (1902). In addition to this report, it has been recently discovered in Codroy Valley NL (Arsenault unpublished data).

***Caloplaca cerina* (Ehrh. Ex Hedwig) Th.Fr.** – Corticolous on smooth, sloughing bark of low, dead branches of *Acer spicatum*, CMS23A-346 (V).

****Caloplaca chysophthalma* Degel.** – Corticolous on trembling *Acer spicatum*, CMS23B-233, 25318 (V).

***Candelariella vitellina* (Hoffm.) Müll.Arg.** – Saxicolous (non-calcareous), 25369 (XIV).

Table 3. Summary of survey effort relative to survey area from three previous lichen floristics surveys.

Region	Area (km^2)	Person days surveying	# species detected	Ratio of person days:km^2	Total estimated species	Reference
Halls Gullies	8.47	10	146	1.181	178	McMullin & Arsenault (2019)
4 geographically separated provincial parks	13.4	8	133*	0.597	133*	McCarthy et al. (2015)
Salmonier Nature Park	14.55	4	137	0.275	144	McMullin & Wiersma (2017)
Charlie's Place	120	17	175	0.142	175	This study

* Primary focus of this survey was macrolichens; lichenicolous fungi were excluded from McCarthy et al. (2015).

***Chaenotheca brachypoda* (Ach.) Tibell** – Corticolous on *Betula papyrifera*, CMS23A-773, CMS23A-778 (V). Lignicolous in a hollow at the base of a *Betula*, 25424 (XVI). Lignicolous on *Betula papyrifera*, 25309 (VII).

***Chaenotheca brunneola* (Ach.) Mull.Arg.** – Lignicolous on an *Abies balsamea* snag, 25314 (VII). Lignicolous on a snag, 25257 (III). Lignicolous on a *Betula* snag, 25363 (V). Lignicolous on a *Pinus strobus* stump, 25402 (X).

***Chaenotheca chrysocephala* (Ach.) Th.Fr.** – Corticolous on *Betula papyrifera*, 25449 (V).
Lignicolous on an old *Pinus strobus* stump, 25154 (II).

***Chaenotheca ferruginea* (Turner & Borrer) Mig.** – Corticolous on *Betula papyrifera*, 25337 (V).

***Chaenotheca furfuracea* (L.) Tibell** – Corticolous on roots of tip up, 25355 (V). Lignicolous in a cavern at the base of a *Betula*, 25423 (XVI). Lignicolous on a stump, 25153 (II).

***Chaenotheca gracillima* (Vain.) Tibell** – Lignicolous on live *Betula papyrifera*, 25429 (XV).

****Chaenotheca stemonea* (Ach.) Müll.Arg.** – Lignicolous on conifer tip-up, CMS23A-748 (V). Lignicolous at tree base, 25280 (II). Lignicolous on a stump, 25152 (II). Terricolous on base of *Betula papyrifera*, 25319 (VII). Previously collected in Newfoundland (McCarthy et al. in prep) but reported here for the first time.

***Chaenotheca trichialis* (Ach.) Th.Fr.** – Lignicolous on a snag, 25464 (X). Second report in Newfoundland and Labrador; first report is in McMullin & Arsenault (2016).

†***Chaenothecopsis pusiola* (Ach.) Vain.** – Lichenicolous on *Chaenotheca gracillima* in the hollow of a live *Betula papyrifera*, 25462 (XV).

†***Chaenothecopsis sp.*** – Lichenicolous on a sterile crustose lichen, 25149 (II). Lignicolous on an old *Pinus strobus* stump, 25150, 25197 (II). *Notes:* ascospores 2-celled, septum pale. Stalk brown, K−, swelling in K.

†*Chaenothecopsis vainioana* (Nádv.) Tibell—** Lignicolous on an old *Pinus strobus* stump with *Trentepohlia* and *Arthonia vinosa*. 25281 (II).

†***Chaenothecopsis viridireagens* (Nádv.) A.F.W. Schmidt** – Lignicolous on an *Abies balsamea* snag, 25305 (VII). Lichenicolous on *Chaenotheca stemonea* on lignum of an old *Pinus strobus* stump, 25277 (II). Lichenicolous on *Chaenotheca* on a conifer snag, 25199 (X). Second report in Newfoundland and Labrador; first report is in McMullin & Arsenault (2016).

***Chaenotricha obscura* (G.Merr.) Suija, McMullin & P.Lõhmus** – Fungicolous on *Trichaptum abietinum*, 25332, 25453 (V).

***Cladonia caespiticia* (Pers.) Flörke** – Corticolous on *Acer rubrum*, 25225 (I).

***Cladonia cenotea* (Ach.) Schaer.** – Terricolous, 25231 (I), 25437 (XV). Lignicolous on a stump, 25270 (II).

***Cladonia chlorophaea* (Flörke *ex* Sommerf.) Spreng.** – Lignicolous on a log, 25443^{TLC} (XV). *Notes*: fumarprotocetraric acid.

