APPLIED ECOLOGICAL STUDIES OF SHORELINE VEGETATION AT LAKES MANAPOURI AND TE ANAU, FIORDLAND

PART 2: THE LAKE EDGE FLORA—HABITATS AND RELATIONS TO LAKE LEVELS

P. N. JOHNSON

Department of Botany, University of Otago, Dunedin

SUMMARY: At non-rocky sites on the shorelines of Lakes Manapouri and Te Anau floristic composition was recorded for one-foot intervals of elevation above and below lake level. Mean daily levels recorded since 1932 have been analysed to find the longest periods of submergence and emergence experienced at each level. A hypothesis that species distribution is governed by extremes of submergence and emergence is supported by the similar periods recorded at the limits of each species at both lakes. At rocky sites at Lake Manapouri the relationship between lake level fluctuation and species ranges is modified by exposure to wind and waves. The means by which species limits are determined by lake level fluctuation and the effect of the lake on reproductive biology are discussed. A full list of species is appended, with information on their habitats.

INTRODUCTION

The conspicuous horizontal zonation of plant communities and the limited vertical range of many species along the shorelines of Lakes Manapouri and Te Anau strongly suggest that natural variation in water level is the largest single factor affecting plant distribution.

With the prospect of new water level regimes being imposed on both lakes by the requirements of the hydro-electric scheme, it seemed desirable to determine species tolerance from a correlation of the vertical ranges of the lake-edge species with the periods of submergence and emergence over these ranges, calculated from daily records of lake levels over the past 38 years.

Ranges of common species on both non-rocky and rocky shores are here compared with lake levels and with exposure.

METHODS

Transects of indefinite width at right angles to the shoreline were surveyed with an abney level and staff to give a series of vertical and horizontal co-ordinates from the lake edge. Presence as mature plants (and, in the case of woody species, as seedlings) was recorded within each foot above and as far as possible below lake level. Elevations were later corrected to the nearest whole foot above mean sea level, using the lake level recorded on the day of study. Thus there is an error of up to one foot inherent in the method. Forty transects were completed on non-rocky shores (either beaches or sites where soil extends down to lake level) at Lake Manapouri, 46 on similar sites at Lake Te Anau and 23 on rocky shores at Lake Manapouri. Each transect was classified in the field as sheltered, moderately exposed or very exposed with respect to wind and wave action. Exposed stations faced mostly north-west or south over a large expanse of water.

The following pairs of species may have been confused in the field so are treated together and referred to hereinafter by the first named: *Gunnera dentata* and *G. arenaria*, *Haloragis depressa* and *H. micrantha*, *Myriophyllum propinquum* and *M. pedunculatum*. It is likely that *Isoetes alpinus* may include *I. kirkii*, *Hypsela rivalis* include *Pratia perpusilla*, and *Lilaeopsis ?orbicularis* and *Utricularia ?monanthos* include other species of the same genera.

TABLE 1. *Variation in the levels of Lakes Manapouri and Te Anau. All levels are above mean sea level.*

Lake	Manapouri	Te Anau
Time span	May 1932-Dec. 1969	May 1932-May 1971
Mean lake level	583.25ft (177.77m)	663.34ft (202.19m)
Highest level recorded	592.16ft (180.49m)	670.47ft (204.36m)
Lowest level recorded	577.16ft (175.92m)	658.98ft (200.86m)
Maximum fluctuation	15.00ft (4.57m)	11.49ft (3.50m)
Mean annual fluctuation	9.0ft (2.74m)	6.9ft (2.10m)

RESULTS

Lake Levels

Almost continuous lake level records have been taken near both lake outlets by the Ministry of Works since May 1932. Daily mean values from then till the time of study (December 1969 for Lake Manapouri; May 1971 for Lake Te Anau) have been analysed to give the values shown in Table 1 and Figure 1. Elevations are in feet or metres above mean sea level at Deep Cove (Lands & Survey 1961). Figure 1 shows the longest continuous periods of submergence and emergence recorded at each foot of lake fluctuation for both Lake Manapouri and Lake Te Anau. The changes in these values from one foot of elevation to the next are considerable, and the one foot possible error in the method should be borne in mind in interpreting the figure.

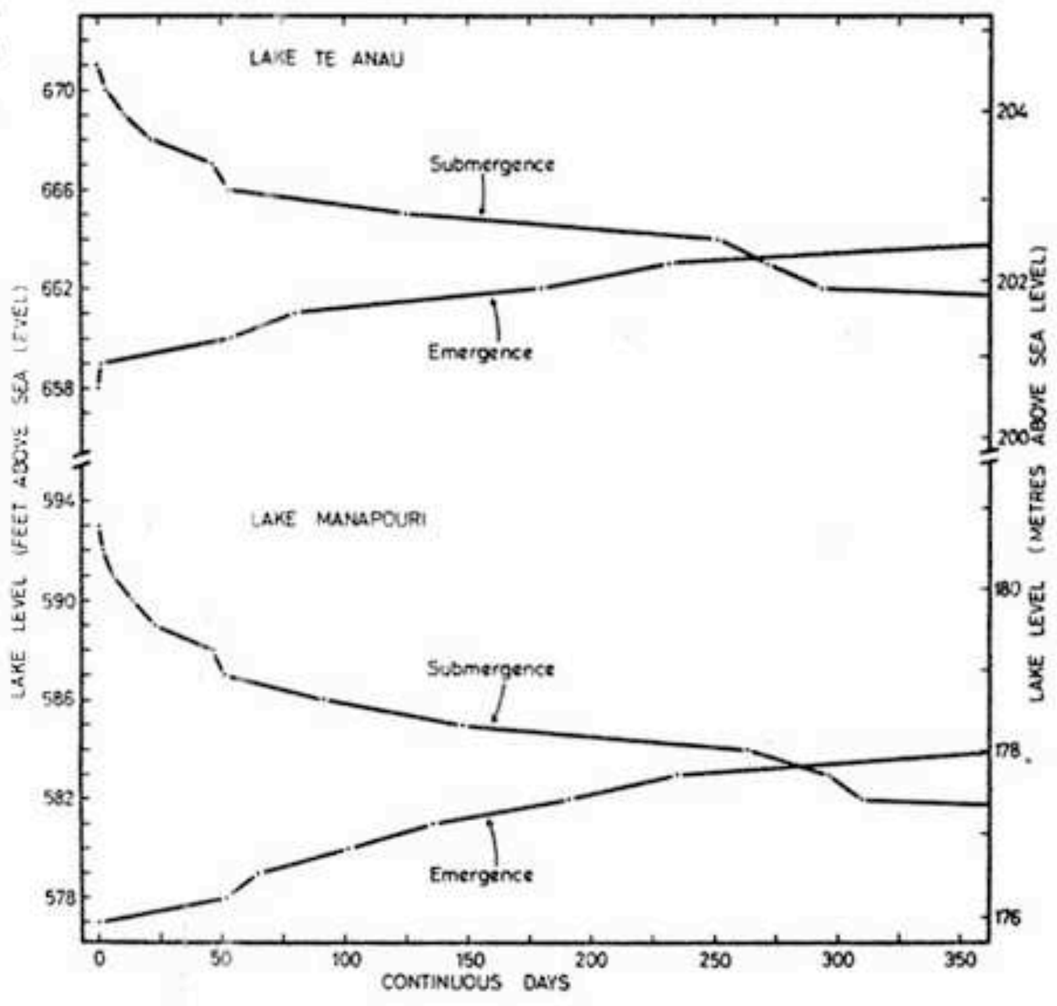

FIGURE 1. *Longest recorded periods under water and out of water at each foot of fluctuation of Lake Manapouri, 1932-1969 (below) and of Lake Te Anau, 1932-1971 (above).*

It should be noted that the values shown for Lake Manapouri differ slightly from those of Baylis, Johnson & Mark (1970) which were calculated on daily mean values corrected to the nearest whole foot.

Species Tolerances

A. Non-rocky shores

Non-rocky shores at both lakes commonly hold the species whose ranges are shown in Figure 2. The species are arranged from top to bottom primarily in order of their lower limits at Lake Manapouri. Table 2 shows the longest periods of submergence and emergence recorded at the limits of these species.

The general pattern of species ranges is similar at the two lakes though the total ranges are, for all but two species, less at Lake Te Anau. The mean range of the species for which both upper and lower limits are shown is 8.1ft (2.5m) at Lake Manapouri and 6.1ft (1.9m) at Lake Te Anau. The difference of 2.0ft (0.6m) is virtually the same as the difference in mean annual fluctuation—2.1ft (0.7m).

It can be seen from the position of maximum and minimum lake levels in Figure 2 that all the species shown grow within the area of fluctuating lake level. The two species at the top, *Myriophyllum elatinoides* and *Isoetes alpinus*, are truly aquatic as they descend at least 20ft (6m) below mean level at both lakes and are continu-

TABLE 2. *Longest recorded number of continuous days submergence and emergence at the lower and upper limits respectively of the more important shoreline species common to Lakes Manapouri and Te Anau.*

	Submergence		Emergence	
	Manapouri	Te Anau	Manapouri	Te Anau
Blechnum discolor	51	125	∞	∞
Callitriche ?petriei	>350	>350	>350	>350
Carex berggrenii	310	293	>350	>350
C. demissa	263	293	>350	>350
C. gaudichaudiana	310	>350	>350	>350
Centella uniflora	272	272	∞	>350
Centrolepis pallida	>350	>350	>350	>350
Coprosma foetidissima	92	125	∞	∞
C. parviflora	92	251	∞	∞
C. propinqua	310	272	∞	∞
Cotula perpusilla	272	293	>350	>350
Dacrycarpus dacrydioides	51	53	∞	∞
Elaeocarpus hookerianus	14	251	∞	∞
Eleocharis acuta	>350	>350	>350	>350
Gentiana grisebachii	148	272	>350	>350
Gratiola ?nana	>350	>350	>350	>350
Griselinia littoralis	14	22	∞	∞
Gunnera dentata	272	293	>350	>350
Haloragis depressa	92	293	∞	>350
Hydrocotyle tripartita	>350	>350	>350	>350
Hymenophyllum multifidum	47	125	∞	∞
Hypsela rivalis	>350	>350	>350	>350
Isoetes alpinus	∞	∞	>350	>350
Juncus gregiflorus	272	272	>350	>350
Lepidosperma australe	263	272	>350	>350
Leptocarpus similis	310	293	∞	>350
Leptospermum scoparium	272	272	∞	∞
Lilaeopsis ?orbicularis	>350	>350	>350	>350
Myriophyllum elatinoides	∞	∞	253	232
M. propinquum	>350	>350	>350	>350
Myrsine australis	14	53	∞	∞
M. divaricata	47	272	∞	∞
Muehlenbeckia axillaris	263	272	∞	>350
Neomyrtus pedunculata	47	251	∞	∞
Nothofagus s. var. *cliffortioides*	23	53	∞	∞
Plantago triandra	>350	>350	>350	>350
Podocarpus hallii	47	125	∞	∞
Potamogeton cheesemanii	∞	∞	235	232
Pratia angulata	272	293	∞	∞
Pseudopanax crassifolium	14	53	∞	∞
Ranunculus recens var. *lacustris*	>350	>350	>350	>350
Schoenus pauciflorus	263	272	>350	>350
Scirpus aucklandicus	>350	>350	>350	>350
Selliera radicans	>350	>350	>350	>350
Sophora microphylla	92	125	∞	∞
Utricularia ?monanthos	>350	>350	>350	>350
Viola lyallii	310	293	∞	>350
Weinmannia racemosa	14	53	∞	∞

∞ Indicates the species extends beyond the lake fluctuations.

