

A lichen species list for Motu Kaikoura, Fitzroy Harbour, Great Barrier Island

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Introduction

Motu Kaikoura (Kaikoura Island) is a 535 ha island off the coast of Great Barrier Island, North Island, New Zealand. The island was purchased by the Crown in 2004 as a reserve. The island has been heavily modified by farming, fires, bush clearances and the impacts of exotic mammals such as fallow deer (*Dama dama*), ship rats (*Rattus rattus*) and cats (*Felis catus*). The vegetation of the island is now dominated by tea tree (*Kunzea* and *Leptospermum*), small patches of broadleaf forest and bare rocky areas (Cameron 2007). A number of vegetation surveys since 2006 recorded a total of 381 species of higher plants (68% native), but bryophytes were not systematically studied (Cameron 2007), and lichens and fungi were not studied at all. Only one specimen (*Stereocaulon ramulosum* (AK283628)) was found in the Auckland Museum herbarium (AK), collected by Jonathan Boow and Bec Stanley in 2003.

Fallow deer have had perhaps the greatest impact on the vegetation of the island, having been present since the 1930s (Cameron 1995) and were estimated to have reached numbers as high as c. 360 individuals (Cameron 2007). Deer were eradicated by shooting, but a recent attempt to eradicate rats failed. However, rats continue to be controlled through trapping and poisoning. A number of permanent quadrats have been set up on Motu Kaikoura to monitor any changes in the vegetation after pest removal, but this has not included monitoring of lichen cover. While it is clear that the deer had a serious impact on the higher plants, it is not clear what, if any, impact they had on lichens. There is limited information available on the prevalence of lichens in the diet of fallow deer in New Zealand. Nugent (1990) found that fallow deer ate significant quantities of fungi and lichens in beech forests in Otago, particularly species of *Usnea*. He commented that the use of lichen may indicate "poor quality habitat". Forsyth et al. (2002) studied the diet preferences of introduced ungulates in New Zealand and found that some lichens (*Pseudocyphellaria* and *Usnea*) were preferred, while others like *Cladonia* and *Stictia* species were avoided by fallow deer or red deer (*Cervus elaphus*).

For this reason, the Motu Kaikoura Trust and Unitec Faculty of Social and Health Sciences funded four trips (July and December 2008, December 2009 and 2010) to the island to catalogue the lichen diversity (see Appendix) and investigate any changes to the lichens after the removal of the deer.

Area surveyed

Over the four trips, most of the island was surveyed, with particular emphasis on the area around the lodge, the pine forest and kanuka forest between the lodge and airstrip, the airstrip, the scrub, around the airstrip, the forested gully up from Houseboat Bay, the Ngati Rehua track, Taraire Valley, Bradshaw Cove, Waitetuna Bay, track to Mt Overlook and the track from there back to the lodge. Six permanent quadrats (Fig. 1) were also set up on rocky substrates between the lodge and Taraire Valley and within Taraire Valley. Ten kanuka trees in the upper part of Taraire Valley were surveyed with horizontal quadrats (relevé). These quadrats will be monitored annually for any changes to lichen diversity or cover.



Fig. 1. Map of the island showing the quadrat sites. (created by G. Aguilar).

Lichens of the general habitats visited

(modified from Cameron 2007)

Badlands/scrub

The badlands are poor in lichens, with only sparse small thalli of *Menegazzia neozelandica* and *Parmelina labrosa* on the twigs of kanuka (*Kunzea ericoides*), manuka (*Leptospermum scoparium*) and *Hakea* spp. Small white patches of the soil crust *Baeomyces heteromorphus* can be seen on eroded banks, although not usually with their characteristic lolly-pink fruiting structures. Scattered speckles of *Stereocaulon vesuvianum* are present on andesite boulders. Very occasional clumps of the red and white *Cladonia floerkiana* can be found on clay soil in sheltered spots (Fig. 2).