***Cladonia cornuta* subsp. *cornuta* (L.) Hoffm.** – Terricolous, 25396 (X), 25439 (XV), 25461 (XVII).

***Cladonia crispata* (Ach.) Flot.** – Terricolous, 25397 (X), 25448 (XVII).

***Cladonia cristatella* Tuck.** – Terricolous, CMS23B-232, 25214, 25452 (XVII). Lignicolous on a stump, 25266 (II).

***Cladonia deformis* (L.) Hoffm.** – Terricolous, 25438 (XV).

***Cladonia digitata* (L.) Hoffm.** – Lignicolous, 25259 (III). Terricolous, 25407 (XI). Lignicolous on a stump, 25383 (XIII).

***Cladonia gracilis* subsp. *turbinata* (Ach.) Ahti** – Terricolous, 25446 (XVII).

***Cladonia grayi* G.Merr. *ex* Sandst.** – Lignicolous on an exposed stump, 25412^{TLC} (X). *Notes*: fumarprotocetraric acid and grayanic acid.

***Cladonia macilenta* var. *macilenta* Hoffm.** – Lignicolous on a log, 25342 (V).

***Cladonia maxima* (Asah.) Ahti** – Terricolous, 25400 (X).

***Cladonia merochlorophaea* Asah.** – Terricolous, 25408^{TLC} (XI). *Notes*: fumarprotocetraric acid and merochlorophaeic acid.

***Cladonia mitis* Sandst.** – Terricolous, 25298, 25299 (VIII), CMS23A-306 (XVII).

***Cladonia ochrochlora* Flörke** – Lignicolous on a log, 25246 (III). Terricolous at the base of a *Betula papyrifera*, 25375 (XI).

***Cladonia pleurota* (Flörke) Schaer.** – Terricolous, 25268 (II), 25302, 25303 (VIII), 25351, 25463 (XVII). Corticolous on a log, 25254 (III).

***Cladonia* cf. *pyxidata* (L.) Hoffm.** – Terricolous, CMS23A-364 (XVII).

***Cladonia rangiferina* (L.) F.H.Wigg.** – Terricolous, CMS23A-307 (XVII), 25306 (VIII), 25455 (X), 25406 (XI). Lignicolous on a log, 25249 (III).

***Cladonia squamosa* Hoffm.** – Lignicolous on stump, 25278 (II).

***Cladonia stellaris* (Opiz) Pouzar & Vězda** – Terricolous, 25304 (VIII), 25413 (X).

***Cladonia uncialis* subsp. *uncialis* (L.) Weber *ex* F. H.Wigg.** – Terricolous, 25308 (VIII).

***Cladonia verticillata* (Hoffm.) Schaer.** – Terricolous, 25313 (VIII).

***Cliostomum griffithii* (Sm.) Coppins** – Lignicolous on a snag, 25260 (III).

***Collema furfuraceum* (Arnold) Du Rietz** – Corticolous on *Populus tremuloides*, 25425 (XVI).

***Collema subflaccidum* Degel.** – Corticolous on *Populus tremuloides*, CH 230612-06 (VI), CH 230614-12 (XX), 25349, CMS23A-738, CMS23B-219 (V).

†***Cyphobasidium hypogymniicola* (Diederich & Ahti) Millanes, Diederich & Wedin** – Lichenicolous on *Hypogymnia* 25435 (XV), 25447 (X).

***Dibaeis baeomyces* (L. f.) Rambold & Hertel** – Terricolous, 25250 (III), 25456 (X), 25451 (XVII).

****Dictyocatenulata alba* Finley & E.F.Morris** – Corticolous on *Betula papyrifera*, 25417 (XVI). Previously collected in Newfoundland (McCarthy et al. in prep) but reported here for the first time.

***Ephebe lanata* (L.) Vain.** – Saxicolous (non-calcareous), 25414 (XIV).

***Felipes leucopellaeus* (Ach.) Frisch & G.Thor** – Corticolous on *Betula papyrifera*, 25338 (V). Corticolous on *Abies balsamea*, 25403 (XI).

***Graphis scripta* (L.) Ach.** – Corticolous on *Acer rubrum*, 25242 (I).

***Heterodermia speciosa* (Wulfen) Trevisan** – Corticolous on *Populus tremuloides*, 25288 (VII).

***Hypogymnia incurvoides* Rass.** – Corticolous on *Betula papyrifera*, CMS23B-363 (XVIII). Corticolous on *Abies balsamea*, 25395 (X), 25379 (XII).

***Hypogymnia physodes* (L.) Nyl.** – Corticolous on *Picea*, CMS23B-250 (V). Corticolous on *Acer rubrum*, 25221 (I).

***Hypogymnia tubulosa* (Schaer.) Hav.** – Corticolous on *Abies balsamea*, CMS23A-433 (XVIII). Corticolous on *Picea mariana* and *Betula papyrifera*, 25328 (V).

