

Moss Communities of Rip Point in Northern Nelson Island, South Shetland Islands, Antarctica

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1. INTRODUCTION

Nelson Island (lat. 61°14'41" and 62°22'11"S, long. 58°49'30" and 59°15'00"W) is one of the largest of the South Shetland archipelago, located near the northern part of the Antarctic Peninsula (Fig. 1). The vegetation of this island was studied for the first time by Skottsberg (1912), describing ecology of some mosses and lichens at Harmony Cove. After this work no other study of Bryophyte ecology was made on Nelson Island. However, Lindsay (1971) presented some data on the Lichen communities of the island.

During the 10th and 13th Brazilian Antarctic Research Expeditions, carried out in January/February 1990 and December 1994 to March 1995, respectively, an ecological study of the moss vegetation in areas along the northern part of Nelson Island (Rip Point), was done.

Rip Point receives direct influence from the sea, especially from Drake Passage and Bransfield Strait, which meet in the Fildes Strait, and isolates Nelson Island from King George Island. The southern limit of the area is Nelson Glacier, which extensively covers the island. Rip Point is about 3 km long and 1.5 km wide, being one of the largest

ice-free areas on Nelson Island, but smaller than Harmony Point, which possesses the richest fauna.

Rip Point has only sparse bird colonies, mostly near the seashore, and forming small breeding colonies.

2. MATERIALS AND METHODS

During the austral summers of 1990 (January-February) and 1994/1995 (December to March), areas of Rip Point were chosen for phytosociological study. They represent the areas with the highest cover of moss communities. In 58 stands a number of quadrats were placed randomly within an area of 20-50m² and within each, the degree of dominance of each moss species occurring within 20×20cm quadrats was calculated according to the phytosociological method of Braun-Blanquet (1964). The degree of cover was determined as follows (Kanda, 1986): 5 (100-75%), 4 (75-50%), 3 (50-25%), 2 (25-10%), 1 (10-1%), + (less than 1%). The percentage frequency of appearance of the species in all quadrats was established as follows: V (80-100%), IV (60-80%), III (40-60%), II (20-30%), I (less than 20%). The class of each species was determined and is presented in the tables below. In the communities, the altitude, vegetation (lichen, algae and fungi) associated to the moss habitat and some other ecological data (topography, water

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supply, snow drift, proximity of bird colonies) were recorded and their influence on the distribution of moss communities discussed.

As there are few official place names on Nelson Island, the studied area was mapped using a Silva Sighting Compass (15TD-CL), recording lines 30m long in relation to a point with a position already known. The inclination was measured using compass with inclinometer, and each stand was located precisely on the map. To avoid any problem in the positioning of the stands, aerial photographs were taken from up to 400m high, using the Brazilian Navy helicopter from the ship *Ary Rongel*, studying them later in the laboratory to modify any misdetermination and to draw the definitive map. The altitude was determined using an altimeter.

The moss species were identified using Putzke & Pereira (1990). Specimens have been deposited in the HUNISC Herbarium, of the University of Santa Cruz do Sul, Brazil.

3. RESULTS AND DISCUSSION

3.1 – Species composition

33 most species were determined during the study, as follows:

Amblystegiaceae

Calliergidium austro-stramineum (C. Muell.) Bartr.
Calliergon sarmentosum (Wahlenb) Kindb.
Sonionia uncinata (Hedw.) Loeske
Campyliadelphus polygamus (B.S.G.) Kanda

Andreaeaceae

Andreaea depressinervis Card.
A. gainii
A. regularis C. Muell.

Bartramiaceae

Bartramia patens Brid.
Conostomum magellanicum Sull.

Bryaceae

Bryum amblyodon C. Muell.
B. argenteum Hedw.
B. pseudoত্রিquetrum (Hedw.) Schwaeg.
B. orbiculatifolium Card. et Broth.
Pohlia cruda (Hedw.) Lindb.
P. inflexa (C. Muell.) Wijk. et Marg.

Dicranaceae

Chorisodontium aciphyllum (Hook. f. et Wils.) Broth.
Dicranoweisia grimmiaea (C. Muell.) Broth.
D. antarctica (C. Muell.) Kindb.

Ditrichaceae

Ceratodon antarcticus Card.
C. grossiretis Card.
Distichium capillaceum (Hedw.) B.S.G.

Encalyptaceae

Encalypta patagonica Broth.