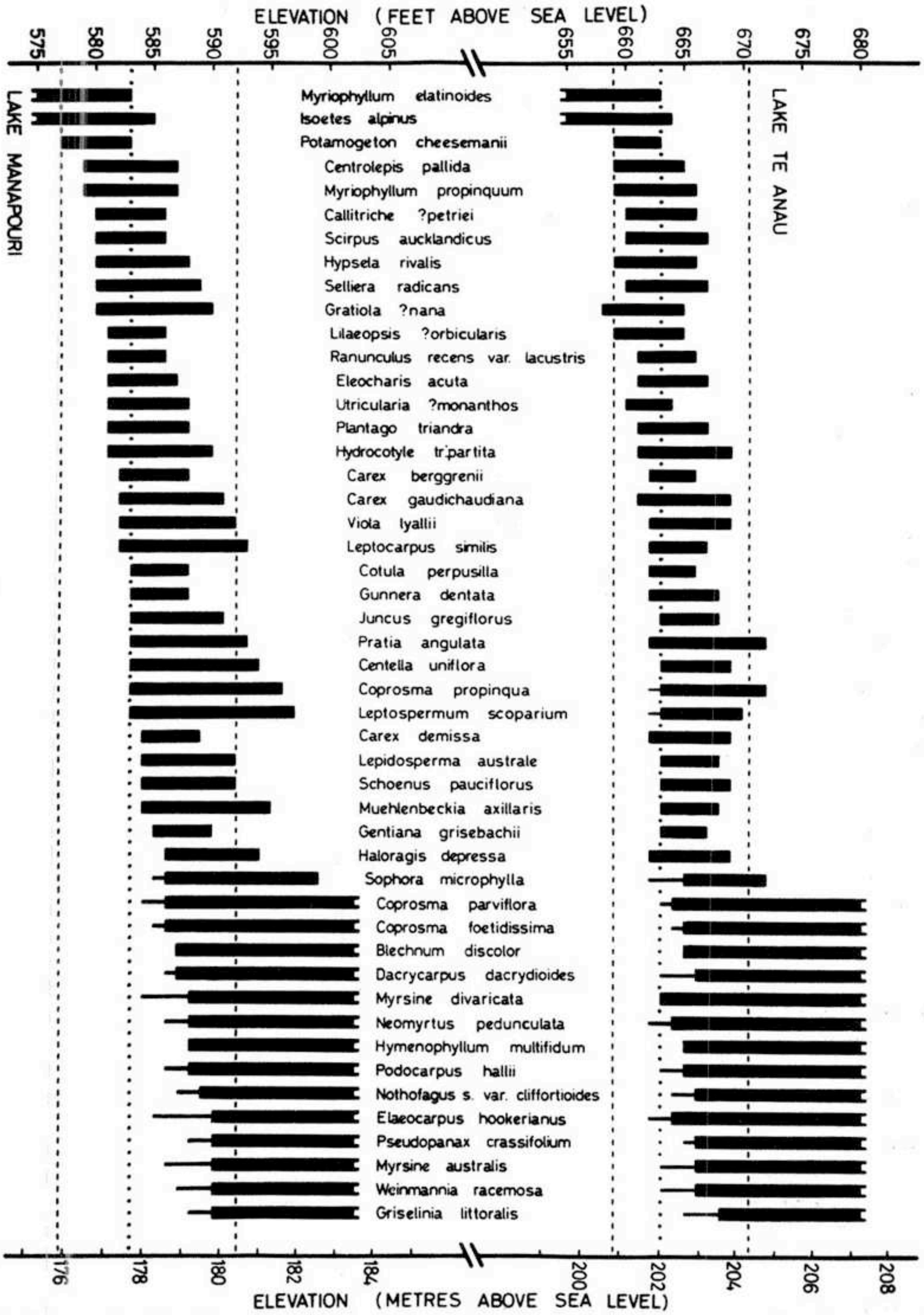

FIGURE 2. *Ranges in elevation of the more important species common to non-rocky shores at Lake Te Anau (right) and Lake Manapouri (left). Blocks represent the maximum extent of the species as mature plants; lines represent additional extent as seedlings only. Horizontal lines indicate mean and extreme levels recorded at each lake.*

ously submerged over most of their range. Nevertheless, at its upper limit, *Isoetes* has experienced periods of emergence exceeding 350 days at both lakes but plants here are stunted, being only 5cm tall, in contrast to the 30cm leaves which are washed up from deep water. *Potamogeton cheesemanii, Centrolepis pallida* and *Myriophyllum propinquum* are also considered aquatic; at both lakes they extend down to levels where they are submerged over 98 per cent of the time. *Potamogeton* is well adapted to a fluctuating water level. This species bears membranous submerged leaves along a stem up to 1.8m long and thick floating leaves near the stem apex. Individual plants can experience a considerable fall in lake level, yet the flaccid stem allows the submerged and floating leaves to retain their positions. Specimens rooted near the upper limit are much smaller and when not submerged lie closely appressed to the wet clay. *Myriophyllum elatinoides* also lies prostrate when not submerged, thus keeping the stem and leaves moist.

Plants of *Centrolepis pallida* do not decrease in size towards the limits of its range, nor do most of the sub-aquatic plants shown below *C. pallida* in Figure 2. *Lilaeopsis ?orbicularis* does so, tending to grow larger near its lower limit, in contrast to *Carex gaudichaudiana* which grows larger near its upper limit. Only *Gratiola ?nana* shows any marked variation in habit with elevation. Plants growing near their lower limit at Lake Manapouri [580ft (176.8m)] are about 13cm high with many upright stems and light-green membranous leaves while those at 589ft (179.5m) are smaller, prostrate with dark leathery leaves and in the 1969-70 summer flowered about a month earlier than those lower down.

Many species can be considered as sub-aquatic, especially those which extend below mean lake level but not above high lake level at both lakes, i.e. those species between *Callitriche petriei* and *Carex gaudichaudiana* in Figure 2. These species have a small vertical range but this is not surprising in view of the range of environmental conditions they are subjected to. *Eleocharis acuta* has a range of only 6ft (1.8m) at both lakes yet has experienced periods of submergence and emergence both of well over a year.

The group of herbs which do not extend much below mean lake level have less claim to subaquatic status. They do not seem to require inundation but nevertheless tolerate long periods of submergence. *Pratia angulata* for example grows down to a level which has experienced 272 days submergence at Lake Manapouri and 293 days at Lake Te Anau.

The larger rushes such as *Leptocarpus similis, Juncus gregiflorus* and *Lepidosperma australe* extend down to similar levels though much of their aerial system would be above water during the long periods their root systems are submerged.

Two of the woody species, *Coprosma propinqua* and manuka (*Leptospermum scoparium*) are notable for their ability to grow as mature shrubs down to mean level at both lakes. Seedlings and saplings of woody forest species extend below mature plants an average of 2.4ft (0.7m) at Lake Manapouri and 2.0ft (0.6m) at Lake Te Anau. Like the herbs, woody species exhibit a range of tolerance to submergence. Kowhai (*Sophora microphylla*) and *Coprosma foetidissima* descend at Lake Manapouri to a level where up to 92 continuous days submergence has been recorded and at Lake Te Anau to a level where the corresponding value is of the same order (125 days).

The lower limit of mature kahikatea (*Dacrycarpus dacrydioides*) is 587ft (178.9m) at Lake Manapouri where it has tolerated 51 days of submergence and 666ft (203.0m) at Lake Te Anau where the comparable value is 53 days. Mountain beech (*Nothofagus solandri* var. *cliffortioides*) has a similar lower limit at Lake Te Anau, but at Lake Manapouri, where it descends to 589ft (179.5m), it has tolerated only 23 days of submergence. Several tree species descend considerably further at Lake Te Anau than might be expected from their lower limits at Lake Manapouri. Pokaka (*Elaeocarpus hookerianus*) was found no lower than 590ft (179.8m) at Lake Manapouri where it has experienced a maximum of only 14 days submergence in contrast to the 251 day value for 664ft (202.4m) at Lake Te Anau. The level at Lake Te Anau which most closely corresponds to a 14 day flood is 669ft (203.9m) which is five feet (1.5m) above the lower limit of pokaka. Similarly, *Myrsine divari-*

cata descends four feet (1.2m) lower at Lake Te Anau than might be expected from its range at Lake Manapouri; *Neomyrtus pedunculata*, lancewood (*Pseudopanax crassifolium*), *Myrsine australis* and kamahi (*Weinmannia racemosa*) all descend three feet (0.9m) lower, mountain beech, *Podocarpus hallii* and *Hymenophyllum multifidum* two feet (0.6m) lower, and *Coprosma parviflora*, *Blechnum discolor* and *Griselinia littoralis* one foot (0.3m) lower.

Two factors possibly contribute to these inconsistencies. Firstly, the slightly larger number of samples taken at Lake Te Anau (46 compared with 40 at Lake Manapouri) would tend to show the plants as having a wider range and therefore a greater tolerance of submergence. The presence at Lake Te Anau of many deltas where pokaka is prominent could account for the lower elevation recorded there for this species. Secondly, mountain beech, pokaka, *Myrsine divaricata*, *M. australis*, kamahi, *Podocarpus hallii* and *Blechnum discolor* all descend one foot (0.3m) lower on the six transects from the Glaisnock River and Narrows deltas than they do anywhere else around Lake Te Anau. In addition, *Neomyrtus* and *Coprosma parviflora* descend one foot lower predominantly at these two sites. It is possible that this part of Lake Te Anau, where the delta at the Narrows constricts the head of North Arm, is subject to a slightly different lake level regime than the rest of the lake.

Non-rocky shores which hold soil and a dense plant cover tend to be sheltered or only moderately exposed, though many of the beaches on which transects were done are very exposed to wind and waves. Nevertheless the species' ranges on these shores do not differ with changes in exposure between sites.

B. Rocky shores

On rocky shores there is a strong trend, as exposure to wind and waves increases, for the lower limit of each species to be further above the lake and for the species ranges to become greater. Figure 3 shows the vertical ranges of the species common on rocky shores at Lake Manapouri. Ranges on sheltered sites, moderately exposed ones and a single very exposed site (the western shore of the largest of the Mahara Islands) are shown.

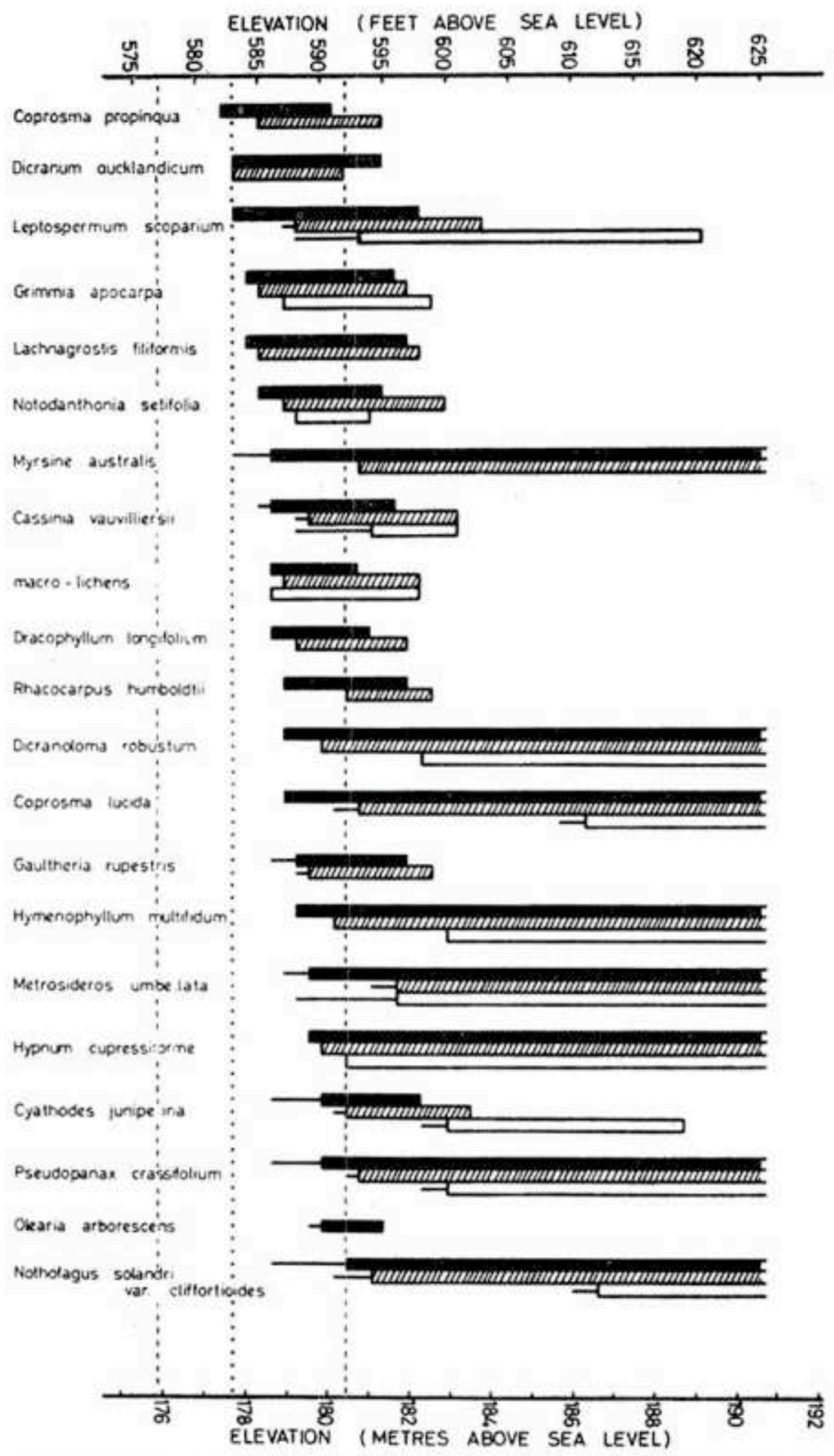

FIGURE 3. *Ranges in elevation of the more important species of rocky shores at Lake Manapouri. Solid blocks represent the ranges on 16 sheltered sites, cross-hatched ones on six moderately exposed sites and open ones on one very exposed site. Vertical lines indicate mean and extreme lake levels recorded.*

