Papers and Proceedings of the Royal Society of Tasmania, Volume 117, 1983.

(ms. received 19.10.1982)

# CONSERVATION OF TASMANIAN MACROPHYTIC WETLAND VEGETATION

by J.B. Kirkpatrick and C.E. Harwood
Department of Geography, University of Tasmania,
and Department of Minerals and Energy, Konedobu, Papua-New Guinea

(with three tables and one text-figure)

ABSTRACT

KIRKPATRICK, J.B. & HARWOOD, C.E., 1983 (31 viii): Conservation of Tasmanian macrophytic wetland vegetation. *Pap. Proc. R. Soc. Tasm.*, 117: 5-20.
https://doi.org/10.26749/rstpp.117.5 ISSN 0080-4703. Department of Geography, University of Tasmania, Hobart, Tasmania, Australia, and Department of Minerals and Energy, Konedobu, Papua-New Guinea.

Approximately 200 macrophytic species, of which thirty-one were poorly reserved or unreserved, were recorded from 530 Tasmanian wetlands. An iterative strategy locates six wetlands within which sixteen of these species occur, individual wetlands being suggested to provide a minimum level of reservation for the remaining species. Half of the major wetland plant communities, as defined by dominant lifeform and species, are unreserved, and a further quarter are poorly reserved.

## INTRODUCTION

The conservation status of Australian wetlands has attracted considerable interest in recent years (e.g. Gooderick 1970, Jones 1978). The main focus of much of the work on Australian wetlands and their conservation has been on the avifauna, although Tyler (1976) discussed the conservation status of the interesting vegetation at the Lagoon of Islands and there is a recent review of Australian wetland vegetation (Briggs 1981). This paper documents the results of an investigation into the conservation of Tasmanian wetland species and plant communities. A later paper will discuss the synecology of the major Tasmanian wetland plant communities.

## METHODS

Wetlands were defined as vegetated or temporarily unvegetated areas covered by non-tidal, still water less than 4 m deep for several months of the year or more. This definition excludes salt marshes, the subject of a previous study of wetland conservation in Tasmania (Kirkpatrick & Glasby 1981). Artificial impoundments and wetlands smaller than 0.5 ha were excluded from the study. Most wetlands below 500 m above sea level were included as was a sample of highland wetlands. Few wetlands were visited in the southwest of the state where accessibility is poor.

The following data relevant to this study were recorded from 530 wetlands:
1) The projective canopy coverage class of the tallest stratum in each perceived plant community (0-10%, 10-30%, 30-70% and 70-100%). These were discriminated on the basis of differences in dominance. The lifeforms used were: tree, shrub, grass (Poaceae), sedge (Cyperaceae), rush (Restionaceae, Juncaceae), herb (non-graminoid, non-woody, non-aquatic), aquatic.
2) The percentage of the area of the wetland covered by each zone. Five classes were used: 0-5%, 5-25%, 25-50%, 50-75% and 75-100%.
3) The percentage cover of each observed macrophytic species, bare ground and water in each zone. The classes in 2) above were used.

The wetland survey data and reliable literature reports were used to discover which species were not known from State Reserves (subsequently referred to as "unreserved"). A check of the specimens in the Tasmanian Herbarium (HO) was then made for these latter species in order to gain information on their range outside wetlands and any possible occurrences in State Reserves. The distributions of the remaining "unreserved" species

were mapped and each wetland was given a score which equalled the number of "unreserved" species recorded from it from all data sources. The wetland with the highest score was then designated the first priority for reservation and/or protection of species. The scores were then recalculated omitting the species found in the first priority wetland. This procedure was repeated until all "unreserved" species were in a wetland designated for reservation and/or protection. Where two or more wetlands had the same score the wetland most feasibly reserved or protected was selected. This procedure, described more fully elsewhere (Kirkpatrick 1983), objectively locates the minimum number of wetlands necessary to ensure that each wetland plant species has at least one population in a safe area in Tasmania.

Most wetlands could only be visited once, which meant that certain species had to be identified from limited reproductive material or from vegetative material only. Where possible, vegetative samples were taken and propagated when identification was in doubt. The difficulties encountered in differentiating between closely related species from often inadequate material made it impossible to consistently differentiate between *Scirpus fluitans* and *S. productus*, most *Rumex* species, *Potamogeton australiensis* and *P. tricarinatus*, *Myriophyllum elatinoides* and *M. propinquum* (wetlands 1-99 only), *Ranunculus* species, *Typha* species and native *Agrostis* species.

The plant community is an imprecise entity. Communities with the same dominant species may differ widely in terms of subordinate species, physical and chemical parameters, and productivity. Nevertheless, as the assemblages and relative abundance of plant species form an integral part of the components of the ecosystem, they are one of the best indices for general conservation purposes.

For the assessment of conservation status the wetland plant communities are placed into one of herbfield, sedgeland, rushland, heath, scrub, forest and aquatic vegetation and are defined by the single species with the greatest cover in the tallest stratum.

Within wetlands, communities judged to be less than 0.2 ha in extent were excluded. Thus it can be seen that many smaller areas of a community may have been excluded from the analysis. However most of the area of a community is contained within its larger occurrences, just as most of the area of wetland in Tasmania is located in the upper 50% of the size range. It should also be noted that for many management objectives, such as providing feeding or breeding grounds for many of the larger vertebrates, only large areas of a community warrant consideration.

The percentage of the total surveyed area of each community found within the State Reserve system was then calculated. For the unreserved and poorly reserved communities, wetlands outside the State Reserve system, but preferably within Lands Department Reserves, Wildlife Sanctuaries, Conservation Areas or Crown Land were selected to bring potential reservation of surveyed wetlands up to 5%.

## RESULTS

### Conservation of the wetland plant species

The vascular plant species observed in the wetlands included in this study are listed in the appendix which also indicates the State Reserves within which particular species are found, shows whether they occur only marginally in wetlands and denotes whether species are Tasmanian endemics, native to Tasmania or introduced to Tasmania.

