

**A BIOLOGICAL SURVEY
OF THE WATERHOUSE AREA,
NORTHEAST TASMANIA**



Wildlife Branch Scientific Report No. 95/5

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A Biological Survey of the Waterhouse Area, Northeast Tasmania

Edited by

Mark C Holdsworth and Sally L Bryant

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Edited by

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EXECUTIVE SUMMARY

A brief biological survey in 1993 of the Waterhouse Protected Area and immediates surrounds identified an area of significant species and community richness and diversity. Typical of the coastal sand plains of northeast Tasmania formed on Quaternary calcareous deposits, the Waterhouse area has been shaped by both the long geological history of sand movement and more recently with European settlement through significant land clearance and drainage for agriculture. Settlement of the area has brought with it other associated impacts such as overfiring, feral pests and weeds, recreational tracks, hunting and the management of dune encroachment by the planting of introduced marram grass. Habitats of the Waterhouse area are dominated by large coastal heathlands fringed by dry forest, coastlines with sandy beaches and rocky outcrops, many ephemeral and permanent wetlands particularly Big Waterhouse Lake, Little Waterhouse Lake and Blackman Lagoon and two near offshore islands, Little Waterhouse Island and Waterhouse Island.

Vegetation communities are dominated by a mosaic of wetland, heath including graminoids and tall, dense coastal scrub. Sixteen generalised communities are described, the structure of which have formed in response to desiccating winds and associated dune formations. The coastal forest and heathland communities are among the richest in the State and are of highest priority for reservation. Floristically the area contains over 400 plant species, several of State and National significance as threatened. Overfiring of the area in recent times is probably the cause of impoverishment in some flora groups.

Eighteen mammal species were recorded in the Waterhouse area, 16 being native and 2 introduced. A further five mammal species were considered likely to be present particularly the rare New Holland mouse which is known nearby and favours coastal habitats. Avifauna in the region consisted of 87 species with the WPA specifically containing 75 breeding or resident native bird species, 2 irregularly recorded in Tasmania, 4 regular non-breeding migrant and vagrants and 6 introduced species. Thirty bird species of high conservation significance were identified including 7 listed on National and State Threatened Species Acts. Five species of frog were confirmed in the area including the green and gold frog which is listed as a vulnerable species in Tasmania. This is not surprising considering the large number of waterbodies and artificial drains throughout the area. Overall reptile diversity appeared to be low with only six species recorded most prominently in heathy habitats with surface rock and fire damaged sandy heaths. It is likely, however, that a further 8 species, may well be present, with two of them already recorded on Waterhouse and Little Waterhouse Island during this survey. While native fish species were not targeted during this survey, good populations of the rare dwarf galaxias and pygmy perch were recorded.

RECOMMENDATIONS

The biological and geological significance of the Waterhouse Protected Area warrants greater conservation protection than is presently afforded. The single most important recommendation of this study is that the area receives a significant upgrade in conservation status to State Reserve and that this should also include Little Waterhouse Island.

Management Issues Include:

- The need for controlled fire management to prevent species loss and enhance diversity.
- Need for eradication (where possible) and management of weed and pest species particularly the spread of *Phytophthora cinnamomi*.
- Cessation of planting of marram grass and its replacement where necessary with suitable sand binding native plant species.
- Reduction and rehabilitation of the burgeoning tracks and vehicles in the area, with controlled access.
- Prevention of vehicles on the beaches during shorebird breeding seasons.
- Protection of waterfowl and other fauna in the area from recreational shooting.
- The need for interpretative material on prohibiting domestic pets in the area, problems of marine debris and need for responsible disposal of rubbish, and use of fire in the reserve.

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PREFACE

Since the completion of this biological survey several important events targetting the Waterhouse Protected Area have occurred. Firstly, a scientific symposium, organised by the Queen Victoria Museum, was held in Launceston in February 1995. This symposium focussed specifically on the biogeography of northeast Tasmania and produced recommendations on land management, research and options for funding (Tassell 1996). The major outcomes were that the security of tenure should be increased and complimented by further investigations of the biological values of the region. Many of the Wildlife Staff contributed papers based on the information collected during this survey and provided a major contribution.