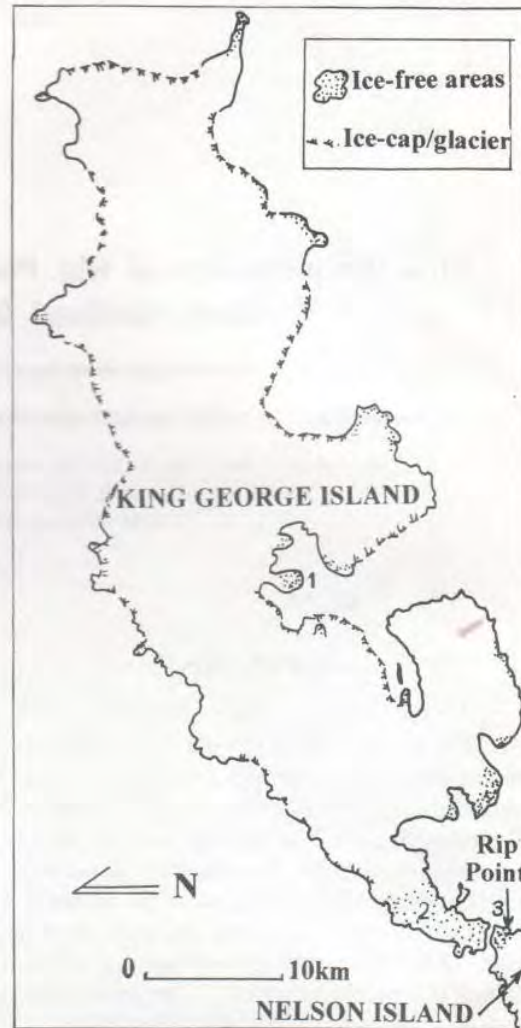


Fig. 1 — Map of King George and Nelson Islands showing the surveyed areas: 1 – Keller Peninsula; 2 – Fildes Peninsula; 3 – Rip Point.

Grimmiaceae

Schistidium rivulare (Brid.) Podp.
S. hyalino-cuspidatum (C. Muell.) B.G. Bell

Hypnaceae

Hypnum revolutum (Mitt.) Lindb.

Polytrichaceae

Polytrichum alpestre Hoppe
P. alpinum Hedw.
P. juniperinum Hedw.
P. piliferum Hedw.

Pottiaceae

P. heimii (Hedw.) Hamp.
Tortula princeps De Not.
T. saxicola Card.

3.2 – Moss communities

The 58 sites studied are indicated in Fig. 2. 25 different communities were identified. These are described below. Some species were found in additional stands, e.g. *Encalypta patagonica* and *Conostomum magellanicum*, but they were included in the list above to complete the moss species list for Rip Point. *Encalypta* occurred in habitats near the shore, especially in bird resting points. *Conostomum* was found farther inland, forming small isolated tufts, up to 3cm diameter.

3.2.1 – *Sanionia uncinata* Sociation

15 sites are formed by extensive carpets of *Sanionia uncinata* (Table I). This is the more frequent sociation in Rip Point. It sometimes has small cushions or tufts of other species, but the occurrence of these is low.

Bryum spp. were found in 10 sites (67%), the most important being associated with present class I (70%) to II (30%) and low cover (+ to 1).

Calliergon sarmentosum was present in 6 sites (40%), being well represented in sites 48 and 49, with presence class of II and cover of + to 3 in both.

Polytrichum alpinum and *Tortula saxicola* both appeared in 4 sites (26,6%), the former being well represented in area 11.

Among the lichens which occurred in 10 sites (66,6%), the most common species were saxicolous, forming a distinct sociation, because they grow directly on rock. These will be discussed in another paper. Among the muscicolous

species, which were recorded in 6 sites (4, 5, 11, 18, 21 and 48), the species *Caloplaca* spp., *Perpusaria epibryon*, *Psoroma* sp. and *Leptogium puberulum* were present.

The sociation occurred between 3 and 32m above sea level, being most common below 10m (80% of the stands). One stand was found (52 at 32m height), the only one in which *Hypnum revolutum* was associated, the others being located near the sea shore line up to 100m away and inland.

3.2.2 – *Sanionia uncinata* – *Calliergon sarmentosum* Sociation

This sociation was found in 8 sites (Table II), but in another 8, *Calliergon* had higher cover value and are treated as a separate sociation (see 3.2.3 and Table III).

In the *Sanionia uncinata*-*Calliergon sarmentosum* Sociation, both species occur in 7 stands. The cover of *Sanionia* is greater than that of *Calliergon* (+ to 5) in each site, ranging from 1 to 5.

Among the other mosses present in the sociation, *Bryum* spp. were the commonest (in 50% of stands). *Hypnum revolutum*, *Polytrichum alpinum* and *P. juniperinum* and *Calliergidium austrostramineum* occurred in three different sites.

The average altitude of the sociation is 15.5m, ranging from 4 to 30.

Among the lichens, in area 23 only saxicolous-crustose species were present. In area 41, 8,3% of the total quadrats (5 from 60) had muscicolous lichens (*Cystocoleus niger*), with cover ranging from 5 to 18%. In site 54, *Leptogium puberulum* (muscicolous) was present, occurring only in 2 quadrats, 2% of cover in both. This indicates that the sociation is relatively pure with only small amounts of parasites.

Algae were present in stands 10, 23 and 41; in the former, *Prasiola crispa* was present.

3.2.3 – *Calliergon sarmentosum* – *Sanionia uncinata* Sociation

This sociation is represented by 8 stands, being comparable to the *Sanionia uncinata*-*Calliergon sarmentosum* sociation. Here, *Calliergon* cover and presence classes are higher than that of *Sanionia* (Table III).