***Icmadophila ericetorum* (L.) Zahlbr.** – Lignicolous on a log, 25343 (V).

***Imshaugia aleurites* (Ach.) S.F.Meyer** – Lignicolous on a stump, 25252 (III).

*†***Intralichen* sp.** – Lichenicolous in blackened apothecia (hymenium and margins) of *Lobarina scrobiculata*, 25200 (II). *Notes:* conidia simple (rarely 1-septate), brown, subglobose to ellipsoid, forming in chains, 5–8 × 3–5 µm, L/B ratio: 1.0–1.9. Based on Diederich's (2021) revised species concepts for *Intralichen*, this specimen is perhaps closest to a young colony of *Intralichen lichenicola* (M.S.Christ. & D. Hawksw.) D.Hawksw. & M.S.Cole, however that species is provisionally treated as restricted to *Candelariella*.

***Ionaspis lacustris* (With.) Lutzoni** – Saxicolous (non-calcareous), 25264 (III).

***Japewia subaurifera* Muhr & Tønsberg** – Corticolous on *Picea*, 25428^{TLC} (XV). Corticolous on *Abies balsamea*, 25440^{TLC} (XV). *Notes*: eumitrin.

***Lecanora allophana* (Ach.) Nyl.** – Corticolous on trunk of *Populus tremuloides* with extensive cyanobacteria cover, CMS23A-336 (V). *Notes:* smaller apothecia than typical.

***Lecanora circumborealis* Brodo & Vitik.** – Corticolous on *Abies balsamea*, 25211 (IV).

***Lecanora hybocarpa* (Tuck.) Brodo** – Corticolous on *Acer rubrum*, 25286 (II).

***Lecanora intricata* (Ach.) Ach.** – Saxicolous (non-calcareous), 25371 (XIV).

***Lecanora symmicta* (Ach.) Ach.** – Corticolous on *Abies balsamea*, 25210^{TLC} (II). *Notes*: usnic acid.

***Lecanora thysanophora* R.C.Harris** – Corticolous on *Acer rubrum*, 25217 (I).

***Lecidea tessellata* Flörke** – Saxicolous (non-calcareous), 25370 (XIV).

***Lepra amara* (Ach.) Hafellner** – Corticolous on dead fallen conifer, CMS23B-253 (V). Corticolous on *Acer rubrum*, 25206 (IV).

***Lepra trachythallina* (Erichsen) Lendemer & R.C. Harris** – Corticolous on *Alnus*, 25340 (II).

***Lepraria elobata* Tønsberg** – Corticolous on *Acer rubrum*, 25365^{TLC} (XII). *Notes*: atranorin, stictic acid, zeorin.

***Lepraria torii* Pérez-Ort. & T.Sprib.** – Corticolous at base of a *Betula papyrifera*, 25269^{TLC} (II). *Notes*: fumarprotocetraric acid, protocetraric acid, roccellic/angardianic acid.

***Leptogium acadiense* J.W.Hinds, F.L.Anderson & Lendemer** – Corticolous on *Populus tremuloides*, CH 230614-15, CH 230614-16 (XXI), 25372 (XI). Corticolous on *Acer rubrum*, 25229 (I).

*†***Lichenoconium erodens* M.S.Christ. & D.Hawksw.** – Lichenicolous on *Parmelia squarrosa*, over dead branch of Picea, CMS23A-347 (V).

†***Lichenosticta alcicornaria* (Lindsay) D.Hawksw.** – Lichenicolous on underside of scattered squamules of *Cladonia*, 25289C (VII).

*†***Lichenostigma alpinum* (R.Stan., Alstrup & D. Hawksw.) Ertz & Diederich** –Lichenicolous on *Ochrolechia gowardii*, 25436 (II). Also known from multiple specimens from Newfoundland's Avalon and Northern Peninsulas (NBM, NY).

*†***Lichenostigma chlaroterae* (F.Berger & Brackel) Ertz & Diederich**. Lichenicolous on *Lecanora* cf. *symmicta* sp. and cf. *Ropalospora viridis* over smooth bark of low, dead branch of *Acer spicatum*, CMS23A-359 (V). First published record for Eastern Canada, though it is known from a few specimens from New Brunswick and Newfoundland's Avalon Peninsula (Driscoll et al. in prep.). It is likely often overlooked due to its small size.

***Lobaria pulmonaria* (L.) Hoffm.** – Corticolous on *Acer rubrum*, CH 230614-18 (XXII), 25216 (I). Corticolous on dead fallen stem of *Acer spicatum*, CMS23A-355 (V). Corticolous on *Populus tremuloides*, CMS23A-418 (V).

***Lobarina scrobiculata* (Scop.) Nyl.** – Corticolous on *Acer rubrum*, 25218 (I). Corticolous on *Acer spicatum*, CMS23A-218 (V).

***Lopadium disciforme* (Flotow) Kullhem** – Corticolous on *Populus tremuloides*, CH 230612-07 (VI). Corticolous on *Abies balsamea*, 25331 (V). Lignicolous on *Betula papyrifera*, 25272 (II).