Most of the native wetland species occur widely on the mainland of Australia. Seven species are Tasmanian endemics. *Centrolepis pulvinata* is reserved only in the Mt William National Park, while the other endemic species are known to have substantial populations in two or more State Reserves. Of the non-endemic native wetland species 30 are not known from any State Reserve.

Sixteen of the thirty-one unreserved and poorly reserved native species could be reserved in six wetlands (table 1). Most of the remaining species are present in reserves

of less secure status than those fully controlled by the Tasmanian National Parks and Wildlife Service, although several species could only be reserved, with present information, by the resumption of privately-owned wetlands (table 1). *Cyperus lucidus*, *C. tenellus*, *Juncus amabilis*, *J. astreptus* and *J. subsecundus* all occur widely outside wetlands in disturbed habitats. Thus, no reservation appears to be necessary.

TABLE 1

DETAILS OF RESERVATION PROPOSALS FOR SPECIES CONSERVATION.

| Wetland Code Number | 1:100 000 Map | Grid Reference | Species | Land tenure |
|---|---|---|---|---|
| 519 | 8416 | 800728 | *Centipeda minima*, *Lythrum salicaria*, *Polygonum strigosum*, *Villarsia exaltata* | private |
| 330 | 8517 | 156343 | *Centrolepis pulvinata*, *Myriophyllum muelleri*, *Scirpus pungens*, *Wilsonia rotundifolia* | Crown land |
| 212 | 8515 | 094220 | *Baumea articulata*, *Amphibromus archeri* | private and Crown land reserve |
| 536 | 8416 | 520750 | *Scirpus caldwellii*, *S. validus* (*S. pungens*) | Crown land |
| 272 | 8515 | 885900 | *Haloragis heterophylla*, *Juncus revolutus* | Crown land |
| 17 | 8313 | 310160 | *Juncus vaginatus*, *Glyceria australis* | Council Wildlife Sanctuary |
| 230 | 8412 | 770780 | *Juncus squarrosus* | private wildlife sanctuary |
| 530 | 8416 | 552710 | *Potamogeton pectinatus* | Crown land reserve |
| 344 | 8517 | 222228 | *Aphelia* sp. | Crown land |
| 707 | 8313 | 130340 | *Amphibromus neesii* | Crown land and private |
| 444 | 8000 | 312939 | *Lepilaena bilocularis* | private |
| 88 | 8311 | 402370 | *Lepilaena preissii* | Crown land reserve |
| 16 | 8313 | 300020 | *Rumex bidens* | private |
| 297 | 8517 | 028662 | *Scaevola albida* | Crown land |
| 305 | 8517 | 010485 | *Wolffia* sp. | private |
| 402 | 8000 | 369609 | *Polygonum plebeium* | Crown land and private |

The native species that are unreserved in Tasmania might be reserved elsewhere in Australia or overseas. None is listed in Leigh, Briggs and Hartley (1981) as threatened or rare. Nevertheless it may be desirable to reserve these species in Tasmania to help avoid local extinction of species or genotypes. To the extent that species reflect habitats, the reservations suggested in table 1 would present the most efficient manner of extending the wetland environments included within the State Reserve system.

The Conservation of Macrophytic Plant Communities

The area of wetland included in the survey was 11 700 ha. Excluding the oligotrophic wetlands in the glacially eroded part of the state, another 2 000 ha of wetland were not included in the survey and approximately 35% (7 000 ha) of the original area of wetland has been drained. Only 643 ha (5.5% of surveyed wetlands) are in State Reserves. Of the wetland vegetation formations only forest and scrub have greater than 5% of their surveyed area reserved (table 2), and these formations had previously been drastically reduced in area as a result of land clearance for agriculture. Sedgeland almost attains a desirable minimum percentage of reservation. Aquatic, herbfield, rushland and grassland are all inadequately reserved (table 2). At the level of communities defined by dominance and structure, reservation is extremely poor. Half the communities occupying more than 10 ha in total are totally unreserved, and less than half of the remaining communities of this extent are adequately reserved (table 3).

TABLE 2

THE RESERVATION STATUS OF THE MAJOR WETLAND VEGETATION FORMATIONS.

| | Cover classes (%) | | | | Total | Area Reserved | Reserved (% of area surveyed) |
|---|---|---|---|---|---|---|---|
| | 70-100 | 30-70 | 10-30 | 0-10 | | | |
| Forest | 1040 | | | | 1040 | 100 | 9.6 |
| Scrub | 664 | 13 | 39 | 15 | 731 | 173.5 | 23.7 |
| Grassland | 70.5 | 8 | 5 | 1.5 | 85 | 0 | 0 |
| Herbfield | 103 | 131 | 156.5 | 256.5 | 647 | 7.5 | 1.2 |
| Rushland | 133 | 76 | 17 | 4 | 230 | 1.5 | 0.7 |
| Sedgeland | 1398.5 | 2606 | 770 | 50 | 4824.5 | 220.5 | 4.6 |
| Aquatic | 702.5 | 1561 | 810.5 | 1075 | 4149 | 140.5 | 3.4 |
| TOTAL | | | | | 11706.5 | 643.5 | 5.5 |

The wetlands recommended as having a high priority for future reservation for community conservation include many of those important for species conservation, and are concentrated in the Furneaux Group and the northeast with a scattering elsewhere in the state (table 3, fig. 1). The selective process ensured that most of these wetland were on Crown land or private land dedicated to nature conservation (table 3).

## DISCUSSION

The preceding analysis and discussion somewhat begs the question of the ideal proportion of reservation for wetland plant species and communities. We have assumed that endemic species might be rendered secure with two populations in reserves, that other native species, apart from the most highly opportunistic, might be secured with populations in one reserved wetland, and that communities might require 5% of their present recorded area for security. Most species and communities would be reserved at greater than this minimal level if our reservation recommendations were implemented. With the present state of knowledge on the ecology of wetland macrophytes there is no means of establishing appropriate reservation levels, which would almost certainly differ among the species and communities. The minimal levels effectively assume that wetlands will be constant through time in their species and community composition.

