POLISH POLAR RESEARCH	15	3–4	111–130	1994

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Lichenological assessment of the Cape Lions Rump, King George Island, South Shetland Islands; a baseline for monitoring biological changes

ABSTRACT: The present paper contains a list of 104 taxa of lichens and lichenicolous fungi, found in the Cape Lions Rump, Site of Special Scientific Interest No. 34 (King George Island, Antarctica), with their distribution and ecological analysis. A provisional vegetation map of the area is also provided. During the field survey the data were collected using the cartogram method in a grid of squares 250 × 250 m. The current abundance and spatial distribution of lichen species provides baseline data for long-term monitoring biological changes.

K e y w o r d s : Antarctica, South Shetlands, SSSI No. 34, lichens distribution, mapping

Introduction

The Cape Lions Rump area, situated at the south-western coast of King George Bay, has unique natural conditions with well developed and non-disturbed ecological systems typical of this region. This area is representative of the terrestrial, limnological and littoral ecosystems of King George Island, possessing diverse biota and rock formations. There occurs a rich flora, especially of lichens. It is an interesting part of the coastal vegetation, which has not been exposed to man's activity yet.

The part of the region, in effect of Polish initiative, was approved as a Site of Special Scientific Interest No. 34.

The aim of the present paper was to describe the occurrence and distribution of lichens — a predominating group in the vegetation of Antarctica — in the reserve and its environs. This may be helpful for the assessing of the flora richness, for management measures, and for seeking the further changes. The detailed maps of distribution have not only scientific value, but also may serve as a basis for future comparative studies, e.g. on species succession or anthropogenic effects.

In face of growing human impact in Antarctica wide research activity in floristics and vegetation science is an urgent task. The Cape Lions Rump may be treated as a reference point for other similarly situated terrains in south-western coast of the Admiralty Bay on King George Island (Fig. 1), which are prone to anthropogenic pressure in the area SSSI No. 8.

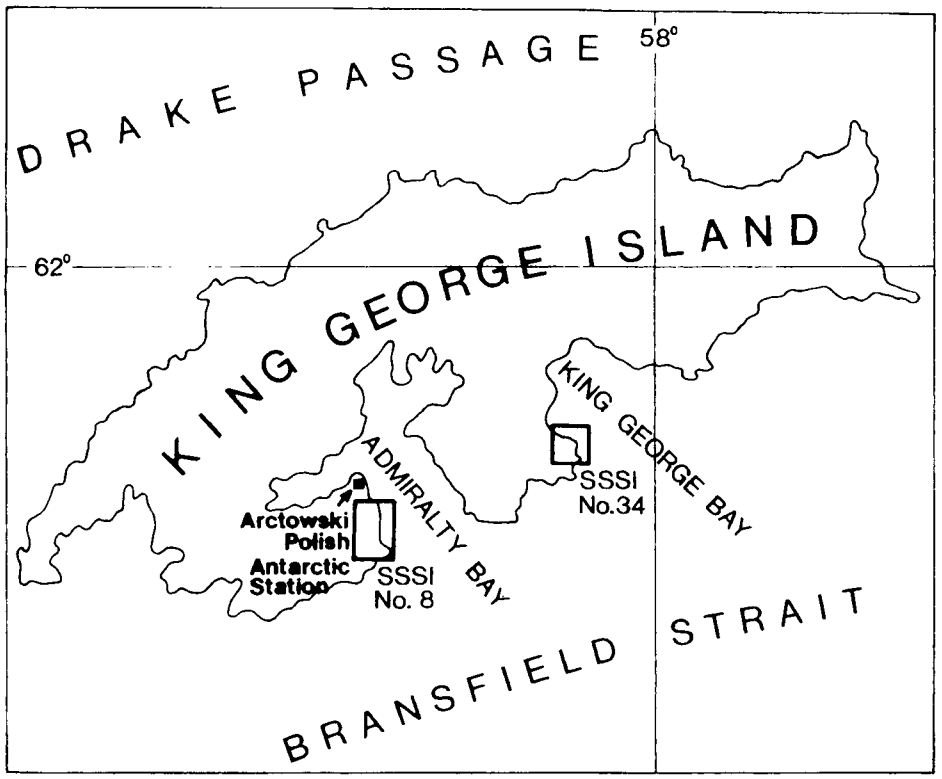


Fig. 1. Localization of the study area.

The materials were collected by the author during the 11th and 13th Polish Antarctic Expeditions to the *Arctowski* Station on King George Island in the years 1986–1988 and 1989/90.

Study area

The Cape Lions Rump is situated at the southwestern side of King George Bay, King George Island (South Shetland Islands — 62°13'S, 58°08'W — Fig. 1). The ice free area exhibits differentiated geomorphological features, including beaches of various width and length, moraines, hills and inland rocks. They provide suitable habitats for the development of terrestrial vegetation. The highest part reaches the altitude c. 190 m. Geologically Lions Rump consists of

Tertiary lavas and tuff containing thin brown coal intercalations and petrified wood fragments. The forefield of White Eagle Glacier is covered by large, domeshaped moraine ridges belonging to several Holocene stages of glacier advance and retreat (Birkenmajer 1981, 1982; Birkenmajer and Gaździcki 1986).

No meteorological data are available, the nearest meteorological station (at the Polish *Arctowski* Station) is situated, as the Cape Lions Rump, on western side of the Admiralty Bay, so that the climate conditions of both places should be similar. The average annual temperature is −2.0°C. The warmest summer month is January (average +2.3°C), and the coldest winter months are July and August (—7.1°C). High air humidity is maintained all over a year, amounting on average to 82%. A major climatic feature of the area are strong winds reaching hurricane force (Rakusa-Suszczewski, Miętus and Piasecki 1993).

Large colonies of penguins and occurrence of other birds have also great effect upon the vegetation.

Material and methods

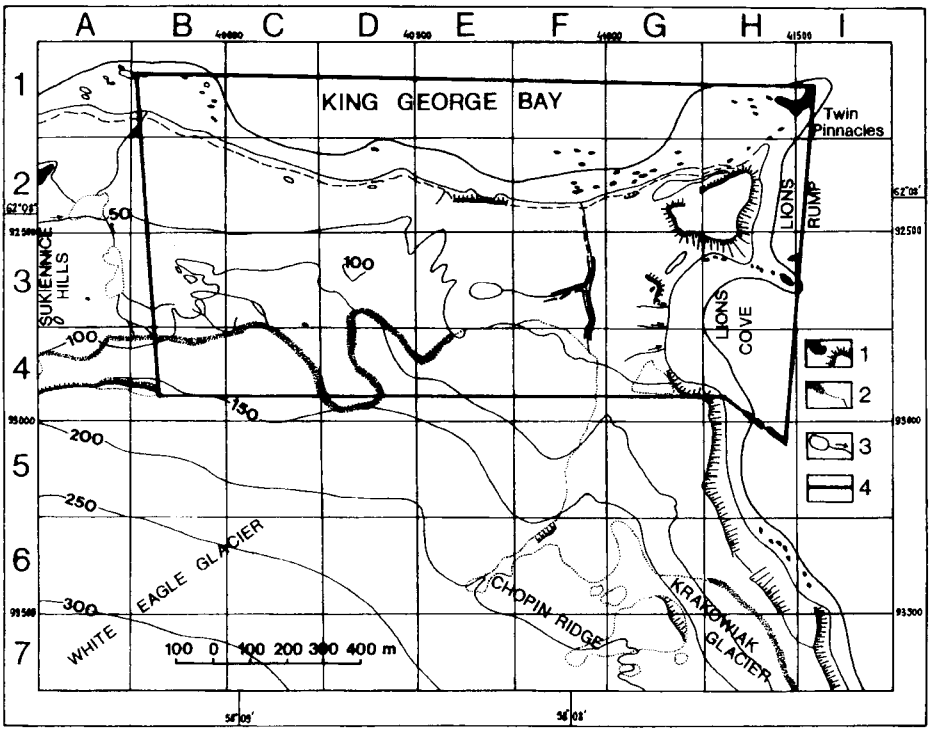


Fig. 2. Topographic outline of the Cape Lions Rump and its division into 250 × 250 m squares. 1 – cliffs and rocks; 2 — recent moraines and glaciers; 3 — lakes and streams; 4 — boundry of the Site if Special Scientific Interest No. 34.

