CONSERVATION OF TASMANIAN MACROPHYTIC WETLAND VEGETATION

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(with three tables and one text-figure)

ABSTRACT


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 equaled 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 informa-
tion, by the resumption of privately-owned wetlands (table 1). Cyperus lucidus, C.
tenellus, Juncus amabilis, J. aestivalis and J. subsecundus all occur widely outside wet-
lands in disturbed habitats. Thus, no reservation appears to be necessary.

TABLE 1
DETAILS OF RESERVATION PROPOSALS FOR SPECIES CONSERVATION.

<table>
<thead>
<tr>
<th>Wetland Code Number</th>
<th>1:100 000 Map</th>
<th>Grid Reference</th>
<th>Species</th>
<th>Land tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>519</td>
<td>8416</td>
<td>800728</td>
<td>Centipeda minima, Lythrum salicaria, Polygonum strigosum, Helicinia salicata</td>
<td>private</td>
</tr>
<tr>
<td>330</td>
<td>8517</td>
<td>156343</td>
<td>Centrolepis pulvinata, Myriophyllum muelleri, Cyperus pungens, Wilsonia rotundifolia</td>
<td>Crown land</td>
</tr>
<tr>
<td>212</td>
<td>8515</td>
<td>094220</td>
<td>Bauwa articulata, Amphibromus archeri</td>
<td>private and Crown land reserve</td>
</tr>
<tr>
<td>536</td>
<td>8416</td>
<td>520750</td>
<td>Scirpus calchwelli, S. validus (S. pungens)</td>
<td>Crown land</td>
</tr>
<tr>
<td>272</td>
<td>8515</td>
<td>885900</td>
<td>Haloragis heterophylla, Juncus revolutus</td>
<td>Crown land</td>
</tr>
<tr>
<td>17</td>
<td>8513</td>
<td>310160</td>
<td>Juncus vaginatus, Glyceria australis</td>
<td>Council Wildlife Sanctuary</td>
</tr>
<tr>
<td></td>
<td>8412</td>
<td>770780</td>
<td>Juncus squarrosus</td>
<td>private wildlife sanctuary</td>
</tr>
<tr>
<td>530</td>
<td>8416</td>
<td>552710</td>
<td>Potamogeton perfoliatus</td>
<td>Crown land reserve</td>
</tr>
<tr>
<td>344</td>
<td>8517</td>
<td>222228</td>
<td>Aphelia sp.</td>
<td>Crown land</td>
</tr>
<tr>
<td>707</td>
<td>8313</td>
<td>130340</td>
<td>Amphibromus nesettii</td>
<td>Crown land and private</td>
</tr>
<tr>
<td>444</td>
<td>8000</td>
<td>312939</td>
<td>Lepilaena bilocularis</td>
<td>private</td>
</tr>
<tr>
<td>88</td>
<td>8311</td>
<td>402370</td>
<td>Lepilaena preissii</td>
<td>Crown land reserve</td>
</tr>
<tr>
<td>16</td>
<td>8313</td>
<td>300020</td>
<td>Rumex bidens</td>
<td>private</td>
</tr>
<tr>
<td>297</td>
<td>8517</td>
<td>028662</td>
<td>Scirvola albida</td>
<td>Crown land</td>
</tr>
<tr>
<td>305</td>
<td>8517</td>
<td>010485</td>
<td>Wolffia sp.</td>
<td>private</td>
</tr>
<tr>
<td>402</td>
<td>8000</td>
<td>369699</td>
<td>Polygononum plebeium</td>
<td>Crown land and private</td>
</tr>
</tbody>
</table>

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 habi-
tats, the reservations suggested in table 1 would present the most efficient manner of
extending the wetland environments included within the State Reserve system.
Conservation of Tasmanian Macrophytic Wetland Vegetation