***Loxospora cismonica* (Beltram.) Hafeller** – Corticolous on *Abies balsamea*, 25353 (V).

***Loxospora elatina* (Ach.) A.Massal.** – Corticolous on *Acer rubrum*, CH 230614-20 (XXII). Corticolous on *Abies balsamea*, CMS23A-361 (V), CMS23A-431 (XVIII), 25202 (IV), 25329 (V). Corticolous on *Betula papyrifera*, 25361 (V), 25289B (VII). Corticolous on dead fallen tree (*Abies balsamea*?), CMS23A-356 (V). Corticolous on *Picea*, 25384 (XII). Terricolous, 25409 (XI).

***Megalaria grossa* (Pers. *ex* Nyl.) Hafellner** – Corticolous on *Populus tremuloides*, 25292 (VII), 25373 (XI), 25385 (V). Corticolous on a *Populus tremuloides* snag, 25420 (XVI).

***Melanelixia subaurifera* (Nyl.) O.Blanco, A.Crespo, Divakar, Essl., D.Hawksw. & Lumbsch** – Corticolous on *Acer rubrum*, 25230 (I).

***Micarea peliocarpa* (Anzi) Coppins & R.Sant.** – Lignicolous on a snag, 25208 (IV).

Micarea prasina group – Lignicolous on twigs of dead fallen branch, with *Lobaria pulmonaria* (suspended from live *Abies balsamea*), CMS23B-602 (VI). *Notes*: thallus of scattered goniocysts, apothecia grey (K+ violaceous in section), ascospores 1-septate, c. 9–10 × 4–4.5 μm. Pycnidia absent or inconspicuous.

***Mycobilimbia* sp.** – Bryicolous (on liverworts) at breast height on trunk of *Populus tremuloides*, CMS23A-348 (V). *Notes*: thallus green, almost granular, not sorediate. Apothecia colorless when young, later grey-brown to brown. Inner edge of exciple adjacent to hymenium and hypothallus with brown pigment, outer exciple hyaline. Ascospores 1–3 septate, smooth-walled, 12–19.5 × 4–5 μm.

***Mycoblastus affinis* (Schaer.) T.Schauer** – Corticolous on *Picea*, CMS23B-249 (V). Corticolous on a conifer snag, 25457^{TLC} (IV). *Notes*: planaic acid.

***Mycoblastus sanguinarioides* Kantvilas** – Corticolous on *Picea*, CMS23B-245 (V). Corticolous on *Populus tremuloides*, CH 230613-13 (XXII). Lignicolous on *Betula papyrifera*, 25203^{TLC} (II). *Notes*: bourgeanic acid, CMS23B-245 with sorediate thallus.

***Mycoblastus* cf. *sanguinarius* (L.) Norman** – Corticolous on *Populus tremuloides*, CH 231019-6 (XXIII).

†***Mycocalicium subtile* (Pers.) Szat.** – Lignicolous on an *Abies balsamea* snag, 25215 (II). Lignicolous on a snag, 25431 (XV).

****Myrionora albidula* (Willey) R.C.Harris** Syn. *Biatora albidula* – Lignicolous on exposed twigs of dead fallen branch suspended from live *Abies balsamea*, CMS23A-765 (VI). This species has been collected previously in New Brunswick (Driscoll & Clayden unpublished data) and western Canada (Spribille unpublished data).

*†***Nectriopsis lecanodes* (Ces.) Diederich & Schroers** – Lichenicolous on *Lobaria pulmonaria* over dead fallen stem of *Acer spicatum*, CMS23A-355 (V).

***Nephroma bellum* (Spreng.) Tuck.** – Corticolous on *Populus tremuloides*, CH 230614-02 (V).

***Nephroma laevigatum* Ach.** – Corticolous on *Populus tremuloides*, CH 230612-07 (VI), 25347, CMS23A-338 CMS23A-390, CMS23B-204 (V), 25382 (XII), 25386, 25389 (XIII), CH 231019-01, CH 231019-08 (XXIII), CMS23A-427 (XVIII), CMS23B-247 (VI). Corticolous on a broken *Abies balsamea* twig on ground, CH 230613-03 (VI). Corticolous on *Acer rubrum*, 25356 (V). Corticolous on *Acer spicatum*, CMS23B-203 (V).

***Nephroma parile* (Ach.) Ach.** – Corticolous on *Acer rubrum*, 25219[TLC] (I). Corticolous on *Populus tremuloides*, 25387[TLC] (XIII). *Notes*: no chemistry running below norstictic acid in solvent C.

***Ochrolechia androgyna* (Hoffm.) Arnold** – Corticolous on *Acer rubrum*, 25238[TLC] (I). *Notes*: gyrophoric acid, multiple fatty acids.

***Ochrolechia gowardii* Brodo** – Corticolous on *Picea mariana*, 25297 (VIII), lignicolous on a snag, 25274 (II). Reported previously from Labrador. Deduke et al (2016). In addition to this report (first for the island), it has been recently discovered on the west coast of NL (Arsenault et al. in prep.; McCarthy et al. in prep.).