The first, scarce data were collected by the author in 1988 during a short stay. The more detailed studies were carried out in 1990. The cartogram method was used, i.e. the floristical list was completed in the grid of squares 250 × 250 m (Fig. 2). This method enables the changes in flora and species distribution to be assessed precisely, allowing further repetitions.

A pilot phytosociological study using the Braun-Blanquet method was also carried out, and a provisional vegetation map of the area was prepared. During the field work a map by Battke and Cisak (1988) on the scale 1:5000 was used.

Lichens and field notes were deposited in the Herbarium of the Institute of Botany, Jagiellonian University (KRA).

Results and discussion

Description of the lichen flora

The lichen flora of SSSI Lions Rump consists of 104 taxa (Tab. I). In comparison with other areas studied (Guzman and Redon 1981, Jacobsen and Kappen 1988, Olech 1989a, 1989b, 1993, Sancho, Kappen and Schroeter 1990, Aptroot and van der Knaap 1993) it seems that this is a rather large number of taxa in this relatively small terrain (above 1.3 km^2).

The richest genera were *Caloplaca* (16 species) and *Buellia* (7 species). The most common were genera consisting of one or two species.

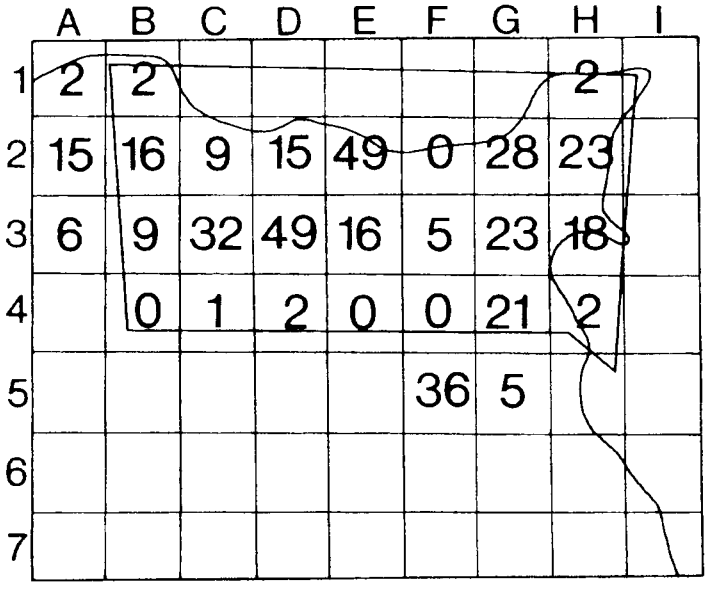


Fig. 3. The number of lichen taxa in the Cape Lions Rump SSSI No. 34.

The number of species in one suare (species richness) ranges from 0 tp 49 (Fig. 3). The highest species richness was found in squares with diversified habitats, e.g. with rocks, near penguin colonies or in places of bird foraging. The lowest species richness was found in freshly uncovered terrains (young moraines) or in snowbeds. The half of the species found occur in one or two squares.

Ecological characteristics of the lichen flora

In the Cape Lions Rump, due to its geomorphological structure, and because of the occurrence of big penguin colonies, habitats are rather diversified. They are inhabited by various ecological groups of lichens.

Saxicolous lichens

The floristic richness of this area is predominantly shaped by the occurrence of saxicolous lichens which percentage amounted to 70% of a total lichen flora. They occur especially on cliff and inland rocks, erratic boulders and small stones on moraines and beaches. The following species occur on cliff rocks: *Acarospora convoluta, Amandinea petermannii, Buellia granulosa, B. latemarginata, Caloplaca cirrochrooides, C. regalis, C. sublobulata, Haematomma erythromma, Lecania brialmontii, L. gerlachei, Lecanora dispersa, Physcia caesia, Ph. dubia, Ramalina terebrata, Thelenella antarctica, Turgidosculum complicatulum* and *Usnea antarctica*. A different lichen flora was found on inland rocks. Here the following species were noted: *Bacidia tuberculata, Buellia perlata, Caloplaca citrina, C. sublobulata, Carbonea assentiens, Cystocoleus ebeneus, Haematomma erythromma, Lecidea lapicida, Leptogium puberulum, Ochrolechia parella, Physcia caesia, Placopsis contortuplicata, Rhizocarpon geographicum, Thelenella kerguelena, Tephromela atra, Usnea antarctica* and *U. aurantiaco-atra*.

Characteristic, but relatively poor lichen flora occupies erratic boulders, often found in this area. There were predominantly: *Caloplaca saxicola, C. sublobulata, Carbonea assentiens, Haematomma erythromma, Lecidella stigmatea* and *Rhizocarpon geographicum*. Small stones, loosely lying on beaches are inhabited by the characteristic, relatively common species: *Acarospora macrocyclos, Aspicilia* sp., *Caloplaca austroshetlantica, C. sublobulata, Candelariella aurella, Carbonea assentiens, Lecanora polytropa, Placopsis contortuplicata, Rhizocarpon geographicum, Staurothele gelida* and also by rarer species as e.g. *Buellia augusta* and *Lecanora intricata*.

Terricolous lichens

In comparison with other areas of South Shetlands (Jacobsen and Kappen 1988, Olech 1989a, 1989b) Cape Lions Rump is characterized by relatively small

number of terricolous lichens. The following species were found here: *Cladonia borealis, C. chlorophaea, Leptogium puberulum, Ochrolechia frigida, Placopsis contortuplicata, Psoroma hypnorum* and *Usnea antarctica*. The lack of species of the genera such as *Bryoria, Cetraria, Stereocaulon* may be explained by the substratum instabilly at young moraines, which predominate in this area.

Epibriophilous lichens

Lichens occurring on mosses or dead plant remains represent an important percentage in total flora of the region. They occupy rock crevices and older moraines, and include: *Caloplaca ammiospila, C. citrina, C. tetraspora, C. tiroliensis, Cladonia pocillum, Collema* sp., *Cystocoleus ebeneus, Lecanora expectans, Lecidella wulfenii, Leptogium puberulum, Massalongia carnosa, Megaspora verrucosa, Ochrolechia frigida, Physconia muscigena, Psoroma hypnorum* and *Rinodina turfacea*. An especially high percentage of this group was found in squares D2 and E2 (an old abandoned penguin rookery).

Nitrophilous species

Remarkably high richness of lichens, both in the number of species and cover, was found near large colonies of birds. The following species are associated with penguin colonies: *Acarospora macrocyclos, Amandinea petermannii, Buellia coniops, B. latemarginata, Caloplaca cirrochrooides, C. lucens, C. regalis, C. sublobulata, Candelaria murrayi, Haematomma erythromma, Lecanora dispersa, Physcia caesia, Ph. dubia, Ramalina terebrata, Thelenella antarctica, Turgidosculum complicatulum, Usnea antarctica, Xanthoria candelaria*. They comprise similar, regarding the structure and habitat conditions, ornithocoprophilous communities as described in the Admiralty Bay region (Olech 1990). Comparing the observations from the other regions (Olech 1989a, 1989b) it may be stated that the species closely associated with penguin colonies are *Caloplaca regalis* and probably *Ramalina terebrata*. On inland rocks and boulders, near single nests or places visited by birds (*Catharacta maccormicki, C. lonnbergi, Larus dominicanus, Sterna vittata*) the following lichen species occur: *Buellia coniops, Caloplaca citrina, C. sublobulata, Candelariella flava, Haematomma erythromma, Physcia caesia, Xanthoria candelaria* and *X. elegans*.

It should be stressed that in the case of inland boulders nitrophilous lichens occur mostly on their tops, being often overgrown by other non-nitrophilous lichen associations. Their number and cover are considerably lower in comparison with cliff rocks. There were frequently found nitrophilous lichens overgrown with mosses or growing on the soil near the nests or sometimes inside them, e.g. *Caloplaca citrina, Xanthoria candelaria, Lecanora expectans* and *Physconia muscigena*.