Coprosma propinqua and manuka demonstrate their wide ecological amplitude by growing on rocky shores as well as non-rocky ones and by

again descending to mean lake level (583ft or 177.7m). Manuka is fairly sensitive to exposure though; its lower limit on moderately exposed shores is 588ft (179.2m) and on the highly exposed site 593ft (180.7m) where its total range is 28ft (8.5m) compared with 15ft (4.6m) on sheltered shores. The mosses *Dicranum aucklandicum* and *Grimmia apocarpa* are rather insensitive to variation in exposure. The two grasses common on rocky shores, *Notodanthonia setifolia* and *Lachnagrostis filiformis* share this characteristic as also do the macrolichens. They form a conspicuous horizontal line on the rock at 586ft (178.6m), a line which is continued on non-rocky shores by a species of *Usnea* growing as an epiphyte, mostly on manuka. The constancy of this line indicates an indifference to exposure.

Among the plants which dominate the rupestral scrub, the distinction between seedlings and mature plants is not very obvious, particularly on exposed sites, as the small plants near the lower limits of their species ranges are not necessarily immature. Plants of *Cassinia vauvilliersii* 15cm high, manuka, *Dracophyllum longifolium* and *Gaultheria rupestris* 30cm high and southern rata (*Metrosideros umbellata*) 60cm high are able to flower freely and much earlier than those on less exposed sites.

Most species of the forest proper are fairly sensitive to exposure. Those shown in Figure 3 descend on an average 4.0ft (1.2m) less on moderately exposed sites and another 8.9ft (2.7m) less on the very exposed site compared with sheltered sites. Mountain beech, which dominates the lake shore forests, forms a forest edge on sheltered rocky shores at 592ft (180.4m), the highest recorded level of Lake Manapouri. On the very exposed site this species descends only to 612ft (186.5m).

DISCUSSION

Fluctuations in the levels of Lakes Manapouri and Te Anau impose upon the lake-edge plants regimes of inundation that vary from one year to the next. Thus if a causal relationship is to be sought between species distribution and some factor of lake fluctuation an extreme factor rather than some mean annual factor seems more likely. As an example of extreme factors, the longest periods of submergence and emergence at various levels since 1932 are presented in Figure 1. Generally similar periods have been experienced at the limits of most species at both lakes. It therefore seems likely that long periods of submergence and emergence, possibly during a particular time of year, actually determine the ranges of most species.

The lower limit of aquatic and some sub-aquatic species is probably determined by some factor related to water depth—for example light reduction. At their upper limit aquatic species are probably limited by desiccation during long periods of emergence—plant size certainly indicates that these plants function better when under water continuously. Extension upwards of sub-aquatic species is likely to be restricted by factors other than simple lack of submersion. Competition, especially for light, with taller plants might be partly responsible but a lack of ground water is probably more critical. Mason's (1969a) observations on many of the same sub-aquatic species (e.g. *Utricularia monanthos*) from lakes in Canterbury indicate that inundation seems necessary to them only in as much as it may keep the soil wet. Esler (1969) relates the distribution of some plants of Manawatu sand plains to mean summer water table, but only a few of his sub-aquatic species are also found around the Fiordland lakes. Over the 1970-71 summer a severe drought resulted in death at Lake Te Anau of some species (e.g. *Gunnera dentata*) near their upper limits.

Species that do not descend much below mean lake level are probably limited here by long periods of submergence. Submergence of foliage could be critical for small herbs but less so for larger species like *Leptocarpus*, manuka and *Coprosma propinqua*. Rhizomatous rushes like *Leptocarpus* probably have little difficulty in establishing in the lower part of their range. Stands of manuka and *Coprosma* near mean lake level have an even-aged appearance, suggesting that the plants established together, probably during a long period with low lake levels. Mature plants of these two species are relatively tolerant of submergence of their root systems.

However, mature forest trees are mostly quite intolerant of prolonged submergence; for example, at neither lake does mountain beech tolerate more than 60 days with its roots submerged. Young plants descend below mature ones but must be prevented from maturing either by periodic long floods or by insufficient soil, a less direct consequence of high lake levels. There is a rather poor correlation between the two lakes in the maximum periods recorded under water at the lower limit of some forest species. The causal factor in lake level fluctuation determining their lower limits might therefore be more complex. A raised water table near the forest edge could have much the same effect on the root systems of these species as a flood: the root system might be effectively submerged for a time after a flood, and in some cases for the interval between high floods and at times when the lake itself does not quite rise to the soil surface around the plant bases.

Some evidence for this comes from an area of forest at the head of Hope Arm of Lake Manapouri. A flat area of about 0.1ha, which is 50m from the lake edge and at 589ft (179.5m), once supported a mixed mountain beech-kahikatea forest with a canopy height of 15-18m. The kahikatea trees are normal, but all except one of the beeches are standing dead. These have probably been killed by waterlogging of the soil and subsequent poor drainage as suggested by the topography and pattern of driftwood. It is possible this occurred in 1957-58 when the lake fluctuated about this level for seven months (although the longest continuous period of submergence recorded at this level is only 23 days). The state of the dead trees and size of regenerating beech saplings suggest the trees could have died about this time. Thus the tolerances to submergence of forest species might, in effect, be slightly greater than those given. This could also be true for a second reason, namely that the tolerances given are the maxima recorded since 1932 only, a period well within the life span of living trees, even those of the forest edge. It is likely that the ranges of tree species are determined by an extreme flood occurring quite infrequently—perhaps only once in a century. Herbaceous species on the other hand, with shorter life spans, will be limited in their range by periods of submergence and emergence occurring at much shorter intervals, so that the tolerances of herbs are not likely to exceed the extreme periods recorded since 1932. Plants at their species limits will be killed if floods or droughts exceed the species tolerance. Subsequent recolonisation would re-establish an equilibrium. Such a dynamic situation, albeit one of only slight variation, probably operates between plant distribution and the levels of each lake.

On exposed rocky shores many species do not descend anywhere near even the highest lake level recorded. Nevertheless the lake can still influence these sites. Even an infrequent coincidence of high lake level and storm would prevent accumulation of soil on such highly exposed sites. Without adequate soil, shrubs and trees of rocky shores are very prone to drought as can be readily seen by the deaths of shrubs and trees on such sites at both lakes as a result of the record 1970-71 drought (Mark, *et al.* 1972).

On beaches the means by which floods limit ranges of the species might be through burial by wave-washed sand (hence the increasing importance towards mean lake level on beaches of the tall *Juncus gregiflorus* and the sand binding *Muehlenbeckia axillaris*) or by uprooting species like *Epilobium melanocaulon* and *Lachnagrostis filiformis* which can nevertheless recolonise rapidly from seed.

Carriage of seed by the lake is important for some species. The yellow seeds of kowhai, in particular, are conspicuous at high water mark on beaches all round the lakes. Kowhai must be dependent on a high lake level to carry its seed to the forest edge (where the species reaches its maximum importance) followed by a lower lake level to allow seedling establishment. Reproductive capacity of some species may be affected by untimely submersion. Flowers of, for example, *Selliera radicans* seem to open under water but whether they are pollinated while submerged is not known. Hill (1926) states that *Lilaeopsis* rarely produces flowers under conditions of partial submergence. Fruiting plants of *Lilaeopsis ?orbicularis* at Lakes Manapouri and Te Anau were found only in the upper parts of the species

ranges. Mason (1969a; p.455) similarly records a lack of flower or fruit production by *Utricularia monanthos* where permanently submerged, though flowers of this species were observed under water at Lake Manapouri. *Viola cunninghamii* is able to produce cleistogamous flowers (Holdsworth 1966). It is likely that the closely related *V. lyallii* can do this under water as fruiting plants were frequently seen submerged at Lake Manapouri. Mason (1969b) notes that *Limosella lincata* in Canterbury gravel pits sets abundant seed while submerged whereas *Glossostigma elatinoides* produces a multitude of flowers when exposed to the air.

CONCLUSIONS

Fluctuations in the levels of Lakes Manapouri and Te Anau cause their lake-edge environments to be alternately under water and out of water for varying periods of time. Plant species which can tolerate such variation in their environment have clearly defined ranges within the overall fluctuations of the lake. Under artificially controlled lake level fluctuations some herbaceous species could be expected to adapt relatively quickly and unobtrusively. This would not be so for the woody species, particularly forest trees which descend only slightly into the range of lake fluctuations thereby showing an intolerance to prolonged submergence of their root systems. Death probably would result if these species were subjected to periods of submergence much longer than they experience naturally, and the re-attainment of an equilibrium may take several centuries.

REFERENCES

ALLAN, H. H. 1961. *Flora of New Zealand*, Vol. 1. Government Printer, Wellington.

BAYLIS, G. T. S., JOHNSON, P. N., and MARK, A. F. 1970. The vegetation and flora of the islands and shoreline of Lake Manapouri. Unpublished report, Botany Department, University of Otago.

BURROWS, C. J., and DOBSON, A. T. 1972. Mires of the Manapouri-Te Anau lowlands. *Proceedings of the New Zealand Ecological Society* 19: 75-99.

CHEESEMAN, T. F. 1925. *Manual of the New Zealand Flora*. Second Edition, Government Printer, Wellington.

ESLER, A. E. 1969. Manawatu sand plain vegetation. *Proceedings of the New Zealand Ecological Society* 16: 32-35.

HAMLIN, B. G. 1972. Hepaticae of New Zealand, Parts I and II: Index of binomials and preliminary checklist. *Records of the Dominion Museum* 7: 243-366.

HOLDSWORTH, M. 1966. The cleistogamy of *Viola cunninghamii*. *Transactions of the Royal Society of New Zealand* (*Botany*) 3: 169-174.

HILL, A. W. 1926. The Genus *Lilaeopsis*: a study in geographical distribution. *Journal of the Linnean Society* (*Botany*) 47: 525-551.

JOHNSON, P. N. 1972. Applied ecological studies of shoreline vegetation at Lakes Manapouri and Te Anau, Fiordland. Part I: Vegetation of Lake Manapouri shoreline. *Proceedings of the New Zealand Ecological Society* 19: 102-119.

KELLY, G. C. 1968. Notes on the botany of Lake Manapouri with particular reference to the smaller islands. Unpublished report, Botany Division, Department of Scientific and Industrial Research.

MARK, A. F., CRUSH, J. R., and MEURK, C. D. 1972. Applied ecological studies of shoreline vegetation at Lakes Manapouri and Te Anau, Fiordland. Part 3: Vegetation of Lake Te Anau shoreline. *Proceedings of the New Zealand Ecological Society* 19: 143-154.

MASON, R. 1969a. The vegetation of freshwater. In *The Natural History of Canterbury*, pp.452-457. G. A. Knox Ed. A. H. and A. W. Reed, Wellington.

MASON, R. 1969b. Some native plants of gravel pits. *Canterbury Botanical Society Journal* 2.