***Ochrolechia* cf. *mahluensis* Räsänen** – Corticolous on *Populus tremuloides*, CH 230612-05 (VI).

***Pannaria subrubiginosa* ined.** – Corticolous on *Populus tremuloides*, CMS23A-794, 25317 (V), CH 230612-11, CH 230613-01 (VI), 25419, CH 231019-11 (XVI), CH 231019-02 (XXIII), CH 231020-02 (XXV). Corticolous on a recently fallen *Populus tremuloides* log, 25390 (XIII). Corticolous on a *Populus tremuloides* snag, 25445 (XV). Corticolous on *Acer spicatum*, CMS23A-312 (V).

***Parmelia squarrosa* Hale** – Corticolous on *Abies balsamea*, CMS23A-438 (XVIII). Corticolous on *Picea*, CMS23A-347 (V). Corticolous on *Acer rubrum*, 25222 (I).

***Parmelia sulcata* Taylor** – Corticolous on *Acer rubrum*, CH 230614-19 (XXII), 25285 (II). Corticolous on *Betula papyrifera*, 25271 (II). Lignicolous on a snag, 25279[TLC] (II). *Notes*: atranorin and salazinic acid.

***Parmeliella triptophylla* (Ach.) Müll.Arg.** – Corticolous on *Populus tremuloides*, CH 230612-04, CH 230612-09, CH 230613-02 (VI), 25334, CMS23B-229 (V), CMS23B-339 (VI). Corticolous on *Acer rubrum*, 25227 (I). Corticolous on a *Populus tremuloides* snag, CMS23A-340 (V), 25444 (XV).

***Parmeliopsis capitata* R.C.Harris** – Corticolous on *Picea mariana*, 25296 (VIII).

***Parmeliopsis hyperopta* (Ach.) Arnold** – Corticolous on *Picea mariana*, 25295 (VIII).

***Pectenia plumbea* (Lightf.) P.M.Jørg., L.Lindblom, Wedin & S.Ekman** Syn. *Degelia plumbea* – Corticolous on *Populus tremuloides*, CH 230612-08(VI), CH 231020-01 (XXIV); RTM and YW also found at XII and XVI (not collected) and DG and JH found at all locations indicated with an open star on Fig. 1.

***Peltigera* cf. *aphthosa* (L.) Willd.** – Terricolous at base of *Populus tremuloides*, observed by CH, not collected (XIV).

***Peltigera canina* (L.) Willd.** – Terricolous at base of a large *Populus tremuloides*, CH 230614-10 (XIX).

***Peltigera evansiana* Gyeln.** – Corticolous on *Acer rubrum*, 25223 (I).

***Peltigera membranacea* (Ach.) Nyl.** – Terricolous, CH 230614-01, CH 230614-04, CH 230614-05, 25322, 25350, CMS23A-339, CMS23B-616 (V).

***Peltigera polydactylon* (Neck.) Hoffm. s.l.** – Terricolous at base of *Betula papyrifera*, CH 230614-07 (V). Terricolous, 25388 (XIII).

***Peltigera rufescens* (Weiss) Humb.** – Terricolous, 25247 (III).

***Pertusaria alpina* Hepp *ex* Ahles** – Corticolous on *Betula papyrifera*, 25418 (XVI).

†***Phaeocalicium compressulum* (Nyl. *ex* Vain.) A.F. W.Schmidt** – Corticolous on *Alnus viridis* subsp. *crispa*, CMS23B-230 (XVII).

***Phlyctis argena* (Spreng.) Flot.** – Corticolous on *Populus tremuloides*, CMS23B-233 (V).

***Platismatia glauca* (L.) W.L.Culb. & C.F.Culb.** – Corticolous on *Abies balsamea*, CMS23A-428 (V), CMS23A-437 (XVIII), 25441 (XV). Corticolous on dead *Picea*, CMS23B-244 (V). Corticolous on *Picea*, CMS23A-329 (XVII). Lignicolous on an *Abies balsamea* snag, 25212 (II).

***Platismatia norvegica* (Lynge) W.L.Culb. & C.F. Culb.** – Lignicolous on an *Abies balsamea* twig, 25391 (X).

***Porpidia thomsonii* Gowan** – Saxicolous, 25300 (VIII).

***Protopannaria pezizoides* (Weber) P.M.Jørg. & S. Ekman** –Corticolous on *Populus tremuloides*, 25380 (XII), CMS23B-331, CMS23B-207 (V). Terricolous, 25327 (V). Terricolous at base of a *Populus tremuloides*, CH 230612-03 (V), CH 230612-10 (VI), CH 230614-09 (XVIII).

*†***Raesaenenia huuskonenii* (Räsänen) D.Hawksw., Boluda & H.Lindgr.** – Lichenicolous on *Bryoria fuscescens*, 25359 (V). Previously collected in Newfoundland (Ahti) and deposited at H (Driscoll et al. in prep.).

***Ramalina dilacerata* (Hoffm.) Hoffm.** – Corticolous on *Abies balsamea*, 25344 (V). Corticolous on *Acer rubrum*, 25239 (I), 25205 (IV).

