Clifford Wetmore

LICHENS OF VOYAGEURS NATIONAL PARK

Final Report

Contract No. PX 6000-7-0922 and PX 6000-8-0922

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PREFACE

Under contract agreement numbers PX6000-7-0922 and PX6000-8-0922 between the National Park Service and the University of Minnesota a study of the lichen flora of Voyageurs National Park was undertaken. Extensive collecting was done during the summers of 1978 and 1979. Field observations were to be made regarding rare lichens, lichens that might be used for air quality monitoring, lichens available for caribou, and areas of special lichenological interest.

All work on the project was done by the principal investigator between May, 1978 and October, 1980. The specimens collected are deposited in the herbarium of the University of Minnesota.

Special thanks are given to the naturalist and ranger personnel of Voyageurs National Park and especially to Research Biologist Glen Cole for generous assistance and helpful suggestions.

INTRODUCTION

Voyageurs National Park lies along the northern border of Minnesota adjacent to Canada and extends for 32 miles along the boundary just east of International Falls. The park was officially established in 1975 and development of the park is still underway. The vegetation of the park is typical southern boreal forest. Extensive parts of the park have quaking aspen (Populus tremuloides Michx.) and white birch (Betula papyrifera Marsh.) forest. Lowland wet areas have black spruce (Picea mariana (P. Mill.) B.S.P.) or cedar (Thuja occidentalis L.) or black ash (Fraxinus nigra Marsh.) Some dry ridges have stands of stunted red oak (Quercus rubra L.) or stands of jack pine (Pinus banksiana Lamb.). Other areas have stands of red pine (Pinus resinosa Ait.) or balsam fir (Abies balsamea (L.) P. Mill.). There are scattered areas with white pine (Pinus strobus L.) or red maple (Acer rubrum L.). Most of the park has been logged at least once beginning about 1910 but a few small areas remain that were never cut. Most of the park area has also been burned several times within the past 100 years as indicated by fire scars and charcoal. Knowledge of some aspects of biology of the park area is quite limited and further studies of those subjects within the park might significantly contribute to an understanding of the ecology of the park. One such subject is that of lichenology.

Lichens are composite plants composed of two different types of organisms. The lichen plant body (thallus) is made of fungi and algae living together in a symbiotic arrangement in which both partners are benefited and the composite plant body can grow in places where neither component could live without the other. Lichens grow very slowly (a few millimeters per year) and so must have a habitat that is relatively undisturbed in order to survive. Lichens are also very sensitive to air pollution since very low levels of sulfur dioxide and other oxidants destroy the delicate balance between the fungus and the algae and the lichen thallus dies. Since lichens are slow growing and long lived, they are

excellent summarizers of environmental conditions in the area where they are found. If the environment is seriously disturbed many of the lichens growing there will die and other species may invade the area.

This study of the lichens in the park was designed to contribute to the knowledge of the biology of the park and of northern Minnesota by providing an inventory of the lichen flora at the present date which can then be used in (1) formulating development plans for the park, (2) interpretive programs in the park, (3) providing more complete lists of the lichen flora of the park, and (4) assisting biologists studying the reintroduction of caribou. This inventory will also document the present lichen flora and can be used as a baseline if future industrial developments outside of the park degrade the quality of the air and precipitation.

HISTORICAL

The earliest records of lichens from the area now within the park were collected in August, 1901 by Bruce Fink, a lichenologist at the University of Minnesota (Wetmore, 1978). At that time Fink was collecting lichens in many parts of the state for the Botanical Survey and two of these localities are now included within the park. One locality was at Rainy Lake City, a mining settlement on the east side of the strait between Rainy Lake and Black Bay, and the other locality was at Kettle Falls. Although these are the locality names given on the collections, he probably collected in various places within a mile or so of them. The results of this collecting trip were first published in a paper on the lichens of the northern boundary (Fink, 1903) and these studies contributed toward Fink's lichens of Minnesota (Fink, 1910). Fink's specimens are preserved in the herbarium of the University of Minnesota and were restudied along with the new collections for this project. No other lichenologist has collected in the park prior to this study. It is fortunate that the 1901 collections by Fink are available since they were collected before

extensive logging and represent the lichen flora in its near virgin condition.

FIELD WORK

Field work was carried out in 1978 and 1979 when a total of 11 weeks was spent collecting over 8000 specim ens at 128 different localities (map). Collection localities were selected for complete coverage of the park and of most vegetational typ es by using topographic maps, aerial photographs and a plane flight over most of the park. Special habitats were sought, such as steep north facing rock cliffs and unlogged areas, where some of the rare lichens found by Fink might still persist. The plane flight assisted in locating several of these areas and in surveying the abundance of arboreal lichens. At each locality all species of lichens found were collected to provide information on lichen distributions within the park and to guard against missing different species that look similar in the field. A list of collection localities is appended to this report (Appendix I). Most of the localities are located near the shoreline of the major lakes because very few trails were available for access to the interior and because all habitat types are available near the shores. On the occasions when inland areas were visited they always had fewer lichens species than similar shoreline habitats but no species not found near shores of the major lakes. Several of the naturalists accompanied me on some of the collecting trips and I assisted them in setting up displays at the visitor center on Kabetogama Lake.

LICHEN FLORA

Lichens are very abundant in most parts of Voyageurs but most of this apparent abundance is due to a few very common species. Most of the uncommon species are found in special habitats or are small and easily overlooked. The following list includes the names of 403 lichen taxa (species and varieties) known from the park. As a part of this study all of the collections by Fink in

1901 were restudied and are included in this list of taxa. Only seven species that were collected by Fink were not found during my collecting. When compared with the approximately 550 taxa known from the whole state of Minnesota, this indicates a very rich lichen flora for the park. This is in part due to the diverse habitats found and in part due to the moist boreal climate of the park. The only area of Minnesota likely to have more species is along the shore of Lake Superior near Grand Portage where the cool lake provides more frequent foggy conditions.

Eighty six new state records and six new North American records are present in this list. Most of these new records were to be expected but a few are notable range extensions: Leptogium arsenii, Leptogium milligranum, Parmelia revoluta, Stereocaulon dactylophyllum. Several species in this list are very rare in Minnesota today but were more common in 1901 according to the notes on the collections of Fink. Species such as Lobaria quercizans, Pseudocyphellaria crocata and Sticta fuliginosa have probably had their ranges greatly reduced by the extnesive logging and fires which have eliminated the moist cool habitats in mature forests required by them.

The lichens marked as being rare in the park are frequently species which are rare in other parts of Minnesota. There are no lichens within Voyagueurs National Park which are endemic to the park. The new records for the state are all found outside of the state or the park.

There are several places of special interest found during the collecting for this project which have an unusual number of rare species. The Cemetery Island bog is an old, wet ash bog which probably has never been logged and a few, rare species were found on the trees there. The Daley Bay Brook swamp area is a middle age cedar swamp which had over 100 lichen species and was one of the two localities where Sticta fuliginosa was found. In other parts of Minnesota the wet, old ash bogs and wet cedar swamps always have the greatest number of

lichens. The Sugarbush Island bog is an old, drier ash bog that probably escaped logging and has several lichens which are rare in northern Minnesota.

Three areas of pines were found which apparently have never been logged. One of these is a small area on the western side of Swansons Bay where numerous very large old red pines remain. Another is a small island in Namakan Lake southeast of Pike Island with some large pines. Southeast of Mukooda Lake is a tract of Indian Tribal land with many very large white and red pines. These uncut forests have a greater numberof rare species than areas in the rest of the park which have been logged and burned. Along the shores of Kabetogama Lake there is a narrow uncut border in many places but this border was not especially rich in lichens. These special areas should be protected from development and no trails or campgrounds located near them.