MOORE, L. B., and EDGAR, E. 1970. *Flora of New Zealand*. Vol. 2. Government Printer, Wellington.

SAINSBURY, G. O. K. 1955. A handbook of the New Zealand Mosses. *Bulletin of the Royal Society of New Zealand* 5: 1-490.

ZOTOV, V. D. 1963. Synopsis of the grass subfamily Arundinoideae in New Zealand. *New Zealand Journal of Botany* 1: 78-136.

APPENDIX

Species and their habitats

The following plants have been recorded from the mainland shores and islands of Lake Manapouri below about 630ft (192m) altitude [with the exception of the large bogs near Hope Arm and Shallow Bay—see Burrows and Dobson (1972)] and the mainland shores of Lake Te Anau below about 710ft (216m) altitude but with emphasis on those shores underlain by unconsolidated materials (see Mark *et al.*, 1972) and omitting those bordered by agricultural land. Thus information on plants of rocky shores at Lake Te Anau will be incomplete and since the study was made in early winter, records of summergreen plants, particularly orchids, are scant. At Lake Manapouri, epiphytic bryophytes were mostly ignored unless they also occurred on the ground. The bryophytes recorded from Lake Te Anau were, with a few exceptions, only the common forest species. In general only the commonest lichens were recorded.

Nomenclature follows Allan (1961), Moore and Edgar (1970), Cheeseman (1925), Zotov (1963), Sainsbury (1955) and Hamlin (1972) except where authorities are given. The assistance of the following people in identification is gratefully acknowledged: Mr K. W. Allison (bryophytes), Dr E. Edgar (sedges and rushes), Dr H. Inoue (*Plagiochila lyallii*), Mr W. Martin (lichens), Miss R. Mason (lake-edge plants), Dr L. B. Moore (orchids), Dr P. H. Raven (*Epilobium*), Dr G. A. M. Scott (bryophytes) and Mr V. D. Zotov (grasses). Mr C. D. Meurk provided the information on forest species at Lake Te Anau.

Voucher specimens of all plants listed except those prefixed + are lodged in the Otago University Herbarium (OTA) and some duplicates are with Botany Division, D.S.I.R. (CHR). Species prefixed K were recorded from Lake Manapouri only by Kelly (1968).

For each species its occurrence, community, tier and importance are given for one or both lakes. Occurrence refers to distribution at each lake; widespread species (but not necessarily their communities) occur regularly around the shore, while local ones are confined to limited areas. The communities are those recognised by Johnson (1972) and Mark *et al.* (1972) except that the beech forest of Lake Manapouri and the beech-podocarp forest of Lake Te Anau are here treated together. Only the tier in which the species is most important is given for each community and importance within this tier is also indicated.

ABBREVIATIONS

Prefixes	*	naturalised
	+	voucher specimen not collected
	K	recorded at Lake Manapouri only by Kelly (1968)
Occurrence	M	Lake Manapouri
	TA	Lake Te Anau
	W	Widespread
	L	Local
	a	Not recorded
Community	LE	Lake-edge turf
	CX	*Carex* sward
	LS	*Leptocarpus* community
	MS	Manuka scrub
	OR	Open rock community
	RS	Rupestral scrub
	BC	Beach community
	BG	Bog
	BR	Beech-Rata forest
	BP	Beech ± Podocarp forest
	DI	*Dacrydium intermedium*—Mountain Beech forest
	K	Swamp Podocarp forest

Major tier	M	Emergent
	C	Canopy
	S	Sub-canopy
	G	Ground
	E	Epiphyte, liane or semi-parasite
Importance	G	Plant very important
	G	Plant moderately important
	g	Plant unimportant
	—	Not present

Notes
1. Also aquatic (continuously submerged).
2. Floating, probably carried into the lake from a swamp.
3. Less important at Lake Manapouri.
4. Less important at Lake Te Anau.
5. A small crucifer, with flowers and fruit, not yet identified. At Botany Division, D.S.I.R.
6. Lophoziaceae, a new species (Dr H. Inoue pers. comm.)

Species	Occurrence		Communities											
	M	TA	LE	CX	LS	MS	OR	RS	BC	BG	BR	BP	DI	K
PTERIDOPHYTA														
Psilopsida														
+*Tmesipteris tannensis*	W	L	—	—	—	—	—	—	—	—	—	e	E	—
Lycopsida														
Isoetes alpinus	W	W	G[1]	—	—	—	—	—	—	—	—	—	—	—
I. kirkii	a	L	g	—	—	—	—	—	—	—	—	—	—	—
Lycopodium billardieri	W	L	—	—	—	—	—	G	—	—	—	g	—	—
L. ramulosum	L	a	—	—	—	—	—	—	—	G	—	—	—	—
L. scariosum	W	a	—	—	—	—	—	G	—	G	—	—	—	—
Filicopsida														
Adianthum cunninghamii	L	L	—	—	—	—	—	—	—	—	—	g	—	—
Asplenium bulbiferum	W	W	—	—	—	—	—	—	—	—	—	g	—	G[3]
A. falcatum	L	L	—	—	—	—	—	—	—	—	—	g	—	—
A. flabellifolium	L	a	—	—	—	—	—	—	—	—	g	—	—	—
A. flaccidum	W	W	—	—	—	—	—	—	—	—	E	E	E	E
A. hookerianum	L	W	—	—	—	—	—	—	—	—	—	g	—	g
A. richardii	a	W	—	—	—	—	—	—	—	—	—	G	—	—
[2]+*Azolla rubra*	L	a	—	—	—	—	—	—	—	—	—	—	—	—
Blechnum capense	W	W	—	—	—	g	—	—	—	—	g	G	G	G
B. discolor	W	W	—	—	—	g	—	—	—	—	G	G	G	G
B. fluviatile	L	L	—	—	—	g	—	—	—	—	—	g	—	G
B. lanceolatum	L	a	—	—	—	—	—	—	—	—	—	—	—	g
B. minus	W	W	—	—	g	G	—	—	—	—	G	G	G	G
+*B. patersonii*	L	a	—	—	—	—	—	—	—	—	—	—	—	g
B. penna-marina	W	W	—	—	—	G	—	—	G	—	—	G	—	G
B. sp.	a	L	—	—	—	—	—	—	—	—	—	—	—	G
Ctenitis glabella	L	a	—	—	—	—	—	—	—	—	—	G	—	—
Cyathea smithii	L	L	—	—	—	—	—	—	—	—	—	S[3]	—	s
Dicksonia squarrosa	L	L	—	—	—	—	—	—	—	—	—	S	—	s
Gleichenia circinata	L	a	—	—	—	—	—	—	—	G	—	—	—	—
G. microphylla	L	a	—	—	—	—	—	—	—	G	—	—	—	—
Grammitis billardieri	W	W	—	—	—	—	—	g	—	—	G	G	G	G
G. heterophylla	W	W	—	—	—	—	—	g	—	—	G	G	G	G
Histiopteris incisa	W	W	—	—	—	g	—	—	—	—	—	G	—	G

Species	Occurrence		Communities											
	M	TA	LE	CX	LS	MS	OR	RS	BC	BG	BR	BP	DI	K
Hymenophyllum armstrongii	L	a	—	—	—	—	—	—	—	—	—	—	E	—
H. bivalve	W	a	—	—	—	—	—	—	—	—	G	G	G	—
+*H. demissum*	L	W	—	—	—	—	—	—	—	—	G	G	G	—
H. flabellatum	W	W	—	—	—	—	—	—	—	—	E	E	E	E
H. lyallii	L	a	—	—	—	—	—	—	—	—	—	—	E	—
H. multifidum	W	W	—	—	—	G	—	G	—	—	G	G	G	G
H. peltatum	L	a	—	—	—	—	—	—	—	—	—	—	—	g
H. pulcherrimum	L	W	—	—	—	—	—	—	—	—	—	E	—	—
H. rarum	W	a	—	—	—	—	—	—	—	—	—	e	E	—
H. revolutum	W	a	—	—	—	—	—	—	—	—	—	g	—	G
H. sanguinolentum	W	a	—	—	—	—	—	—	—	—	G	G	G	G
H. villosum	a	W	—	—	—	—	—	—	—	—	—	G	—	—
Hypolepis millefolium	W	L	—	—	—	—	—	—	—	—	—	g	—	g
H. rugosula	a	W	—	—	—	—	—	—	—	—	—	g	—	—
H. tenuifolia	W	L	—	—	—	—	—	—	—	—	—	g	—	g
Leptolepia novae-zelandiae	L	L	—	—	—	—	—	—	—	—	—	g	—	g
Ophioglossum coriaceum	L	L	G	—	—	—	—	—	—	—	—	—	—	—
+*Paesia scaberula*	W	a	—	—	—	g	—	—	—	—	—	—	—	—
Phymatodes diversifolium	W	W	—	—	—	—	—	G	—	—	G	G	G	G
Pilularia novae-zelandiae	W	W	G	—	—	—	—	—	—	—	—	—	—	—
Polystichum richardii	L	a	—	—	—	—	—	—	—	—	—	—	—	g
P. vestitum	W	W	—	—	—	—	—	—	—	—	—	G	—	G
Pteridium aquilinum var. *esculentum*	W	L	—	—	—	g	—	—	—	—	G	G	G	—
Pyrrosia serpens	W	W	—	—	—	—	G	G	—	—	E	E	E	—
Rumohra adiantiformis	L	a	—	—	—	—	—	—	—	—	—	—	—	E
Schizaea fistulosa	L	a	—	—	—	—	—	—	—	G	—	—	—	—
Thelypteris pennigera	L	a	—	—	—	—	—	—	—	—	—	—	—	G
Todea superba	L	W	—	—	—	—	—	—	—	—	—	G	—	G
Trichomanes reniforme	L	L	—	—	—	—	—	—	—	—	G	G	G	—
T. venosum	L	L	—	—	—	—	—	—	—	—	E	E	—	E
GYMNOSPERMAE														
Dacrycarpus dacrydioides (Rich.) de Laubenfels	L	L	—	—	—	s	—	—	—	—	—	m	—	M
+*Dacrydium bidwillii*	L	a	—	—	—	—	—	—	—	m	—	—	—	—
D. biforme	L	a	—	—	—	s	—	—	—	—	—	—	C	—
D. cupressinum	W	W	—	—	—	s	—	—	—	—	m	M	M	C
D. intermedium	L	L	—	—	—	—	—	—	—	—	—	—	C	—
+*D. laxifolium*	L	a	—	—	—	—	—	—	—	g	—	—	—	—
Phyllocladus alpinus	W	L	—	—	—	—	—	c	—	—	s	S	C	—
Podocarpus ferrugineus	W	W	—	—	—	—	—	—	—	—	s	C	c	C
P. hallii	W	W	—	—	—	c	—	—	—	—	S	C	S	C
P. spicatus	L	L	—	—	—	s	—	—	—	—	—	M[3]	—	M
MONOCOTYLEDONES														
Agavaceae														
Cordyline australis	L	L	—	—	—	M[3]	—	—	m	—	—	—	—	s
+*Phormium tenax*	L	L	—	—	—	g	—	—	M	—	—	—	—	—
Centrolepidaceae														
Centrolepis ciliata	L	a	G	—	—	—	—	—	—	—	—	—	—	—
C. pallida	W	W	G	—	—	—	—	—	—	—	—	—	—	—
Cyperaceae														
[K]*Baumea tenax*	L	a	—	—	—	—	—	—	—	M	—	—	—	—
Carex berggrenii	W	W	G	G	—	—	—	—	—	—	—	—	—	—
C. buchananii	a	L	m	M	—	—	—	—	—	—	—	—	—	—