Secondly, since undertaking this survey the status of the Waterhouse area has changed from being a Protected Area administered under the *Crown Lands Act 1976* to a Conservation Area (25 December 1996) managed within the *National Parks and Wildlife Act 1970*. The wildlife act provides for the preparation of management plans and affords greater protection to some of the conservation values. An upgrade in status was one of the major recommendations of this report, hence, one of our goals has in part been achieved. The information presented in this report has been invaluable for the Department and has provided direct input into the management plan currently being prepared.

Finally, all information collected during this survey has been made available to any requests prior to the publishing of this report.

ACKNOWLEDGEMENTS

The concept of a collaborative survey was initiated by Nick Mooney and enthusiastically supported by Wildlife staff and PWS managers. The WPA survey team would like to thank Eric Nichols for the use of the 'Waterhouse' shearers quarters and amenities and to the Roberts family of Hobart for allowing team members to visit Waterhouse Island to carry out survey work. The study was not without its cost to the operation of the Hobart office and we are indebted to David Rounsevell, David Randall and Jenny Helm for 'holding the fort' while we were in the field. Thank you also to Sib Corbett who undertook a large amount of preliminary work to provide the baseline vegetation maps used by all survey groups.

PWS extend their appreciation to all participants from other institutions as their involvement helped to ensure that a broad perspective and understanding of the WPA's values was attained. A full list of participants is provided in this report.

ABBREVIATIONS

DELM	Department of Environment and Land Management
GIS	Geographic Information System
PWS	Parks and Wildlife Service, Department of Environment & Land Management
TASPAWS	Tasmanian Parks and Wildlife Service Biological Database
WHA	World Heritage Area
WPA	Waterhouse Protected Area

BACKGROUND INFORMATION

The Waterhouse Protected Area (WPA) is located in the northeast of Tasmania in the district of Dorset and municipality of Scottsdale being approximately 100 kilometres from Launceston. The area forms a coastal strip between Tomahawk and Bridport and comprises approximately 6700 ha of dunes, coastal heath and coastal scrub surrounded by cleared land and improved pasture (Map 1). Waterhouse was proclaimed a Protected Area under Section 8 of the *Crown Lands Act 1976* on 10 April 1980 (Order No. 47) being specifically for the purposes of land conservation and public recreation and amusement.

The natural and cultural values of the WPA have long been recognised though little studied. Floristically the WPA is biogeographically important and contains a number of threatened flora species and communities (Mary Cameron pers. comm.). Kirkpatrick's (1977) study nominated Waterhouse Point as the highest conservation priority for heathland plant communities in Tasmania. In 1982 Little Waterhouse Lake was listed as a wetland of international significance under the Ramsar Convention based on its dense aquatic growth and species richness. Likewise the extensive coastal dune system throughout the WPA has recently been nominated as a geomorphological monument (Bradbury 1993) despite the Waterhouse Sand Dune Reclamation Project which has been ongoing for over 40 years. The WPA is known to contain a number of fauna of high conservation significance especially coastal bird species, native galaxiids, the rare New Holland mouse and Bouganville's skink. Many faunal species of national and state conservation significance occur in the area for example the nationally endangered little tern and vulnerable hooded plover which breed on the sandy coast. Culturally, the area contains a number of important aboriginal sites including coastal shell middens and a stone quarry.

While few detailed reports exist of the natural values and processes affecting the area, the WPA is subject to medium to high impact recreational activities especially fishing, hunting and off-road vehicles. The area contains a maze of tracks, shack sites, camp sites and boat ramps, etc. with continued interest in the area reflected in, for example, the proposal in 1991 by the Northern Tasmanian Fisheries Association (Scottsdale Branch) to stock Big Waterhouse Lake with Atlantic salmon and to plant a shelter belt of *Pinus radiata* on the northern side of Blackmans Lagoon. Introduced marram grass has been used extensively to prevent the encroachment of sand dunes onto agricultural land and 'soldier settlements' and advocates for its use for dune stabilisation continues with the submission of a five year plan in 1991. Threatening processes to the biological values of the area include too-frequent firing, spread of the root rot fungus *Phytophthora cinnamomi*, introduced weeds and feral pests exacerbated by increasing tracks, unauthorised hunting and increasing vehicle use along beaches.