The Kettle Falls area and bog is significant because it is one of the two areas within the park that was visited by Fink in 1901. Although Fink probably collected in many places around the stated localities, the bog at Kettle Falls is almost certainly one that he did collect in since some of the species he reported from the area only grow in these bogs and since it was so close to the trading post it would have been easy for him to get to. This area is the only exact place in the park where we have collections from 1901 and 1978 in which we can accurately compare the lichen flora over a 77 year time span. When Fink collected there probably had beenminimal disturbance. Since then the area has been logged, the lodge built, and the bog size has been reduced by roads. There is no other area in the park that we have comparable information over a 77 year time span and every effort should be made to preserve what remains of the bog against further development or reduction due to roads or expansion of the lodge grounds.

Along Lake Superior one of the most prominent lichens is the bright orange Xanthoria elegans which covers large areas of the rocks near the shore. Within Voyageurs this lichen is quite uncommon but can be found on the shores of all

three of the large lakes in small patches. The reason for this difference in abundance is uncertain but may be related to wave splash. A reconnaissance survey was made of most of the shoreline in eastern Kabetogama Lake to locate places where this Xanthoria was growing. In all cases the lichen was present on steep shoreline rocks that were facing the open lake. It was not found on low rocky shores or on steep rocks protected from the open lake by islands. It is abundant on the steep rocks outside of the west end of Finger Bay on Rainy Lake and fairly large areas were found on the northern end of Headlight Island and on a small island west of the Kabetogama Narrows ranger station. Many species of Caloplaca and Xanthoria grow much better in areas rich in nitrogen such as farmyards and bird perches but in Voyageurs on some of the small rocky islands used by the gulls these lichens were absent or rare. It would appear that rocks with strong wave splash are necessary for the growth of these lichens but that the growth is enhanced by the presence of birds if the splash is present also.

The availability of lichens for winter food for caribou is important in discussions concerning the reintroduction of woodland caribou to the park. In 1976 and 1977 I spent five weeks on the Slate Islands, Ontario (in Lake Superior) studying the lichens in relation to the large caribou herd there. On the Slate Islands the caribou have eaten most of the available lichens from the trees up as far as they can reach and have eaten the rock and soil lichens down to mere scraps. Compared to the Slate Islands Voyageurs has a great abundance of soil and rock lichens such as Cladonia, Stereocaulon, Peltigera, and Parmelia and the arboreal lichens (Usnea, Evernia, Bryoria) are abundant in some localities. Bergerud and Nolan (1970) state that caribou utilize ground lichens in the fall and spring and arboreal lichens in the winter when the snow is too deep for them to find the lichens under the snow. In Voyageurs the soil and rock lichens are very abundant and could easily sustain caribou, and in some places within the park arboreal lichens are fairly common, especially in some of the beaver

ponds and in Tom Cod Bay swamp. The white tailed deer have made a slight browse line on the arboreal lichens by their winter feeding on the lichens (Wetmore, 1979) and this must be taken into account when studying the effects of any introduction of caribou. Based on the lichens available in Voyageurs compared to the Slate Islands, there should be no shortage of winter food for a herd of woodland caribou in the park.

Lichens are very sensitive to air pollution and other changes in the environment and therefore are good indicators of environmental changes. This study provides a baseline for monitoring air quality changes caused by industrial developments outside of the park. The fruticose lichens are most sensitive to air pollution (De Slover & Le Blanc, 1968). Fruticose lichens of the genera Usnea, Bryoria, Evernia and Cladonia are abundant now in all parts of the park which indicates that there is no significant air pollution. These genera are as abundant at the western part of the park as at Kettle Falls which also indicates that there is no obvious air pollution reaching the park from International Falls. Almost no studies have been done on the sensitivity of lichens to acid rain but the effects would probably be the same as with gaseous pollutants, i.e., the lichens would quickly be killed and disappear. Future surveys of the lichens in Voyageurs National Park will be able to use the information from this study to monitor air quality changes by studying the survival of the sensitive lichens at each locality. This will be possible because complete collections of all lichen species were made at all collection localities.

Physical damage to lichens leads to the destruction of lichens and is obvious in some areas in the park. Even moderate trampling by human activity can quickly destroy the mats of Cladonia and Stereocaulon which grow on the rocks and soil reducing the mats to small scraps of several species mixed together or complete elimination of the fruticose lichens. This damage can be expected around campsites and along trailson rocky ridges. On some of the lakeshores and ridges fruticose lichens have already been damaged or destroyed by visitor activity. Trails and campsites should be located with this in mind.

LICHEN SPECIES LIST

The following list of 403 lichen species and varieties includes all species collected for this project and also those collected by Fink in 1901. The Fink collections have all been revised according to the modern taxonomy and nomenclature of lichens. A few crustose specimens remain unidentified and are not included here. The nomenclature generally follows that of Hale & Culberson (1970) with modifications based on more recent monographic studies, primarily in the Physcia group and the Bryoria (=Alectoria) group. All collections have been deposited in the University of Minnesota Herbarium and added to the computer data base. Duplicates have been sent to the Smithsonian Institution and other herbaria and a reference set of species has been sent to Voyageurs National Park. Taxa that are apparently new records for Minnesota are preceded by an asterisk, new records for North America are indicated by a plus, those found by Fink but not by me are indicated by #, and rare species (found only once or twice) are noted in the list.

~ 162 by Fink

Acarospora

*badiofusca (Nyl.) Th. Fr.

F fuscata Arn.

smaragdula (Wahlenb. ex Ach.) Mass.

Actinogyra

F muehlenbergii (Ach.) Schol.

Anaptychia

palmulata (Michx.) Vain.--Rare.

Arthonia

F *caesia (Körb.) Körb.

didyma Körb.

patellulata Nyl.

F radiata (Pers.) Ach.

Arthopyrenia

cinereopruinosa (Schaer.) Mass. -- Rare.

faginea (Schaer.) Swinsc.

padi Rabenh. -- Rare.

Arthothelium

ruanideum Rehm in Rabenh.

Bacidia

*accedens (Arn.) Lett.

atrogrisea (Del. ex Hepp) Körb.

chlorococca (Graewe ex Stenh.) Lett.

*epixanthoides (Nyl.) Lett.

fuscorubella (Hoffm.) Bausch
inundata (Fr.) Körb. -- Rare.
rubella (Hoffm.) Mass.

sabuletorum (Schreb.) Lett.

schweinitzii (Fr. ex Michen. in Darl.) Schneid.

sphaeroides (Dicks.) Zahlbr.

suffusa (Fr.) Schneid.

umbrina (Ach.) Bausch

Baeomyces

carneus (Retz.) Flörke

rufus (Huds.) Rebent.

Biatorella

microhaema Norm. in Th. Fr. -- Rare.

*resinae (Fr.) Th. Fr.

Bryoria

furcellata (Fr.) Brodo & Hawksw.

trichodes (Michx.) Brodo & Hawksw.

Buellia

#alboatra (Hoffm.) Branth & Rostr.

arnoldii Serv. & Nadv.

#dialyta (Nyl.) Tuck. — not in Fink

disciformis (Fr.) Mudd

punctata (Hoffm.) Mass.

schaerei De Not.

stillingiana J. Stein.

Calicium

abietinum Pers.

*glaucellum Ach.

*parvum Tibell

salicinum Pers. -- Rare.

trabinellum (Ach.) Ach.

Caloplaca

arenaria (Pers.) Müll. Arg.

cerina (Ehrh.) Th. Fr.

chrysophthalma Degel.

cinnabarina (Ach.) Zahlbr.

citrina (Hoffm.) Th. Fr.

feracissima Magn.

flavovirescens (Wulf.) DT & Sarnth.

holocarpa (Hoffm.) Wade

pollinii (Massal.) Jata -- Rare.

#saxicola (Hoffm) Nordin

sideritis (Tuck.) Zahlbr.

ulmorum (Fink) Fink

vitellinula (Nyl.) Oliv.

Candelaria

concolor (Dicks.) B. Stein

*fibrosa (Fr.) Müll. Arg.

Candelariella

*efflorescens Harris & Buck

F vitellina (Ehrh.) Mull. Arg.