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 55% (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>
<thead>
<tr>
<th>TABLE 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>THE RESERVATION STATUS OF THE MAJOR WETLAND VEGETATION FORMATIONS.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cover classes (%)</th>
<th>Total</th>
<th>Reserved (% of area surveyed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-100</td>
<td>30-70</td>
<td>10-30</td>
</tr>
<tr>
<td>Forest</td>
<td>1040</td>
<td>1040</td>
</tr>
<tr>
<td>Scrub</td>
<td>664</td>
<td>13</td>
</tr>
<tr>
<td>Grassland</td>
<td>70.5</td>
<td>8</td>
</tr>
<tr>
<td>Herbfield</td>
<td>103</td>
<td>131</td>
</tr>
<tr>
<td>Rushland</td>
<td>133</td>
<td>76</td>
</tr>
<tr>
<td>Sedgeland</td>
<td>1398.5</td>
<td>2606</td>
</tr>
<tr>
<td>Aquatic</td>
<td>702.5</td>
<td>1561</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11706.5</td>
<td>643.5</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Community</th>
<th>Surveyed area (ha)</th>
<th>% reservation of surveyed area</th>
<th>Recommended reservation</th>
<th>Land ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOREST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acacia melanoxylon</td>
<td>1600</td>
<td>9.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SCRUB</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilkesia argyrophylla</td>
<td>864</td>
<td>22.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>E. squamata</em></td>
<td>35</td>
<td>71.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lepidospernum ambiguum</em></td>
<td>34</td>
<td>6.0</td>
<td>well-reserved outside surveyed wetlands</td>
<td>Crown land</td>
</tr>
<tr>
<td><strong>GRASSLAND</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Phragmites australis</em></td>
<td>50</td>
<td>0.0</td>
<td>35 (Derwent River Wildlife Sanctuary)</td>
<td>Crown land</td>
</tr>
<tr>
<td><strong>HERBFIELD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centella cordifolia</td>
<td>18</td>
<td>2.7</td>
<td>193 075538 8514</td>
<td>private</td>
</tr>
<tr>
<td><em>L. squarrosa</em></td>
<td>15</td>
<td>0.0</td>
<td>505 582085 8416</td>
<td>private wildlife sanctuary</td>
</tr>
<tr>
<td><em>L. lanigerus</em></td>
<td>15</td>
<td>6.0</td>
<td>505 582085 8416</td>
<td>private wildlife sanctuary</td>
</tr>
<tr>
<td><strong>RUSHLAND</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juncus kraussii</td>
<td>122</td>
<td>0.0</td>
<td>284 075718 8517</td>
<td>Crown land</td>
</tr>
<tr>
<td><strong>SEDGELAND</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>E. sphacelata</em></td>
<td>121</td>
<td>0.0</td>
<td>286 042743 8518</td>
<td>Crown land</td>
</tr>
<tr>
<td><em>S. cephalocentra</em></td>
<td>15</td>
<td>0.0</td>
<td>286 042743 8518</td>
<td>Crown land</td>
</tr>
<tr>
<td><em>E. sphacelata</em></td>
<td>121</td>
<td>0.0</td>
<td>286 042743 8518</td>
<td>Crown land</td>
</tr>
<tr>
<td><strong>AQUATIC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>E. sphacelata</em></td>
<td>121</td>
<td>0.0</td>
<td>286 042743 8518</td>
<td>Crown land</td>
</tr>
<tr>
<td><em>E. sphacelata</em></td>
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<td>0.0</td>
<td>286 042743 8518</td>
<td>Crown land</td>
</tr>
<tr>
<td><em>E. sphacelata</em></td>
<td>121</td>
<td>0.0</td>
<td>286 042743 8518</td>
<td>Crown land</td>
</tr>
</tbody>
</table>

**Note**: Table 3 lists 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.
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

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REFERENCES


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APPENDIX 1

PLANT TAXA OBSERVED IN THE TASMANIAN WETLAND SURVEY.

+ = introduced taxon  m = wetland margins

**DICOTYLEDONAE**

**BORAGINACEAE**
m Nectus australis R.Br.

**CALLITRICHAECES**
+ Callitriche stagnalis Scop.

**CARYOPHYLLACEAE**
+ Cerastium spp.
+ Sagittaria maritima Don ex Sm. & Sow.
+ Sparganium media (L.) Presl.  G,M,MW
+ Stellaria media (L.) Cyrillo
  S. palateus Ehrh. ex Retz.  P

**CHENOPODIACEAE**
m Atriplex cineara 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
  *C. punctatum* pentapodium R.Br.  AR,M,MW
  *Paushiodendron arborescens* (R.Br.) A.J.Scott AR
  Suaeda australis (R.Br.) Moq.  M
  S. claquiflora (Bunge ex Ung.-Sternb.) A.J. Scott AR,F,M,MW,SW