Species	Occurrence M	TA	LE	CX	LS	MS	OR	Communities RS	BC	BG	BR	BP	DI	K
C. coriacea	L	a	—	—	S	G	—	—	—	—	—	—	—	—
**C. demissa* Hornem	W	W	—	G	G	G	G	—	—	—	—	—	—	—
C. dipsacea	W	L	—	—	G	G	—	—	—	—	—	—	—	—
C. dissita	L	W	—	g	g	G	—	—	—	—	—	—	—	g
C. flaviformis	a	L	—	g	—	—	—	—	—	—	—	—	—	G
C. gaudichaudiana	W	W	M	C	S	g	—	—	—	—	—	—	—	—
C. maorica	a	L	g	—	—	—	—	—	—	—	—	—	—	—
C. raoulii	a	L	—	—	—	—	—	—	—	—	—	—	—	G
C. secta	a	L	—	g	—	—	—	—	—	—	—	—	—	—
C. testacea	a	L	—	—	—	G	—	—	—	—	—	—	—	—
C. virgata	L	L	—	—	S	G	—	—	—	—	—	—	—	G
Eleocharis acuta	W	W	M	C	S	—	—	—	—	—	—	—	—	—
E. gracilis	L	L	G	—	—	—	—	—	—	—	—	—	—	—
Gahnia procera	L	a	—	—	—	—	—	—	—	—	—	—	S	—
Lepidosperma australe	W	W	—	—	C	S	—	—	—	M	—	—	—	—
Oreobolus impar	L	a	—	—	—	—	—	—	—	G	—	—	—	—
O. strictus	W	a	—	—	—	—	—	—	—	G	—	—	—	—
Schoenus maschalinus	W	W	G	G	G	G	—	—	—	—	—	—	—	—
S. pauciflorus	W	W	—	—	S	G	—	s	—	M	—	—	—	—
Scirpus aucklandicus	W	W	G	G	g	—	—	—	—	—	—	—	—	—
S. fluitans	L	a	—	—	—	—	—	—	—	G	—	—	—	—
S. habrus	L	L	g	G	—	—	—	—	—	—	—	—	—	g
S. inundatus	W	W	G	G	G	G	—	—	—	—	—	—	—	—
S. prolifer	L	a	—	—	—	—	—	—	—	—	—	—	—	g
Uncinia caespitosa	a	L	—	—	—	G	—	—	—	—	—	—	—	—
U. gracilenta	a	L	—	—	—	G	—	—	—	—	—	—	—	—
U. rupestris	a	L	—	—	—	—	—	—	G	—	—	—	—	—
U. uncinata	W	W	—	—	—	G	—	—	—	—	—	g	—	G
Gramineae														
**Agrostis* sp.	a	L	—	—	—	—	—	—	G	—	—	—	—	g
**Aira caryophyllea* L.	W	W	—	—	—	—	G	—	G	—	—	—	—	—
Chionochloa rubra	L	a	—	—	—	—	—	—	m	—	—	—	—	—
Cortaderia richardii	L	L	—	—	—	S	—	—	M	—	—	—	—	—
Deschampsia caespitosa	W	W	g	—	—	—	G	—	G	—	—	—	—	—
D. novae-zelandiae	W	a	—	—	—	—	—	—	G	—	—	—	—	—
Deyeuxia avenoides	W	a	—	—	—	—	—	—	G	—	—	—	—	—
K*D. quadriseta*	—	a	—	—	—	G	—	—	—	—	—	—	—	—
Dichelachne sciurea	L	a	—	—	—	—	—	—	g	—	—	—	—	—
**Holcus lanatus* L.	L	W	g	—	—	—	—	—	G	—	—	—	—	—
Lachnagrostis filiformis (Forst. f.) Trin.	W	W	g	G	G	g	G	g	G	—	—	—	—	—
K*L. lyallii*	—	a	—	—	—	—	G	—	—	—	—	—	—	—
L. striata	L	W	G	G	G	g	—	—	—	—	—	—	—	—
Microlaena avenacea	L	L	—	—	—	—	—	—	—	—	—	g	—	—
Notodanthonia buchananii	L	a	—	—	—	—	—	—	g	—	—	—	—	—
N. gracilis	W	W	—	—	—	g	G	—	G	—	—	—	—	—
N. setifolia	W	W	—	—	—	—	G	G	—	—	—	—	—	—
**Poa annua* L.	L	L	—	—	—	—	G	—	G	—	—	—	—	—
Hydrocharitaceae														
**Elodea canadensis* Michx.	W	a	G[1]	—	—	—	—	—	—	—	—	—	—	—
Iridaceae														
Libertia ixioides	L	L	—	—	—	g	—	—	—	—	—	g	—	—
L. pulchella	L	a	—	—	—	—	—	—	—	—	—	g	G	G
Juncaceae														
**Juncus articulatus* L.	W	W	M	C	S	—	—	—	—	—	—	—	—	g
**J. bufonius* L.	L	L	G	G	—	—	—	—	—	—	—	—	—	—

Species	Occurrence M	TA	LE	CX	LS	Communities MS	OR	RS	BC	BG	BR	BP	DI	K
J. bulbosus L.	L	a	—	—	—	—	—	—	—	G	—	—	—	—
J. gregiflorus	W	W	—	M	C	S	—	—	M	—	—	—	—	—
J. novae-zelandiae	W	L	g	G	G	—	—	—	G	G	—	—	—	—
J. planifolius	L	L	G	G	G	—	—	—	—	—	—	—	—	—
J. pusillus	W	L	G	G	G	—	—	—	—	—	—	—	—	—
Luzula picta	W	W	—	—	—	G	—	—	G	—	—	—	—	—
L. rufa	W	W	—	—	—	G	—	—	G	—	—	—	—	—
Juncaginaceae														
Triglochin striatum	W	W	G	—	—	—	—	—	—	—	—	—	—	—
Liliaceae														
Astelia fragrans	L	a	—	—	—	—	—	—	—	—	—	—	—	G
[K]*A. grandis*	—	a	—	—	—	—	—	—	—	—	—	—	—	G
A. nervosa	W	L	—	—	—	G	—	—	—	—	—	—	G	G
Orchidaceae														
Adenochilus gracilis	W	a	—	—	—	—	—	—	—	—	G	G	G	—
Aporostylis bifolia	W	a	—	—	—	—	—	—	—	—	G	G	G	—
Caladenia carnea	L	a	—	—	—	—	—	—	—	—	—	G	G	—
Chiloglottis cornuta	L	a	—	—	—	—	—	—	—	—	—	G	—	—
Corybas oblongus	L	a	—	—	—	—	—	—	—	—	—	g	G	—
C. rivularis	L	a	—	—	—	—	—	—	—	—	—	g	g	—
C. trilobus	W	a	—	—	—	—	—	—	—	—	G	G	G	G
Dendrobium cunninghamii	W	W	—	—	—	—	—	S	—	—	S	E[4]	S	—
Drymoanthus adversus	L	a	—	—	—	—	—	—	—	—	c	e	—	—
Earina autumnalis	W	W	—	—	—	—	g	G	—	—	G	E	G	—
E. mucronata	W	W	—	—	—	—	g	G	—	—	E	E	E	—
Gastrodia cunninghamii	L	a	—	—	—	—	—	—	—	—	g	—	—	—
Microtis unifolia	W	a	—	g	g	G	—	—	—	—	—	—	—	—
Prasophyllum colensoi	L	a	—	—	—	g	—	—	—	—	—	—	—	—
Pterostylis australis	L	a	—	—	—	—	—	—	—	G	—	—	G	G
P. graminea	W	a	—	—	—	—	—	—	—	—	—	G	G	G
Thelymitra pauciflora	W	a	—	—	—	—	G	—	—	G	—	—	—	—
T. pulchella	W	a	—	—	—	—	G	—	—	G	—	—	—	—
+*T.* sp.	—	L	—	—	—	—	—	—	—	—	—	g	—	—
Philesiaceae														
Luzuriaga parviflora	L	L	—	—	—	G	—	—	—	—	G	G	G	—
Potamogetonaceae														
Potamogeton cheesemanii	W	W	G[1]	—	—	—	—	—	—	—	—	—	—	—
P. suboblongus	L	a	—	—	—	—	—	—	—	g	—	—	—	—
Restionaceae														
Calorophus minor	L	a	—	—	—	—	—	—	—	G	—	—	—	—
Leptocarpus similis	W	W	M	M	C	S	—	—	M	—	—	—	—	—
Smilacaceae														
Ripogonum scandens	L	L	—	—	—	—	—	—	—	—	—	e	—	E[4]
DICOTYLEDONES														
Apocynaceae														
[K]*Parsonsia capsularis*	—	a	—	—	—	—	—	—	—	—	—	—	—	—
P. heterophylla	L	L	—	—	—	—	—	—	—	—	—	E	—	E
Araliaceae														
Pseudopanax colensoi (Hook. f.) Philipson	W	L	—	—	—	—	—	C	—	—	S	S	C	—
P. crassifolium	W	W	—	—	—	—	—	C	—	—	S	S	C	S
P. lineare	W	W	—	—	—	—	—	C	—	—	S	—	S	—
P. simplex (Forst. f.) Philipson	W	W	—	—	—	—	—	—	—	—	S	S	S	—
Schefflera digitata	L	W	—	—	—	—	—	—	—	—	—	g	—	S

Species	Occurrence		Communities											
	M	TA	LE	CX	LS	MS	OR	RS	BC	BG	BR	BP	DI	K
Boraginaceae														
**Myosotis caespitosa* Schultz	L	a	—	G	—	—	—	—	g	—	—	—	—	—
M. pygmaea	L	a	—	—	—	—	—	—	g	—	—	—	—	—
Callitrichaceae														
Callitriche ?petriei	W	W	G	G	g	—	—	—	—	—	—	—	—	g
Campanulaceae														
Wahlenbergia albomarginata	L	a	—	—	—	—	—	—	G	—	—	—	—	—
W. colensoi	L	a	—	—	—	—	G	—	G	—	—	—	—	—
W. gracilis	L	a	—	—	—	—	G	—	G	—	—	—	—	—
Caryophyllaceae														
Colobanthus apetalus	L	L	g	—	—	—	g	—	g	—	—	—	—	—
[K]*C. strictus*	—	a	g	—	—	—	g	—	—	—	—	—	—	—
Spergularia marginata	L	a	—	—	—	—	g	—	—	—	—	—	—	—
**Stellaria graminea* L.	L	a	—	—	—	—	—	—	g	—	—	—	—	—
S. parviflora	L	a	—	—	—	—	—	—	—	—	—	g	—	—
Compositae														
Brachycome linearis	L	L	—	g	—	g	—	—	—	—	—	—	—	—
Cassinia vauvilliersii	W	W	—	—	—	S	M	C	—	—	—	—	—	—
Cotula maniototo	L	W	G	—	—	—	—	—	—	—	—	—	—	—
C. perpusilla	W	W	G	G	G	G	—	—	—	—	—	—	—	—
**Cirsium vulgare* (Savi) Ten.	L	a	—	—	—	—	—	—	g	—	—	—	—	—
Erechtites minima	L	a	—	—	—	—	—	—	g	—	—	—	—	—
E. quadridentata	L	a	—	—	—	—	—	—	g	—	—	—	—	—
Gnaphalium collinum	W	W	—	—	—	—	G	—	G	—	—	—	—	—
G. hookeri	L	a	—	—	—	—	g	—	—	—	—	—	—	—
G. luteo-album	W	W	—	—	—	—	G	—	G	—	—	—	—	—
+Helichrysum bellidioides	W	W	—	—	—	—	—	—	G	—	—	—	—	—
+H. filicaule	a	W	—	—	—	—	—	—	G	—	—	—	—	—
**Hypochaeris radicata* L.	L	L	—	—	—	—	G	G	G	—	—	—	—	—
Lagenophora petiolata	W	W	—	—	—	G	—	—	G	—	G	—	—	—
**Mycelis muricata* (L.) Dcm.	L	a	—	—	—	—	—	—	—	—	—	—	—	g
Olearia arborescens	W	W	—	—	—	—	—	C	—	—	—	—	—	—
O. nummularifolia	L	a	—	—	—	—	—	c	—	—	—	—	—	—
Raoulia hookeri	W	W	—	—	—	—	—	—	G	—	—	—	—	—
R. tenuicaulis	L	L	—	—	—	—	—	—	G	—	—	—	—	—
**Senecio sylvaticus* L.	L	a	—	—	—	—	g	—	—	—	—	—	—	—
Coriariaceae														
Coriaria arborea	W	W	—	—	—	—	—	C	M	—	—	—	—	—
Cornaceae														
Corokia cotoneaster	L	W	—	—	—	S	—	S	M	—	s	s	—	—
Griselinia littoralis	W	W	—	—	—	—	—	c	—	—	S	S	C	s
Crassulaceae														
Tillaea sinclairii	W	W	G	G	—	—	—	—	—	—	—	—	—	—
Cruciferae														
Cardamine debilis	L	L	g	—	—	G	—	—	g	—	—	g	—	g
Unidentified genus[5]	a	W	G	—	—	—	—	—	—	—	—	—	—	—
Cunoniaceae														
Weinmannia racemosa	W	W	—	—	—	—	—	c	—	—	C	C	C	c
Droseraceae														
Drosera binata	L	a	—	—	—	—	—	—	—	g	—	—	—	—
D. spathulata	W	W	—	—	g	G	—	—	—	G	—	—	—	—
D. stenopetala	L	a	—	—	—	—	—	—	—	g	—	—	—	—