*xanthostigma (Ach.) Lett. -- Rare.

Cetraria

F aurescens Tuck. -- Rare.

*fendleri (Nyl.) Tuck.

F halei W. Culb. & C. Culb.

orbata (Nyl.) Fink

F pinastri (Scop.) S. Gray

sepincola (Ehrh.) Ach. -- Rare.

Cetrelia

F (wainioi) chicitae (W. Culb.) W. Culb. & C. Culb.

olivetorum (Nyl.) W. Culb. & C. Culb.

Chaenotheca

brunneola (Ach.) Müll. Arg.

F chrysocephala (Turn.) Th. Fr.

*ferruginea (Turn. & Borr.) Mig.

*hispidula (Ach.) Zahlbr.

*laevigata Nadv.

stemonea (Ach.) Müll. Arg.

trichialis (Ach.) Th. Fr.

*xyloxena Nadv. -- Rare.

Chaenothecopsis

*consociata (Nadv.) Schmidt -- Rare.

*debilis (Turn. & Borr. in Schaer.) Tibell

*lignicola (Nadv.) Schmidt -- Rare.

F #*rubescens Vain. — not in Fink

+*savonica (Räs.) Tibell - Rare.

*subpusilla (Vain.) Tibell - Rare.

*viridireagens (Nadv.) Schmidt -- Rare.

Cladonia

*acuminata (Ach.) Norrl.

F amaurocraea (Flörke) Schaer.

F bacillaris Nyl.

F botrytes (Hag.) Willd.

F caespiticia (Pers.) Flörke

cariosa (Ach.) Spreng.

F cenotea (Ach.) Schaer.

chlorophaea (Flörke ex Somm.) Spreng.

F coccifera (L.) Willd.

F coniocraea (Flörke) Spreng.

*conista (Ach.) Robb. in Allen

cornuta (L.) Hoffm.

F crispata (Ach.) Flot.

F cristatella Tuck.

cryptochlorophaea Asah.

*cyanipes (Fr.) Flörke

*cylindrica (Evans) Evans -- Rare.

F decorticata (Flörke) Spreng.

deformis (L.) Hoffm.

digitata (L.) Hoffm.

F fimbriata (L.) Fr.

floerkeana (Fr.) Flörke

F furcata (Huds.) Schrad.

F gracilis (L.) Willd.

*grayi Merr. ex Sandst.

*merochlorophaea Asah. -- Rare

F mitis Sandst.

multiformis Merr.

parasitica (Hoffm.) Hoffm.

F phyllophora Hoffm.

pityrea (Flörke) Fr.

F pleurota (Flörke) Schaer.

pseudorangiformis Asah. -- Rare

F pyxidata (L.) Hoffm.

F rangiferina (L.) Wigg.

rei Schaer.

robbinsii Evans -- Rare

F scabriuscula (Del. ex Duby) Nyl.

F squamosa (Scop.) Hoffm.

F stellaris (Opiz) Pouz. & Vezda

F subulata (L.) Wigg.

sulphurina (Michx.) Fr. -- Rare

symphycarpa (Ach.) Fr.

F turgida (ehrh.) Hoffm.

F uncialis (L.) Wigg.

F verticillata (Hoffm.) Schaer.

Collema

F *conglomeratum Hoffm.

F flaccidum (Ach.) Ach.

F nigrescens (Huds.) DC.

pulcellum Ach.

subflaccidum Degel.

tuniforme (Ach.) Ach. -- Rare.

Coniocybe

*furfuracea (L.) Ach. -- Rare.

F pallida (Pers.) Fr. -- Rare.

Cyphelium

F lucidum (Th. Fr.) Th. Fr.

tigillare (Ach.) Ach.

Dermatocarpon

F fluviatile (G. Web.) Th. Fr.

F miniatum (L.) Mann

F #tuckermanii (Rav.) Zahlbr.

Dimerella

lutea (Dicks.) Rev.

*diluta (Pers.) Trev. -- Rare.

Diploschistes

F scruposus (Schreb.) Norm.

Eopyrenula

F leucoplaca (Wallr.) Harris

Ephebe

*lanata (L.) Vain. -- Rare.

*ocellata Henss.

Evernia

F mesomorpha Nyl.

Graphis

F scripta (L.) Ach.

Gyalecta

*truncigena (Ach.) Hepp

Haematomma
elatinum (Ach.) Mass.

Heterodermia

hypoleuca (Mühl.) Trev. -- Rare.

F speciosa (Wulf.) Trev.

Hypogymnia

F physodes (L.) W. Wats.

Icmadophila

F ericetorum (L.) Zahlbr.

Lasallia

F papulosa (Ach.) Llano

Lecanactis

chloroconia Tuck.

Lecania dimera (Nyl.) Th. Fr.

Lecanora

allophana Nyl.

caesiocinerea Nyl. ex Malbr.

caesiorubella

var. saximontana Imsh. & Brodo

cenisia Ach.

chlarona (Ach.) Nyl.

F chrysoleuca (Sm.) Ach.

F cinerea (L.) Somm.

F collocarpa auct.

F frustulosa (Dicks.) Ach.

+*impudens Degel.

*melanophthalma (Ram.) Ram.

meridionalis Magn.

F muralis (Schreb.) Rabenh.

mutabilis Somm.

pallida

var. rubescens Imsh. & Brodo -- Rare.

piniperda Körb.

polytropa (Ehrh.)Rabenh.

rugosella Zahlbr.

saligna (Schrad.) Zahlbr. -- Rare.

strobilina (Spreng.) Kieff.

F +*symmictera Nyl.

F +*thysanophora Harris

F varia (Ehrh.) Ach. -- Rare.

*wisconsinensis Magn.

Lecidea

aeruginosa Borr.

+*albohyalina (Nyl.) Th. Fr.

*anthracophila Nyl.

berengeriana (Mass.) Th. Fr.

*carpathica (Körb.) Szat. -- Rare.

F elabens Fr.

F *elaeochroma (Ach.) Ach.

+*epixanthoidiza Nyl.

*erratica Körb.

*friesii Ach.

fusca (Schaer.) Th. Fr.

glomerulosa (DC.) Steud.

granulosa (Hoffm.) Ach.

*helvola (Körb.) Oliv.

F lucida (Ach.) Ach.

F macrocarpa (DC.) Steud.

*nylanderi (Anzi) Th. Fr.

*oligotropha Laund.

*plana Lahm ex Körb.

F rufonigra (Tuck.) Nyl.

*scalaris (Ach.) Ach.

*stigmatea Ach.

F turgidula Fr.

F uliginosa (Schrad.) Ach.

F vernalis (L.) Ach.

Lepraria

F *finkii (B. de Lesd. in Hue) Harris

neglecta auct.

zonata Brodo

Leptogium

*arsenei Sierk -- Rare.

F burnetiae Dodge

F cyanescens (Ach.) Körb.

F lichenoides (L.) Zahlbr.

*millegranum Sierk -- Rare.

minutissimum (Flörke) Fr. -- Rare.

F saturninum (Dicks.) Nyl.

tenuissimum (Dicks.) Fr.

Leptorhaphis

F epidermidis (Ach.) Th. Fr.

Lobaria

F pulmonaria (L.) Hoffm.

F quercizans Michx.

Micarea

*denigrata (Fr.) Hedl. -- Rare.

*melaena (Nyl.) Hedl.

prasina (Fr.) Körb.

viridescens (Schrad.) Brodo

Microthelia

micula Körb. -- Rare.

wallrothii (Hepp) Grumm. -- Rare.

Mycoblastus

sanguinarius (L.) Norm. -- Rare.

Mycocalicium

parietinum (Ach. ex Schaer.) Hawksw.

Nephroma

bellum (Spreng.) Tuck.

F helveticum Ach.

F parile (Ach.) Ach.

F resupinatum (L.) Ach.

Normandina

*pulchella (Borr.) Nyl.