Snowbeds

In the snowbeds and also in strongly wet places a moderately rich, but distinctive lichen flora occurs, with e.g. *Aspicilia* sp., *Carbonea assentiens, Lecanora polytropa, Leptogium puberulum, Polyblastia* cf. *gothica, Staurothele gelida* and *Thelocarpon cyaneum.*

Local species distribution

The spatial distribution of lichens is presented by means of cartograms (Figs 4 – 12) and Table I.

Table I.

A preliminary list of lichens from Cape Lions Rump SSSI No. 34

TAXON	SQUARE
Acarospora convoluta Darb.	D2; G2; H2
A. macrocyclos Vain.	A2; C2; E2; G2; H2,3
Amandinea coniops (Wahlenb. in Ach.) Scheid.	B3; C3; D3; E2,3; G2; H3
A. petermannii (Hue) Matzer, Mayrch. et Scheid.	C3; E2; G2,3; H2,3
Arthonia rufidula (Hue) D. Hawskw., R. Sant. et Øvstedal (on *Umbilicaria antarctica*)	C3
A. subantarctica Øvst.	C3; D3; E3; F3; G2.3; H2,3
Aspicilia sp.	A2; B2; C3.4; D3; G4.5
Bacidia stipata Lamb	C3; G3
B. trachona (Ach.) Lettau	D3
B. tuberculata Darb.	F5; G4
Buellia anisomera Vain.	C3; D3; E3; G3
B. augusta Vain	A2
B. granulosa (Darb.) Dodge	A2; D2; E2; G2; H2
B. latemarginata Darb.	E2; G2,3; H2,3
B. perlata (Hue) Darb.	D3; F5
B. pycnogonoides Darb.	F5; G4
B. russa (Hue) Darb.	G2
Caloplaca ammiospila (Ach.) Oliv.	F5
C. austroshetlandica (Zahlbr.) Olech et Søchting	A2; B2; C2,3; D3; E2; G4
C. buelliae Olech et Søchting	D3; E2,3
C. cirrochrooides (Vain.) Zahlbr.	D2; E2; G2; H2,3
C. citrina (Hoffm.) Th. Fr.	A3; D3; E2,3; F3,5; G2,3,4
C. coralligera (Hue) Zahlbr.	C3
C. holocarpa (Hoffm.) Wade s.l.	A2; B2; D3; E2; G4
C. lucens (Nyl.) Zahlbr.	B2; C2; E2; G2; H2,3,4
C. phaeocarpella (Nyl.) Zahlbr.	D3
C. psoromatis Olech et Søchting	C3; D3; F5; G3,4

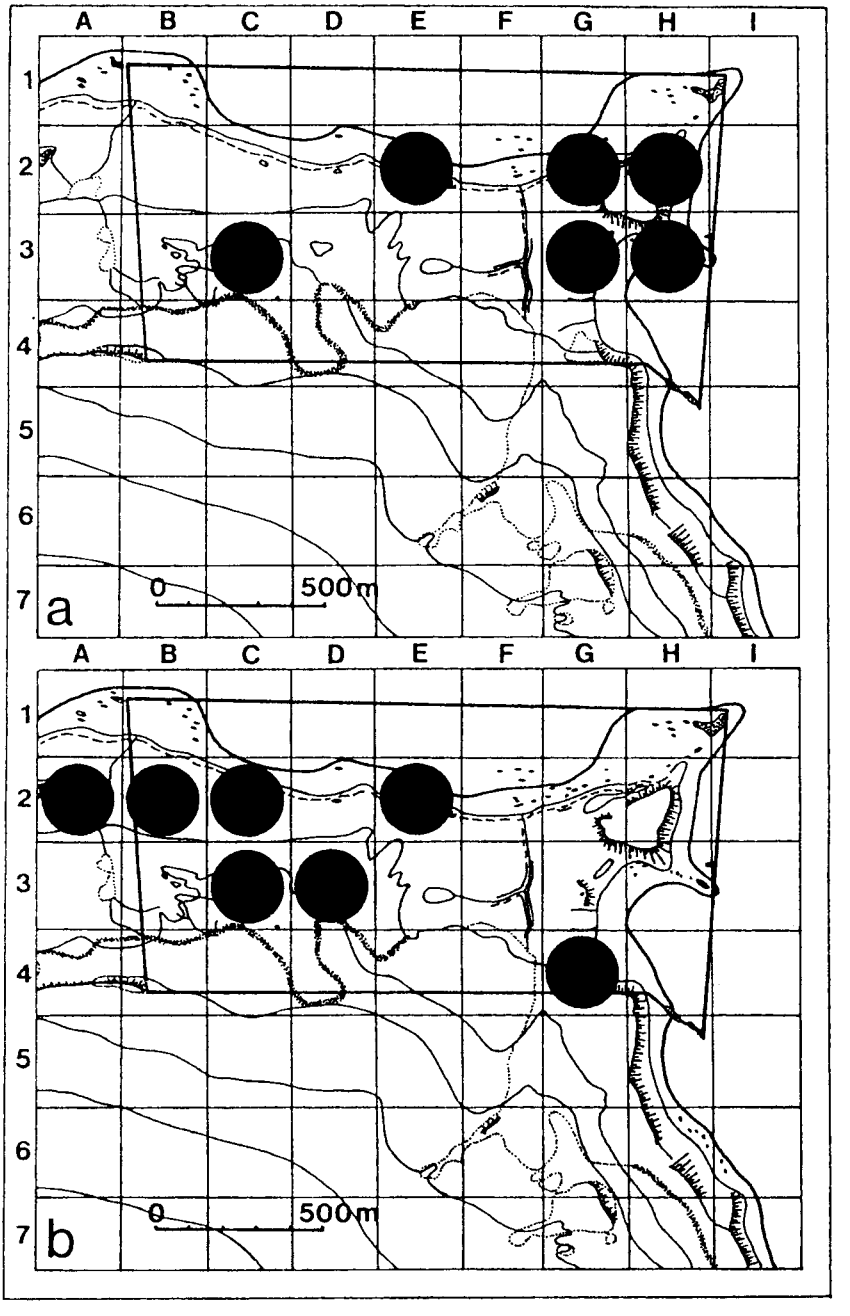
c.d. Table I

TAXON	SQUARE
C. regalis (Vain.) Zahlbr.	G2,3; H2,3
C. saxicola (Hoffm.) Nordin	C2; D2; F3
C. sublobulata (Nyl.) Zahlbr.	B2,3; C2,3; D2,3; E2; F3; G2,3,4; H2,3
C. tenuis Øvst.	C3; D2; E2; F5; G4
C. tetraspora (Nyl.) Oliv.	F5
C. tiroliensis Zahlbr.	E2
Candelaria murrayi Poelt	G2
Candelariella aurella (Hoffm.) Zahlbr.	C3; D3; E2; F5; G3
C. flava (C.W. Dodge et G.E.Baker) Castello et Nimis	D3; E2; G2,3; H2
C. vitellina (Hoffm.) Müll. Arg.	D2; F5
Carbonaea assentiens (Nyl.) Hertel	A2; C3; D2,3; E2,3; F5; G4,5
C. vorticosa (Flöerke) Hertel	A2; B2; G4
Catillaria corymbosa (Hue) Lamb	C3; G2
Cladonia borealis Stenroos	E2
C. chlorophaea (Föerke ex Sommerf.) Spreng	F5
C. galindezii Øvst.	F5
C. lepidophora Achti et Kashiw	E2
C. pocillum (Ach.) O.J.Rich.	E2
Collema sp.	E2,3
Cystocoleus ebeneus (Dillwyn) Thwaites	F5
Haematomma erythromma (Nyl.) Zahlbr.	B2,3; C2; D2,3; E2; F5; G2; H2,3
Lecania brialmontii (Vain.) Zahlbr.	C3; G2; H2
L. gerlachei (Vain.) Zahlbr.	E2; G2
Lecanora dispersa (Pers.) Sommerf.	B3; D2,3; E2; F3; G2,3,4; H2,3
L. expectans Darb.	D3; E2; G3
L. intricata (Ach.) Ach.	D3; E2
L. polytropa (Erhr. ex Hoffm.) Rabenh.	A2; B2; C3; D3; E2,3; F5; G4
Lecanora sp.	D3; E2
Lecidea atrobrunnea (Ramond. ex Lam. et DC.) Schaer.	F5
L. lapicida (Ach.) Ach.	A2; B2; D3; E2; G4
Lecidella stigmatea (Ach.) Hertel et Leuckert	B2; D3; F5
L. wulfenii (Hepp). Körb.	F5
Lepraria sp.	D3
Leprocaulon subalbicans (I.M. Lamb) I.M.Lamb et A.M.Ward	E3; F5
Leptogium puberulum Hue	A2,3; B3; C3; D3; E2,3; F5; G4,5
Lichenoconium usneae (Anzi) D. Hawksw. (on *Rhizoplaca aspidophora*)	C3
Massalongia carnosa (Dicks.) Körb.	D3; F5
Megaspora verrucosa (Ach.) Haffelner et V. Virth	D3; E2,3; F5
Micarea sp.	D3; E2,3; F5
Muellerella pygmaea (Körber) D. Hawskw. (on *Carbonea assentiens*)	E2
Ochrolechia frigida (Sw.) Lynge	B3; C3; D3; E2,3; F5; G4,5
O. parella (L.) A. Massal	C3; D3; F5