AIM

The main aim of this exercise was to undertake a collaborative survey of the Waterhouse Protected Area to increase the scientific understanding of biological values and to provide recommendations considering environmental protection, people management, facilities and development as well as future research needs. In conducting this survey it was hoped that the conservation significance of the WPA would be more fully recognised.

A secondary aim of the exercise was to enable *Wildlife* staff to collaborate on a field survey with the potential to refine survey techniques, broaden the skills base of staff and to provide a forum for social interaction which is often stifled by the constraints, commitments and demands of the normal work environment.

METHODS AND LOGISTICS

The majority of field work was undertaken from 22-26 November 1993, however, some staff returned at different times for short follow up investigations. In total 37 people assisted with various parts of the survey (listed inside front cover), including 29 *Wildlife* staff, 2 officers from the Inland Fisheries Commission, 3 private consultants, 1 staff member from the Queen Victoria Museum and 2 postgraduate students from the University of Tasmania.

Departmental vehicles were made available for travel and each person supplied their own food and camping equipment. A base camp was established at the 'Waterhouse' property's shearers quarters which

served as the field operations base where planning meetings and general activities were held and where data could be entered directly onto the computer facilities provided. Information collected was entered immediately onto the PWS GIS system using the 1: 25 000 Tasmaps Waterhouse and Oxberry.

A complete list of fauna and flora is contained in Appendix A.

WATERHOUSE AND THE NORTHEAST COASTAL PLAINS: AN HISTORICAL PERSPECTIVE

David Steane
(D. Steane & Associates)

The Waterhouse area is fairly typical of much of the coastal plains of northeast Tasmania and was occupied for pastoral purposes by the mid 1800s. The physiography and ecology of Waterhouse could be described generally as undulating sand plains supporting dry and wet heath vegetation types and traversed by east - west oriented dune ridges of Pleistocene Age supporting dry sclerophyll woodland dominated by *Eucalyptus viminalis*, *E. amygdalina* and *E. pauciflora*.

Drainage of the plains has been impeded since the last ice age by the build up of high coastal sand dunes which resulted in the impoundment of lagoons and swamps. At the time of European settlement the dunes were probably mostly well vegetated by coastal scrub including *Acacia sophorae*, *Leucopogen parviflora*, *Banksia marginata* and *Bursaria spinosa*, with *Allocasuarina verticillata* and some eucalypts on older sites.

Management for grazing was based on regular burning of the bush to reduce woody growth and to encourage grasses and other herbaceous plants. It is likely that the Aborigines had also practiced bush burning for thousands of years, but less frequently, and certainly the soft footed native game caused less damage to ground cover than the herds of close cropping, hard hoofed sheep and cattle that were subsequently introduced. The dramatic explosion of the introduced rabbit population in the early part of this century added greatly to the impact on the landscape. Other than burning, the main method of improving grazing for livestock on coastal lands was to sow pasture seed on freshly burnt areas. Heavy grazing, combined with excessive burning of dunes, resulted in severe site degradation and eventually to the breaking away of massive sand blows which by the 1950's consumed probably more than fifty percent of the coastal dune system of the area.