Ochrolechia

*androgyna (Hoffm.) Arn.

F *rosella (Tuck.) Vers.

Opegrapha

*lichenoides pers.

F pulicaris (Hoffm.) Schrad. -- Rare.

Pachyphiale

fagicola (Hepp in Arn.) Zw.

Pachyspora

mutabilis (Ach.) Mass.

Pannaria

conoplea (Ach.) Bory

F leucophaea (Vahl) Jörg.

F leucosticta (Michen. in Darl.)Tuck. -- Rare.

praetermissa Nyl. -- Rare.

Parmelia

albertana Ahti

aurulenta Tuck.

baltimorensis Gyeln.

bolliana Müll. Arg.

caperata (L.) Ach.

F conspersa (Ehrh. ex Ach.) Ach.

F crinita Ach.

cumberlandia (Gyeln.) Hale

disjuncta Erichs.

exasperata De Not.

exasperatula Nyl. -- Rare.

flaventior Stirt.

*fraudans Nyl.

F galbina Ach.

F glabratula Lamy

*hypopsila Müll. Arg. -- Rare.

*infumata Nyl.

mexicana Gyeln. -- Rare.

F obsessa Ach.

F olivacea (L.) Ach.

plittii Gyeln.

*revoluta Flörke -- Rare.

F rudecta Ach.

septentrionalis (Lynge) Ahti

soredica Nyl.

sorediosa Ahlmb.

*squarrosa Hale

subargentifera Nyl.

F subaurifera Nyl.

subolivacea Nyl. in Hasse -- Rare.

subrudecia Nyl.

F *substygia Räs.

F sulcata Tayl.

taractica Kremp.

trabeculata Ahti

Parmeliopsis

aleurites (Ach.) Nyl.

ambigua (Wulf.) Nyl.

var. ambigua -- Rare.

var. capitata Harris ex Meyer

hyperopta (Ach.) Arn.

placorodia (Ach.) Nyl.

Peltigera

F aphthosa (L.) Willd.

F canina (L.) Willd.

var. canina

var. praetextata (Flk. in Somm.) Hue

var. rufescens (Weiss) Mudd

var. spuria (Ach.) Schaer.

*elisabethae Gyeln.

evansiana Gyeln.

F horizontalis (Huds.) Baumg.

lepidophora (Nyl.) Vain.

leucophlebia (Nyl. Gyeln.

F malacea (Ach.) Funck

+*neckeri Müll. Arg.

F polydactyla (Neck.) Hoffm.

*scabrosa Th. Fr.

Pertusaria

alpina Hepp ex Ahles

amara (Ach.) Nyl. -- Rare.

F consocians Dibben

leucostoma (Bernh.) Mass.

F multipunctoides Dibben

F ophthalmiza (Nyl.) Nyl.

stenhammari Hellb.

trachythallina Erichs.

F velata (Turn.) Nyl. -- Rare.

Phaeocalicium

*compressulum (Nyl. ex Szat.) Schmidt

F polyporaeum (Nyl.) Tibell

*populneum (Brond ex Duby) Schmidt

Phaeophyscia

adiastola (Essl.) Essl.

cernohorskyi (Nadv.) Essl.

chloantha (Ach.) Moberg

F ciliata (Hoffm.) Essl.

F endococcinea (Körb.) Essl.

hispidula (Ach.) Essl.

*imbricata (Vain.) Essl.

pusilloides (Zahlbr.) Essl.

rubropulchra (Degel.) Essl.

sciastra (Ach.) Moberg

Phlyctis

*argena (Spreng.) Flot.

Phylliscum

demangeonii (Moug. & Mont.) Nyl.-- Rare.

Physcia

F adscendens (Th. Fr.) Oliv.

F aipolia (Ehrh.) Hampe

F caesia (Hoffm.) Hampe

dubia (Hoffm.) Lett. -- Rare.

millegrana Degel.

F phaea (Tuck.) Thoms.

F stellaris (L.) Nyl.

F subtilis Degel.

tribacoides Nyl.

Physconia

detersa (Nyl.) Poelt

Placynthium

nigrum (Huds.) S. Gray

Platismatia

tuckermanii (Oakes) W. Culb. & C. Culb.

Polyblastiopsis

*fallaciosa (Stizenb.) Zahlbr.

Pseudevernia

consocians (Vain.) Hale & Culb. -- Rare.

Pseudocyphellaria

crocata (L.) Vain. -- Rare.

Pyxine

sorediata (Ach.) Mont.

Ramalina

americana Magn. ex Hale

dilacerata (Hoffm.) Hoffm.

intermedia Nyl.

sinensis Jatta

Rhizocarpon

badioatrum (Flörke ex Spreng.) Th. Fr.

cinereovirens Müll. Arg.) Vain.

concentricum (Dav.) Beltr. -- Rare.

disporum (Naeg. ex Hepp) Müll. Arg.

geographicum (L.) DC.

grande (Flörke ex Flot.) Arn.

*hochstetteri (Körb.) Vain.

obscuratum (Ach.) Mass.

plicatile (Leight.) A. L. Sm.

*subgeminatum Eith.

Rinodina

archaea (Ach.) Arn.

dakotensis Magn.

F exigua (Ach.) S. Gray -- Rare.

iowensis Zahlbr. -- Rare.

milliaria Tuck.

F oreina (Ach.) Mass.

pachysperma Magn. -- Rare.

populicola Magn.

subminuta Magn.

tephraspis (Tuck.) Herre

turfacea (Wahlenb.) Körb.

F verrucosa Sheard -- Rare.

Sarcogyne

simplex (Dav.) Nyl.

Sphinctrina

*anglica Nyl.

F turbinata (Pers. ex Fr.) De Not.

Spilonema

*revertens Nyl.

Staurothele

F clopima (Wahlenb. ex Ach.) Th. Fr.

fissa (Tayl.) Zw.

Stenocybe

*major Nyl. ex Körb.

*pullatula (Ach. ex Somm.) B. Stein

Stereocaulon

dactylophyllum Flörke -- Rare.

F paschale (L.) Hoffm.

saxatile Magn.

tomentosum Fr.

Sticta

F fuliginosa (Dicks.) Ach. -- Rare.

#weigelii (Ach.) Vain. —— not in Fink 1903

Teloschistes

chrysophthalmus (L.) Th. Fr. -- Rare.

Thelocarpon

laureri (Flot.) Nyl. -- Rare.

Thrombium

F epigaeum (Pers.) Wallr. -- Rare.

Umbilicaria

deusta (L.) Baumg.

hyperborea (Ach.) Hoffm. -- Rare.

F mammulata (Ach.) Tuck.

F vellea (L.) Ach.

Usnea

F cavernosa Tuck.

F dasypoga (Ach.) Röhl.

fulvoreagens (Räs.) Räs.

F hirta (L.) Wigg.

F #longissima Ach.

F subfloridana Stirt.

Verrucaria

margacea Wahlbenb.

nigrescens Pers.

Xanthoria

F elegans (Link) Th. Fr.

F fallax (Hepp) Arn.

F polycarpa (Ehrh.) Oliv.

sorediata (Vain.) Poelt

Xylographa

*abietina (Pers.) Zahlbr. -- Rare.

*disseminata Will. -- Rare.

*vitiligo (Ach.) Laund. -- Rare.

RECOMMENDATIONS

The following recommendations are presented with regard to the lichens of Voyageurs National Park to aid in planning and management of the park for the preservation of the present lichen flora and to take adavantage of the excellent opportunity to explain lichens to the public.

1. In locating trails, campsites and docking areas consideration should be given to the lichens present and these facilities should be located away from areas with abundant lichen covered rocks or cedar or ash bogs. Existing visitor areas should be monitored for lichen damage since it may take up to 50 years for recovery once the lichens have been destroyed.