This assumption may be invalid as many wetland environments are highly unstable, particularly in respect to the period of inundation. This instability is very likely necessary for the regeneration and/or maintenance of many of the wetland species and communities (e.g. regeneration of *Melaleuca* scrublands in deep aquatic zones is believed to require exceptionally dry periods). Suitable environments for the growth of particular species disappear for protracted periods or shift drastically within a wetland (Millar 1973). These habitat disappearances are countered in most species by the ability to remain dormant in underground organs or seed until suitable conditions for re-establishment or

TABLE 3

PLANT COMMUNITIES RECORDED FROM MORE THAN 10 HA, with reservation recommendations for those having less than 5% of their surveyed area in the State Reserve system.

| Community | Surveyed area (ha) | % reservation of surveyed area | Recommended reservation Code & grid reference | | | Land ownership |
|---|---|---|---|---|---|---|
| FOREST | | | | | | |
| *Acacia melanoxylon* | 1040 | 9.6 | | | | |
| SCRUB | | | | | | |
| *Melaleuca ericifolia* | 664 | 22.6 | | | | |
| *M. squarrosa* | 33 | 71.2 | | | | |
| *Leptospermum laniger*um | 34 | 0.0 | well-reserved outside surveyed wetlands | | | |
| GRASSLAND | | | | | | |
| *Phragmites australis* | 50 | 0.0 | 35 (Derwent River Wildlife Sanctuary) | | | Crown land |
| HERBFIELD | | | | | | |
| *Centella cordifolia* | 18 | 2.7 | 193 | 078538 | 8514 | private |
| *Lilaeopsis brownii* | 15 | 0.0 | 530 | 552710 | 8416 | Crown land reserve |
| *Mimulus repens* | 15 | 0.0 | 508 | 820854 | 8416 | private wildlife sanctuary |
| *Pratia platycalyx* | 10 | 0.0 | 348 | 155178 | 8517 | Crown land |
| *Sarcocornia quinqueflora* | 13 | 0.0 | well-reserved in tidal salt marsh | | | |
| *Selliera radicans* | 152 | 0.3 | 303 | 100520 | 8517 | Wildlife Sanctuary Crown land |
| | | | 538 | 560785 | 8416 | Crown land reserve |
| | | | 330 | 156343 | 8517 | Crown land |
| | | | 195 | 073422 | 8513 | Crown land |
| *Wilsonia backhousei* | 211 | 0.0 | 284 | 075710 | 8517 | Crown land |
| *W. rotundifolia* | 122 | 0.0 | 286 | 042743 | 8518 | Crown land |
| | | | 511 | 811879 | 8416 | private wildlife sanctuary |
| | | | 515 | 812870 | 8416 | private wildlife sanctuary |
| RUSHLAND | | | | | | |
| *Juncus kraussii* | 212 | 0.7 | well-reserved in tidal salt marsh | | | |
| SEDGELAND | | | | | | |
| *Baumea arthrophylla* | 2518 | 6.5 | - | | | |
| *B. juncea* | 63 | 41.3 | - | | | |
| *Carex gaudichaudiana* | 85 | 0.0 | well-reserved outside surveyed wetlands | | | |
| *Chorizandra cymbaria* | 96 | 0.0 | 708 | 115355 | 8313 | Crown land |
| *Eleocharis acuta* | 54 | 0.0 | 423 | 385100 | 8000 | private |
| | | | 717 | 853405 | 8213 | private |
| *E. sphacelata* | 185 | 6.8 | - | | | |
| *Gahnia filum* | 45 | 0.0 | 510 | 795888 | 8416 | private wildlife sanctuary |
| *G. trifida* | 203 | 0.0 | 273 | 880890 | 8518 | Crown land |
| *Lepidosperm*um *longitudinale* | 1072 | 0.9 | 16 | 300020 | 8313 | private |
| *Schoenus tesquorum* | 77 | 1.3 | 717 | 853405 | 8213 | private |
| *Scirpus caldwellii* | 100 | 0.0 | 97 | 400375 | 8313 | private wildlife sanctuary |
| *S. cernuus* | 20 | 0.0 | 271 | 870920 | 8518 | Crown land |
| *S. fluitans* | 214 | 0.0 | 708 | 115355 | 8313 | Crown land |
| AQUATIC | | | | | | |
| *Chara* spp. | 14 | 0.0 | 722 | 603607 | 8214 | Crown land reserve |
| *Lamprothamnium* spp. | 1255 | 0.0 | 303 | 100520 | 8517 | Crown land Wildlife Sanctuary |
| | | | 717 | 853405 | 8213 | private |
| *Lepilaena cylindrocarpa* | 151 | 0.0 | 330 | 156343 | 8517 | Crown land |
| *L. bilocularis* | 11 | 0.0 | 444 | 312939 | 8000 | private |
| *Mimulus repens* | 33 | 0.0 | 1338 | 225260 | 8517 | Crown land |
| *Myriophyllum elatinoides* | 495 | 20.1 | - | | | |
| *M. propinquum* | 257 | 0.6 | 722 | 603607 | 8214 | Crown land reserve |
| *Ruppia* spp. | 740 | 0.8 | 35 | (Derwent River Wildlife Sanctuary) | | Crown land |
| *Scirpus fluitans* | 90 | 2.2 | 519 | 800728 | 8416 | private |
| *Triglochin procera* | 911 | 10.2 | - | | | |
| *Villarsia reniformis* | 11 | 0.0 | 624 | 993573 | 7815 | Crown land |