**COMPOSITAE**
Angienthus eriocephalus Benth. endemic GR,SW
A. preiseianus (Steete) Benth.  LB
+ Bellis perennis L.
  m Calocephalus larsens Less.
  Erucastrum cardiocarpa F. Mueller. ex Benth.  MW
  B. graminea ([Labill.]) F. Mueller.  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. wyntonsii Benth.  B,H,CM,LB,M
  m Crepis glaucus ([Labill.]) Spreng.
  + Onophium candidissimum Lam.
  m C. collinum Labill. var. monoccephalum Hook. f.
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- Gnaphalium involucratum Forst. f.
- G. luteo-album L.
- Helichrysum bicolor Lindl. M, MW
- H. dealbatum Labill. M, MW
- Hypochaeris radiata L.
- Lagenophora atipitata (Labill.) Druce
- L. Leysseri (Wallr.) Beck
- Leptosyne squamatae (Labill.) Less.
- Nablonium caligo-sordidus Cass. endemic
- S. asper (L.) Hill
- Taraxacum officinale Weber

CONVOLVULACEAE
- Wilsonia backhousei Hook. f. F, M
- W. rotundifolia Hook.

CRASSULACEAE
- Crassula helmsii (Kirk) Cockayne LV, MCW

CRUCIFERAE
- Cabile dentata (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

BLATTINACEAE
- Blatine gratioloides A. Cunn. HG, MF

EPACRIDACEAE
- Epaoris lanuginosa Labill.
- E. obtusifolia Sm.
- E. serpyllifolia R.Br.
- Sprengelia tinctoria Sm.

FICOIDEAE
- Carpobrotus rosette Schwartz
- Disphyma australie (Soland.) J.M. Black M
- Tetragonia expansa Murr.

GENTIANACEAE
- Centaurium erythraea Rafn.
- Diptrapium gummii Hook. f. MF, SW
- Nymphoides exigua (F. Muell) Kuntze endemic MW, P, SM
- Sebasa albiflora F. Muell. V.
- Villarea exaltata (Soland. ex Sims) F. Muell.

GERANIACEAE
- Erodium cicutarium (L.) L'Hérit. ex Ait.

GOODENIACEAE
- Dampiera striga (Sm.) R.Br.
- Goodenia humilis R.Br. MW
- Scaevola albida (Sm.) Druce
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Scaevola hookeri (de Vriese) Hook. f.  BL,CM,HM,LB,MF,MW

HALORAGACEAE
Gonocarpus microstigma Thumb. BN,LB,MW
Haloragis brownii (Hook. f.) Schindl. LV,TH
H. heterophylla Brongn.
Myriophyllum amphibia Labill. LV,LM,MCW
N. elatinoides Gaudich. AR,LB,LM,MCW,TH
N. muelleri Sendt.
N. pedunculatum Hook. f. F,M,MW
N. propinqua A. Cunn. AR,L,M,MW

HYPERICACEAE
Hypericum gramineum Forst. f. LB,MW

LABIATAE
Mentha diemenica Spreng. MCW,TH

LAURACEAE
Casasytha glabella R.Br.

LEGUMINOSAE
Acacia melanoxylon R.Br.
A. sophorae R.Br.
A. verticillata Willd.
Dillwynia glaberrima Sm.
Lotus corniculatus L.
Medicago spp.
Melilotus indicus (L.) All.
Pultenaea dentata Labill.
Trifolium spp.
Ulex europaeus L.
Vicia spp.

LENTIBULARIACEAE
Utricularia dichotoma Labill. F,LM,MW,SW
U. subtiliflora R.Br. F,LM,RE

LINACEAE
Linum marginale A. Cunn.

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

LOGANIACEAE
Mirraaceme distylos F. Muell. MW

LYTHRACEAE
Lythrum hyssopifolia L. LV
L. salicaria L.

MALVACEAE
Lawrencea spicata (Hook.) Benth. F,LM,MW
J.B. Kirkpatrick and C.E. Harwood

MYOPORACEAE
m Myoporum insulare R.Br.

MYRTACEAE
m Eucalyptus amygdalina Labill.
m E. ovata Labill.
m E. roedleri R.T. Baker & H.T. Smith endemic
m E. viminalis Labill.

PITTOSPORACEAE
m Billardiera longiflora Benth.

PLANTAGINACEAE
+ Plantago australis
P. bellidifolius Dcne. endemic
P. coronopus L.
P. major L.

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

PORTULACACEAE
Neopaxia australasia (Hook. f.) O. Nilss.

PRIMULACEAE
+ Anagallis arvensis L.
Samuel repens (Forst. et f.) Pers.

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

RANUNCULACEAE
Ranunculus ricolariis Banks & Sol.
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ROSACEAE
- Anoma novaehollandiae Kirk.
- Potentilla anglica Laicharding
- Rubus fruticosus L.

RUBIACEAE
- Galium gauchichaudii DC.

RUTACEAE
- Boronia parviflora Sm.

SALICACEAE
- Salix spp.