***Ramalina farinacea* (L.) Ach.** – Corticolous on *Acer rubrum*, 25213 (I).

***Ramboldia elabens* (Fr.) Kantvilas & Elix** – Lignicolous on exposed stump, 25411 (X).

***Rhizocarpon reductum* Th.Fr.** – Saxicolous, 25459 (XVII).

***Rhizocarpon* sp.** – Saxicolous (non-calcareous), 25364 (XIV). *Notes:* thallus yellow, apothecia absent.

***Ricasolia quercizans* (Michx.) Stizenb.** – Corticolous on *Acer rubrum*, 25209, 25228 (I). Corticolous on *Populus tremuloides*, CH 230612-01, CMS23B-170, 25333 (V), CH 230612-07 (VI), CMS23A-425 (XVIII).

****Rinodina polyspora* Th.Fr.** – Corticolous on smooth, sloughing bark of low, dead branches of *Acer spicatum*, CMS23A-359 (V). Previously collected in Newfoundland (McCarthy et al. in prep.) but reported here for the first time.

****Rinodina subminuta* H.Magn.** – Corticolous on smooth, sloughing bark of low, dead branches of *Acer spicatum*, CMS23A-346 (V). This species is often associated with *Acer saccharum*, but Clayden et al. (2023) discussed two specimens occurring on *Sorbus*. With no *Acer saccharum* in Newfoundland, search efforts for *Rinodina subminuta* on the island could focus on *Acer spicatum* and *Sorbus americana* as potential phorophytes.

***Rinodina subpariata* (Nyl.) Zahlbr.** – Corticolous on dead fallen tree (*Abies balsamea*?), CMS23A-356 (V).

***Ropalospora viridis* (Tønsberg) Tønsberg** – Corticolous on *Betula papyrifera*, 25262[TLC] (III). *Notes*: perlatolic acid.

†***Sarea coeloplata* (Norman) J.K.Mitch., Garrido-Ben. & Quijada** – Resinicolous on *Picea mariana*, 25377 (X). Second record in Newfoundland; first reported in Mitchell JK, Garrido-Benavent I, Quijada L, Pfister DH. Sareomycetes: more diverse than meets the eye. IMA Fungus. 2021 Mar 16;12 (1):6. doi: 10.1186/s43008-021-00056-0.

†***Sarea difformis* (Fr.) Fr.** – Resinicolous on *Picea mariana*, 25320 (V).

*†***Sclerococcum lobariellum* (Nyl.) Ertz & Diederich** – Lichenicolous on *Ricasolia quercizans,* CMS23B-243 (V). Previously collected in Newfoundland (Ahti) and deposited at H (Driscoll et al. in prep.).

***Scoliciosporum chlorococcum* (Stenh.) Vězda** – Corticolous on smooth, sloughing bark of low, dead branches of *Acer spicatum*, CMS23A-346 (V).

***Scytinium tenuissimum* (Dicks.) Otálora, P.M.Jørg. & Wedin** – Corticolous on *Acer rubrum*, 25237 (I). Terricolous at base of a *Populus tremuloides*, CH 230612-02 (V), CMS23A-310 (V).

*†***Skyttea* sp.** – Lichenicolous on *Loxospora elatina*, 25289A (VII). *Notes*: ascomata c. 0.15–0.24 mm in diameter, exciple mostly green in cross section, ascospores simple, 7.5–11 × 2.5–4 µm. This is an unnamed species previously documented by multiple specimens from the four Atlantic Canadian provinces, where it occurs on *Loxospora elatina* and *L. ochrophaea*. Formal description is in progress (Driscoll et al. in prep.).

†***Stenocybe pullatula* (Ach.) Stein** – Corticolous on *Alnus incana* subsp. *rugosa*, 25312 (VII), 25426 (XV). Second report in Newfoundland and Labrador; first report is in McMullin & Arsenault (2016).

†***Stenocybe major* Nyl. *ex* Körb.** – Corticolous on *Abies balsamea*, 25276 (II).

***Stereocaulon condensatum* Hoffm.** – Terricolous, CMS23A-334 (XVIII), 25460 (XVII).

***Stereocaulon pileatum* Ach.** – Terricolous, 25311 (VII), 25454 (XVII).

***Stereocaulon* cf. *tomentosum* Fr.** – Terricolous, 25399 (X).

†***Stictis radiata* (L.) Pers.** – Corticolous on a *Populus tremuloides* stump, 25423 (XI), CMS23B-237 (V). Not frequently collected. Last collected in NL by Waghorn (in the late 1800s) as confirmed by Sherwood (1977). In addition to this report, it has been recently discovered on the north side of Gander Lake (Arsenault, unpublished data).

****Stictis urceolatum* (Ach.) Gilenstam** – Corticolous on *Acer rubrum*, 25282 (II).

***Thelotrema lepadinum* (Ach.) Ach.** – Corticolous on *Abies balsamea*. Observed by YFW, not collected (V).

***Trapeliopsis flexuosa* (Fr.) Coppins & P.James** – Lignicolous, 25245 (III). Second report in Newfoundland and Labrador; first report is in McMullin & Arsenault (2016).