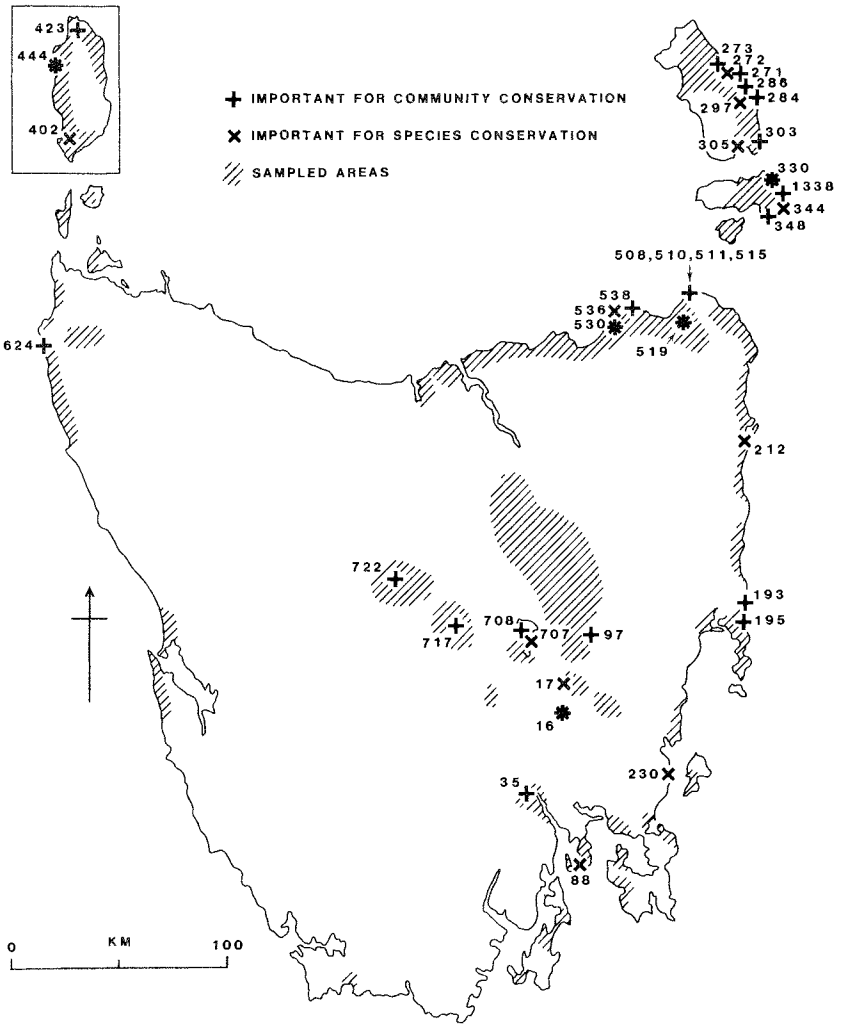


FIG. 1 - Distribution of wetlands recommended for reservation and regions in which wetlands were surveyed.

growth recur (Valk & Davis 1978). Others may depend for re-establishment on the dispersal of propagules from adjacent wetlands.

The probabilities of dispersal of species from one wetland to another are a function partly of distance and partly of the strength of the dispersal agent. Wetland species, being inhabitants of a highly disjunct environment, generally have adaptations for long distance dispersal, and thus have wide distributions. The main agents for dispersal for most species are almost certainly the wetland avifauna, and within catchments, floods (Sculthorpe 1967). Thus, the maintenance of a species complement in a particular wetland may partially depend on the maintenance of the paths of bird migration and local movement.

These paths may be disrupted by widespread drainage of surrounding wetlands, and an overall reduction in the area of wetlands may lead to a total reduction in the populations of particular bird species, and thus of the opportunities for particular wetlands to receive propagules of species eliminated through environmental fluctuations.

The Tasmanian wetland environments appear to be relatively resistant to the invasion of exotic species, which are substantially confined to the infrequently inundated zone on the margins of wetlands in agricultural country, particularly those disturbed by introduced grazing animals. Most of the native species which occupy this zone are themselves opportunistic and persist well even in the face of such invasions. Thus, wetlands appear to be suitable for small reserves in developed country, and a series of small reserves may be better for the preservation of variation in wetland communities and species than a few large reserves containing a similar number of wetlands, albeit with greater area.

A substantial reduction in area of any vegetation type is likely to lead to some extinction of localized or widespread but rare species. For example, several of the unreserved species recorded in this study might well be eliminated in Tasmania by the drainage of just one wetland.

The major conclusion of this study has to be that although the level of reservation of wetland vegetation as a whole might be construed as adequate, the reservation of species and communities, apart from those characteristic of oligotrophic environments, is markedly inadequate. This inadequacy can largely be rectified by the transfer of Crown land and some Lands Department Reserves to the status of State Reserve, but purchases of privately owned wetlands or their management as conservation areas with declared Management Plans are also necessary.

Part of the value of a study such as this one is that it focusses attention on those species and communities that are rare or endangered. It might be that intensive searches for these, now that they have been identified, will reveal other occurrences, which will enable secure reservation to be made more easily.

## ACKNOWLEDGEMENTS

The authors wish to thank the following people: Dr Rod Buckney and Mr Stephen Harris, who carried out some of the field work, Mr Paul Barnett and Mr Derek Smith, who were helpful in many ways during our visits to King and Flinders Islands, Dr Winifred Curtis, Dr Michael Brown, Mr Dennis Morris, and Prof. W.D. Jackson, who helped with identification of species, staff of the Geography Department, University of Tasmania, for help in many ways, and finally the many private landowners, without whose kind permission to visit and study the many Tasmanian wetlands on private land, the study would not have been possible. The study was financed by a grant from the National Heritage Commission to the Tasmanian Conservation Trust Inc.

## REFERENCES

Briggs, S.V., 1981: Freshwater wetlands. In Groves, R.H. (Ed.): AUSTRALIAN VEGETATION. Cambridge University Press, London.