c.d. Table I

TAXON	SQUARE
Pannaria hookeri (Borrer ex SM.) Nyl.	F5
Parmaliella sp.	D3; G3,4
Pertusaria corallophora Vain.	D3; F5
P. dactylina (Ach.) Nyl.	E2; F5
P. signyae Øvst.	D3; E2
Phacopsis usneae Dodge (on *Usnea antarctica*)	A3; D2
Physcia caesia (Hoffm.) Fürnr.	C3; E2; G2,3; H2,3
Ph. dubia (Hoffm.) Lettau	E2; G2,3; H2
Physconia muscigena (Ach.) Poelt	E2
Placopsis contortuplicata Lamb	D3,4; F5; G4,5
Polyblastia cf. *gothica* Th. Fr.	D3
Polycoccum rugulosarium (Lindsay) D. Hawskw. (on *Caloplaca sublobulata*)	H2
Psoroma hypnorum (Vahl) Gray	A3; C3; D3; E2; F5; G3,4
P. tenue Henssen	G4
Ramalina terebrata Hook et Tayl.	D2; G2,3; H2
Rhizocarpon geminatum Körb.	A2; B2
R. geographicum (L.) DC.	A2; B2; D2,3; E2,3; F5
Rhizoplaca aspidophora (Vain.) Redon	B2; C3; D3; E2; G2; H2
R. melanophtalma (DC. in Lam et DC.) Leuckert et Poelt	C2,3; D3; E2; G3; H2
Rinodina turfacea (Wahlenb.) Körb.	E2,3
Staurothele gelida (Hook et Tayl.) Lamb.	A2; B2; C3; D3; E2,3; F5; G4
Tephromela atra (Huds.) Haffelner	B2,3; C2,3; D3; E2; G2; H2,3
Thelenella antarctica (M. Lamb) Eriksson	D2; G2; H2,3
T. kerguelena (Nyl.) Mayrh.	A3; D3
Thelocarpon cyaneum Olech et Alstrup	D3
Turgidosculum complicatulum (Nyl.) Kohlm. et Kohlm	E2; G2; H2,3,4
Umbilicaria cf. *africana* (Jatta) Krog et Swinscow.	C3
U. antarctica Frey et Lamb*	C3; D3; G3
Usnea antarctica Du Rietz	A2,3; B2,3; C2,3; D2,3,4; E2,3; F5; G2,3,4,5; H2,3
U. aurantiaco-atra (Jacq.) Bory	F5
Verrucaria elaeoplaca Vain.	D3
V. psychrophila Lamb	A1; B1; H1,3
V. tesselatula Nyl.	A1; B1; H1,3
Xanthoria candelaria (L.) Th.Fr.	C3; D3; G2,3; H2,3
X. elegans (Link.) Th.Fr.	B3; C3; D3; G3

* Taxonomic remark: *Umbilicaria antarctica* is often mistakenly cited as *U. rufidula*. The species name *"rufidula"* belongs to an *Arthonia* species lichenicolous on *Umbilicaria antarctica* (Hawksworth 1991).



Figs 4–12. Distribution of lichen taxa in the Cape Lions Rump:
Fig. 4 a — *Amandinea petermannii*; b — *Caloplaca austroshetlandica*.