SCROPHULARIACEAE
- Euphrasia diemenica Spreng.
- Gratiola latifolia R.Br. MN
- G. nana Bent. MN
- Linnaea lineata Gluck LB,LV,MCW,TH
-Macro pleurite R.Br. MN
- Mimulus repens R.Br. BN,FL,B,M,MW
- Parentucellia spp.
- Veronica gracilis R.Br.

SOLANACEAE
- Solanum nigrum L.

STYLIDIACEAE
- Stylidium despectum R.Br. MW
- S. graminitifolium Rich.

UMBELLIFERAE
- Apium prostratum Vent. G,M,MCW,SW
- Centella cordifolia Nannf. BN,FL,B,M,MCW,MW,TH
- Eryngium vesiculosum Labill. FL,B,M,MCW,MW,TH
- Hydrocotyle javanica Thunb.
- H. musoeca R.Br. FL,B,LV,M,MCW,MW,TH
- H. pterocarpa F. Muell. LW,MCW
- H. sibthorpioides Lamk.
- Lilaeopsis brownii A.W. Hill endemic BN,FL,B,LV,M,MCW,MW,SW,TH
- Drepanocladus argentea Hook. f.

URTIACAEA
- Urtica incisa Poir.

VIOLACEAE
- Viola hederaeae Labill.

MONOCOTYLIDONAE

CENTROLEPIDACEAE
- Aphiella spp.
- Centrolepis aristata (R.Br.) Roem. & Schult. MN
- C. facetticularis Labill. MW,LV
- C. polygona (R. Br.) Hieron. MN
- C. pulvinata (R.Br.) Desv. endemic MW
- C. strigosa (R.Br.) Roem. & Schult. BN,LB,MW
- Trithuria submersa Hook. f. MW
J.B. Kirkpatrick and C.E. Harwood

CYPERACEAE

Bauera acuta (Labill.) Palla F,M, MW
B. anthrophyllea (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
Barca alpina R.Br. BL, CM, PC, 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. torresii F. Muell. M
Chorrhiza gymbocarpa 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. grisea R.Br. SW
E. paucilla R.Br. MW, TH
E. sphacelata R.Br. BN, F, LB, M, MW
Gahnia fluitans (R.Br.) F. Muell. AR, F, M
G. grandis S.T. Blake
G. sieberiana Kunth.
G. trifida Labill. MCW, MW, TH
Gymnochaeris aphaerocoeplias (R.Br.) Hook. f. CM, F, FC, LH, MF, MW, RC, SW

Agropyron convexum R.Br.
A. filiforme Labill. CM, F, FC, LH, M, MF, SW
A. langsdorffiana Labill. BN, F, LB, M, MCW, MW, TH
Schoenus apogon Poem. & Schult. F, MW
S. brevifolius R.Br. MW
S. fluctans Hook. f. M, MW
S. maxillosus Poem. & Schult. BN, LV, MCW, MW
S. tesquereri J.M. Black F, MW
Sesigmus caldwellii Cook
S. ovatus Vahl BN, F, LB, LV, MCW, MW, SW
S. flatanes L. AR, BN, F, M, MCW, MW
S. gungi Boeck SW
S. inundatus (R.Br.) Poir. BN, F, L, LB, LV, MCW, MW, TH
S. montivagus S.T. Blake MF
S. nodosus Roth.
S. platycarpus S.T. Blake Z
S. productus C.B. Clarke MW
S. pungens Vahl
S. validus Vahl

S. capillaris (F. Muell.) J.M. Black MW, SW

GRAMINEAE

Agropyron littoralis (SM.) C.E. Hubbard
Agropyron scoparium (Labill.) Pal. Beauv.
Agrostis aemula R. Br.
A. avinacea J.F. Gmel.
A. billardieri R.Br.
A. rudis Roem. & Schult.
A. stolonifera L.
A. tenella Sibth.
A. avinacea Link
Amphibromus archeri (Hook. f.) P.F. Morris
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**Amphibromus neesii** Steud.
A. recurvatus J.R. Swallen F,MW