Gooderick, G.N., 1970: A survey of wetlands of coastal New South Wales. *CSIRO Aust. Div. Wildl. Res. Tech. Mem.* No.5.

Jones, W., 1978: THE WETLANDS OF THE SOUTHEAST OF SOUTH AUSTRALIA. Nature Conservation Society of South Australia, Adelaide.

Kirkpatrick, J.B., 1983: An iterative method for establishing priorities for the selection of Nature Reserves: an example from Tasmania. *Biol. Conserv.*, 16: 127-134.

_____ and Glasby, J., 1981: Salt marshes in Tasmania: distribution, community composition and conservation. *Dept Geography, Univ. of Tasmania, Occasional Paper* No.8.

Leigh, J., Briggs, J. and Hartley, W., 1981: Rare or threatened Australian plant species. *Australian National Parks and Wildlife Service, Spec. Pub.* No.7.

Millar, J.B., 1973: Vegetation changes in shallow marsh wetlands under improving moisture regime. *Can. J. Bot.*, 51: 1443-1457.
Sculthorpe, C.D., 1967: THE BIOLOGY OF AQUATIC VASCULAR PLANTS. Arnold, London.
Tyler, P.A., 1976: Lagoon of Islands, Tasmania - death knell for an unique ecosystem? *Biol. Conserv.*, 9: 1-11.
Valk, van der, A.G. and Davis, C.B., 1978: The role of seed banks in the vegetation dynamics of prairie glacial marshes. *Ecology*, 59: 322-335.

## APPENDIX 1

PLANT TAXA OBSERVED IN THE TASMANIAN WETLAND SURVEY.

\+ = introduced taxon  m = wetland margins

DICOTYLEDONEAE

BORAGINACEAE
m *Mysotis australis* R.Br.

CALLITRICHACEAE
\+ *Callitriche stagnalis* Scop.

CARYOPHYLLACEAE
\+ *Cerastium* spp.
\+ *Sagina maritima* Don ex Sm. & Sow.
*Spergularia media* (L.) Presl. G,M,MW
\+ *Stellaria media* (L.) Cyrillo
*S. palustris* Ehrh. ex Retz. P

CHENOPODIACEAE
m *Atriplex cinerea* Poir.
\+ *A. hastata* L.
m *A. paludosa* R.Br.
\+ *A. patula* L.
*Chenopodium glaucum* spp. *ambiguum* (R.Br.) Murr. & Thell. ex Thell. F,LV,M,TH
*Hemichroa pentandra* R.Br. AR,M,MW
*Pachycornia arbuscula* (R.Br.) A.J.Scott AR
*Suaeda australis* (R.Br.) Moq. M
*Sarcocornia blackiana* (Ulbrich) A.J.Scott M
*S. quinqueflora* (Bunge ex Ung.-Sternb.) A.J. Scott AR,F,M,MW,SW

COMPOSITAE
*Angianthus eriocephalus* Benth. endemic GR,SW
*A. preissianus* (Steetz) Benth. LB
\+ *Bellis perennis* L.
m *Calocephalus lacteus* Less.
*Brachycome cardiocarpa* F. Muell. ex Benth. MW
*B. graminea* (Labill.) F. Muell. M,MCW
*Centipeda minima* (L.) A. Br. & Aschers.
\+ *Cirsium arvense* (L.) Scop.
\+ *C. vulgare* (Savi) Ten.
*Cotula alpina* Hook. f. CM,BL
*C. coronopifolia* L. F,G,LB,LV,M,MW,TH
*C. longipes* (Hook.f.) W.M. Curtis F,MW,SW,TH
*C. reptans* Benth. BN,CM,LB,M
m *Craspedia glauca* (Labill.) Spreng.
\+ *Gnaphalium candidissimum* Lam.
m *G. collinum* Labill. var. *monocephalum* Hook. f.

m *Gnaphalium involucratum* Forst. f.
m *G. luteo-album* L.
*Helichrysum bicolor* Lindl. M,MW
*H. dealbatum* Labill. M,MW
\+ *Hypochaeris radicata* L.
m *Lagenophora stipitata* (Labill.) Druce
\+ *Leontodon leysseri* (Wallr.) Beck
m *Leptorhynchos squamatus* (Labill.) Less.
*Nablonium calyceroides* Cass. endemic MCW,SW,WP
m *Senecio biserratus* Belcher
m *S. quadridentatus* Labill.
\+ *Sonchus asper* (L.) Hill
\+ *Taraxacum officinale* Weber

CONVOLVULACEAE
m *Dichondra repens* J.R. & G. Forst.
*Wilsonia backhousei* Hook. f. F,M
*W. rotundifolia* Hook.

CRASSULACEAE
*Crassula helmsii* (Kirk) Cockayne LV,MCW

CRUCIFERAE
\+ *Cakile edentula* (Bigelow) Hook.
*Cardamine heterophylla* Hook. BL,CM,M,MCW,MF,TH
\+ *Coronopus didymus* (L.) Sm.
\+ *Nasturtium officinale* R.Br.

DROSERACEAE
*Drosera binata* Labill. F,LV,M,MW
*D. pygmaea* DC. F,LB,LV,M,MW

ELATINACEAE
*Elatine gratioloides* A. Cunn. HG,MF

EPACRIDACEAE
m *Epacris lanuginosa* Labill.
m *E. obtusifolia* Sm.
m *E. serpyllifolia* R.Br.
m *Sprengelia incarnata* Sm.

FICOIDEAE
m *Carpobrotus rossii* Schwartes
*Disphyma australe* (Soland.) J.M. Black M
m *Tetragonia expansa* Murr.

GENTIANACEAE
\+ *Centaurium erythraea* Rafn.
*Liparophyllum gunnii* Hook. f. MF,SW
*Nymphoides exigua* (F. Muell) Kuntze endemic MW,P,SW
*Sebaea albidiflora* F. Muell. M
*Villarsia exaltata* (Soland. ex Sims) F. Muell.
*V. reniformis* R.Br. AR,BN,F,LB,LV,M,MCW,MW,TH

GERANIACEAE
\+ *Erodium cicutarium* (L.) L'Hérit. ex Ait.