Bryum spp. were present in four stands, but with a low cover (+–2) and presence (I). *Bartramia patens* and *Pohlia cruda* appeared in three

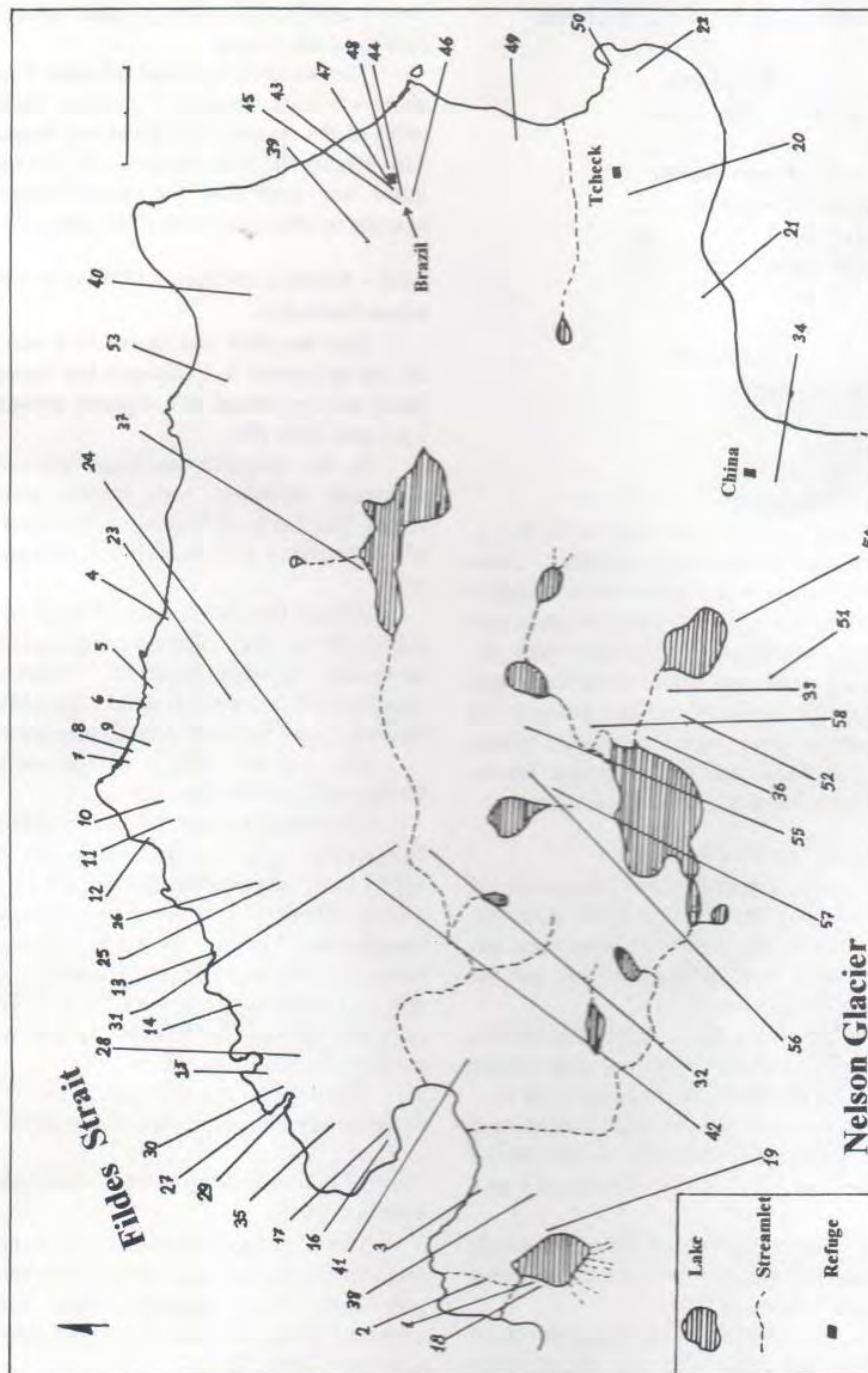


Fig. 2 — Rip Point, Nelson Island, showing the sites (numbered) where phytosociological data were obtained. (Tables I-VI).

TABLE I
Species composition and phytosociological data of the *Sanionia uncinata* Sociation. The degree of cover is given within four quadrats in each site.

Site	4	5	11	12	14	16	18	21	22	30	34	47	48	49	52
Number of quadrats	50	100	10	50	30	50	20	70	70	20	50	20	20	40	15
Altitude (m)	04	03	25	05	04	05	06	07	06	05	07	09	09	12	32
<i>Sanionia</i>	5355	5554	1211	5555	5343	5455	1223	5543	4555	3234	5554	5555	3225	3234	5545
<i>S. uncinata</i>	V	V	IV	V	V	V	V	V	V	V	V	V	V	V	V
<i>Bryum</i>	++++	1+11	—	++++	—	++++	—	—	+++1	—	+++1	+++1	+12+	11+1	++2+
<i>B. spp.</i>	I	I	—	I	—	I	—	—	II	—	I	I	II	II	I
<i>Calliergon</i>	—	—	1+++	1+1+	—	—	—	++33	++2+	—	—	—	+++3	++3+	—
<i>C. sarmentosum</i>	—	—	I	I	—	—	—	I	I	—	—	—	II	II	—
<i>Tortula</i>	—	1+++	—	—	—	—	—	—	+1++	+1+2	—	—	—	++++	—
<i>T. saxicola</i>	—	I	—	—	—	—	—	—	II	I	—	—	—	I	—
<i>Pottia</i>	—	—	—	—	—	—	—	—	—	11++	—	—	—	—	—
<i>P. spp.</i>	—	—	—	—	—	—	—	—	—	II	—	—	—	—	—
<i>Polytrichum</i>	—	+++1	++21	—	—	—	—	—	—	++31	—	—	—	++2+	—
<i>P. alpinum</i>	—	I	III	—	—	—	—	—	—	II	—	—	—	I	—
<i>Ceratodon</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	+1++	—
<i>C. spp.</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	I	—
<i>Bartramia</i>	—	—	—	—	—	—	—	—	+++1	—	—	—	—	+++1	—
<i>B. patens</i>	—	—	—	—	—	—	—	—	I	—	—	—	—	I	—
<i>Hypnum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+++1
<i>H. revolutum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	II
<i>Prasiola</i>	—	—	—	+++1	2322	—	—	—	—	12+1	—	—	—	—	—
<i>P. crispa</i>	—	—	—	I	IV	—	—	—	—	II	—	—	—	—	—
Other	—	—	—	—	—	—	—	+++1	—	—	—	—	—	—	—
Algae	—	—	—	—	—	—	—	I	—	—	—	—	—	—	—
Lichens	121+	+1+1	4555	—	—	—	3343	+1+3	3+1	331+	11++	+1+1	+1++	—	—
	III	III	V	—	—	—	V	III	II	IV	I	III	II	—	—