Species	Occurrence M	TA	Communities LE	CX	LS	MS	OR	RS	BC	BG	BR	BP	DI	K
Elaeocarpaceae														
+*Aristotelia fruticosa*	a	L	—	—	—	S	—	—	—	—	—	—	—	—
A. serrata	L	L	—	—	—	—	—	—	—	—	—	s	—	—
Elaeocarpus hookerianus	W	W	—	—	—	M[3]	—	—	—	—	C	C	C	C
Epacridaceae														
Archeria traversii	W	a	—	—	—	—	—	—	—	—	S	—	S	—
Cyathodes empetrifolia	L	L	—	—	—	g	g	—	—	G	—	—	—	—
+*C. fraseri*	W	W	—	—	—	—	g	—	G	—	—	—	—	—
C. juniperina	W	W	—	—	—	S	M	C	—	—	S	S	S	—
Dracophyllum longifolium	L	a	—	—	—	C	M	C	m	—	—	—	S	—
+*Pentachondra pumila*	L	a	—	—	—	—	—	—	—	G	—	—	—	—
Ericaceae														
Gaultheria antipoda	L	L	—	—	—	—	—	S	—	—	s	—	S	—
G. rupestris	W	W	—	—	—	M	S	—	—	—	—	—	—	—
+*Pernettya macrostigma*	W	W	—	—	—	G	—	—	—	G	—	—	—	—
Escalloniaceae														
Carpodetus serratus	L	W	—	—	—	—	—	—	—	—	—	S	—	S
Fagaceae														
+*Nothofagus fusca*	a	L	—	—	—	—	—	—	—	—	—	C	—	—
N. menziesii	L	W	—	—	—	—	—	—	—	—	c	C[3]	c	C
N. solandri var. *cliffortioides*	W	W	—	—	—	—	—	C	—	—	C	C	C	C[4]
Gentianaceae														
Gentiana grisebachii	W	W	—	—	G	G	—	—	—	g	—	—	—	—
Geraniaceae														
+*Geranium microphyllum*	a	L	—	—	—	g	—	—	—	—	—	—	—	—
Goodeniaceae														
Selliera radicans	W	W	G	G	G	—	—	—	—	—	—	—	—	—
Haloragaceae														
Gunnera arenaria	W	L	G	G	G	G	—	—	—	—	—	—	—	—
G. dentata	W	W	G	G	G	G	—	—	—	—	—	—	—	—
Haloragis depressa	W	W	—	—	g	G	—	—	—	—	—	—	—	—
H. micrantha	W	W	—	—	g	G	—	—	—	g	—	—	—	—
H. procumbens	L	a	—	—	—	G	—	—	—	—	—	—	—	—
Myriophyllum elatinoides	W	W	G[1]	—	—	—	—	—	—	—	—	—	—	—
M. pedunculatum	W	W	G[1]	—	—	—	—	—	g	—	—	—	—	—
M. propinquum	W	W	G[1]	—	g	—	—	—	—	—	—	—	—	—
Icacinaceae														
Pennantia corymbosa	L	L	—	—	—	—	—	—	—	—	—	—	—	S[4]
Labiatae														
Mentha cunninghamii	L	L	—	—	—	g	—	—	G	—	—	—	—	—
**Prunella vulgaris* L.	W	W	—	G	G	G	—	—	—	—	—	—	—	g
Lentibulariaceae														
Utricularia ?monanthos	W	W	G	—	—	—	—	—	—	G	—	—	—	—
U. novae-zelandiae	L	a	—	—	—	—	—	—	—	G	—	—	—	—
Linaceae														
**Linum catharticum* L.	L	L	—	—	—	—	g	—	g	—	—	—	—	—
Lobeliaceae														
Hypsela rivalis	W	W	G	—	—	—	—	—	—	—	—	—	—	—
Pratia angulata	W	W	g	G	G	G	—	—	G	—	—	—	—	—
P. perpusilla	W	W	G	G	G	—	—	—	—	—	—	—	—	—
Loranthaceae														
Elytranthe colensoi	a	L	—	—	—	—	—	—	—	—	—	e	—	—
E. flavida	W	a	—	—	—	—	—	—	—	—	E	E	E	—
E. tetrapetala	W	a	—	—	—	—	—	—	—	—	E	E	E	—
Loranthus micranthus	W	a	—	—	—	—	—	—	—	—	—	e	—	—

Species	Occurrence		Communities											
	M	TA	LE	CX	LS	MS	OR	RS	BC	BG	BR	BP	DI	K
Tupeia antarctica	a	L	—	—	—	E	—	—	—	—	—	—	—	—
Malvaceae														
+*Hoheria lyallii*	a	L	—	—	—	g	—	—	—	—	—	—	—	—
Myrsinaceae														
Myrsine australis	W	W	—	—	—	c	—	—	—	—	S	S⁴	S	S
M. divaricata	W	W	—	—	—	C	—	—	M	—	S	S	S	S
Myrtaceae														
Leptospermum scoparium	W	W	—	M	M	C	M	C	M	M	—	s	S	s
Lophomyrtus obcordata	L	L	—	—	—	S	—	—	—	—	—	—	—	S
Metrosideros diffusa	L	L	—	—	—	—	—	—	—	—	—	E	—	—
M. umbellata	W	W	—	—	—	s	M	C	—	—	C	c	C	—
Neomyrtus pedunculata	W	W	—	—	—	C	—	—	—	—	S	S	S	S
Onagraceae														
Epilobium atriplicifolium	W	a	—	—	—	—	—	—	G	—	—	—	—	—
E. brunnescens (Ckn.) Raven & Englehorn	L	a	—	—	—	—	g	—	—	—	—	—	—	—
E. cinereum	L	a	—	—	—	—	—	—	g	—	—	—	—	—
E. komarovianum	W	W	G	G	—	—	—	—	—	—	—	—	—	—
E. melanocaulon	W	W	—	—	—	—	—	—	G	—	—	—	—	—
E. pedunculare	a	L	—	—	—	—	—	—	—	—	—	—	—	G
E. pubens	W	a	—	—	—	—	G	—	—	—	—	—	—	—
Fuchsia excorticata	L	L	—	—	—	—	—	—	—	—	—	s	—	s
Oxalidaceae														
+*Oxalis lactea*	L	a	—	—	—	—	—	—	—	—	—	—	—	g
+*O. stricta*	L	a	—	—	—	—	—	—	—	—	—	—	—	g
Papilionaceae														
K*Carmichaelia arborea*	—	W	—	—	—	S	—	—	—	—	—	—	—	—
C. virgata	W	a	—	—	—	S	—	—	M	—	—	—	—	—
**Cytisus scoparius* L.	L	a	—	—	—	—	—	—	m	—	—	—	—	—
**Lupinus* sp.	L	a	—	—	—	—	—	—	m	—	—	—	—	—
Sophora microphylla	W	W	—	—	—	—	—	—	M	—	C	—	—	s
**Trifolium dubium* Sibth.	L	L	—	—	—	—	g	—	g	—	—	—	—	—
Pittosporaceae														
Pittosporum colensoi	W	W	—	—	—	—	—	—	—	—	C	C	—	—
P. eugenioides	L	L	—	—	—	—	—	—	—	—	—	c	—	—
P. tenuifolium	W	L	—	—	—	—	—	—	—	—	C	s	—	s
Plantaginaceae														
Plantago triandra	W	W	—	G	G	G	G	g	—	—	—	—	—	—
Polygonaceae														
Muehlenbeckia australis	L	L	—	—	—	e	—	—	—	—	E	E	—	—
M. axillaris	W	W	—	—	—	—	—	—	G	—	—	—	—	—
+*M. complexa*	a	L	—	—	—	—	—	—	—	—	—	—	—	E
**Rumex acetosella* L.	L	L	—	—	—	—	—	—	g	—	—	—	—	—
R. flexuosus	L	L	—	—	—	—	—	—	g	—	—	—	—	—
Portulacaceae														
Neopaxia australasica (Hook. f.) O. Nilss.	L	L	g	g	—	—	—	—	g	—	—	—	—	—
Ranunculaceae														
Clematis paniculata	L	L	—	—	—	—	—	—	—	—	—	e	—	e
**Ranunculus flammula* L.	L	a	—	G	—	—	—	—	—	—	—	—	—	—
R. hirtus	L	L	—	—	—	—	—	—	g	—	—	—	—	g
R. lappaceus	L	L	—	—	—	G	—	—	G	—	—	—	—	—
R. recens var. *lacustris*	W	W	G	G	G	—	—	—	—	—	—	—	—	—
R. rivularis	L	L	g	g	—	g	—	—	—	—	—	—	—	—
Rosaceae														
Acaena novae-zelandiae	L	L	—	—	—	—	—	—	g	—	—	—	—	g

Species	Occurrence M	TA	LE	CX	LS	MS	OR	Communities RS	BC	BG	BR	BP	DI	K
Potentilla anserinoides	W	L	g	G	—	—	—	—	g	—	—	—	—	—
Rubus australis	L	a	—	—	—	—	—	—	—	—	—	—	—	E
R. cissoides	a	W	—	—	—	—	—	—	—	—	—	E	—	E
R. schmidelioides	L	W	—	—	—	—	—	—	—	—	—	E	—	E
Rubiaceae														
Coprosma astonii	a	L	—	—	—	—	—	—	—	—	—	S	—	—
C. banksii	L	a	—	—	—	—	—	—	—	—	s	—	—	—
C. brunnea	L	a	—	—	—	—	—	—	g	—	—	—	—	—
C. cheesemanii	L	a	—	—	—	—	g	—	—	—	—	—	—	—
+*C. ciliata*	a	W	—	—	—	—	—	—	—	—	—	S	—	S
C. colensoi	L	W	—	—	—	—	—	—	—	—	—	S	—	—
C. foetidissima	W	W	—	—	—	s	—	C	—	—	S	S	S	S
C. linariifolia	L	W	—	—	—	—	—	—	—	—	s	S	s	S
C. lucida	W	W	—	—	—	s	—	C	—	—	S	S[4]	S	s
C. parviflora	W	L	—	—	—	S	—	—	—	—	S	S	S	S
C. polymorpha	W	W	—	—	—	s	—	—	—	—	S	S	S	S[4]
C. propinqua	W	W	—	m	M	C	M	C	M	—	—	s	—	s
K*C. rhamnoides*	—	a	—	—	—	—	—	—	—	—	—	—	—	—
C. rotundifolia	L	W	—	—	—	—	—	—	—	—	—	S	—	S
+*C. rugosa*	L	L	—	—	—	s	—	s	m	—	—	—	—	—
Galium perpusillum	L	L	—	—	—	—	—	—	g	—	—	g	—	—
G. propinquum	W	W	G	G	G	G	—	—	—	—	—	—	—	—
G. tenuicaule	W	L	—	—	G	G	—	—	G	—	—	—	—	g
Nertera depressa	W	W	—	—	g	G	—	—	G	—	—	g	g	G
N. dichondraefolia	W	W	—	—	—	G	—	—	—	—	—	G	G	G[4]
Salicaceae														
**Salix* sp.	L	L	—	M	M	—	—	—	M	—	—	—	—	—
Scrophulariaceae														
Euphrasia australis	L	a	—	—	—	—	g	—	—	—	—	—	—	—
Glossostigma elatinoides	W	W	G	—	—	—	—	—	—	—	—	—	—	—
G. submersum	L	a	G	—	—	—	—	—	—	—	—	—	—	—
Gratiola ?nana	W	W	G	G	G	—	g	—	—	—	—	—	—	—
+*Hebe odora*	L	a	—	—	—	—	—	—	g	—	—	—	—	—
H. salicifolia	L	L	—	—	—	—	—	C	—	—	—	s	—	g
Limosella lineata var. *lineata*	W	W	G	—	g	—	—	—	—	—	—	—	—	—
L. lineata var. *spathulata*	L	a	G	—	—	—	—	—	—	—	—	—	—	—
Mazus radicans	L	a	—	—	—	g	—	—	—	—	—	—	—	—
K*Mimulus repens*	L	a	g	—	—	—	—	—	—	—	—	—	—	—
Parahebe catarractae	L	a	—	—	—	—	—	g	—	—	—	—	—	—
P. lyallii	L	a	—	—	—	—	—	g	g	—	—	—	—	—
Stylidiaceae														
Forstera sedifolia	L	a	—	—	—	—	—	—	—	g	—	—	—	—
Tetrachondraceae														
Tetrachondra hamiltonii	L	L	G	G	—	—	—	—	—	—	—	—	—	—
Thymelaeaceae														
Pimelea gnidia	L	a	—	—	—	—	—	S	—	—	—	—	—	—
Umbelliferae														
Centella uniflora	W	L	g	G	G	G	g	—	—	g	—	—	—	—
Hydrocotyle americana	W	W	—	—	G	G	—	—	—	—	—	G	—	—
+*H. dissecta*	L	a	—	—	—	—	—	—	—	—	—	—	—	g
H. moschata	L	a	—	—	—	—	—	—	G	—	—	—	—	—
H. novae-zelandiae	a	W	—	—	—	—	—	—	G	—	—	g	—	g
H. tripartita	W	W	G	G	G	G	—	—	—	—	—	—	—	—
Lilaeopsis ?orbicularis	W	W	G	—	—	—	—	—	—	—	—	—	—	—
Schizeilema cockaynei	W	W	G	G	G	G	—	—	—	—	—	—	—	—