GOODENIACEAE
m *Dampiera stricta* (Sm.) R.Br.
*Goodenia humilis* R.Br. MW
*Scaevola albida* (Sm.) Druce

*Scaevola hookeri* (de Vriese) Hook. f. BL,CM,HM,LB,MF,MW
*Selliera radicans* Cav. AR,BN,F,G,LB,LV,M,MCW,MW,SW,TH

HALORAGACEAE
*Gonocarpus micranthus* Thunb. BN,LB,MW
*Haloragis brownii* (Hook. f. ) Schindl. LV,TH
*H. heterophylla* Brongn.
*Myriophyllum amphibium* Labill. LV,M,MCW
*M. elatinoides* Gaudich. AR,LB,LV,MCW,TH
*M. muelleri* Sond.
*M. pedunculatum* Hook. f. F,M,MW
*M. propinquum* A. Cunn. AR,L,M,MW

HYPERICACEAE
m *Hypericum gramineum* Forst. f.
*H. japonicum* Thunb. ex Murr. LB,MW

LABIATAE
*Mentha ?diemenica* Spreng. MCW,TH

LAURACEAE
m *Cassytha glabella* R.Br.

LEGUMINOSAE
m *Acacia melanoxylon* R.Br.
m *A. sophorae* R.Br.
m *A. verticillata* Willd.
m *Dillwynia glaberrima* Sm.
\+ *Lotus corniculatus* L.
\+ *Medicago* spp.
\+ *Melitotus indica* (L.) All.
m *Pultenaea dentata* Labill.
\+ *Trifolium* spp.
\+ *Ulex europaeus* L.
\+ *Vicia* spp.

LENTIBULARIACEAE
*Utricularia dichotoma* Labill. F,LV,M,MW,SW
*U. lateriflora* R.Br. F,LV,RC

LINACEAE
m *Linum marginale* A. Cunn.

LOBELIACEAE
*Isotoma fluviatilis* (R.Br.) F. Muell. ex Benth. MF
*Lobelia alata* Labill. LB,LV,M,MCW,MW,SW,TH
*Pratia pedunculata* R.BR. LB
*P. platycalyx* F. Muell. MCW,TH
*P. surrepens* (Hook. f.) F.E. Wimmer CM,WJ

LOGANIACEAE
*Mitrasacme distylis* F. Muell. MW

LYTHRACEAE
*Lythrum hyssopifolia* L. LV
*L. salicaria* L.

MALVACEAE
*Lawrencia spicata* (Hook.) Benth. F,LB,M,MW

MYOPORACEAE
m *Myoporum insulare* R.Br.

MYRTACEAE
m *Eucalyptus amygdalina* Labill.
m *E. ovata* Labill.
m *E. rodwayi* R.T. Baker & H.T. Smith endemic
m *E. viminalis* Labill.
m *Leptospermum laevigatum* (J. Gaertn.) F. Muell.
*L. lanigerum* Sm. AR,CM,F,M,MCW,MW,SW
*L. scoparium* J.R. & G. Forst AR,BN,F,LV,M,MCW,MW,SW
*Melaleuca ericifolia* Sm. AR,LV,MCW,MW,TH
*M. gibbosa* Labill. F,M,MW
*M. squamea* Labill. CM,F,FC,M,SW
*M. squarrosa* Donn ex Sm. BN,F,L,LV,M,MCW,MW

ONAGRACEAE
*Epilobium* spp. BN,LV,MCW,MW,TH

OXALIDACEAE
m *Oxalis corniculata* L.

PITTOSPORACEAE
m *Billardiera longiflora* Benth.

PLANTAGINACEAE
\+ *Plantago australis*
*P. bellidioides* Dcne. endemic MCW,P
\+ *P. coronopus* L.
\+ *P. major* L.

PLUMBAGINACEAE
*Limonium australe* (R.Br.) Kuntze AR

POLYGONACEAE
\+ *Polygonum aviculare* L.
*P. plebeium* R.Br.
*P. strigosum* R. Br.
\+ *Rumex acetosella* L.
*R. bidens* R.Br.
*R. brownii* Campd. M
\+ *R. conglomeratus* Murr.
\+ *R. crispus* L.

PORTULACACEAE
*Neopaxia australasica* (Hook. f.) O. Nilss. AR,CM

PRIMULACEAE
\+ *Anagallis arvensis* L.
*Samolus repens* (Forst. et f.) Pers. AR,F,G,M,MW,SW

PROTEACEAE
m *Banksia marginata* Cav.
m *Hakea sericea* Schrad. & J. Wendl.

RANUNCULACEAE
*Ranunculus rivularis* Banks & Sol. AR,LV,M.MCW,MW,TH

ROSACEAE
m *Acaena novae-zelandiae* Kirk.
\+ *Potentilla anglica* Laicharding
\+ *Rubus fruticosus* L.

RUBIACEAE
m *Galium gaudichaudii* DC.

RUTACEAE
m *Boronia parviflora* Sm.

SALICACEAE
\+ *Salix* spp.

SCROPHULARIACEAE
m *Euphrasia diemenica* Spreng.
*Gratiola latifolia* R.Br. MW
*G. nana* Benth. MW
*Limosella lineata* Gluck LB,LV,MCW,TH
*Mazus pumilio* R.Br. M
*Mimulus repens* R.Br. BN,F,LB,M,MW
\+ *Parentucellia* spp.
m *Veronica gracilis* R.Br.

SOLANACEAE
\+ *Solanum nigrum* L.

STYLIDIACEAE
*Stylidium despectum* R.Br. MW
m *S. graminifolium* Rich.