Kanuka forest and scrub

The kanuka forest and associated scrub are also poor in lichens, with only a few species found on the trunks

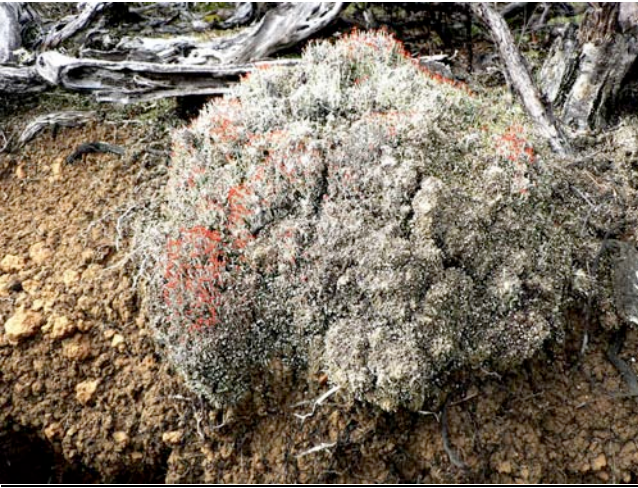


Fig. 2. *Cladonia floerkiana*, track between airstrip and Mt Overlook, July 2008. All Photos D. J. Blanchon.



Fig. 3. Fruiting *Pseudocyphellaria* species on a kanuka, upper Taraire Valley, December 2008.



Fig. 4. *Sticta*, kanuka trunk, upper Taraire Valley, July 2008.



Fig. 5. *Pseudocyphellaria poculifera*, on fallen branch in light gap, Taraire Valley, July 2008.



Fig. 6. *Strigula delicata* on fallen taraire leaf, from Taraire Valley, December 2009.



Fig. 7. *Baeomyces heteromorphus*, shaded roadside banks between lodge and airstrip, July 2008.



Fig. 8. *Pseudocyphellaria carpoloma* on shaded bluff, Ngati Rehua track, July 2008.



Fig. 9. *Leprocaulon arbuscula* on volcanic breccia, Ngati Rehua track, July 2008.



Fig. 10. *Xanthoparmelia* species on top of inland bluff, Ngati Rehua track, July 2008.



Fig. 11. *Jackelixia ligulata* on coastal rocks below Mt Overlook, July 2008.



Fig. 12. Top House orchard, with plum tree festooned in lichens, July 2008.



Fig. 13. *Teloschistes flavicans* on plum tree in Top House orchard, July 2008.

and branches. In more sheltered sites, small thalli of *Parmelina labrosa*, *Menegazzia neozealandica* and occasional hanging fat tubes of *Hypogymnia subphysodes* are growing on branches and twigs. Green or brown clumps of *Cladia aggregata* are found in some of the light gaps. The white coral lichen (*Cladia retipora*) is only rarely present in some areas on soil, with a particularly good site above Houseboat Bay. It is possible that this usually common species was being eaten by deer. Rocks in shaded sites sometimes have patches of the bluish crustose *Porpidia albocaerulescens*, while those in the open are covered in species of *Heterodermia*, *Parmotrema* and *Xanthoparmelia*.

Broadleaf forest

Pockets of broadleaf forest in watersheds support the highest number of lichen species on the island, perhaps because of the shade and higher humidity but also the diversity of substrates available. The different bark types of taraire (*Beilschmiedia taraire*), kohekohe (*Dysoxylon spectabile*), pohutukawa (*Metrosideros excelsa*) and old kanuka (*Kunzea ericoides*), and the shaded bluffs and boulders all provide habitats quite different from the drier kanuka trunks elsewhere on the island. The trunks of taraire and kohekohe support mainly crustose lichens, including *Porina exocha*, but the greatest diversity can be found at the tops of the valleys on the trunks of mature kanuka. A range of large foliose lichens, particularly species of *Pseudocyphellaria* (Fig. 3), *Sticta* (Fig. 4), *Peltigera* and *Pannaria* are conspicuous. The bright yellow-green thalli of *Pseudocyphellaria aurata* and *P. poculifera* (Fig. 5) are reasonably common on trunks of kanuka in light gaps. Many of these species are also present on shaded rock faces, and the rock faces near the track in Taraire Valley are covered in unusually large sheets of the yellow-green *Porina exocha*. Fallen leaves of taraire are covered in silvery or green spots of the foliicolous (leaf-dwelling) lichen, *Strigula delicata* (Fig. 6).

Kauri-associated forest

The kauri forest (*Agathis australis*) was not visited by the authors, but pieces of bark were brought back to the lodge by Maureen Young and Alison Wesley. These supported a range of lichen species, including *Menegazzia aucklandica*, *Parmelia testacea*, *Parmotrema grayanum* and *P. reticulatum* and *Usnea rubicunda*.