Prior to World War II the coastal plains were used mainly by wealthy Midlands graziers as winter runs to rest home paddocks and to give stock a varied diet. Stock taken back to the lush spring growth in the Midlands did very well, however, it was found that stock left too long on the coast lost condition and if not removed, soon perished. The symptoms, of what became known as 'coast disease', included loss of weight and stamina, anaemia, rough coat, broken fleece and steely wool. By the 1950's researchers had established that the cause of 'coast disease' was due to a deficiency of the trace element copper. About the same time, agronomists throughout Australia were working on problems of pasture establishment and growth on coastal heaths. Of particular concern was the difficulty in establishing and maintaining healthy clover. An important breakthrough came with the isolation of strains of *Rhizobium* bacteria from the root nodules of healthy clovers in other districts and the development of techniques for inoculating clover seeds with *Rhizobium* prior to sowing. Inoculated seed was coated with lime as a buffer against the acid heath soils and not spread together with superphosphate but sown separately. These and other discoveries resulted in a change of the carrying capacity from perhaps one sheep per 10-20 acres, to 3-6 sheep per acre and they could be kept and bred safely on coast country. These dramatic changes led the large scale development of coastal heath lands and closer settlement particularly as a result of soldier settlement schemes.

With the change in land value, management systems and general land development it suddenly became important to prevent the encroachment of the huge sand blows onto the new farm lands. A Sand Dune Reclamation Unit was set up at Bridport in 1955 under the Lands Department to develop a reliable system of dune stabilisation based on the planting of marram grass. From very small beginnings the unit developed into a valuable, specialised work force, focused on dune stabilisation. Over the past fifteen years the unit has diversified its activities and now undertakes a wide range of conservation and development works in parks and reserves throughout the north of Tasmania.

There is some evidence that suggested that marram grass, an exotic species, is a serious environmental weed, however, this hardy and versatile plant has played an important role in stabilising dunes in very harsh conditions. Without marram grass it is highly likely that the Waterhouse district would have been devastated. In addition to marram grass several native plants have also played a valuable role in the units activities. In particular, coast wattle, *Acacia sophorae* and spinifex, *Spinifex sericeus* are important. Although neither of

these species can yet compete with marram as a reliable and economic primary stabiliser for large raw dunes, *A. sophorae* is a good secondary species while *S. sericeus* can be used for primary stabilisation in relatively small areas under certain conditions. More emphasis is now being given to developing reliable techniques for using native species on beaches and dunes around Tasmania. Marram grass has played a useful role and it can now be observed how native species are successfully invading and replacing marram as site conditions improve.

Some of the changes that have affected the Waterhouse Protected Area over the past century and, more particularly, over the past forty years are described below.

Natural communities have been greatly affected by several factors. Perhaps the most significant are the impact of introduced livestock, farm development in its various forms, and the subsequent encroachment of the sand dunes. Fortunately livestock are now better controlled and rarely venture into the natural areas in large numbers and, while fire is used regularly in the management of marram grass nurseries, there have been amazingly few wild fires on the reserve in the last twenty years. It took quite a few years to break traditional firing practices of farmers and hunters. Interestingly the planting of *Pinus radiata* at belts at intervals throughout the reserve resulted in the reduction of fire as the plantations were generally recognised as a useful and valuable crop requiring protection from fire.

The development and settlement of farms at Waterhouse has impacted on the reserve in the following ways:

- Clearing and pasture development pushed back the boundary of the bushland but also provided a bounty of feed for both domestic and native animals.
- Land drainage affected water tables, rate of water run off and probably eutrophication. The seasonal pattern of wetland water levels was altered considerably.
- Pasture and woody weed invasion.
- Cats and rabbits invaded.
- Hunting pressures, particularly on waterfowl, increased as access became easier. Waterfowl numbers are now much reduced.

Dune encroachment over the past forty years has had a huge impact on habitats. Many plant communities from woodlands on sand ridges to a variety of wetland communities, have been obliterated from hundreds of hectares of the reserve. The size and nature of the remaining wetlands has been greatly altered. Several lagoons which covered tens of hectares have been reduced to very small remnants or totally destroyed. Another sad change is that in many cases wetlands were deepest to the west (down slope) and sand blows have filled the deep lagoons leaving only the eastern shallow swamps and marshes. In some cases wetlands seem to have been pushed back eastwards to higher ground. Where this has occurred it is likely that seasonal changes are different from a natural regime, with the new wetlands drying out much faster as a result of the increased ground water gradient. The inland migration of dunes has resulted in the formation of some new and mostly very shallow wetlands on the seaward side of the dunes. The vegetation of these lagoons and swamps are generally much less varied than that of the old wetlands east of the dune system.