UMBELLIFERAE
*Apium prostratum* Vent. G,M,MCW,SW
*Centella cordifolia* Nannf. BN,F,LB,M,MCW,MW,TH
*Eryngium vesiculosum* Labill. F,LB,M,MCW,MW,TH
m *Hydrocotyle javanica* Thunb.
*H. muscosa* R.Br. F,LB,LV,M,MCW,MW,TH
*H. pterocarpa* F. Muell. LV,MCW
m *H. sibthorpioides* Lamk.
*Lilaeopsis brownii* A.W. Hill endemic BN,F,LB,LV,M,MCW,MW,SW,TH
m *Oreomyrrhis argentea* Hook. f.

URTICACAEA
m *Urtica incisa* Poir.

VIOLACEAE
m *Viola hederacea* Labill.

MONOCOTYLODONEAE

CENTROLEPIDACEAE
*Aphelia* spp.
*Centrolepis aristata* (R.Br.) Roem. & Schult. MW
*C. fascicularis* Labill. MW,LV
*C. polygona* (R. Br.) Hieron. MW
*C. pulvinata* (R.Br.) Desv. endemic MW
*C. strigosa* (R.Br.) Roem. & Schult. BN,LB,MW
*Trithuria submersa* Hook. f. MW

CYPERACEAE
*Baumea acuta* (Labill.) Palla F,M,MW
*B. arthrophylla* (Nees) Boeck. BN,F,LB,LV,M,MW,TH
*B. articulata* (R.Br.) S.T. Blake
*B. juncea* (R.Br.) Palla BN,F,LV,M,MCW,MW,TH
*B. rubiginosa* (Spreng.) Boeck. MCW
*B. tetragona* (Labill.) S.T. Blake F,M,MW
*Carpha alpina* R.Br. BL,CM,FC,MB,MF,SW
*Carex appressa* R.Br. L,LV,M,MCW,TH
*C. fascicularis* Soland. ex Boott in Hook. f. LV,MCW
*C. gaudichaudiana* Kunth. BL,CM,HM,M,MF,SW
*C. tereticaulis* F. Muell. M
*Chorizandra cymbaria* R. Br. F,M,MW
*Cyperus lucidus* R.Br.
*C. tenellus* L. f.
*Eleocharis acuta* R. Br. BN,F,LV,M,MCW,MW,TH
*E. gracilis* R.Br. SW
*E. pusilla* R.Br. MW,TH
*E. sphacelata* R.Br. BN,F,LB,M,MW
*Gahnia filum* (Labill.) F. Muell. AR,F,M,
m *G. grandis* S.T. Blake
m *G. sieberiana* Kunth.
*G. trifida* Labill. MCW,MW,TH
*Gymnoschoenus sphaerocephalus* (R.Br.) Hook. f. CM,F,FC,LH,MF,MW,RC,SW
m *Lepidosperma concavum* R.Br.
*L. filiforme* Labill. CM,F,FC,LH,M,MF,SW
*L. longitudinale* Labill. BN,F,LB,M,MCW,MW,TH
*Schoenus apogon* Poem. & Schult. F,MW
*S. brevifolius* R.Br. MW
*S. fluitans* Hook. f. M,MW
*S. maschalinus* Roem. & Schult. BN,LV,MCW,MW
*S. nitens* (R.Br.) Poir. AR,BN,F,G,LB,LV,M,MCW,MW,SW,TH
*S. tesquorum* J.M. Black F,MW
*Scirpus caldwellii* Cook
*S. cernuus* Vahl BN,F,LB,LV,MCW,MW,SW
*S. fluitans* L. AR,BN,F,M,MCW,MW
*S. gunnii* Boeck SW
*S. inundatus* (R.Br.) Poir. BN,F,L,LB,LV,MCW,MW,TH
*S. montivegus* S.T. Blake MF
m *S. nodosus* Rottb.
*S. platycarpus* S.T. Blake Z
*S. productus* C.B. Clarke MW
*S. pungens* Vahl
*S. validus* Vahl
*Tetraria capillaris* (F. Muell.) J.M. Black MW,SW

GRAMINEAE
+ *Agropogon littoralis* (SM.) C.E. Hubbard
m *Agropyron scabrum* (Labill.) Pal. Beauv.
m *Agrostis aemula* R. Br.
m *A. avenacea* J.F. Gmel.
m *A. billardieri* R.Br.
m *A. rudis* Roem. & Schult.
+ *A. stolonifera* L.
+ *A. tenuis* Sibth.
+ *Ammophila arenaria* Link.
*Amphibromus archeri* (Hook. f.) P.F. Morris

*Amphibromus neesii* Steud.
*A. recurvatus* J.R. Swallen F,MW
\+ *Anthoxanthum odoratum* L.
m *Danthonia caespitosa* Gaudich.
m *D. laevis* J.W. Vickery
m *D. semiannularis* (Labill.) R.Br.
m *D. setacea* R.Br.
*Deyeuxia quadriseta* Benth. BN,LB,M,MW
m *Dichelachne crinita* Hook.
*Distichlis distichophylla* (Labill.) Fassett AR,F,M,MW
m *Eragrostis ? brownii* (Kunth) Nees & Steud.
\+ *Festuca arundinacea* Schreb.
*Glyceria australis* C.E. Hubbard
\+ *Glyceria maxima* (Hartm.) Holmb.
*Hemarthria uncinata* R.Br. MW
\+ *Holcus lanatus* L.
\+ *Hordeum* spp.
\+ *Lagurus ovatus* L.
\+ *Monerma cylindrica* (Willd.) Coss. & Durieu
\+ *Parapholis incurva* (L.) C.E. Hubbard
m *Pentapogon quadrifidus* Baill.
\+ *Phalaris arundinacea* L.
\+ *P. minor* Retz.
\+ *Phleum pratense* L.
*Phragmites australis* (Cav.) Trin. ex Steud. F,M,MCW,MW
\+ *Poa annua* L.
m *P. labillardieri* Steud.
m *P. poiformis* Druce
\+ *Polypogon monspeliensis* (L.) Desf.
*Pucinellia stricta* (Hook. f.) C. Blom M
\+ *Spartina townsendii* H. & J. Groves
*Sporolobus virginicus* (L.) Kunth MW
\+ *Stenotaphrum secundatum* (Walt.) Kuntze
*Stipa stipoides* (Hook.) Veldkamp AR,G,M,SW
*Tetrarrhena acuminata* R.Br. F,MW
*T. distichophylla* (Labill.) R.Br. F,LB,M,RC
\+ *Vulpia* spp.
*Zoisia matrella* (L.) E.D. Merrill MW

HYDROCHARITACEAE
\+ *Elodea canadensis* Michx.
*Vallisneria spiralis* L. GR

HYPOXIDACEAE
m *Hypoxis hygrometrica* Labill.