and two sites, respectively, both also with low cover (+-1) and presence (I).

In site 55, *H. revolutum* occurred with the same presence class (III) as *Calliergon sarmentosum* and *Sanionia uncinata*, giving rise to a *Calliergon sarmentosum-Hypnum revolutum-Sanionia uncinata* Sociation, since the cover of the three species was 1-5, (+-5) and (+-4), respectively. The same species occurred in site 58, but with lower and insignificant percentages.

Lichens were present in 4 sites. In stands 24, 31 and 58 only saxicolous species were present. In 51, *Leptogium puberulum* (muscolous) occurred, but only in one square and with total cover of 20%.

Algae had low percentages in five stands (19, 24, 31, 37 and 58), in which a good water supply was present. *Prasiola crispa* occurred only in stand 37.

TABLE II
Species composition and phytosociological data of the *Sanionia uncinata* – *Calliergon sarmentosum* Sociation. The degree of cover is given within four quadrats in each site.

Site	1	2	3	10	15	23	41	54
Number of quadrats	30	300	40	90	20	20	60	20
Altitude (m)	07	06	04	29	05	28	15	30
<i>Sanionia</i>	5555	4513	5213	5553	3355	3343	4125	3153
<i>S. uncinata</i>	V	V	V	V	V	V	V	IV
<i>Calliergon</i>	+211	++53	2+53	2++3	3311	3+11	2+41	3+12
<i>C. sarmentosum</i>	III	III	III	III	III	IV	III	III
<i>Bryum</i>	—	1+++	+1++	—	—	1+++	++1+	—
<i>B. spp.</i>	—	I	I	—	—	I	I	—
<i>Hypnum</i>	—	—	—	—	—	—	2+++	—
<i>H. revolutum</i>	—	—	—	—	—	—	I	—
<i>Polytrichum</i>	—	—	+1++	—	—	—	—	—
<i>P. spp.</i>	—	—	I	—	—	—	—	—
<i>Calliergidium</i>	—	—	—	++2+	—	—	—	—
<i>C. austrostramineum</i>	—	—	—	I	—	—	—	—
<i>Prasiola</i>	—	—	—	+1++	—	—	—	—
<i>P. crispa</i>	—	—	—	I	—	—	—	—
Other	—	—	—	—	—	+43+	++++	—
Algae	—	—	—	—	—	III	I	—
Lichens	—	—	—	—	—	+1+3	+3++	+1++
	—	—	—	—	—	II	I	I

Site 19 was located around the northeast side of the lake no. 1, which receives water directly from the glacier and ends in the southern part of the area.

Site 24 covered about 80×60 (+–)m field, which is continuous to the west, being here and there intermixed with muscicolous lichen communities. Site 31 was located near a small stream which originates from the lake 1, being crossed by small water streams originating from ice melted further north.

Site 37 is a large carpet located at the northern part of lake 1. It is crossed by a small stream originating in lake no. 4 and from ice melted around

this lake to the north (persisting during almost all the summer season). The presence of skuas breeding in this site may explain the presence of *Prasiola crispa*.

Site 51 begins near one intrusion covered by *Usnea* spp. and *Himantormia lugubris* near Hauser Mountain at the southern part of Rip Point near the edge of the Nelson Glacier. It follows the southern side of a small stream originating from glacier and which flows to lake 3.

Site 53 is located around two small streams formed from ice fields to the south. It is a large and thick carpet of about 100m².

Site 55 and 58 are close together, located in the site delimited by lakes 1, 4 and 2. Stand 58 is a

TABLE III
Species composition and phytosociological data of the *Calliergon sarmentosum* – *Sanionia uncinata* Sociation. The degree of cover is given within four quadrats in each site.

Site	19	24	31	37	51	53	55	58
Number of quadrats	20	20	20	30	40	45	20	30
Altitude (m)	07	50	34	70	59	26	36	34
<i>Calliergon</i>	3533	3535	5334	4533	4+45	5341	2115	554+
<i>C. sarmentosum</i>	V	V	V	V	IV	V	III	V
<i>Sanionia</i>	4243	1+++	1133	2+42	323+	24+3	+4++	+213
<i>S. uncinata</i>	V	II	IV	III		IV	III	IV
<i>Bryum</i>	—	++1+	12++	—	—	++12	—	++++
<i>Bryum</i> spp.		I	I			I		I
<i>Hypnum</i>	—	—	—	—	—	—	2+51	+++1
<i>H. revolutum</i>							III	I
<i>Bartramia</i>	—	—	—	—	—	++1+	++1+	++1+
<i>B. patens</i>						I	I	I
<i>Pohlia</i>	—	—	—	—	—	—	++1+	+++1
<i>P. cruda</i>							I	I
<i>Prasiola</i>	—	—	—	+1++	—	—	—	—
<i>P. crispa</i>				I				
Other	++++	++31	+2++	++11	—	—	—	++++
Algae	I	II	II	I				I
Lichens	—	3+12	23++	—	+2++	—	—	++++
		I	II		I			II

carpet, ca. 50m², and both occur in a very wet site following and being crossed by small streams.