Species	Occurrence		Communities											
	M	TA	LE	CX	LS	MS	OR	RS	BC	BG	BR	BP	DI	K
Urticaceae														
Urtica incisa	L	L	—	—	—	G	—	—	—	—	—	—	—	g
Violaceae														
+*Melicytus lanceolatus*	L	a	—	—	—	—	—	—	m	—	—	—	—	—
M. ramiflorus	L	L	—	—	—	—	—	—	—	—	—	s	—	s
Viola filicaulis	L	L	—	—	—	G	—	—	**G**	—	—	g	—	g
V. lyallii	W	W	G	**G**	**G**	G	G	—	**G**	—	—	—	—	—
Winteraceae														
Pseudowintera colorata	W	W	—	—	—	S	—	—	—	—	S	S	—	S
MOSSES														
Acanthocladium extenuatum	W	L	—	—	—	—	—	G	g	G	—	G	**G**	G
Acrocladium auriculatum	W	W	—	—	—	—	—	—	—	—	**G**	**G**	—	G
Andreaea subulata	L	a	—	—	—	—	G	—	—	—	—	—	—	—
Barbula australasiae	W	a	—	—	—	—	G	—	—	—	—	—	—	—
Bartramia halleriana	L	a	—	—	—	—	G	—	—	—	—	—	—	—
B. papillata	L	L	—	—	—	G	G	—	—	—	—	g	—	—
Blindia tenuifolia	L	a	—	—	—	—	—	—	—	—	—	—	G	—
Brachythecium plumosum	L	a	—	—	—	—	g	—	—	—	—	—	—	—
B. rutabulum	L	a	—	—	—	—	G	—	—	—	—	—	—	—
Breutelia affinis	L	a	—	—	—	—	G	G	—	—	—	—	—	—
B. elongata	L	a	—	—	—	—	—	—	—	—	—	—	G	—
B. pendula	W	W	g	—	g	**G**	g	G	G	—	g	g	—	g
Bryum dichotomum	L	a	—	—	—	—	G	—	—	—	—	—	—	—
B. laevigatum	W	a	—	—	—	—	**G**	—	—	—	—	—	—	—
B. truncorum	W	W	—	—	g	**G**	—	—	G	—	**G**	**G**	**G**	**G**
Camptochaete angustata	L	a	—	—	—	—	—	—	—	—	—	—	—	**G**
C. arbuscula	L	a	—	—	—	—	—	—	—	—	—	—	—	G
C. ramulosa	L	W	—	—	—	—	—	—	—	—	—	G	—	**G**
C. pulvinata	W	W	—	—	—	—	—	—	—	—	**G**	**G**	**G**	**G**
Campylopus bicolor	W	a	—	—	—	—	**G**	—	—	**G**	—	—	—	—
C. clavatus	W	a	—	—	—	—	**G**	**G**	—	**G**	—	—	—	—
C. introflexus	W	a	—	—	—	—	G	G	—	—	g	—	—	—
Catagonium politum	W	a	—	—	—	—	—	—	—	—	**G**	—	—	—
Ceratodon purpureus	W	a	—	—	—	—	—	G	—	—	—	—	—	—
Cladomnion ericoides	W	L	—	—	—	—	—	—	—	—	—	G	—	—
Climacium dendroides	L	a	g	—	—	—	—	—	—	—	—	g	—	—
Cratoneuropsis relaxa	L	a	—	—	—	—	—	—	—	—	g	—	—	—
Cyathophorum bulbosum	L	W	—	—	—	—	—	—	—	—	g	g	G	g
Dendroligotrichum dendroides	L	L	—	—	—	—	—	—	—	—	—	g	—	—
Dicranoloma billardieri	L	W	—	—	—	—	—	—	—	—	G	G	G	—
D. cylindropyxis	W	L	—	—	—	—	—	—	—	—	—	g	—	—
D. dicarpum	W	a	—	—	—	—	—	—	—	—	**G**	**G**	**G**	—
D. menziesii	W	a	—	—	—	—	g	—	—	—	**G**	**G**	**G**	**G**
D. plurisetum	a	L	—	—	—	—	—	—	—	—	—	g	—	—
D. robustum	W	W	—	—	—	g	g	**G**	G	—	**G**	**G**	**G**	g
D. robustum var. *setosum*	L	W	—	—	—	—	—	—	—	—	—	g	—	—
Dicranum aucklandicum	W	a	—	—	—	—	**G**	—	—	—	—	—	—	—
Distichophyllum pulchellum	L	a	—	—	—	g	—	—	—	—	—	G	—	—
Ditrichum flexifolium	W	a	—	—	—	—	—	—	—	—	G	g	—	—
Drepanocladus aduncus	L	a	—	—	g	g	—	—	—	G	—	—	—	—
D. fluitans	W	a	—	—	G	G	—	—	—	**G**	—	—	—	—
Entodon truncorum	L	a	—	—	—	—	—	—	—	—	g	g	—	—

Species	Occurrence		Communities											
	M	TA	LE	CX	LS	MS	OR	RS	BC	BG	BR	BP	DI	K
Erythrobarbula binsii	W	a	—	—	—	—	g	—	—	—	—	—	—	—
Eucamptodon inflatus	W	a	—	—	—	—	G	G	—	—	G	—	—	—
Eurhynchium asperipes	a	L	—	—	—	—	—	—	—	—	—	g	—	—
Fissidens adianthoides	L	a	g	—	—	—	—	—	—	—	—	—	—	—
F. asplenioides	W	W	G	G	G	—	g	—	—	—	—	—	—	—
Glyphothecium sciuroides	L	a	—	—	—	—	—	—	—	—	—	g	—	—
Grimmia apocarpa	W	a	—	—	—	—	G	—	—	—	—	—	—	—
G. pulvinata	L	a	—	—	—	—	G	—	—	—	—	—	—	—
Hedwigia ciliata	W	a	—	—	—	—	G	—	—	—	—	—	—	—
H. integrifolia	L	a	—	—	—	—	G	—	—	—	—	—	—	—
Hypnodendron arcuatum	W	W	—	—	g	G	—	—	—	—	G	G	G	G
H. marginatum	W	L	—	—	g	G	—	—	—	—	—	G	—	G
Hypnum cupressiforme	W	W	—	—	—	G	G	G	G	—	G	G	G	G
Hypopterygium novae-seelandiae	W	W	—	—	—	—	—	—	—	—	G	G	G	G
H. setigerum	W	a	—	—	—	—	—	—	—	—	—	—	—	G
Lembophyllum clandestinum	W	a	—	—	—	—	G	—	—	—	G	G	—	—
Leptotheca gaudichaudii	L	a	—	—	—	—	—	G	—	—	G	—	—	—
Leucobryum candidum	W	W	—	—	—	—	—	—	—	—	G	g	G	—
Macromitrium erosulum	L	a	—	—	—	—	—	G	—	—	G	—	—	—
M. longipes	a	L	—	—	—	—	—	—	—	—	—	g	—	—
M. longirostre	a	W	—	—	—	—	—	—	—	—	—	g	—	g
M. prorepens	L	a	—	—	—	—	—	G	—	—	g	—	—	—
Mesotus celatus	a	L	—	—	—	—	—	—	—	—	—	G	—	—
Mniodendron comosum	W	a	—	—	—	G	—	—	—	—	—	G	G	G
Mnium longirostre	L	a	—	—	—	—	—	—	—	—	—	g	—	—
Orthorrhynchium elegans	L	a	—	—	—	—	—	—	—	—	—	—	—	G
Papillaria flavo-limbata	a	W	—	—	—	—	—	—	—	—	—	G	—	—
Philonotis tenuis	L	a	—	—	—	—	G	—	—	—	—	—	—	—
Polytrichum commune	L	a	—	—	—	G	—	—	—	G	—	—	—	—
P. formosum	L	a	—	—	—	—	—	—	—	G	—	—	—	—
P. juniperinum	W	L	g	—	—	G	—	—	G	G	—	—	—	—
Pterygophyllum quadrifarium	W	a	—	—	—	—	—	—	—	—	g	g	G	G
Ptychomnion aciculare	W	W	—	—	—	G	—	—	g	—	G	G	G	G
Rhacocarpus humboldtii	W	a	—	—	—	—	G	—	—	G	—	—	—	—
Rhacomitrium crispulum	W	a	—	—	—	—	G	G	—	—	—	—	—	—
R. lanuginosum var. *pruinosum*	W	a	—	—	—	—	G	G	—	—	—	—	—	—
Rhacopilum strumiferum	L	a	—	—	—	—	—	—	—	—	G	—	—	G
Rhaphidorrhynchium amoenum (Hedw.) Fleisch.	a	W	—	—	—	—	—	—	—	—	—	G	—	—
Rhizogonium bifarium	W	W	—	—	—	—	—	—	—	—	G	G	G	G
R. distichum	L	L	—	—	—	—	—	—	—	—	—	G	—	—
R. mnioides	W	W	—	—	—	G	—	—	G	—	G	G	—	G
R. novae-hollandiae	L	a	—	—	—	—	—	—	—	—	—	g	—	—
R. pennatum	L	a	—	—	—	—	—	—	—	—	—	—	—	G
Sauloma tenella	L	a	—	—	—	—	—	—	—	—	G	G	—	—
Sciadocladus menziesii	L	a	—	—	—	—	—	—	—	—	—	G	—	—
Sphagnum australe	L	a	—	—	—	—	—	—	—	G	—	—	—	—
S. cristatum	W	a	—	—	—	—	—	—	—	G	—	—	—	—
S. falcatulum	L	a	—	—	—	—	—	—	—	g	—	—	—	—
S. subsecundum	L	a	—	—	—	—	—	—	—	g	—	—	—	—
Thuidium furfurosum	W	W	—	—	—	G	G	G	G	—	G	G	G	G