IRIDACEAE
m *Diplarrena moraea* Labill.
m *Patersonia fragilis* (Labill.) Druce

JUNCACEAE
*Juncus amabilis* Edgar
\+ *J. articulatus* L.
*J. astreptus* L.A.S. Johnson
*J. australis* Hook. f. SW,Z
*J. bufonius* L. BN,LB,LV,MW
\+ *J. bulbosus* L.

*Juncus caespiticius* E. Mey. in Lehm. MCW,MW,TH
*J. falcatus* E. Mey. CM
*J. holoschoenus* R.Br. M
*J. kraussii* Hochst. AR,F,G,LB,M,MCW,SW,TH
*J. pallidus* R.Br. L,LV,M,MW,TH
*J. pauciflorus* R.Br. LV,M
*J. planifolius* R.Br. BN,LB,LV,M,TH
*J. prismatocarpus* R.Br. M
*J. procerus* E. Mey. AR,BN,L,LV,M,MW
*J. revolutus* R.Br.
*J. squarrosus* L.
*J. subsecundus* N.A. Wakefield
*J. vaginatus* R.Br.
*J.* T6 CM,FC,HM,LV

JUNCAGINACEAE
*Triglochin minutissima* F. Muell. L,MW
*T. procera* R.Br. AR,BN,F,L,LB,LV,M,MCW,MW,TH
*T. striata* Ruiz. & Pav. BN,F,G,LB,LV,M,MCW,MW,SW,TH

LEMNACEAE
*Lemna minor* L. L,LV,MCW
*L. trisulca* L. F
*Wolffia arrhiza* (L.) Hork. ex Wimm.

LILIACEAE
m *Dianella caerulea* Sims
m *D. revoluta* R.Br.

POTAMOGETONACEAE
*Potamogeton australiensis* A. Bennett MCW
*P. pectinatus* L.
*P. tricarinatus* F. Muell. & A. Bennett ex A. Bennett CM,MF,WR

ORCHIDACEAE
m *Cryptostylis subulata* (Labill.) Reichb. f.
m *Microtis parviflora* R.Br.
m *M. unifolia* (Forst. f.) Reichb. f.
m *Prasophyllum odoratum* R.S. Rogers
*Spiranthes sinensis* (Pers.) Ames ssp. *australis* (R.Br.) Kitamura F
m *Thelymitra ixioides* Swartz
m *T. retecta* H.M.R. Rupp
m *T. venosa* R.Br.

RESTIONACEAE
*Empodisma minus* (Hook. f.) Johnson & Cutler AR,CM,F,M,MF,MW,RC,SW
*Leptocarpus brownii* Hook. f. G,M,SW
*L. tenax* (Labill.) R.Br. BN,F,M,MW,SW
*Lepyrodia muelleri* Benth. F,LV,M,MW
m *L. tasmanica* Hook. f.
m *Restio complanatus* R.Br.
*R. tetraphyllus* Labill. FC,LV,RC,SW

RUPPIACEAE
*Ruppia* spp. AR,F,LB,TH

TYPHACEAE
+ *Typha latifolia* L.

XYRIDACEAE
*Xyris operculata* Labill. F,M,MW,SW

ZANNICHELLIACEAE
*Lepilaena bilocularis* T. Kirk.
*L. cylindrocarpa* (Kornicke) Benth. F,LB
*L. preissii* (Lehm.) F. Muell.

PTERIDOPHYTA

AZOLLACEAE
*Azolla filiculoides* Lam. LV,TH

GLEICHENIACEAE
m *Gleichenia microphylla* R.Br.

ISOETACEAE
*Isoetes gunnii* HM,SW

SCHIZAEACEAE
m *Schizaea bifida* Willd.

SELAGINELLACEAE
*Selaginella gracillima* (Kunze) Alston L,MW
*S. uliginosa* (Labill.) Spring F,L,LB,LV,M,MW

Also recorded were the algal genera, *Chara, Lamprothamnium, Nitella* and *Nostoc,* and the presence of mosses and/or liverworts.

AR = Asbestos Range National Park
BL = Ben Lomond National Park
BN = Bruny Neck Game Reserve
CM = Cradle Mt - Lake St Clair National Park
F = Freycinet National Park
FC = Frenchmans Cap National Park
G = Green Point Nature Reserve
GR = Gordon River State Reserve
HG = Hellyer Gorge State Reserve
HM = Hartz Mountains National Park
L = Labillardiere State Reserve
LB = Lime Bay Nature Reserve
LH = Lyell Highway State Reserve
LV = Lavinia Nature Reserve
M = Maria Island National Park
MCW = Mt Cameron West Aboriginal Site
MF = Mt Field National Park
MW = Mt William National Park
P = Pieman River State Reserve
RC = Rocky Cape National Park
SW = South West National Park
TH = Three Hummock Island Nature Reserve
WJ = Walls of Jerusalem National Park
WP = West Point Aboriginal Site
WR = Wild Rivers National Park
Z = Brown Mt - Remarkable Cave State Reserve

Reserves shown only for species not marked + or m.