This sociation prefers very wet places, adjacent to the small streams, around lakes or water supplies originating from ice melted in the ice deposits.

3.2.4 – *Sanionia uncinata* – *Bryum* spp. Sociation

This sociation is found in 4 sites as shown in Table IV. All occur at low heights, between 5 and 6m above sea level, and near the shore line.

Stand 7 is located near Canela Point (east side), which has a petrel (*Macronectes giganteus*) breeding colony and where penguins rest. The

Sanionia uncinata carpet is mixed with large *Bryum pseudotriquetrum*, but with no *Bryum orbiculatifolium* present. Among the lichens, only muscicolous taxa were present, especially *Cladonia* spp., *Ochrolechia frigida* and *Sphaerophorus globosus*.

Stand 13 is located on an extensive flat beach, which receives large amounts of bird excrements brought by the wind from the breeding point of Rip Point and from penguin moulting sites. This excrement has caused the death of much of the carpet of *Sanionia* and of the tufts of *Bryum* spp., which explains their low percentage presence and cover. No lichens were present.

TABLE IV
Species composition and phytosociological data of the *Sanionia uncinata* – *Bryum* spp. Sociation. The degree of cover is given within four quadrats in each site.

Site	7	13	50	8
Number of quadrats	20	20	25	10
Altitude (m)	06	05	06	05
<i>Sanionia</i>	5355	3++5	5512	5532
<i>S. uncinata</i>	V	II	V	V
<i>Bryum</i>	2221	42+1	+154	1++5
<i>B. pseudotriquetrum?</i>	IV	II	III	IV
<i>Tortula</i>	—	—	1111	—
<i>T. saxicola</i>	—	—	II	—
<i>Bryum</i>	—	—	++11	—
<i>B. orbiculat.</i>	—	—	II	—
<i>Prasiola</i>	—	—	++++	—
<i>P. crispa</i>	—	—	I	—
<i>Deschampsia</i>	—	—	—	1+++
<i>D. antarctica</i>	—	—	—	I
Lichens	2332	—	—	—
	V	—	—	—

Stand 50 is at the southern end of Frantz Bay. The site is a breeding site and feeding place (large deposits of *Nacella* shells cover the ground) of gulls (*Larus dominicanus*). *Bryum orbiculatifolium* occurs in this sociation, associated to *Bryum pseudotriquetrum*. *Prasiola crispa* is present also, because of the bird excrement present in the area. Small streams cross the stand.

Site 8 has large cushions of *Bryum*, and a small amount of *Deschampsia antarctica* is present.

3.2.5 – Other Sociations

In addition to the sociations discussed above, another 20 were reconised at Rip Point (Tables V and VI). Some features of each are briefly discussed below, using the corresponding letter of the Tables.

A – *Bryum orbiculatifolium* – *Sanionia uncinata* – *Bryum* sp. – *Tortula saxicola* Sociation

This sociation was found in site 6, at 3-8m high above sea level. Close by, there are breeding colonies of *Macronectes*, *Daption* and *Larus*. *Bryum orbiculatifolium* is the dominant species. There are small cespedes of *Deschampsia antarctica* among the mosses, reaching 0.5 meter in diameter. No lichens were associated. The formation is crossed by small streams.

B – *Polytrichum alpinum* – *Sanionia uncinata* Sociation

It is found in sites 9 and 33. Stand 9 is located near the sea shore at 10m above sea level, and is dominated by *Polytrichum alpinum* turfs surrounded by *Sanionia uncinata* carpets. The formation is also colonized by muscicolous lichens, as for example, *Sphaerophorus globosus*, *Ochrolechia frigida*, *Cladonia* spp. which are the commonest. Stand 33 is located inland, at 33m above sea level at an elevation between lakes 3 and 2. Here, the muscicolous lichens are also common and abundant, with the same species cited in site 9. All the sociation is surrounded by saxicolous lichen communities (dominated especially by *Usnea* spp.). *Andreaea regularis* and *A. gainii* are also present, but are scarce.

C – *Schistidium* spp. – *Sanionia uncinata* Sociation

This sociation is found in large rocky plateaux, adjacent to a *Sanionia uncinata* carpet but up to 2m from above it. The saxicolous *Schistidium rivulare* and *S. hyalino-cuspidatum* occur with high cover, intermixed with *S. uncinata* and crustose lichens. Among the latter, are *Acarospora macrocyclos*, *Buellia* spp., *Lecania brialmotii*, *Usnea antarctica* and others. Birds occasionally use some of the rocks as perches, excrement and shells were noted and the lichens are nitrophilous species. The water supply comes from precipitation only. These two factors are the most important in influencing the composition of the sociation.