Species	Occurrence M	TA	LE	CX	LS	MS	OR	Communities RS	BC	BG	BR	BP	DI	K
T. laeviusculum	L	a	—	—	—	—	G	—	—	—	—	g	—	—
Tortella knightii	L	a	—	—	—	—	—	—	—	—	g	—	—	—
Tridontium tasmanicum	W	W	G	—	—	—	—	—	—	—	—	—	—	—
Weissia controversa	W	a	—	—	—	—	G	—	—	—	G	G	G	G
Weymouthia cochlearifolia	W	W	—	—	—	G	—	—	—	—	—	—	—	—
W. mollis	W	W	—	—	—	—	—	—	—	—	E	e	E	E
HEPATICS														
Acrobolus lophocoleoides	L	a	—	—	—	—	—	—	—	—	G	—	—	—
Acromastigum anisostomum	L	a	—	—	—	—	—	—	—	—	—	—	G	—
A. marginatum	L	a	—	—	—	—	—	—	—	G	—	—	g	—
Aneura lobata	W	a	—	—	—	G	—	—	—	—	g	G	G	G
Balantiopsis rosea	L	a	—	—	—	—	—	—	—	G	—	—	—	—
Bazzania adnexa	W	L	—	—	—	—	—	—	—	—	G	G	G	—
B. involuta	L	a	—	—	—	—	—	—	—	—	G	—	—	—
B. novae-zelandiae	W	a	—	—	—	—	—	—	—	—	G	G	G	—
B. nitida	L	a	—	—	—	—	—	—	—	—	—	—	G	—
Chandonanthus squarrosus	W	W	—	—	—	—	—	G	—	—	G	G	G	—
Chiloscyphus allodontus	W	L	—	—	—	—	—	—	—	—	g	G	G	—
C. ammophilus	L	L	—	—	—	G	—	—	—	—	—	g	—	—
C. billardieri	W	a	—	—	—	G	—	—	—	—	G	G	G	G
C. coalitus	L	W	—	—	—	—	—	—	—	—	—	G	G	—
C. fissistipus	L	a	—	—	—	—	—	—	—	—	—	—	G	—
C. polycladus	L	L	g	—	G	—	—	—	—	—	—	G	—	—
C. sinuosus	L	a	—	—	—	—	—	—	—	—	G	—	—	—
C. splendidus	a	L	—	—	—	—	—	—	—	—	—	G	—	—
Clasmatocolea strongylophylla	L	a	—	—	—	G	—	—	—	—	—	—	—	—
Cryptochila grandiflora	L	a	—	—	—	—	—	—	—	—	—	—	g	—
Cuspidatula monodon	L	a	—	—	—	—	—	—	—	—	G	g	G	—
Fossombronia sp.	L	a	—	—	g	—	—	—	—	—	—	—	—	—
Frullania falciloba	L	W	—	—	—	—	—	g	—	—	g	G	—	—
F. fugax	L	a	—	—	—	—	g	—	—	—	g	—	—	—
Gackstroemia weindorferi	L	a	—	—	—	—	—	—	—	—	G	G	G	—
Haplomitrium gibbsiae	L	a	—	—	—	—	—	—	—	g	—	—	—	—
Hymenophyton flabellatum	L	W	—	—	—	G	—	—	—	—	—	G	—	G
Isotachis lyallii	L	a	—	—	—	—	—	—	—	G	—	—	g	—
I. montana	L	a	—	—	—	—	—	—	—	G	—	—	g	—
Jamesoniella colorata	W	a	—	—	—	—	—	—	—	—	G	G	—	—
J. tasmanica	W	a	—	—	—	—	—	—	—	—	g	g	G	—
Kurzia allisonii	L	a	—	—	—	G	—	—	—	G	—	—	g	—
K. compacta	L	a	—	—	G	G	—	—	—	—	—	—	—	—
K. hippuroides	W	a	—	—	G	G	—	—	—	G	—	—	—	—
K. pallescens	L	a	—	—	—	—	—	—	—	—	—	g	—	—
Lepicolea scolopendra	L	a	—	—	—	—	G	—	—	—	—	—	G	—
Lepidolaena clavigera	W	a	—	—	—	—	—	—	—	—	G	G	G	—
L. hodgsoniae	W	a	—	—	—	—	—	—	—	—	G	G	G	—
L. palpebrifolia	W	a	—	—	—	—	—	G	—	—	G	G	G	G
L. taylorii	L	L	—	—	—	—	—	—	—	—	G	—	G	—
Lepidozia concinna	W	a	—	—	—	—	—	—	—	—	G	G	G	g
L. glaucophylla	L	a	—	—	—	—	—	—	—	—	—	—	g	—
L. microphylla	a	L	—	—	—	—	—	—	—	—	—	G	—	—
L. pendulina	W	a	—	—	—	—	—	—	—	—	G	G	G	—
L. setigera	L	a	—	—	—	—	—	—	—	—	G	—	G	—
L. spinosissima	L	a	—	—	—	—	—	—	—	—	—	—	g	—
Lophocolea austrigena	L	a	—	—	—	—	—	—	—	G	—	—	G	—

Species	Occurrence		Communities											
	M	TA	LE	CX	LS	MS	OR	RS	BC	BG	BR	BP	DI	K
L. ?biciliata	L	a	—	—	—	g	—	—	—	—	—	—	—	—
L. leucophylla	W	a	—	—	—	—	—	—	—	—	G	G	G	—
L. planiuscula	W	a	—	—	—	—	g	—	—	—	—	—	—	—
L. semiteres	L	a	—	—	—	—	g	—	—	—	g	—	—	—
L. variabilis	L	a	—	—	—	—	—	—	—	—	—	g	—	—
L. villosa	L	a	—	—	—	—	—	—	—	—	—	g	—	—
Lophoziaceae[6] (unnamed sp.)	L	a	—	—	—	—	g	—	—	—	—	—	—	—
Marchantia foliacea	L	a	—	—	—	—	—	—	—	—	—	g	—	—
Marsupidium knightii	L	a	—	—	—	—	—	—	—	—	G	—	—	—
Mastigophora flagellifera	L	a	—	—	—	—	—	—	—	—	—	G	—	—
Megaceros sp.	L	a	—	—	—	G	—	—	—	—	—	g	—	—
Metzgeria colensoi	L	a	—	—	—	—	—	—	—	—	—	—	G	—
M. ?decrescens	L	a	—	—	—	G	—	—	—	—	—	—	—	—
M. ?hamata	W	a	—	—	—	G	—	—	—	—	G	G	G	G
M. sp.	—	W	—	—	—	—	—	—	—	—	—	g	—	g
Pallavicinia connivens	L	a	—	—	—	—	—	—	—	—	—	G	—	—
P. xiphoides	L	a	—	—	G	G	—	—	—	—	—	—	—	—
Plagiochila deltoidea	W	L	—	—	—	—	—	—	—	—	G	G	G	G
P. fuscella	a	L	—	—	—	—	—	—	—	—	—	G	—	—
P. gregaria	W	a	—	—	—	—	—	—	—	—	G	G	G	—
P. lyallii	W	W	—	—	—	G	G	—	—	—	—	G	—	—
P. retrospectans	W	a	—	—	—	—	—	—	—	—	G	G	G	G
P. rutlandii	a	W	—	—	—	—	—	—	—	—	—	G	—	G
P. stephensoniana	L	a	—	—	—	—	—	—	—	—	—	—	—	G
P. strombifolia	W	a	—	—	—	—	—	—	—	—	g	g	—	—
Plagiochilion conjugatus	L	a	—	—	—	—	—	—	—	—	g	—	—	—
Porella elegantula	W	W	—	—	—	—	—	—	—	—	g	g	g	g
Psiloclada clandestina	L	a	—	—	—	—	—	—	—	—	—	—	G	—
Radula dentifolia	L	a	—	—	—	—	—	—	—	—	—	—	G	—
R. plicata	L	a	—	—	—	—	—	—	—	—	—	—	G	—
Riccardia ?lobulata	W	a	G	—	—	G	—	—	—	—	g	G	G	G
R. sp.	—	W	—	—	—	—	—	—	—	—	—	G	—	—
Schistochila ciliata	W	a	—	—	—	—	—	—	—	—	G	G	G	G
S. glaucescens	a	L	—	—	—	—	—	—	—	—	—	g	—	—
S. nobilis	W	W	—	—	—	—	—	—	—	—	G	G	G	G
Solenostoma sp.	L	a	—	—	—	—	g	—	—	—	—	—	—	—
Symphyogyna hymenophyllum	L	a	—	—	—	g	—	—	—	—	—	G	—	G
S. prolifera	L	a	—	—	—	G	—	—	—	—	—	—	—	G
Telaranea gottscheana	W	L	—	—	—	—	—	—	—	—	g	g	G	g
T. herzogii	a	L	—	—	—	—	—	—	—	—	—	g	—	—
T. ?meridiana	a	L	—	—	—	—	—	—	—	—	—	g	—	—
T. tetradactyla	L	a	—	—	—	—	—	—	—	—	—	g	—	—
Temnoma pulchellum	L	a	—	—	—	—	—	—	—	—	—	g	G	—
Treubia lacunosa	L	a	—	—	—	—	—	—	—	—	—	G	—	—
Trichocolea mollissima	W	W	—	—	—	—	—	—	—	—	G	G	G	G
Trichotemnoma corrugatum	L	a	—	—	—	—	—	—	—	—	—	—	G	—
Tylimanthus saccatus	L	a	—	—	—	—	—	—	—	—	—	g	G	—
T. tenellus	L	a	—	—	—	—	—	—	—	—	g	—	—	—
Zoopsis argentea	L	a	—	—	—	—	—	—	—	—	—	—	G	—
Z. leitgebiana	L	a	—	—	—	—	—	—	—	—	—	—	G	—
Z. setulosa	L	a	—	—	—	—	—	—	—	—	—	—	G	—
LICHENS														
Cladia aggregata (Sw.) Ach.	W	a	—	—	—	—	G	G	—	—	—	—	—	—

Species	Occurrence M	TA	LE	CX	LS	MS	OR	Communities RS	BC	BG	BR	BP	DI	K
C. sullivanii (Mull. Arg.) Martin	W	a	—	—	—	—	G	G	—	—	—	—	—	—
Cladonia amaurocraea (Flk.) Schaer	L	a	—	—	—	—	G	—	—	—	—	—	—	—
C. capitellata var. *fastigiata* Vain.	L	a	—	—	—	—	G	—	—	—	—	—	—	—
C. crispata (Ach.) Flot.	W	a	—	—	—	—	G	—	—	—	—	—	—	—
C. ?gracilis (L.) Willd.	L	a	—	—	—	—	—	—	—	—	g	—	—	—
C. leptoclada Des. Abb.	W	a	—	—	—	—	G	G	—	—	—	—	—	—
C. scabriuscula (Del.) Leight.	L	W	—	—	—	—	—	—	—	—	—	g	—	—
Coenogonium implexum Nyl.	L	a	—	—	—	—	—	—	—	—	g	—	—	—
Parmelia borreri (Sm.) Turn.	W	a	—	—	—	—	G	—	—	—	—	—	—	—
P. conspersa (Ach.) Ach.	W	a	—	—	—	—	G	—	—	—	—	—	—	—
Peltigera sp.	a	W	—	—	—	—	—	—	—	—	—	g	—	g
Placopsis sp.	W	a	—	—	—	—	G	—	—	—	—	—	—	—
Pseudocyphellaria colensoi (Nyl.) Vain.	L	a	—	—	—	—	—	—	—	—	G	—	—	—
P. endochrysea (Del.) Vain.	L	a	—	—	—	—	—	—	—	—	G	—	—	—
P. freycinetii (Del.) Malme	W	a	—	—	—	—	G	—	—	—	—	—	—	—
P. ?homeophylla Nyl.	L	a	—	—	—	—	—	—	—	—	—	—	G	—
P. mougeoteana (Del.) Vain.	W	a	—	—	—	—	G	—	—	—	—	—	—	—
P. spp.	—	W	—	—	—	—	—	—	—	—	—	G	—	G
Siphula sp.	W	a	—	—	—	—	G	G	—	—	—	—	—	—
Sphaerophorus tener Laur.	a	W	—	—	—	—	—	—	—	—	—	G	—	g
Stereocaulon colensoi Bab.	W	a	—	—	—	—	G	G	—	—	—	—	—	—
S. corticatulum Nyl.	W	a	—	—	—	—	G	G	—	—	—	—	—	—
Usnea capillacea Mot.	W	a	—	—	—	—	G	—	—	—	—	—	—	—
U. sp.	W	W	—	—	—	E	E	—	—	—	—	—	—	—
ALGAE														
Chara corallina Klein ex Willd. var. *nobilis* (A. Braun) R.D. Wood	W	a	G[3]	—	—	—	—	—	—	—	—	—	—	—
C. fibrosa R.D. Wood	W	a	G[3]	—	—	—	—	—	—	—	—	—	—	—
Nitella sp.	W	a	G[3]	—	—	—	—	—	—	—	—	—	—	—