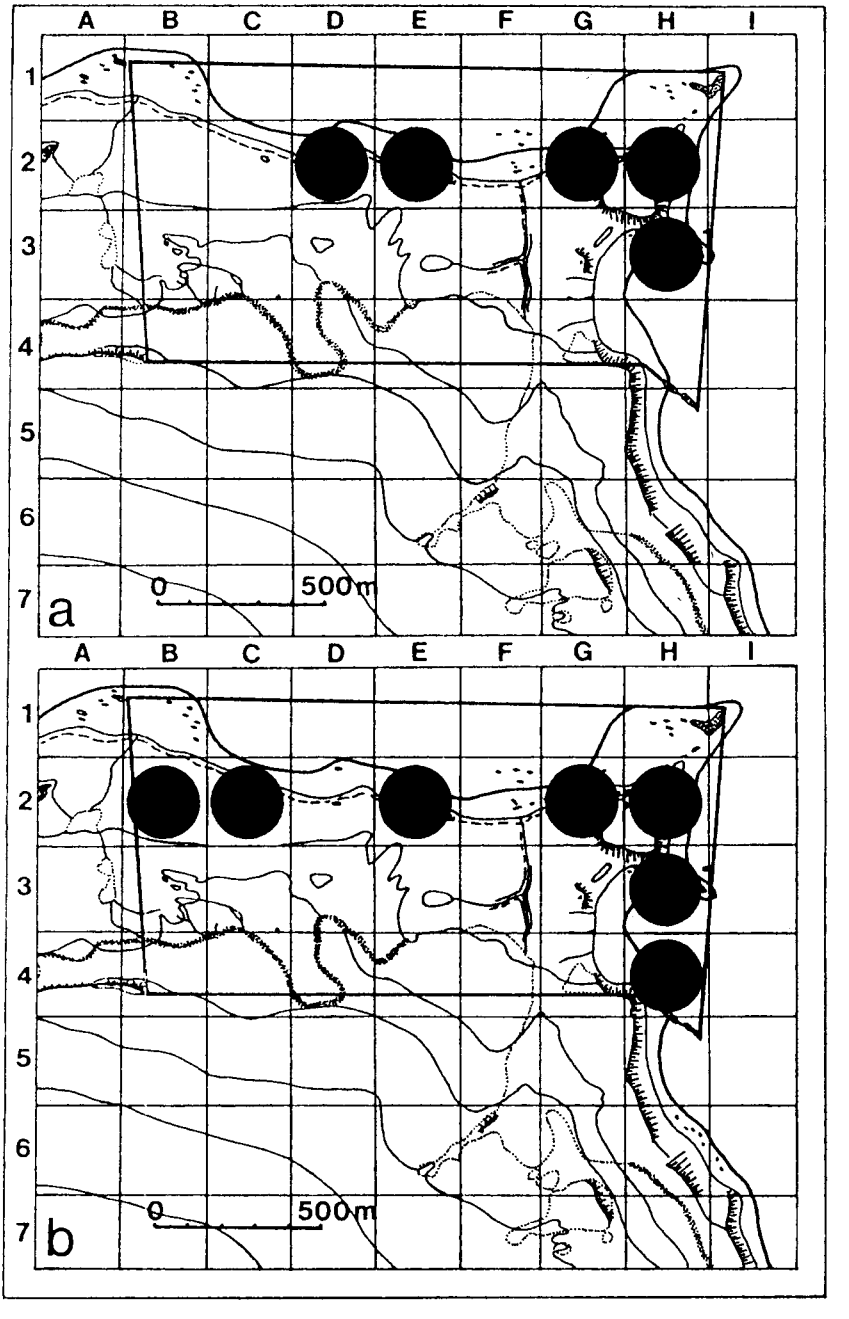


Fig. 5. a — *Caloplaca cirrochrooides;* b — *Caloplaca lucens.*

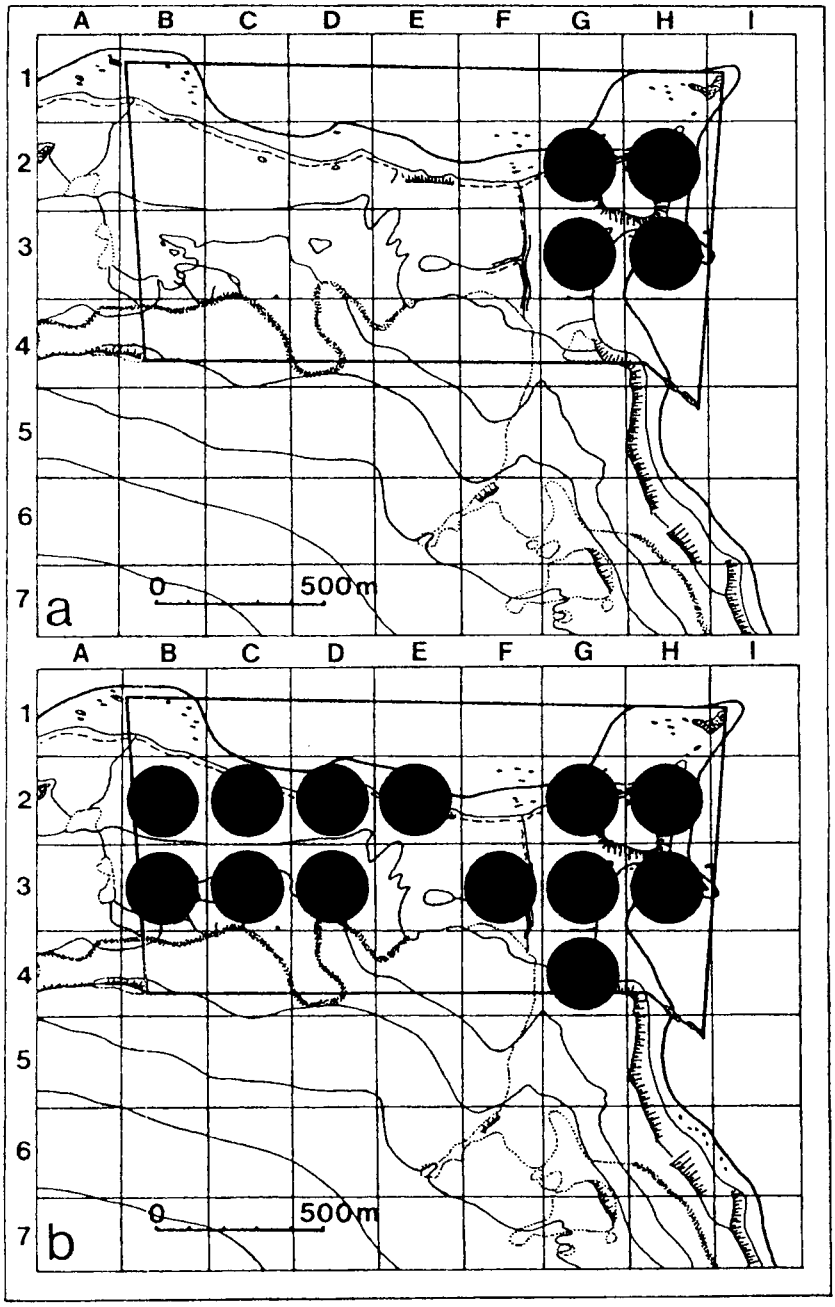


Fig. 6. a *Caloplaca regalis;* b – *Caloplaca sublobulata.*

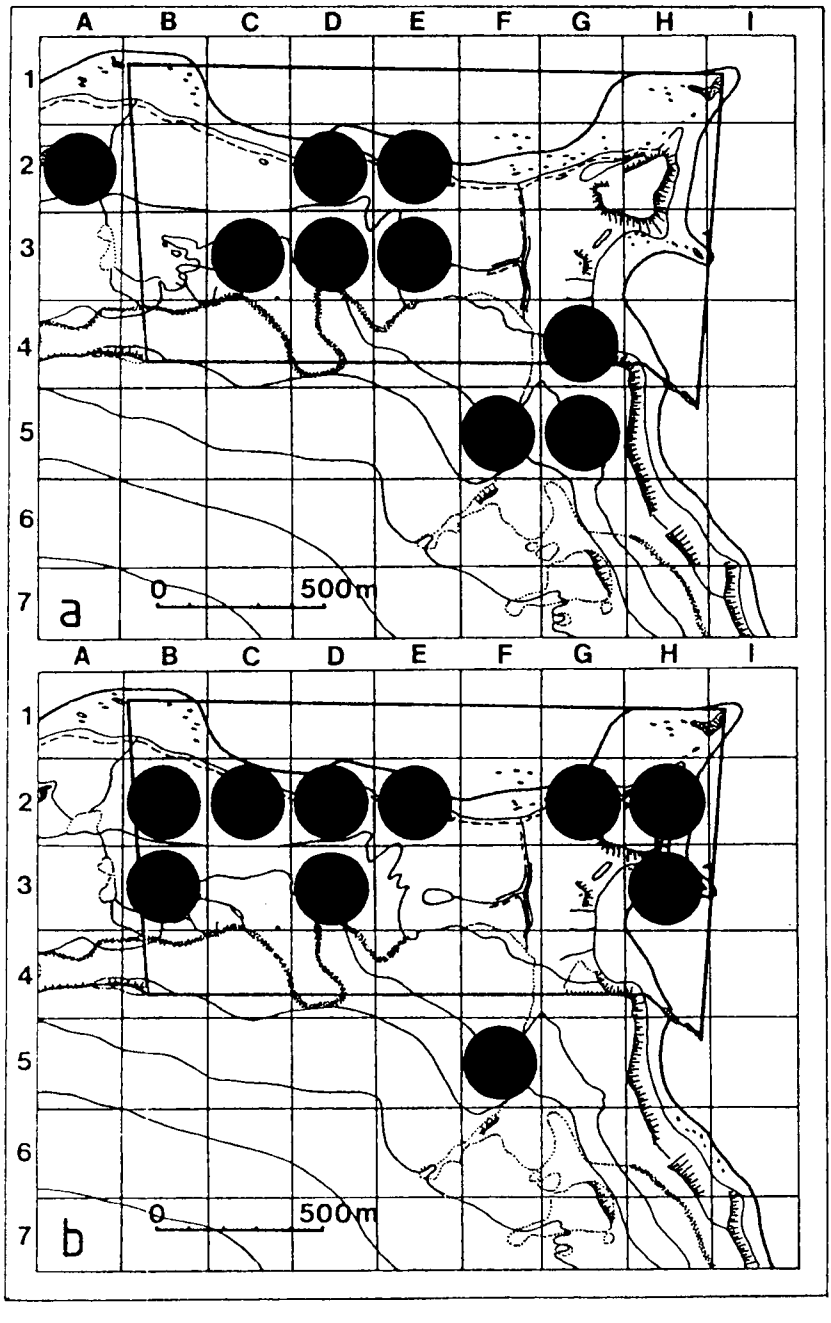