***Trapeliopsis granulosa* (Hoffm.) Lumbsch** – Terricolous on an old tip up, 25244 (III).

***Trapeliopsis viridescens* (Schrader) Coppins & P. James** – Lignicolous on a stump, 25261[TLC] (II). *Notes*: gyrophoric acid.

***Tuckermanopsis americana* (Spreng.) Hale** – Corticolous on *Larix laricina* twigs, 25433 (XV). Corticolous on *Picea mariana*, 25294 (VIII).

***Tuckermanopsis orbata* (Nyl.) M.J.Lai** – Resinicolous on *Picea mariana*, 25360 (V).

***Umbilicaria polyphylla* (L.) Baumg.** – Saxicolous, 25198 (location: 30 m N of N shore of Gander Lake, 330 m WNW of Silent Witness Memorial, 3.8 km S of Gander International Airport; 48.91254N, –54.57928W).
***Usnea dasopoga* (Ach.) Nyl.** – Corticolous on *Abies balsamea*, 25326[TLC] (V), 25442[TLC] (XV). Corticolous on *Picea*, CMS23A-328 (XVII). *Notes*: salazinic acid, usnic acid.
***Usnea longissima* Ach.** – Corticolous on *Abies balsamea*, 25401 (X).
***Violella fucata* (Stirt.) T.Sprib.** – Corticolous on *Acer rubrum*, 25220 (I). Corticolous on *Betula papyrifera*, 25323 (V).
***Vulpicida pinastri* (Scop.) J.-E.Mattsson & M.J.Lai** – Corticolous on *Picea mariana*, 25293 (VIII).
***Xanthosyne varians* s.l. ined.** – Corticolous on *Alnus*, 25339 (II).
†***Zythia resinae* (Ehrenb.) P.Karst.** – Resinicolous on *Picea mariana*, 25376 (V), 25357 (X).

Discussion

The area of Central Newfoundland known as Charlie's Place has a notably high diversity of lichens for the province, comparable to other well-documented areas of high lichen diversity along the south coast (McCarthy et al. 2015) and on the central Avalon (McCarthy et al. 2015; McMullin & Wiersma 2017; McMullin & Arsenault 2019). In addition to the high diversity, and the number of new reports for the province, Charlie's Place has many cyanolichens (23), which are generally more sensitive to air quality and habitat disturbance (Cameron & Richardson 2006; Merinero et al. 2014). Their presence can indicate a forest state with high ecological integrity (Cameron 2002). Similarly, high numbers of calicioids can indicate forests that have preserved biodiversity in spite of past disturbances and/or selective harvesting (Selva 2003). Several of the species we found are of conservation concern (**Table 2**), including *Chaenotheca brachypoda*, which is listed by Selva (2003) as a rare to extremely rare species indicative of late-successional forest stands. Six calicioids are considered by Selva (2003) to be indicative, in gymnosperm-dominated forests, of stands that have reached a mid-successional status (*Calicium glaucellum*, *Chaenotheca ferruginea*, *Ch. furfuracea*, *Ch. gracillima*, *Ch. stemonea*, *Chaenothecopsis viridireagens*). Eleven are indicators in angiosperm-dominated forests, of stands that have reached a mid-successional status (*Calicium glaucellum*, *C. lenticulare*, *C. salicinum* (corticolous), *C. viride*, *Chaenotheca chrysocephala*, *Ch. ferruginea, Ch. furfuracea*, *Ch. gracillima*, *Ch. stemonea, Chaenothecopsis viridireagens*, *Stenocybe pullatula*), according to Selva (2003).

In the conservation planning literature, there has historically been considerable emphasis on the identification of areas with high species diversity, with the suggestion that hotspots be prioritized as areas to be set aside as protected areas (Myers et al. 2000; Prendergast et al. 1993). Certainly, Charlie's Place has a high diversity of lichens, but whether or not it can be designated as a hotspot for Central Newfoundland depends on systematic surveys of the remainder of the ecoregion. During surveys of stands between the town of Glenwood and Charlie's Place, and in nearby area, we have noted that the forests surrounding Charlie's Place are quite young and do not harbor high lichen diversity (Arsenault pers. obs.).

Central Newfoundland is the part of the island most prone to wildfire (Arsenault et al. 2016). In addition, outbreaks of spruce budworm between 1972–1992 and hemlock looper between 1966–2010 have defoliated 65.9% and 14% of the ecoregion, respectively (Arsenault et al. 2016), with some of these disturbances overlapping in space. Central Newfoundland has experienced high levels of forest harvest in the last century, with 23.3% of the ecoregion being industrially harvested since 1926 (Arsenault et al. 2016). However, intensive forest harvest in Charlie's Place has been relatively limited (further details below). The areas we surveyed are dominated by large aspen trees within mixed deciduous-coniferous stands, a forest stand type that appears to be relatively rare across the island. Consequently, we suspect that this area is an outlier for lichen richness compared to most of the forest in the wider Central Newfoundland ecoregion. More extensive survey work is necessary to confirm this.