Pine forest

Pine forest (*Pinus pinaster* and *P. radiata*) supports a reasonable range of lichens, with foliose lichens ranging from the small *Parmelinopsis afrorevoluta* to larger inflated thalli of *Hypogymnia subphysodes* and large paint-like patches of the leprose lichens such as the bright yellow *Chrysothrix candelaris*, dull yellow *Lepraria* cf. *eburnea* and grey-green *Lepraria incana*. A number of lichen species such as species of *Usnea*

and *Parmotrema* grow in the canopy and can be found on the ground after storms. The fruticose *Stereocaulon ramulosum* can be seen on exposed clay banks, and in some areas, large white patches of *Baeomyces heteromorphus*, with bright lolly-pink podetia (Fig. 7) can also be found.

Inland bluffs

The inland bluffs were noted as being botanically interesting by Cameron (2007), and the lichens found on these sites are similarly interesting. The sides of most of the bluffs are covered in mats of bryophytes and filmy ferns (particularly *Hymenophyllum sanguinolentum*) and they are also covered in an extensive range of lichens. The shadier parts support species of the large foliose *Pseudocyphellaria*, *Sticta* and *Peltigera* (Fig. 8), while sunnier spots have long strands of the fruticose lichens *Ramalina australiensis*, *Usnea rubicunda* and occasionally *Heterodermia leucomela*. Of most interest were the sites where the rarely collected *Leprocaulon arbuscula* could be found on shaded vertical bluffs of volcanic breccia (Fig. 9). The well-lit tops of the bluffs are covered in stunted brown clumps of *Cladia aggregata* and patches of species of *Xanthoparmelia* (Fig. 10), *Heterodermia*, *Cladonia* and *Parmotrema*.

Rocky outcrops

The exposed rocky outcrops were more difficult to reach, but when investigated they supported a range of *Xanthoparmelia*, *Parmotrema*, *Cladonia* species, *Heterodermia obscurata* and *Cladia aggregata*.

Stream margins

Most of the streams on the island were dry when visited in December, but the stream still flowing below the Top House plunged through a cut in the rocky cliff. This area supported moisture-loving cyanobacterial lichens such as *Pseudocyphellaria dissimilis* and *Leptogium denticulatum* and bluish patches of *Porpidia albocaerulescens*.

Rocky shore

The rocky beaches and cliffs support the bright orange *Jackelixa ligulata* (formerly *Xanthoria ligulata*) (Fig. 11) and white splashes of the "bird-dropping lichen" *Poeltiaria turgescens*. The grey *Phycia erumpens* can be found on rocks above the high-tide mark. Yellow spots of *Rhizocarpon geographicum* are rare. The fruticose *Ramalina australiensis* is not uncommon on the cliffs at several points around the island. The similar, but less common *R. meridionalis* was collected at Waitetuna Bay. This species is largely restricted to rocky peninsulas and islands off the east coast of Northland (Blanchon and Bannister 2002), and has been collected nearby at a number of sites on Great Barrier Island (e.g. Oruawharo Bay, AK 169325) and associated islands (e.g. Rakitu Island, AK 166151). On rocks below the high tide mark, the black marine lichen, *Lichina pygmaea* is locally abundant at most of the rocky bays.

Mangroves

Some large mangroves were found at Houseboat Bay. Few lichens were found, but the cyanobacterial *Leptogium aucklandicum* was reasonably common, as was the graphid *Thallocoma subvellata*.

Top House orchard

The orchard at the Top House supported a large number of lichen species. In particular, the two plum trees (*Prunus persica*) and the pear (*Pyrus communis*) had a range of typical orchard lichens growing on the trunks and branches (Fig. 12), with *Usnea rubicunda*, *Parmotrema reticulatum* and *Ramalina celastri* most abundant. More unusual was the presence of typical native forest lichens such as *Menegazzia neozelandica*, *Sticta martini*, *Heterodermia leucomela* and *Porina exocha*. The most interesting find was a clump of the bright orange *Teloschistes flavicans* (Fig. 13), which is uncommon on the mainland, although it can be found on other offshore islands.