2. The following localities should be protected from all development and increased visitor activity in these areas should be discouraged;

   A. Kettle Falls bog (the parts off the present road and trails)

   B. Daley Brook swamp (the area with stands of cedar)

   C. Cemetery Island in Namakan Lake (the bog with ash and cedar)

   D. Swansons Bay, west side (area of virgin red pines)

   E. Small Island southeast of Pike Island in Namakan Lake (with virgin pines)

3. The historic bog area around Kettle Falls should not be disturbed by further development of trails, roads or cabins.

4. Interpretive displays and brochures should be prepared to make visitors aware of the lichens and their importance in the boreal forest.

5. Lichens should be pointed out and identified on self-guided trails as these trails are developed.

6. A long term monitoring program should be established using the lichens as indicators of air quality within the park.

7. If and when it is decided to reintroduce caribou to the park a detailed study of the lichens should be started to document the changes caused by the introduction.

SUMMARY

Over 8000 Lichens were collected at 128 different localities within the park during 11 weeks spent in the park in 1978 and 1979. All lichens have been identified and the 403 taxa known from the park are listed. Several areas of special interest to the lichen flora are noted. Numerous new state records were found within these collections and all but seven of the species collected by Bruce Fink in 1901 were recollected. Some of the rare lichens noted are probably rare because of the logging and forest fires during the past 80 years. There are no lichens endemic to the park. Lichens for winter food for caribou would probably not be a limiting factor in the success of any reintroduction of woodland caribou to the park. The scarcity of the orange lakeshore lichen, Xanthoria elegans, was studied and is probably due to lack of wave splash. The lichen flora is rich in fruticose lichens which suggests that no air pollution is present. Lichen communities are subject to physical damage by human activity and have been damaged in some locations in the park. Recommendations are presented regarding the location of campsites and trails, preservation of special areas important for their lichens, treatment of lichens in the park interpretive programs, and establishment of more detailed monitoring programs using the lichens.

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Localities where lichens were collected arranged by date of collection.

St. Louis County

24 May 1978. On point south of Lost Lake at east end of Kabetogama Lake. In mixed woods with some rock outcrops. Sec. 24, T69, R20W.

25 May 1978. Small island south of Round Bear Island in eastern Kabetogama Lake. Along rocky shore near water. Sec. 26, T69N, R20W.

25 May 1978. On point on northeast side of Blind Ash Bay in eastern Kabetogama Lake. On steep rocky hillside with jack pines and rocks. Sec. 26, T69N, R20W.

26 May 1978. East end of Kabetogama Lake south of Kohler Bay. On rock outcrops near shore with scattered white pines and aspens. Sec. 19, T69N, R19W.

27 May 1978. South side of Old Dutch Bay at west end of Namakan Lake. In mature pine area with white pine, red pine and few balsam fir. Sec. 29, T69N, R19W.

27 May 1978. Just east of Old Dutch Bay at west end of Namakan Lake. In wet ash bog with black ash and few Thuja. Sec. 28, T69N, R19W.

28 May 1978. Wolf Island in east end of Kabetogama Lake. In mixed balsam fir and white spruce with some hardwoods and rocks. Sec. 21, T69N, R20W.

30 May 1978. On mainland north of Sexton Island in western end of Namakan Lake. In young jack pines over rock outcrops. Sec. 16, T69N, R19W.

30 May 1978. Near campsite outside Sullivan Bay in eastern Kabetogama Lake. In stand of mature big tooth aspen on south facing hillside on a small bay. Sec. 30, T69N, R19W.

31 May 1978. At mouth of Lost Bay at east end of Kabetogama Lake, opposite Wolf Island. In spruce, balsam fir forest with rock outcrops. Sec. 15, T69N, R20W.

2 June 1978. At end of Mud Bay on south side of Kabetogama Lake. At end of bay in black ash bog. Sec. 32, T69N, R20W.

2 June 1978. East side of Bowman Bay on south side of Kabetogama Lake. On rock outcrops with few pines. Sec. 36, T69N, R21W.

2 June 1978. Deer Creek east of Sugarbush Island in Kabetogama Lake. On north facing hillside with young balsam fir and some Thuja. Sec. 18, T69N, R20W.

3 June 1978. Hill west of Blind Ash Bay in eastern Kabetogama Lake. On hill with jack pine and rock outcrops. Sec. 27, T69N, R20W.

3 June 1978. Southwest side of Blind Ash Bay in eastern Kabetogama Lake. In black, spruce-balsam fir forest on steep slope to bay. Sec. 26, T69N, R20W.

3 June 1978. One mile west of Blind Ash Bay on south side of Kabetogama Lake. In mature aspen-birch woodland on ridge west of a small cove. Sec. 27, T69N, R20W.

4 June 1978. On north side of Kohler Bay at west end of Namakan Lake. Area with scattered rock outcrops and small red oak trees. Sec. 20, T69N, R19W.

4 June 1978. South side of Kohler Bay in western Namakan Lake. On steep north facing rock hillside with balsam fir and black spruce and with jack pine on top. Sec. 20, T69N, R19W.

4 June 1978. Near mouth of Kohler bay at west ene of Namakan Lake. On ridge on north side of bay with old quaking aspens, red maple and white pines. Sec. 20, T69N, R19W.

6 June 1978. At Cranberry Creek at west end of Locator Lake. Around falls and rock ledges with balsam fir, white birch, white pine and black spruce. Sec. 16, T70N, R21W.

7 June 1978. At Meadwood Ranger Station just west of passage to Sullivan Bay. On cliffs south of road. Sec. 25, T69N, R20W.

7 June 1978. Headlight Island in eastern end of Kabetogama Lake. On rock shores of small island. Sec. 20, T69N, R20W.

8 June 1978. Daley Brook swamp south of Daley Bay on Kabetogama Lake. In Thuja swamp near edge of park with some black ash and balsam poplar near stream. Sec. 7 & 8, T68N, R20W.

9 June 1978. Hoist Bay on Namakan Lake. In black spruce bog on hill-top on west side of bay with some low rocks. Sec. 34, T69N, R19W.

9 June 1978. Williams Island in Namakan Lake. On east end on rock outcrops with jack pines and red pines. Sec. 26, T69N, R19W.

9 June 1978. Cemetery Island in Namakan Lake. In ash bog near eastern end of island with black ash and some old Thuja. Sec. 22, T69N, R19W.

10 June 1978. Sullivan Bay off eastern end of Kabetogama Lake. On steep rock hillside on south side of bay with balck spruce and red pine and few white pine and balsam fir. Sec. 31, T69N, R19W.

11 June 1978. Northeast of Johnson Bay in northwest Namakan Lake, north of Gagnon Island. In tamarack-black spruce bog. Sec. 22, T69N, R19W.

11 June 1978. Southwest of Mica Island on mainland in northwest Namakan Lake. On rocky ridges back from lake with balsam fir and jack pine. Sec. 1, T69N, R19W.

12 June 1978. 3.5 miles west of Kettle Falls on north side of Mica Bay in northwestern Namakan Lake. On steep north facing hillside above small bay. Sec. 36, T70N, R19W.

12 June 1978. Four miles west of Kettle Falls on north side of Mica Bay in norwestern Namakan Lake. Along stream between small bay and beaver ponds with black ash and balsam fir. Sec. 35, T70N, R19W.

12 June 1978. At head of Mica Bay in northwestern Namakan Lake. In jack pine area on south facing rocky slope above bay. Sec. 35, T70N, R19W.

13 June 1978. Small bay east of Kempton Bay in Rainy Lake. In small black ash bog back from bay. Sec. 20, T70N, R19W.

13 June 1978. Point on west side of Finger Bay on Rainy Lake. Rocky point with steep cliffs into lake and jack pine on top. Sec. 21, T70N, R19W.

13 June 1978. Northwest side of Anderson Bay on Rainy Lake. Around north side of rock cliffs with white birch and brush. Sec. 22, T70N, R19W.

14 June 1978. North of Kettle Falls on Rainy Lake in small bay south of Rabbit Island. In ash bog with ash and balsam poplar. Sec. 28, T70N, R18W.