Fig. 7. a — *Carbonea assentiens;* b — *Haematomma erythromma.*

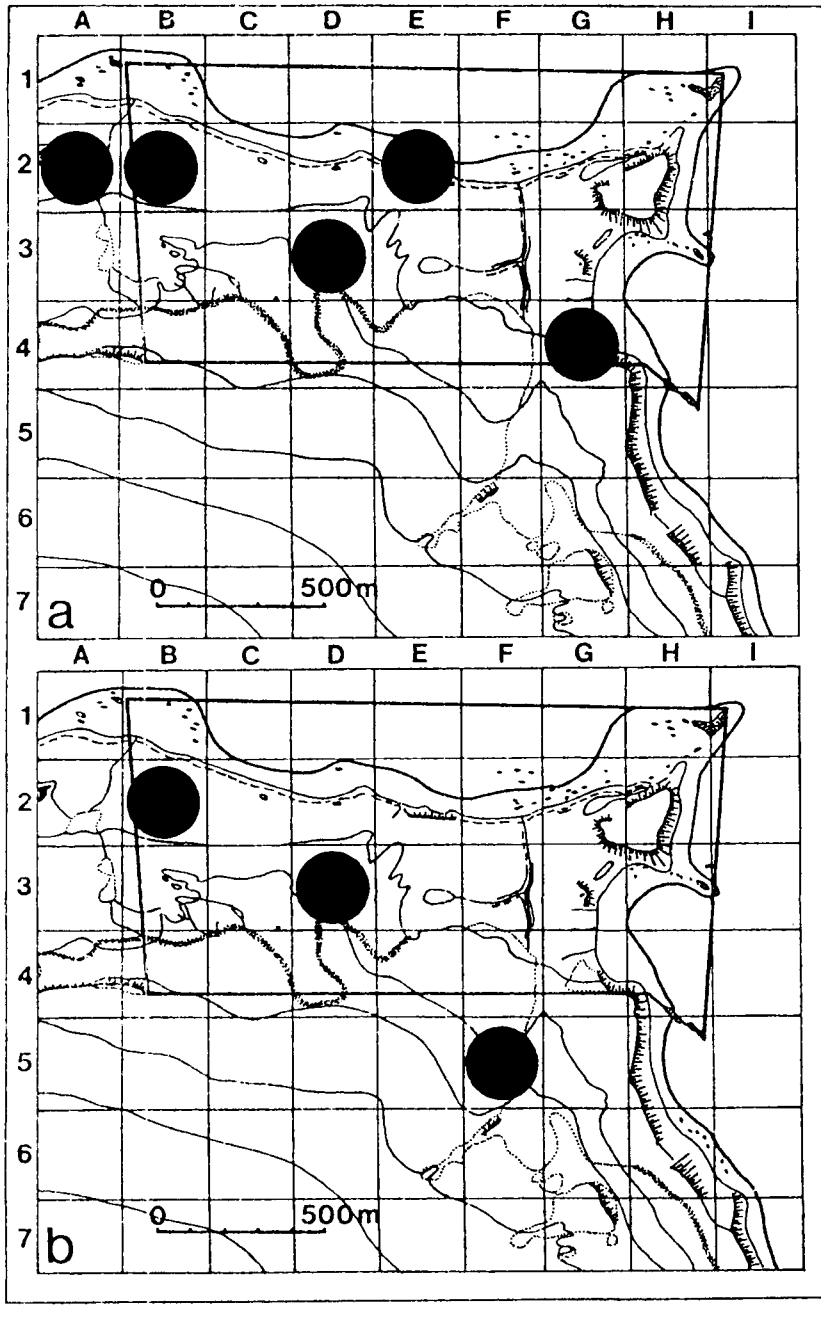


Fig. 8. a — *Lecidea lapicida;* b — *Lecidella stigmatea.*

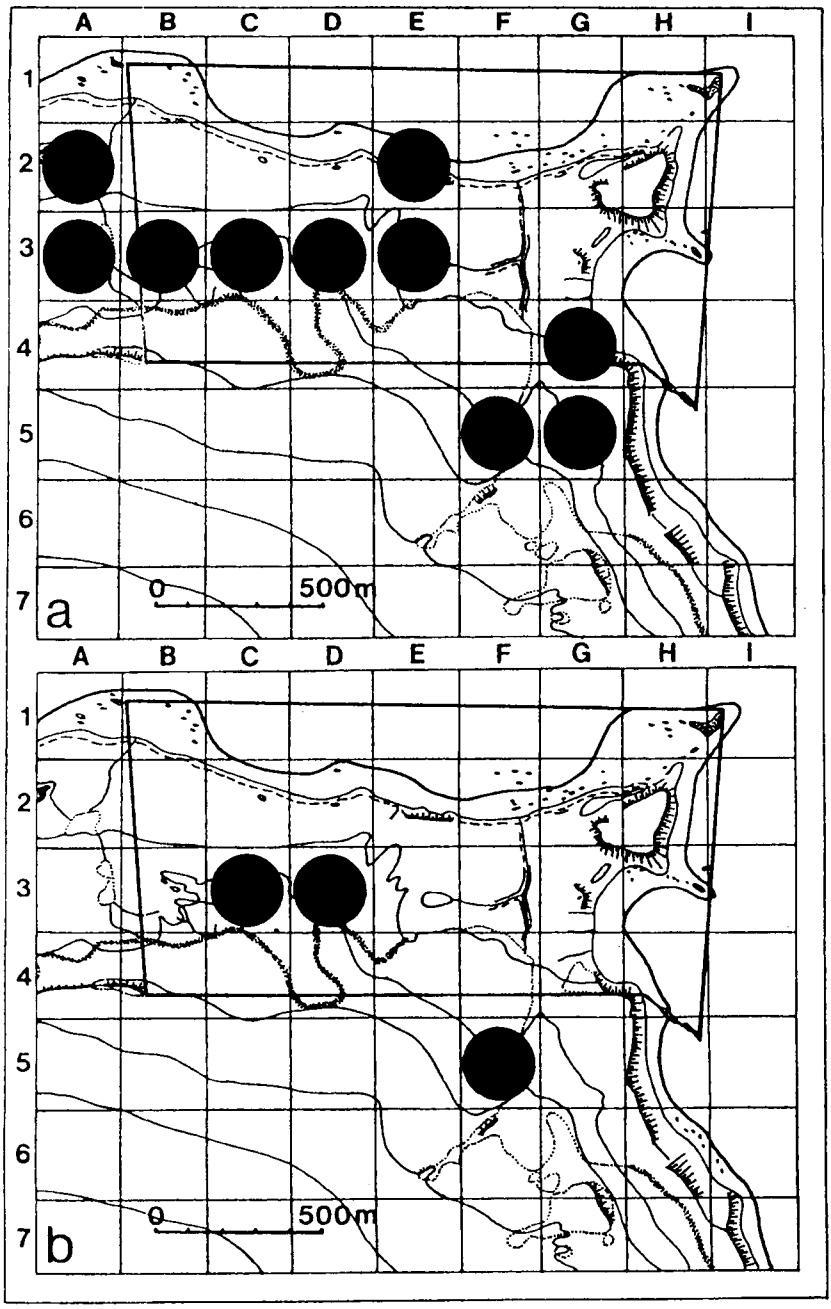


Fig. 9. a — *Leptogium puberulum;* b — *Ochrolechia parella.*

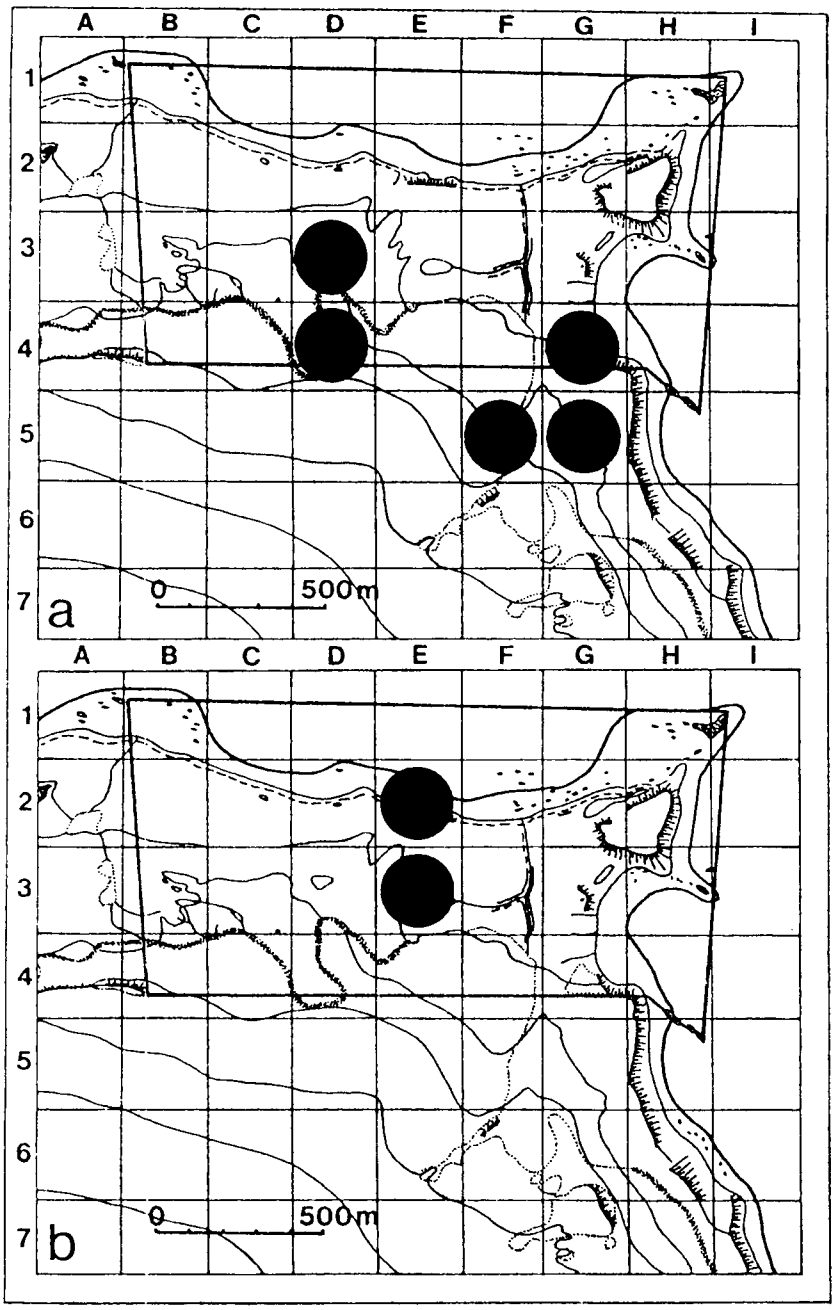