Comparison with nearby islands

Hayward and Hayward (1986) recorded 247 lichen taxa from Great Barrier and adjacent islands, and their list included most of the lichens found on Motu Kaikoura. Smaller studies of parts of Great Barrier island, include that of Dakin and Galloway (1980),

who found 27 largely montane lichen species on Hirakimata (Mt Hobson), and Hayward and Hayward (1973), who reported 40 species from habitats near Whangaparapara. The most useful comparison is with Rakitu Island off the east coast of Great Barrier, where Hayward and Hayward (1982) reported 124 species from this 350 ha island. Motu Kaikoura is larger (535 ha), but to date we have only identified 114 species from the island. It is likely that Rakitu island has a larger lichen flora due to its more diverse and intact vegetation.

Conclusion

Despite the relatively small size of the island and the poor state of the vegetation, there were a high number of lichen species present. Some of the more unusual species seem to be restricted in their distribution. Particularly important habitats include the Top House orchard, broadleaf forest areas and shaded inland bluffs. Removal of the deer may result in the recovery of some lichens or recolonisation by others if they were in fact being eaten by the deer. Conversely, recovery by grasses and other vascular plants may impact negatively on soil and rock-dwelling lichens. In some of our quadrats this appears to be already the case (unpublished observations).

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Appendix: Motu Kaikoura lichen species list.

Compiled from collections made in July and December 2008, December 2009 and December 2010. Names follow Galloway (2007), with updates where appropriate.

Lichens	Voucher		
<i>Baeomyces heteromorphus</i>	Unitec 4584	<i>Candelariella vitellina</i>	Unitec 4160
<i>Buellia stellulata</i>	Unitec 4623	<i>Canoparmelia pustulescens</i>	Unitec 4090
<i>Calicium hyperelloides</i>	Unitec 4111	<i>Chrysothrix candelaris</i>	Unitec 3365
<i>Caloplaca acheila</i>	Unitec 4622	<i>Cladia aggregata</i>	Unitec 3188
<i>Caloplaca litoral</i>	Unitec 4157	<i>Cladia retipora</i>	Unitec 4575
		<i>Cladonia confusa</i>	Unitec 3362
		<i>Cladonia capitellata</i>	Unitec 4609