14 June 1978. Inland from small bay west of Surveyors Island on Rainy Lake. In cut over black spruce bog. Sec. 33, T70N, R18W.

Ontario, Canada

14 June 1978. Oakpoint Island east of Kettle Falls at east end of Rainy Lake. On southern part of island in old Thuja swamp with areas of ash.

St. Louis County

15 June 1978. Kettle Falls, near resort, at eastern end of Rainy Lake. In black ash bog near end of long bay from Namakan Lake. Sec. 33, T70N, R18W.

Koochiching County

16 June 1978. Tom Cod Bay Swamp at western end of Kabetogama Lake. On north branch of river in Thuja swamp. Sec. 2, T69N, R22W.

16 June 1978. Bay west of Chief Wooden Frogs Islands in western Kabetogama Lake. In ash bog on east side of bay between bay and small lake. Sec. 25, T70N, R22W.

St. Louis County

17 June 1978. Lost Bay Trail to Agnes Lake, eastern Kabetogama Lake. On steep north facing rocks in balsam fir forest at south edge of swamp. Sec. 7, T69N, R19W.

17 June 1978. North of Agnes Lake east of Lost Bay on Kabetogama Lake. On rocky ridges with jack pine and thick young balsam fir. Sec. 7, T69N, R19W.

18 June 1978. East of La Bontys Point in northwestern Kabetogama Lake. On ridge and low areas with balsam fir and some spruce. Sec. 28, T70N, R21W.

18 June 1978. Point south of Sucker Creek in northwestern Kabetogama Lake. On wooded rocky ridge with old white pines, white spruce, balsam fir and hardwoods. Sec. 34, T70N, R21W.

20 June 1978. South of west end of Sullivan Bay. On ridge east of gravel pit in mixed hardwoods. Sec. 36, T69N, R20W.

21 June 1978. Namakan Island in Namakan Lake. In low area in eastern part of island with black ash, Thuja and alder. Sec. 24, T69N, R19W.

21 June 1978. Kubel Island in Namakan Lake. On northeast corner on ridges and in black spruce swamps. Sec. 14, T69N, R19W.

22 June 1978. Point inside Duckfoot Island in Rainy Lake. In stand of upland black spruce and balsam fir a little up from shore. Sec. 8, T70N, R20W.

23 June 1978. On southeast point of small island south of Stevens Island in Namakan Lake. On steep rocky shore with jack pines on top. Sec. 26, T69N, R19W.

24 June 1978. Sugarbush Island in Kabetogama Lake. In black ash bog with basswood and elm. Sec. 14, T69 N, R21W.

24 June 1978. East of Cutover Island in Kabetogama Lake on a point north of Donut Island. Area with mature red pines and white pines with some balsam fir. Sec. 1, T69N, R21W.

25 June 1978. On east side of Hoist Bay on Namakan Lake. On high ridge with jack pines and few red pines. Sec. 26, T69N, R19W.

25 June 1978. Behind point south of Namakan Island on Namakan Lake. On east side of point near bay in mixed hardwoods. Sec. 25 T69N, R19W.

26 June 1978. Fox Island in Rainy Lake. Small island with some rocky shores and red pine, jack pine, balsam fir and some Thuja. Sec. 24, T71N, R21W.

27 June 1978. North of Lost Bay on Trail to Shoepack Tower, Kabetogama Lake. Near beaver pond and in swamp in cut over land with young quaking aspens. Sec. 15, T69N, R20W.

28 June 1978. South side of Junction Bay on Namakan Lake near Hamilton Island. In black ash bog with large old balsam poplar. Sec. 31, T69N, R18W.

28 June 1978. Along Johnson River in Junction Bay on Namakan Lake. On east bank of beaver pond and falls in old Thuja stand with patches of ash. Sec. 5, T68N, R18W.

29 June 1978. On west side of Junction Bay across from Sheen Point in Namakan Lake. On rocky hillside with jack pines and rocks. Sec. 31, T69N, R19W.

29 June 1978. North end of McManus Island in Namakan Lake. On east side of island in mature hardwoods. Sec. 30, T69N, R18W.

3 July 1978. Namakan Narrows peninsula at eastern end of Namakan Lake. In ash bog behind old resort with few Thuja. Sec. 27, T69N, R17W.

3 July 1978. Small island west of My Island in eastern Namakan Lake. High island with steep rocky shores. Sec. 21, T69N, R17W.

4 July 1978. Point northwest of O'Leary Lake in eastern Namakan Lake. Forest of jack pines with some red pines and white pines. Sec. 31, T69N, R17W.

4 July 1978. Island in mouth of Hammer Bay in eastern Namakan Lake. Old aspen-white birch area. Sec. 28, T69N, R17W.

4 July 1978. South side of Hammer Bay near west end, off Namakan Lake. On steep north facing rock hillside with black spruce and few old red pines. Sec. 33, T69N, R17W.

5 July 1978. Burnt Island in Sand Point Lake. On rocky cliffs with jack pines on top. Sec. 1, T68N, R17W.

5 July 1978. Small bay to south near mouth of Grassy Bay on Sand Point Lake. On west facing rocky hillside with black spruce and some balsam fir. Sec. 23, T68N, R17W.

6 July 1978. Grassy Bay on Sand Point Lake on hill near Little Trout Lake. Rocky cliffs and hillside NE of small islands with red oak, jack pines and some hardwoods. Sec. 9, T68N, R17W.

6 July 1978. Point on Steege Bay off Sand Point Lake. Northern point of narrow part of main bay in black spruce area on shore. Sec. 21, T68N, R17W.

7 July 1978. In bay west of Namakan Narrows on eastern Namakan Lake. In black ash bog with Thuja and black spruce. Sec. 34, T69N, R17W.

Koochiching County

12 June 1979. Dryweed Island in western Rainy Lake. On rocky outcrops on south side of island. Dry ridges and rocky shore cliffs. Sec. 26, T71N, R22W.

13 June 1979. South of Perry Point on Black Bay in mature white pine and red pine forest with some rock areas. Sec. 3, T71N, R22W.

14 June 1979. In bay on northeast side of Black Bay. Behind ridge near bay with balsam fir, quaking aspen, some jack pines, basswood. Sec. 2, T70N, R22W.

14 June 1979. On pine point in east end of Black Bay. Low rocky point with old jack pine, red pine and white pine and oak. Sec. 11, T70N, R22W.

15 June 1979. At end of bay south of Big American Island off western Rainy Lake. Along boggy stream with ash and some Thuja and balsam poplar. Sec. 34, T71N, R22W.

15 June 1979. Point outside Dove Bay in western Rainy Lake (S of Dryweed Island). Ridge with middle age red pine and white pine. Sec. 36, T71N, R22W.

16 June 1979. In bay north of Graves Island in Black Bay. In ash bog on north side of bay with mostly young and middle age ash. Sec. 3, T70N, R22W.

St. Louis County

16 June 1979. Southeast corner of Black Bay in small bay NE of Gold Portage. On south side of bay in mixed forest, mainly maple, aspen and birch. Sec. 18, T70N, R22W.

17 June 1979. Little Cranberry Island (E of Cranberry Island) in western Rainy Lake. On rocky shores. Sec. 28, T71, R21W.

17 June 1979. Island at mouth of Cranberry Bay, east of Arden Island. in western Rainy Lake. Low island with rock outcrops and alder swamps. Sec. 34, T71N, R21W.

17 June 1979. West of Cranberry Bay in black spruce swamp south of small bay west of Cranberry Bay. Sec. 31, T71N, R21W.

19 June 1979. Point on south side of Lost Bay in Rainy Lake. On ridge with middle age quaking aspen, some red oak and jack pines. Sec. 36, T71N, R21W.

19 June 1979. Harbor Island near Lost Bay on Rainy Lake. Area with mature red pine and white pine. Sec. 26, T71N, R21W.

Koochching County

20 June 1979. East of Dove Island across Black Bay Narrows (S of Rainy Lake City). Along north facing rock cliffs between bay and small inland lake in mixed forest. Sec. 34, T71N, R22W.