Fig. 10. a *Placopsis contortuplicata*; b – – *Rinodina turfacea*.

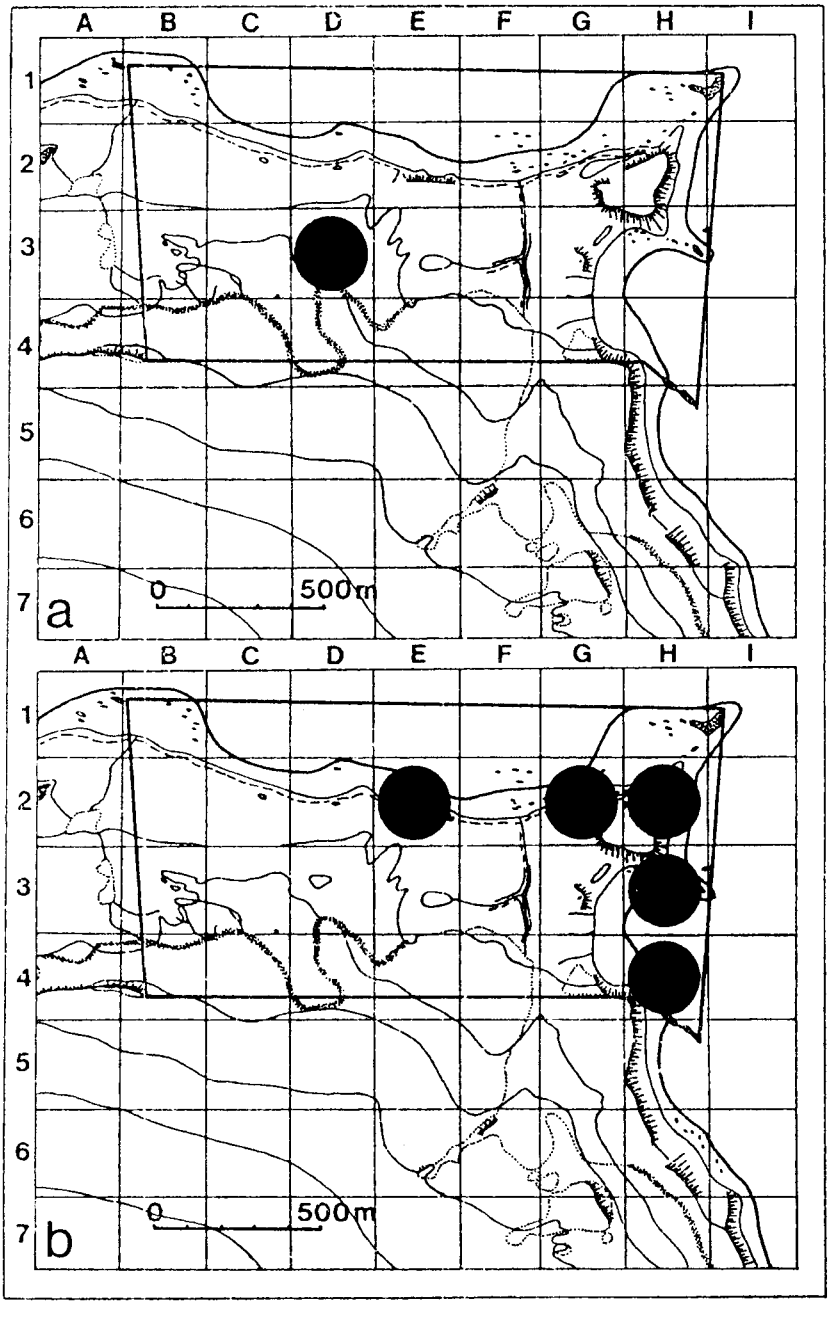


Fig. 11. a — *Thelocarpon cyaneum*; b — *Turgidosculum complicatulum*.

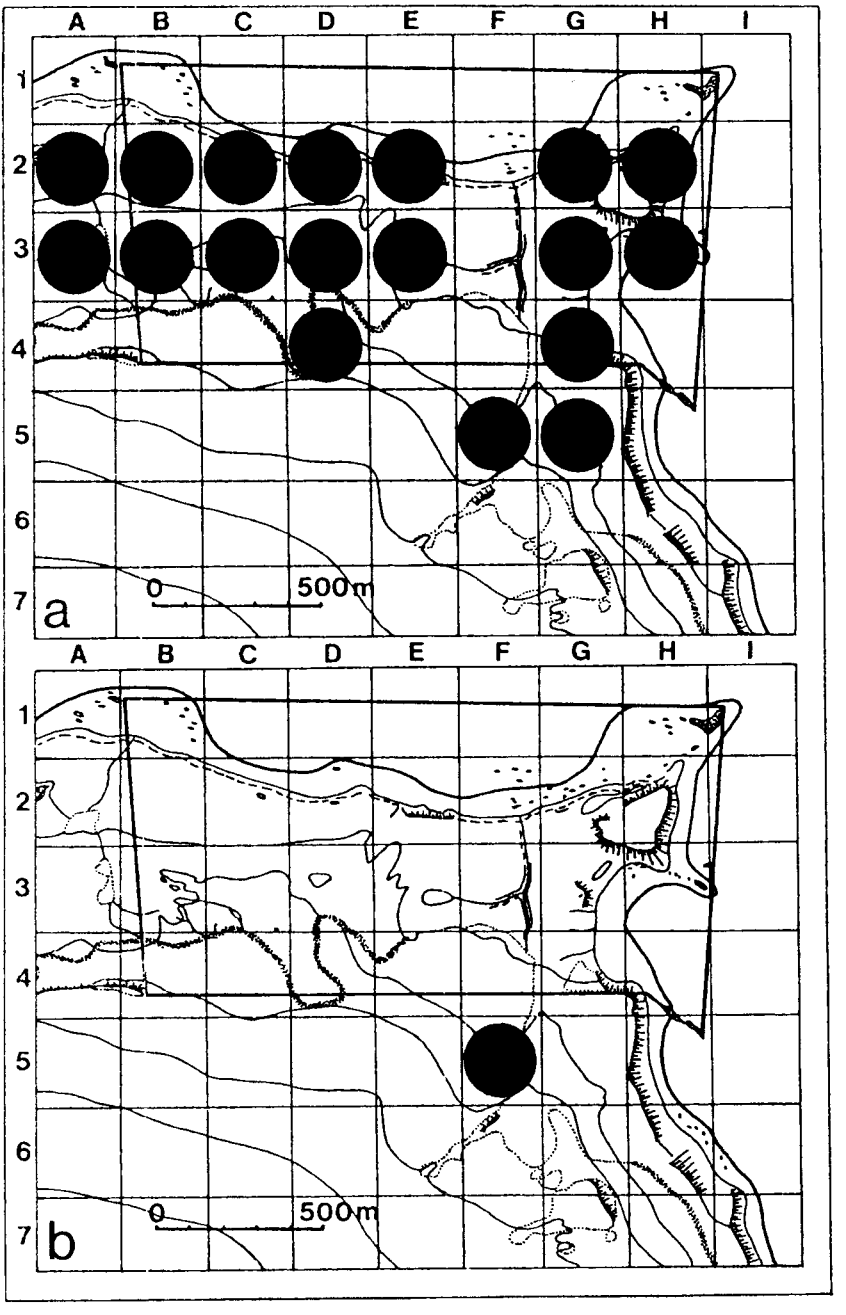


Fig. 12. a — *Usnea antarctica*; b — *Usnea aurantiaco-atra*.