<i>Cladonia chlorophaea</i>	Unitec 4626	<i>Physcia erumpens</i>	Unitec 4566
<i>Cladonia floerkiana</i>	Unitec 4109	<i>Physcia poncinsii</i>	Unitec 4084
<i>Coccocarpia palmicola</i>	Unitec 3176	<i>Poeltiaria turgescens</i>	
<i>Collema kauaiense</i>	Unitec 3420	<i>Porina exocha</i>	Unitec 3163
<i>Degelia durietzii</i>	Unitec 4167	<i>Porpidia albocaerulescens</i>	Unitec 4601
<i>Dirinaria applanata</i>	Unitec 4100	<i>Pseudocyphellaria aurata</i>	Unitec 3154
<i>Flavoparmelia haywardiana</i>	Unitec 4081	<i>Pseudocyphellaria carpoloma</i>	Unitec 3155
<i>Fuscodermia limbatum</i>	Unitec 3395	<i>Pseudocyphellaria chloroleuca</i>	Unitec 3926
<i>Heterodermia chilensis</i>	Unitec 4565	<i>Pseudocyphellaria crocata</i>	Unitec 3149
<i>Heterodermia japonica</i>	Unitec 3184	<i>Pseudocyphellaria dissimilis</i>	Unitec 4567
<i>Heterodermia leucomela</i>	Unitec 3166	<i>Pseudocyphellaria haywardiorum</i>	Unitec 3356
<i>Heterodermia microphylla</i>	Unitec 3717	<i>Pseudocyphellaria montagnei</i>	Unitec 3388
<i>Heterodermia obscurata</i>	Unitec 3185	<i>Pseudocyphellaria multifida</i>	Unitec 3148
<i>Heterodermia speciosa</i>	Unitec 3916	<i>Pseudocyphellaria pickeringii</i>	Unitec 3391
<i>Hypogymnia subphysodes</i>	Unitec 4108	<i>Pseudocyphellaria poculifera</i>	Unitec 3152
<i>Jackelixia ligulata</i>	Unitec 4552	<i>Pseudocyphellaria rubella</i>	Unitec 3151
<i>Lecanora intumescens</i>	Unitec 4170	<i>Pseudocyphellaria wilkinsii</i>	Unitec 3167
<i>Lecidella elaeochroma</i>	Unitec 4103	<i>Punctelia borreri</i>	Unitec 4091
<i>Leiorreuma exaltatum</i>	Unitec 4101	<i>Punctelia perreticulata</i>	Unitec 3193
<i>Lepraria cf. eburnea</i>	Unitec 4557	<i>Punctelia subflava</i>	Unitec 3196
<i>Lepraria incana</i>	Unitec 4166	<i>Pyrenula sp.</i>	Unitec 4501
<i>Leprocaulon arbuscula</i>	Unitec 4155	<i>Pyxine subcinerea</i>	Unitec 4169
<i>Leptogium aucklandicum</i>	Unitec 4154	<i>Ramalina australiensis</i>	Unitec 3162
<i>Leptogium cyanescens</i>	Unitec 3187	<i>Ramalina celastri</i>	Unitec 4105
<i>Leptogium denticulatum</i>	Unitec 4568	<i>Ramalina meridionalis</i>	Unitec 4553
<i>Leptogium propaguliferum</i>	Unitec 4153	<i>Ramalina peruviana</i>	Unitec 3159
<i>Lichina pygmaea</i>	Unitec 3426	<i>Rhizocarpon geographicum</i>	Unitec 3414
<i>Megalaria maculosa</i>	Unitec 4093	<i>Stereocaulon corticatulum</i>	Unitec 3189
<i>Megalospora atrorubicans</i>	Unitec 4600	<i>Stereocaulon ramulosum</i>	Unitec 3418
subsp. <i>australis</i>		<i>Stereocaulon vesuvianum</i>	Unitec 4113
<i>Megalospora gompholoma</i>	Unitec 4590	<i>Sticta fuliginosa</i>	Unitec 3355
subsp. <i>gompholoma</i>		<i>Sticta lacera</i>	Unitec 3928
<i>Menegazzia aucklandica</i>	Unitec 4582	<i>Sticta latifrons</i>	Unitec 3378
<i>Menegazzia neozelandica</i>	Unitec 3198	<i>Sticta martinii</i>	Unitec 3195
<i>Pannaria araneosa</i>	Unitec 3497	<i>Sticta squamata</i>	Unitec 3423
<i>Pannaria crenulata</i>	Unitec 3174	<i>Sticta subcaperata</i>	Unitec 3361
<i>Pannaria immixta</i>	Unitec 3171	<i>Strigula delicata</i>	Unitec 4569
<i>Pannaria aff. patagonica</i>	Unitec 3172	<i>Strigula fossulicola</i>	Unitec 4572
<i>Pannaria subcrustacea</i>	Unitec 3175	<i>Teloschistes flavicans</i>	Unitec 3191
<i>Parmelia testacea</i>	Unitec 4579	<i>Teloschistes sieberianus</i>	Unitec 3192
<i>Parmelina conlabrosa</i>	Unitec 4088	<i>Teloschistes xanthorioides</i>	Unitec 4082
<i>Parmelina labrosa</i>	Unitec 4106	<i>Tephromela atra</i>	Unitec 4168
<i>Parmelinopsis afrorevoluta</i>	Unitec 4107	<i>Thallolema subvellata</i>	Unitec 4178
<i>Parmotrema austrocetratum</i>	Unitec 3180	<i>Thelotrema lepadinum</i>	Unitec 4092
<i>Parmotrema cetratum</i>	Unitec 3161	<i>Xathoparmelia australasica</i>	Unitec 4593
<i>Parmotrema crinitum</i>	Unitec 3168	<i>Xanthoparmelia furcata</i>	Unitec 3194
<i>Parmotrema grayanum</i>	Unitec 4578	<i>Xanthoparmelia isidiigera</i>	Unitec 4596
<i>Parmotrema mellissii</i>	Unitec 3922	<i>Xanthoparmelia scabrosa</i>	Unitec 3197
<i>Parmotrema perlatum</i>	Unitec 3911	<i>Xanthoparmelia verrucella</i>	Unitec 4595
<i>Parmotrema reticulatum</i>	Unitec 3181	<i>Usnea angulata</i>	Unitec 4554
<i>Parmotrema subtinctorum</i>	Unitec 3177	<i>Usnea rubicunda</i>	Unitec 4581
<i>Peltigera nana</i>	Unitec 3424		
<i>Pertusaria subplanaica</i>	Unitec 4576		