20 June 1979. North side of Dryweed Island near east end (Rainy Lake). Along shore on steep rock cliffs in moist forest with balsam fir, Thuja and black spruce. Sec. 24, T71N, R22W.

St. Louis County

22 June 1979. Small outside island east of Dove Bay in western Rainy Lake. Island with middle age red pine and white pine. Sec. 30, T71N, R21W.

22 June 1979. South side of Cranberry Bay off Rainy Lake. In area with low rock ridges with young aspen and red maple. Sec. 4, T71N, R21W.

23 June 1979. Frank Island south of Soldier Point in Rainy Lake. Small island with some old white pine, young red pine and jack pine. Sec. 33, T71N, R20W.

23 June 1979. Big Island by Kempton Channel in Rainy Lake. In small ash bog on south side of bay. Sec. 24, T70N, R20W.

23 June 1979. Along bay in Big Island by Kempton Channel in Rainy Lake. Along cliffs on south side of bay. Sec. 23, T70N, R20W.

24 June 1979. Water falls area on south side of Kempton Channel in Rainy Lake. Along stream from west end of bay to beaver pond south of bay. Sec. 25, T70N, R20W.

24 June 1979. South of Kempton Bay on rock ridge. On rock outcrops on ridgetop with scattered brush between small outcrop areas. Sec. 24, T70N, R20W.

24 June 1979. Large island on north side of Hitchcock Bay in Rainy Lake. Along shore open to lake and in black spruce balsam fir forest near shore. Sec. 10, T70N, R20W.

27 June 1979. Browns Bay in Rainy Lake. On south side near end of bay in mixed forest of quaking aspen, white birch, balsam fir and jack pine. Sec. 29, T70N, R19W.

27 June 1979. Point on east side of Finger Bay in Rainy Lake. On rocky hills with jack pine. Sec. 22, T70N, R19W.

28 June 1979. In bay behind Smith Island in Rainy Lake. Along small north facing cliffs and along end of beaver pond in Thuja swamp. Sec. 29, T70N, R18W.

29 June 1979. Eastern end of Anderson Bay in Rainy Lake behind small island. On large rock outcrop above shore with jack pine. Sec. 25, T70N, R19W.

29 June 1979. Point of land one mile east of Anerson Bay in Rainy Lake. In thick young stand of jack pine on fairly moist site. Sec. 25, T70N, R19W.

30 June 1979. Small island one mile east of Anderson Bay in Rainy Lake. Along rocky shore and in moist forest. Sec. 25, T70N, R19W.

30 June 1979. Behind Sand Bay Island in eastern Rainy Lake. Inland from point in balsam fir woods in lowland and pines on higher ground. Sec. 20, T70N, R18W.

1 July 1979. Peninsula northwest of Surveyors Island in eastern Rainy Lake. In ash bog at end of bay. Sec. 28, T70N, R18W.

1 July 1979. Two miles east of Anderson Bay on Rainy Lake. In small bay with mixed conifer-hardwood forest up from bay. Sec. 25, T70N, R19W.

5 July 1979. West of bay west of O'Leary Lake in eastern Namakan Lake. On rock outcrops up from west side of bay. Sec. 36, T68N, R17W and Sec. 6, T68N, R17W.

5 July 1979. Small island southeast of Pike Island in eastern Namakan Lake, east of Deep Slough (Mulligan Bay). Probably virgin forest of red pine and white pine with some black spruce. Sec. 25, T69W, R18W.

6 July 1979. Half mile south of Deep Slough in eastern Namakan Lake. In ash bog back from shore. Sec. 35, T69N, R18W.

6 July 1979. Lakeshore outside of Deep Slough in eastern Namakan Lake. On top of rocks back -rom shore with young jack pines and few balsam fir. Sec. 27, T69N, R18W.

7 July 1979. Bay behind Swansons Bay in Sand Point Lake. On rock outcrops on south side of stream in area probably never logged. Sec. 2, T68N, T17W.

7 July 1979. On peninsula northeast of Grassy Bay in Sand Point Lake. In an interior black spruce swamp. Sec. 11, T68N, R17W.

9 July 1979. Southwest of Namakan Narrows in northern Sand Point Lake. On and around rock outcrops in first bay west of south end of narrows. Sec. 34, T69N, R17W.

9 July 1979. On peninsula south of Namakan Narrows in Sand Point Lake. In mixed hardwood forest with scattered large old spruce. Sec. 2, T68N, R17W.

10 July 1979. Northeast end of Junction Bay in Namakan Lake. In lowland at north end of small side bay with old Thuja and young ash. Sec. 32, T69N, R18W.

10 July 1979. Southeast of Jug Island in Namakan Lake. Inland from shore on steep north facing cliffs in moist forest with Thuja and black spruce. Sec. 33, T69N, R18W.

11 July 1979. On west side of Staege Bay off Sand Point Lake. In Thuja bog back from shore with many alders in center. Sec. 28, T68N, R17W.

11 July 1979. At southeast corner of Staege Bay off Sand Point Lake. On rocky ridge with mature pines and some old white pine with red oak and red maple. Sec. 33, T68N, R17W.

12 July 1979. Near end of Grassy Bay off Sand Point Lake. Near shore in stand of balsam fir and black spruce with ash near cove. Sec. 5, T68N, R17W.

12 July 1979. Upper end of Grassy Bay off Sand Point Lake. A little beyond Browns Bay on broad ledge on northeast side of bay with mainly young big tooth aspen. Sec. 5, T68N, R17W.

13 July 1979. Back from west side of Browns Bay off Sand Point Lake. On large smooth rock outcrops inland from bay with some jack pine around edges. Sec. 17, T68N, R17W.

13 July 1979. East side of Browns Bay off Sand Point Lake. On steep large rock cliffs south of boy scout camp with mountain maple and birch. Sec. 21 and 16, T68N, R17W.

14 July 1979. At mouth of Grassy Bay in Sand Point Lake. On scattered small rock outcrops back from shore with black spruce and hardwoods. Sec. 14, T68N, R17W.

14 July 1979. On south shore of Grassy Bay south of Little Trout Lake (Sand Point Lake area). On north facing slope with mossy boulders, black spruce and balsam fir. Sec. 9, T68N, R17W.

15 July 1979. Mukooda Bay off Sand Point Lake near portage. In ash bog at end of bay. Sec. 36, T68N, R17W.

15 July 1979. North side of small bay south of Mukooda Lake in Sand Point Lake area. On gentle slope with very large old red pine and white pine with balsam fir and white birch understory. Sec. 1, T67N, R17W.

16 July 1979. Northern end of Crane Lake near narrows to last bay. In ash bog on east side of bay. Sec. 2, T67N, R17W.

16 July 1979. Northeast of Wolf Point in Crane Lake. Around steep rock cliffs on east side of bay with some pines on top. Sec. 2, T67N, R17W.

17 July 1979. Between north end of Mukood Lake and Sand Point Lake on hillside above old resort. With balsam fir, black spruce and rock outcrops. Sec. 23, T68N, R17W.