D – *Hypnum revolutum* – *Bartramia patens* Sociation

This is an unusual community, since it is an association between an acrocarpic and a pleurocarpic moss. It is located near the Czech Republic

TABLE V
Species composition and phytosociological data of 11 sociations found in Rip Point.
The degree of cover is given within four quadrats in each site.

Sociation	A	B	B	C	D	E	F	G	H	I	J
Site	6	9	33	17	20	25	26	27	28	29	32
Number of quadrats	40	60	14	10	30	15	10	05	10	10	20
Altitude (m)	04	10	33	05	28	69	56	05	06	05	30
<i>Sanionia</i>	+2++	3224	3222	21++	++32	2422	+142	1+21	4444	+12+	1111
<i>S. uncinata</i>	III	V	V	IV	II	V	IV	IV	V	III	III
<i>Bryum</i>	+2++	—	—	—	++++	—	++++	—	—	+1++	—
<i>B. spp.</i>	III	—	—	—	I	—	II	—	—	II	—
<i>Bryum</i>	5233	—	—	—	—	—	+411	—	—	—	—
<i>B. orbiculat.</i>	V	—	—	—	—	—	III	—	—	—	—
<i>Polytrichum</i>	—	4332	3333	—	—	1+++	—	—	—	—	++++
<i>P. alpinum</i>	—	V	V	—	—	II	—	—	—	—	I
<i>Calliergidium</i>	++32	—	—	—	—	—	+++3	—	—	—	—
<i>C. austrostra.</i>	III	—	—	—	—	—	IV	—	—	—	—
<i>Tortula</i> sp.	++++	—	—	—	++++	—	+113	—	—	1244	—
	III	—	—	—	I	—	III	—	—	V	—
<i>Andreaea</i>	—	—	+++1	—	—	+12+	—	—	—	—	+++1
	—	—	I	—	—	III	—	—	—	—	III
<i>Schistidium</i>	—	—	—	1152	—	—	++++	11+1	—	—	++++
	—	—	—	V	—	—	II	IV	—	—	I
<i>Hypnum</i>	—	—	—	—	5534	—	—	—	—	—	—
<i>H. revolutum</i>	—	—	—	—	V	—	—	—	—	—	—
<i>Bartramia</i>	—	—	—	—	11+2	—	—	—	—	—	—
<i>B. patens</i>	—	—	—	—	III	—	—	—	—	—	—
<i>Pohlia</i>	—	—	—	—	11++	1+++	—	—	—	—	—
<i>P. cruda</i>	—	—	—	—	II	I	—	—	—	—	—
<i>Calliergon</i>	—	—	—	—	—	—	2+++	—	—	—	—
<i>C. sarmentosum</i>	—	—	—	—	—	—	II	—	—	—	—
<i>Distichum</i>	—	—	—	—	—	—	++12	—	—	—	—
<i>D. capillaceum</i>	—	—	—	—	—	—	III	—	—	—	—
<i>Tortula</i>	—	—	—	—	—	—	—	21+1	—	5422	—
<i>T. princeps</i>	—	—	—	—	—	—	—	IV	—	V	—

TABLE V (Continuation)

Sociation	A	B	B	C	D	E	F	G	H	I	J
Site	6	9	33	17	20	25	26	27	28	29	32
Number of quadrats	40	60	14	10	30	15	10	05	10	10	20
Altitude (m)	04	10	33	05	28	69	56	05	06	05	30
<i>Pottia</i>	—	—	—	—	—	—	—	—	2222	—	++++
<i>P. spp.</i>	—	—	—	—	—	—	—	—	V	—	II
<i>Brachythecium</i>	—	—	—	—	—	—	—	—	—	+++1	—
<i>B. austro-sal.</i>	—	—	—	—	—	—	—	—	—	I	—
<i>Dicranoweisia</i>	—	—	—	—	—	—	—	—	—	—	+1+1 III
<i>Deschampsia</i>	+++3 II	—	—	—	—	—	—	—	—	—	—
Lichens	—	2315 V	2332 V	4523 V	—	3345 V	5+++ IV	5555 V	2222 V	111+ III	2333 V
Algae	—	—	—	—	++2+ II	—	++++ II	—	—	—	—

A = *Bryum orbiculatifolium* – *Sanionia uncinata* – *Calliergidium austrostramineum* – *Bryum* sp. – *Tortula saxicola* Sociation. B = *Polytrichum alpinum* – *Sanionia uncinata* Soc. C = *Schistidium* – *Sanionia uncinata* Soc. D = *Hypnum revolutum* – *Bartramia patens* Soc. E = *Sanionia uncinata* – *Andreaea* Soc. F = *Sanionia uncinata* – *Calliergidium austrostramineum* – *Tortula saxicola* – *Bryum orbiculatifolium* – *Distichium capillaceum* Soc. G = *Tortula princeps* – *Sanionia uncinata* – *Schistidium* Soc. H = *Sanionia uncinata* – *Pottia austrogeorgica* Soc. I = *Tortula princeps* – *Sanionia uncinata* – *Tortula* sp. Soc. J = *Sanionia uncinata* – *Dicranoweisia* sp. – *Andreaea* Soc.

Station, at 28m altitude, along a small stream, which dries in late summer. *Hypnum revolutum* is the most abundant and frequent species, with lower cover of *Bartramia patens*. Small and infrequent tufts or cushions of other species are also present, but they are not significant; several are important in adjacent sociations.