Survey effort also plays a role in assessing the potential significance of the biodiversity relative to elsewhere on the island. Compared to other forested areas of the island of Newfoundland that have been intensively surveyed for lichens (involving subsets of the authors listed here), Charlie's Place has the second highest diversity. Only Halls Gullies (on the

Avalon Peninsula) is higher at 178. The high diversity in Halls Gullies is influenced by the Tuckerman Workshop survey in 2007, which brought over 30 lichenology experts to that area for a day (Pitcher & Clayden 2007). The list of 146 species from Halls Gullies published in McMullin & Arsenault (2019) is based on 10 person-days of field work by two of the authors of this paper. We spent 17 person-days surveying Charlie's Place. Moreover, KD (who spent one day in Charlie's Place) is an expert on lichenicolous fungi, and thus some of the diversity of those species (26 species total) reported here is due to her expertise, which was absent from other surveys in the province.

It is clear that the lichen species richness of Charlie's Place is comparable to other localities in Newfoundland, including existing protected areas (McCarthy et al. 2015; McMullin & Wiersma 2017) and Halls Gullies, which is a proposed Ecological Reserve (WERAC 2020). Charlie's Place also has a very high abundance (over 400 thalli enumerated) of blue felt lichen *Pectenia plumbea* (syn. *Degelia plumbea*) (see red triangles on **Fig. 1**), which is listed as "Special Concern" under Canada's Species at Risk Act and as "Vulnerable" under the Newfoundland and Labrador Endangered Species Act. This alone should warrant placing a high priority on protecting Charlie's Place.

An investigation of the reasons for the high lichen diversity in Charlie's Place is beyond the scope of this paper, although we can hypothesize several. First, while parts of Charlie's Place were logged, some as recently as the 1950s and 1960s, other areas appear to have been left unharvested, perhaps because they did not contain merchantable timber at the time of harvest activity, or because the areas were too rugged and/or remote for efficient harvest. These remnant forests appear to be contributing to diversity in and of themselves, and probably also have facilitated lichen re-colonization in regenerating forests over the last 60–70 years. Second, lichens can be highly sensitive to humidity (Alam et al. 2015), with cyanolichens requiring relative humidity levels of 80–90% in addition to liquid water (Phinney et al. 2019; Rikkinen 2015). Given its location between two large rivers, with a large water body to the north, Charlie's Place likely is exposed to higher humidity than other areas of Central Newfoundland. This may explain the assumed higher diversity here compared to other parts of the region. As well, many of the earlier clearcuts were probably smaller than more contemporary cutovers (due to changes in equipment and technology). Larger clearcuts and gaps are hypothesized to lower the humidity in adjacent unharvested patches, with a negative effect on lichen diversity. The smaller cutover areas here may have minimized lichen species loss in the standing forests and facilitated more rapid recolonization. A comparison of the history of forest harvest patterns in Charlie's Place in relation to other parts of the island would provide evidence to assess our hypothesis that forest harvest history has influenced lichen diversity in Charlie's Place.

The Mi'kmaq of Qalipu First Nation, specifically members of Francis Clan, have always recognized the intrinsic value of the forests of Charlie's Place. Collaboration with western scientists has validated their knowledge with empirical data on species diversity. The members of Francis Clan envision setting this area aside as an Indigenous Protected and Conserved Area (IPCA). Although the provincial government of Newfoundland and Labrador currently does not have an explicit mechanism for establishing IPCAs, community members are exploring options for other means to limit industrial development while supporting traditional access and use. Their own government (QFN) has recognized the ecological value of Charlie's Place through financial support of an Indigenous Land Guardians Program and ongoing political and logistical support of Chief and Council.

The species survey reported here represents what we plan as the start of many years of exploration and research in a unique forested area of Central Newfoundland, following the model of mutual knowledge coexistence (as opposed to knowledge assimilation) as outlined by Reid et al. (2020). Collaboration between western scientists and traditional knowledge holders will have mutual benefits; as JH says, the current model is "us working together." Traditional land users know the area intimately and can facilitate access and identify key habitats. Learning the names of species in Charlie's Place helps the Mi'kmaq reconnect with the land that has sustained their ancestors since time immemorial, and helps connect nature and culture, and re-build

knowledge about the natural world. Our preliminary work suggests that Charlie's Place provides high quality habitat for a high number of cyanolichens. We plan to collaborate going forward, combining local Indigenous knowledge and western science, to assess how forest and land use history in this area, combined with abiotic and biotic drivers, affect forest biodiversity and whether some areas have high continuity (as described in McMullin & Wiersma 2019; Wiersma & McMullin 2019). One thing is certain—the contribution of local Indigenous Knowledge held by the first three authors was critical for drawing the attention of the other authors to this region. We anticipate that continued collaboration following the concept of *Etuaptmumk* will enhance ecological understanding and future discoveries in Charlie's Place.

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