**Anthoxanthum odoratum** L.

**Dactylorhiza cespitosa** Gaudich.

**D. laevia** J.W. Vickery

**D. semiannuaria** (Labill.) R.Br.

**D. octava** R.Br.

**Deyeuxia quadriaceta** Benth. BN,LB,M,MW

**Dichelachne orientata** Hook.

**Distichlis distichophylla** (Labill.) Fassett AR,F,M,MW

**Eragrostis tenuis** (Kunth) Nees & Steud.

**Eriophorum angustifolium** Schreb.

**Glyceria australis** C.E. Hubbard

**G. maxima** (Hartm.) Holm.

**Hemarthria uncinata** R.Br. MW

**Holcus lanatus** L.

**Hordeum annuum** app.

**Lagurus ovatus** L.

**Menyanthes trifoliata** (Willd.) Coss. & Durieu

**Paspalum annuum** (L.) C.E. Hubbard

**P. quadrifidum** Baill.

**P. arundinacea** L.

**P. minor** Retz.

**P. pratense** L.

**Phragmites australis** (Cav.) Trin. ex Steud. F,M,MCW,MW

**Poa annua** L.

**P. pratensis** Steud.

**P. poiformis** Druce

**Polypogon monspeliensis** (L.) Desf.

**Puccinellia disticta** (Hook. f.) C. Blom M

**Spartina townsendii** (Walt.) Kuntze

**Sporolobus virginicus** L. MW

**Sporobolus virginicus** L. Kunth MW

**S. secundatum** (Walt.) Kuntze

**Stipa alpina** (Hook.) Veldkamp AR,G,M,SW

**Tetrapogon quadrisetum** R.Br. F,MW

**T. distichophylla** (Labill.) R.Br. F,LB,M,RC

**Vulpia spp.**

**Zoia matrella** (L.) E.D. Merrill MW

**HYDROCHARITACEAE**

**Elodea canadensis** Michx.

**Vallisneria spiralis** L. GR

**HYPOXIDACEAE**

**Hypoxis hirsutella** Labill.

**IRIDACEAE**

**Diplarrhena moraea** Labill.

**Patersonia fragilis** (Labill.) Druce

**JUNCACEAE**

**Juncus articulatus** Edgar

**J. sessilis** Edgar

**J. astreptus** L.A.S. Johnson

**J. australis** Hook. f. SW,Z

**J. bufonius** L. BN,LB,IV,MW

**J. bulbosus** L.
J.B. Kirkpatrick and C.E. Harwood

Juncus caespiticosus E. Mey. in Lehm.  MCW,MW,TH
J. fasciculatus E. Mey.  CM
J. holosepalus E. Mey.  N
J. kraussii Hochst.  AR,F,G,LE,M,MCW,SW,TH
J. pallidus R.Br.  L,LV,M,MM,TH
J. pacificus R.Br.  LV,M
J. pisiformis R.Br.  BN,LE,LV,M,TH
J. pinnatum var. P. R.Br.  M
J. procumbens E. Mey.  AR,BN,LE,LV,M,MM
J. revolutus R.Br.  C
J. squarrosus L.
J. subaequus N.A. Wakefield
J. vaginatus R.Br.  CM
J. T6  LV

JUNCAGINACEAE

Triglochin minuta F. Muell.  N
T. procera R.Br.  AR,BN,FI,LE,M,MCW,MM,TH
T. striata Ruiz. & Pav.  BN,F,LE,LV,M,MCW,MM,SW,TH

LEMNACEAE

Lemna minor 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.  MCW
P. tricarinatus F. Muell. & A. Bennett ex A. Bennett  CM,MF,WR

ORTHIDACEAE

m Cryptostylis subulata (Labill.) Reichb. f.

m Microtis parviflora R.Br.

m M. uniflora (Forst. f.) Reichb. f.

m Peasophyllum odoratum R.S. Rogers

Spiranthus sinensis (Pers.) Ames spp. australis (R.Br.) Kitamura  F

m Thelymitra izoloides Swartz.

m T. retecta H.M.R. Rupp

m T. venosa R.Br.

RESTIONACEAE

Empodium minus (Hook. f.) Johnson & Cutler  AR,CM,F,F,M,MM,SW,RC,SW
Leptocarpus brownii Hook. f.  G,MM,SW
L. tenax (Labill.) R.Br.  BN,F,F,MM,SW
Leptoryloia mulleri Benth.  F,LE,MM

m L. tasmanica Hook. f.

m Restio simplex R.Br.  N.

R. tetraphyllus Labill.  FC,LE,RC,SW

RUPPIACEAE

Ruppia spp.  AR,FI,LE,TH
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**TYPHACEAE**
+ Typha latifolia L.

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

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

**PTERIDOPHYTA**

**AZOLLACEAE**
Azolla filiculoides Lam. LV,TH

**GLEICHENIACEAE**
+ Gleichenia microphylla R.Br.

**ISOETACEAE**
Isoetes gamitt HM,SW

**SCHIZAEACEAE**
+ Schizaea bifida Willd.

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

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

Reserves shown only for species not marked + or m.