Vegetation map

It was attempt to prepare a provisional vegetation map basing on the preliminary phytosociological investigtions. The distribution of distinctive plant communities seen during the field survey is shown on the map. Since the knowledge respecting vegetational differentiation of this area has not been sufficiently developed yet, the map has only working character. The map was drawn on the base map done by Battke and Cisak (1988) on the scale 1:5000.

Survey of the vegetation units is shown on the map (Fig. 13).

Acknowledgements. — Thanks are due to Professor Jan Kornaś for critically reviewing the manuscript.

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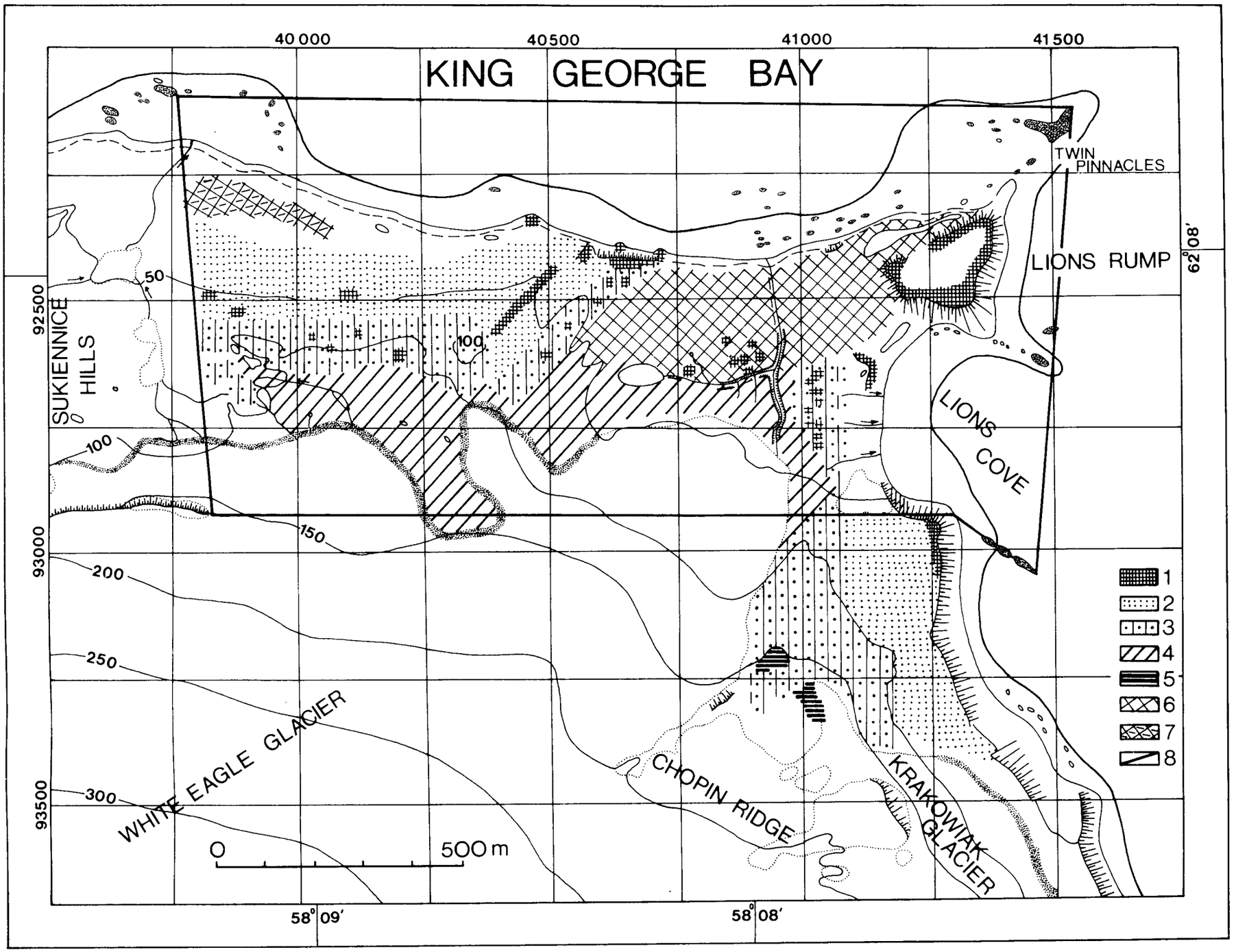

Fig. 13. A provisional map of the Cape Lions Rump SSSI No. 34:

1 — Ornithocoprophilous lichen communities;

2 — Mosaic composed of communities associated with screes on the hill slopes, moraine slopes and snowbeds with initial lichen communities. There are sparse saxicolous and terricolous lichens such as *Lecanora polytropa, Rhizocarpon geographicum, Carbonea assentiens* and *Leptogium puberulum*. In more wet places the community with *Leptogium puberulum, Staurothele gelida* and *Aspicilia* sp. dominates;

3 — Terricolous lichen communities with *Usnea antarctica*. A mosaic of communities with the great share of *Usnea antarctica, Ochrolechia frigida, Psoroma hypnorum, Leptogium puberulum*. Sometimes the mosses might be found here and occasionally *Deschampsia antarctica* and *Colobanthus quitensis* (especially in lower localities of the terrain). These communities develop in crest parts of the established moraines and also on their gentle slopes;

4 — Moraines without plants. Usually the youngest moraines with unstable substratum;

5 — Epilithic lichen communities with *Usnea aurantiaco-atra*. The community associated with higher elevations, on inland rocks. Clearly nitrophobous species dominate here. In addition to *Usnea aurantiaco-atra* also *U. antarctica, Ochrolechia parella, Pannaria hookeri* and *Cystocoleus ebeneus* occur here;

6 — Community of *Drepanocladus uncinatus* occurs on beach, floristically poor;

7 — *Prasiola crispa* and *Deschampsia antarctica* communities. The nitrophilous alga *Prasiola crispa* dominates here in cover. Sometimes associated with tussocks of *Deschampsia;*

8 — Borders of the reserve

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Received January 20, 1995
Accepted March 25, 1995

Streszczenie

Przylądek Lions Rump wyspy King George (Szetlandy Południowe) jest niezwykle interesującym rejonem przyrodniczym. Obszar wolny od lodu jest mocno zróżnicowany zapewniając odpowiednie siedliska dla rozwoju lądowej roślinności. Rejon ten, na wniosek Polski, został zatwierdzony przez SCAR jako tzw SSSI No. 34 (fig. 1 i 2). Autorka pracy zbierała materiały w rejonie Lions Rump w czasie dwu wypraw — 11-tej i 13-tej Polskiej Ekspedycji Antarktycznej do Stacji im. H. Arctowskiego w latach 1986–88 i 1989–90. Zebrane materiały posłużyły do sporządzenia listy porostów badanego obszaru (ogółem 104 taksony; Tab. 1, Rys. 3). Sporządzono dokładne mapy rozmieszczenia porostów i mapę roślinności rejonu Lions Rump przy użyciu siatki kwadratów o boku 250 m (fig. 4–12). Dane te będą podstawą dla długookresowych badań monitoringowych zmian środowiska przyrodniczego.