E – *Sanionia uncinata* – *Andreaea* Sociation

This sociation occurs in one stand (25) at 69m altitude; skuas breed in the area. Many muscicolous lichens occur among the two moss species, and become locally dominant. The most important are *Usnea fasciata*, *Himantormia lugubris*, *Sphaerophorus globosus*, *Caloplaca* spp., *Psoroma* spp. and *Ochrolechia*. No snow remains at this site in December, restricting the water supply eventually to precipitation. The *Andreaea* occurs among the *Sanionia* carpets on

small rocks and gives a characteristic color to the sociation. The presence of rocks also makes possible the coexistence of saxicolous lichens.

F – *Sanionia uncinata* – *Calliergidium austrostramineum* – *Tortula saxicola* – *Bryum orbiculatifolium* – *Distichium capillaceum* Sociation

This occurs at 56m altitude, between two east-west running slopes and receiving water from them. This sociation is recognized by the presence of *Distichium capillaceum* among the *Sanionia-Calliergidium* carpet and *Bryum* and *Tortula* cushions.

G – *Tortula princeps* – *Sanionia uncinata* – *Schistidium* Sociation

This occurs at 5m altitude and receives altitude water sprayed from the waves and fresh water dropped from the steep slope at the southern

TABLE VI
Species composition and phytosociological data of 10 Sociations found in Rip Point.
The degree of cover is given within four quadrats in each site.

Sociation	K	L	M	M	N	N	O	P	Q	R	S	T
Site	35	36	38	45	39	56	40	42	43	44	46	57
Number of quadrats	05	10	05	10	50	40	05	20	30	30	30	25
Altitude (m)	120	30	15	24	30	36	43	39	15	17	23	36
<i>Sanionia</i>	2131	—	1+22	3111	+12+	++++	—	—	2233	2+42	—	4311
<i>S. uncinata</i>	V	—	IV	II	I	II	—	—	V	V	—	V
<i>Bryum</i>	—	—	—	—	++++	—	—	—	3432	++23	1231	—
<i>B. spp.</i>	—	—	—	—	I	—	—	—	V	IV	V	—
<i>Polytrichum</i>	+2++	—	—	—	—	—	—	—	—	—	—	1121
<i>P. alpinum</i>	III	—	—	—	—	—	—	—	—	—	—	V
<i>Polytrichum</i>	—	—	5433	3444	—	—	—	—	—	—	—	—
<i>P. piliferum</i>	—	—	V	V	—	—	—	—	—	—	—	—
<i>Tortula</i> sp.	—	5555	—	—	—	—	—	—	—	—	—	—
<i>T. princeps</i>	—	V	—	—	—	—	—	—	—	—	—	—
<i>Calliergon</i>	—	—	—	—	5555	5355	—	—	—	43+1	—	—
<i>C. sarmentosum</i>	—	—	—	—	V	III	—	—	—	V	—	—
<i>Schistidium</i>	—	—	—	—	—	++++	—	—	—	—	—	—
	—	—	—	—	—	I	—	—	—	—	—	—
<i>Pohlia</i>	—	—	—	—	—	++++	++++	++1+	—	+1++	—	—
<i>P. cruda</i>	—	—	—	—	—	I	I	I	—	I	—	—
<i>Bartramia</i>	—	—	—	—	—	++++	—	—	—	—	1+++	++++
<i>B. patens</i>	—	—	—	—	—	I	—	—	—	—	II	I
<i>Hypnum</i>	—	—	—	—	—	—	—	4354	—	—	—	—
<i>H. revolutum</i>	—	—	—	—	—	—	—	V	—	—	—	—
<i>Tortula</i>	—	—	—	—	—	—	—	—	112+	+++1	+1+1	—
<i>T. saxicola</i>	—	—	—	—	—	—	—	—	V	I	IV	—
<i>Calliergidium</i>	—	—	—	—	—	—	—	—	+++2	++++	5435	—
<i>C. austrostram.</i>	—	—	—	—	—	—	—	—	I	I	V	—
<i>Andreaea</i>	1112	—	—	++1+	—	++++	3344	—	—	—	—	1121
<i>A. spp.</i>	V	—	—	II	—	I	V	—	—	—	—	IV
Lichens	4545	1111	1333	2233	—	++++	1224	11++	11++	++2+	—	3444
	V	V	V	V	—	I	V	III	III	II	—	V
Algae	—	++11	—	—	+1++	+3++	—	+2++	++++	—	—	—
	—	II	—	—	I	I	—	II	I	—	—	—

K = *Sanionia uncinata* – *Andreaea* spp. – *Polytrichum alpinum* Sociation. L = *Tortula princeps* Soc. M = *Polytrichum piliferum* – *Sanionia uncinata* Soc. N = *Calliergon sarmentosum* Soc. O = *Andreaea gainii* Soc. P = *Hypnum revolutum* Soc.
Q = *Sanionia uncinata* – *Tortula saxicola* – *Bryum* spp. Soc. R = *Calliergon sarmentosum* – *Sanionia uncinata* – *Bryum* spp. Soc. S = *Calliergidium austrostramineum* – *Bryum* spp. – *Tortula saxicola* Soc. T = *Sanionia uncinata* – *Polytrichum alpinum* – *Andreaea* spp. Soc.

side and which forms the Hebert Point, with colonies of *Daption capense*. These combinations help in the structure of this community, dominated by *Tortula princeps* and *Sanionia uncinata*. The presence of rocks at low depths permits the appearance of *Schistidium* sp., which presents a good cover and presence class. Crustose nitrofilous lichens are also present, as *Usnea antarctica*, *Xanthoria candelaria*, *Umbilicaria* sp. and others.