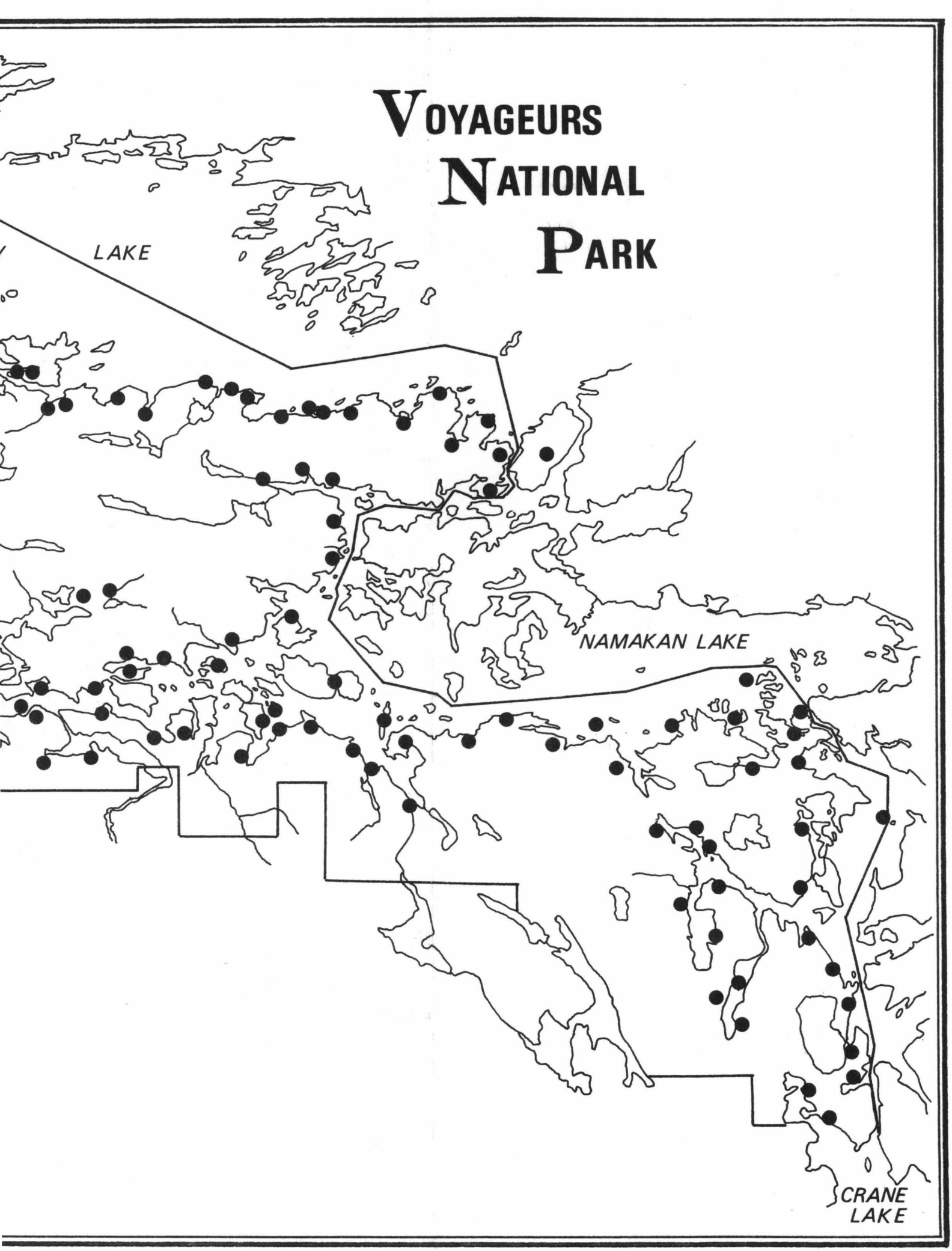
17 July 1979. On hillside between Sand Point Lake and Mukooda Lake below radio tower. On rock outcrops with jack pine, red oak and some red and white pines. Sec. 36, T68N, R17W.

18 July 1979. At north end of Namakan Narrows at east end of Namakan Lake. Around old resort along trails in birch forest. Sec. 27, T69N, R17W.

3 November 1979. Steep rock cliffs on east side of Browns Bay south of boy scout camp. At base of cliff with mountain maple and white birch. Sec. 16 and 21, T68N, R17W.

3 November 1979. At north end of Namakan Narrows at eastern end of Namakan Lake. On rock ledges around old resort. Sec. 27, T69N, R17W.

3 November 1979. Northeast of Wolf Point in northwest bay of Crane Lake. On steep west facing cliffs a little back from shore. Sec. 2, T67W, R17W.


VOYAGEURS
NATIONAL
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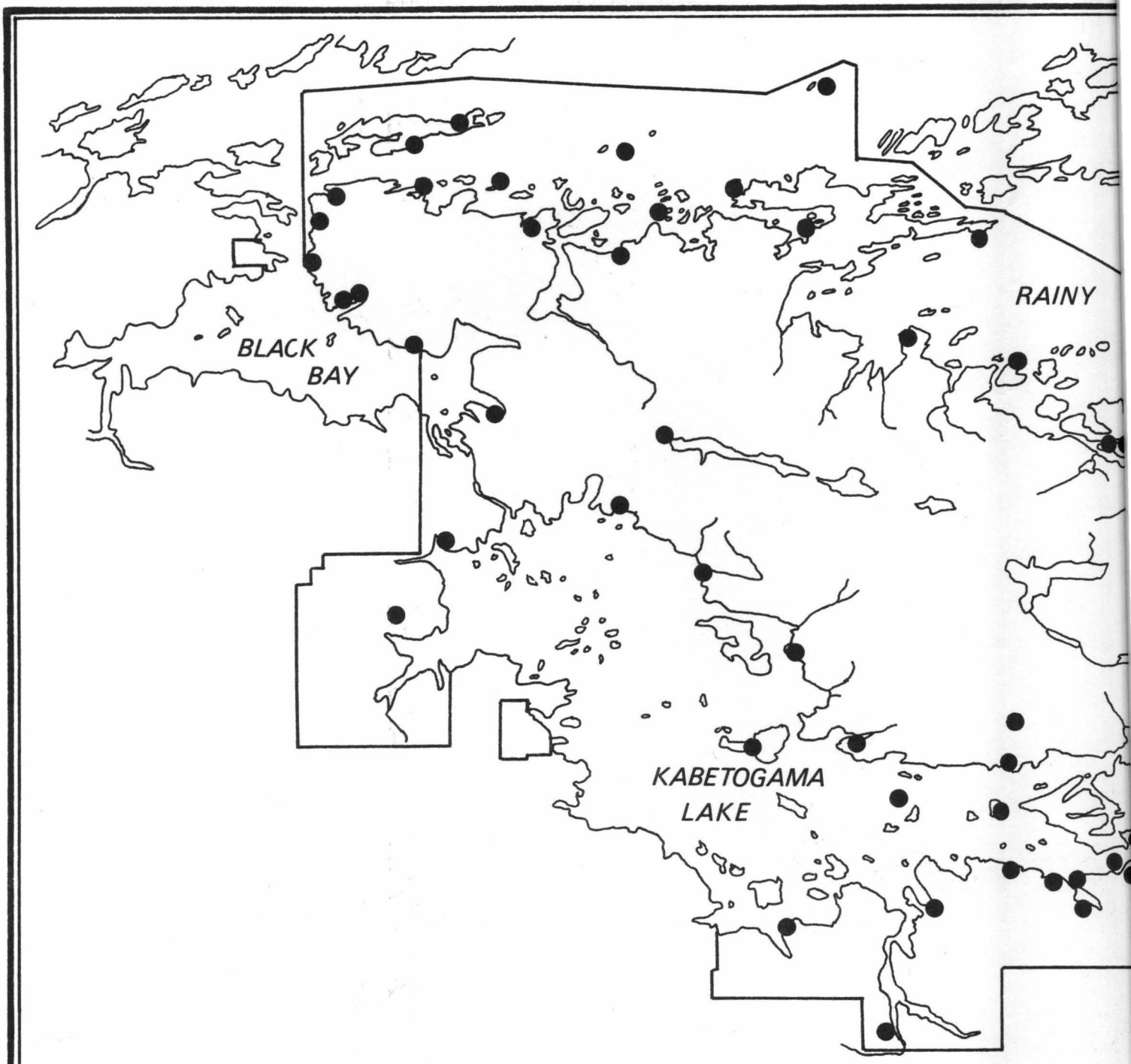
NAMAKAN LAKE
CRANE
LAKE



● LOCATION OF LICHEN COLLECTIONS

0 8 KILOMETERS

0 5 MILES

NORTH