H – *Sanionia uncinata* – *Pottia austrogeorgica* Sociation

In this sociation, located at 6m altitude, there are small streams crossing the carpet of *Sanionia uncinata* which originates from a permanent ice deposit. The large percentages of presence and cover of *Pottia austrogeorgica* gives to this sociation a characteristic different from the other discussed above. There are some rocks up to 5cm diam. rocks intermixed and also some patches of dead mosses. The presence of some amounts of bird excrements cause the death of the mosses.

I – *Tortula princeps* – *Sanionia uncinata* – *Tortula* sp. Sociation

The proximity of this sociation with G explains its similarities. The presence of a second *Tortula* species makes the difference. Some cushions of *Bryum* sp. are also present, together with nitrofilous crustose and fruticulose lichens.

J – *Sanionia uncinata* – *Dicranoweisia* sp. – *Andreaea* Sociation

The presence of *Dicranoweisia* makes this sociation different from *S. uncinata*-*Andreaea* Sociation (E). It occurs at 30m altitude, at the southern side of middle Rio Grande do Norte Small stream, on a sandy soil deposit.

K – *Sanionia uncinata* – *Andreaea* spp. Sociation

This sociation occurs at the highest place of Rip Point at the West side, receiving direct impact of the dominant western winds. This particular sociation is mixed with a muscicolous lichen community. Representatives of it are the following species: *Himantormia lugubris*, *Psoroma hypnorum*, *Stereocaulon* sp., *Hypogimnia lugubris*, *Sphaerophorus globosus*.

L – *Tortula princeps* Sociation

It is located inland (30m altitude), on an elevation at the mouth of the small stream coming

from lake 3 into lake 2. *Tortula princeps* is the only moss species present, occurring intermixed with some saxicolous lichens like *Usnea antarctica*, *Caloplaca* spp., *Buellia* spp. and others. *Prasiola crispa* was also found. This sociation occurs on the top (10 square meters) of a small elevation, being characterised by the brightness of the piliferous leaves tips. It is normally visited by skuas, receiving some excrements.

M – *Polytrichum piliferum* – *Sanionia uncinata*

It is found in two sites, 38 at 15m high and 45 at 24m altitude, at opposite sides in Rip Point: one on the East side and other on the West side, practically with the same distance from the sea. This compact community has muscicolous lichens as associates, as *Pertusaria hepibryon* and *Ochrolechia* sp. on stand 38, and *Leptogium puberulum*, *Cladonia* spp. and *Cystocoleus niger* in stand 45.

N – *Calliergon sarmentosum* Sociation

Found in stands 39 and 56, this sociation is composed mainly of *Calliergon sarmentosum* carpets. In 39 at 30m high, no other association was found beyond *S. uncinata* and some algae. In 56 at 36m high, there was found *S. uncinata*, *Schistidium*, *Bartramia patens*, *Pohlia cruda*, lichens and algae, but at low percentages.

O – *Andreaea gainii* Sociation

Found in stand 40 at 43m high, this sociation has as associates only *Pohlia cruda* and lichens (unidentified).

P – *Hypnum revolutum* Sociation

Found in a very wet place, at 39m high, inland, this sociation is composed of *Hypnum revolutum* intermixed here and there only by saxicolous lichens, occurring on stones up to 10cm diam., and *Pohlia cruda* var. *imbricata*, which appeared in 2 quadrats with low percentages.

Q – *Sanionia uncinata* – *Tortula saxicola* – *Bryum* spp.

Is found in site 43 at 15m high, being formed by those three moss species associated to *Leptogium puberulum*. *Calliergidium austrotramineum* appeared in two quadrats, but with low percentages.

R – *Calliergon sarmentosum* – *Sanionia uncinata*
– *Bryum* spp. Sociation

The stand 44 at 17m high is formed by this sociation, which has *Leptogium puberulum*, *Calliergidium austrostramineum* and *Tortula saxicola* as associates.

S – *Calliergidium austrostramineum* – *Bryum* spp.
– *Tortula saxicola*

Found in stand 46 at 23m high, this sociation is a transition between those reported at the site around Cruls Refuge (Brazil), especially from "R", discussed above. *Bartramia patens* is present too, but no lichen species was found. It occurs at a flat site, with fine sandy soil, being characterised by the yellowish appearance of the predominant moss.

T – *Sanionia uncinata* – *Polytrichum alpinum*
– *Andreaea* spp.

Found in stand 57 at 36m high, near lake 4, this is another characteristic community, ca. 100m square. Lots of muscicolous lichens are found on the moss components of the sociation, especially *Humantormia lugubris*, *Pannaria hookerii*, *Usnea fasciata*, *Ochrolechia* sp., *Cystocoleus niger*,

Cladonia spp. etc. *Bartramia patens* was found in one square, being rare.

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SUMMARY

The phytosociology of the moss vegetation in the northern ice-free areas of Nelson Island (South Shetland Islands, Antarctica) was investigated during the 1980/90 and 1994/95 summer seasons. A total of 33 moss species were recorded, and 25 communities recognized. These are described and the possible causes for their distribution in the area are discussed.

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