Recreational pressure on the reserve is not generally extensive except around some favourite coastal areas which are used by day visitors and campers. Shack sites are concentrated in small areas mainly at Blackman's Lagoon and Little Waterhouse Lake. A change that is of great concern is the unauthorised modification of Blackman's Swamp south of Blackman's Lagoon. Enthusiastic anglers have used earth moving machinery to construct a long diversion drain to pick up flood water from Stone Chimney Creek and bring it north to supplement Blackman's Lagoon. Unfortunately they passed through and tapped Blackman's Swamp on the way with the result that this beautiful and varied marshland has dried out. The variety of habitats is much reduced; waterfowl use the area less often; and weeds are invading rapidly. With some consideration the situation can be rectified to a large extent while still allowing Stone Chimney Creek water to be used to top up Blackman's Lagoon.

The Waterhouse Protected Area is a wonderful and varied reserve serving both the local communities of north eastern Tasmania and visitors from further afield. The habitats and fauna of the reserve need protection, but the reserve also has other important functions, notably coastal protection and a range of recreation opportunities. A wildlife assessment and management plan is long over due. These will be useful to guide staff and visitors alike and enhance the protection of the areas values. In addition, Waterhouse has great potential as an outdoor study and research area with a special value for the development and demonstration of practical land conservation practices including coastal protection and habitat management. In this changing world we need to develop positive management techniques in addition to nature conservation based on exclusion and prohibitions.

PLANT COMMUNITIES OF THE WATERHOUSE AREA

Sib Corbett

GENERAL DESCRIPTION

Waterhouse Protected Area (WPA) can be divided into two areas along an east-west line running through Little Waterhouse Lake (map 2). The northern section has two small areas of active sand dune formation but is generally stable, with outcropping dolerite in the western half and granite in the east and a thick cover of old dune sand, stabilised into low east-west ridges and swales. The southern section consists of a west facing coastal strip about 2-3 km wide and 15 km long where large sand dunes (up to 30 m high) are actively forming and eroding.

Vegetation in the northern part of the study area follows the wind induced east-west grain. A mosaic of wetlands, heath and graminoid heath which is rich in the spectacular *Xanthorrhoea australis* tends to occupy the old dune tops, with tall dense coastal scrub *Banksia marginata*, *Leucopogon parviflorus*, *Acacia sophorae*, *Dodonea viscosa* in more sheltered areas. *Allocasuarina* and *Eucalyptus* spp. occupy well drained dolerite ridges and other sites where soil fertility is favourable. A wind-pruned woody heath extends for several hundreds of metres inland on most of the western coast and small herbfields, often grazed to 'marsupial lawns', are found throughout.

In the southern area vegetation wages a constant battle with shifting sand. The sand was derived from the west when the sea level was lower during the Last Glacial Stage (Bowland 1978). If there is no further significant source of sand then the present finite supply, if left undisturbed, must gradually migrate downwind (east-south-east) until stabilised. The fore-dunes are being colonised by *Acacia sophorae* and *Leucopogon parviflorus*, with reed beds (various *Juncus* and *Lepidosperma* species) in the damp swales. Between 1 and 3 km inland *Acacia* scrub is replaced by a dense shrubbery dominated by *Banksia* with *Allocasuarina verticillata* and eucalypts becoming important further inland.

METHODS

Vegetation mapping is derived in the first instance from the 1:42 000 black and white aerial photography taken in 1992. Kirkpatrick (1977) describes eight heath communities in the study area, while Kirkpatrick and Harris (1995) describe 16 coastal vascular plant communities. Wetland communities have been described by Kirkpatrick and Harwood (1981). Few of these floristic communities are able to be mapped. The mapped communities described here are generalised, the more so because most of them have transitional relations with their neighbours. They are simple enough to be recognised with fair consistency in the field and on air photos.

Communities are described below. Each description is based on observations over reasonably large areas of uniform vegetation while avoiding the transition zones. In any given community there will be some geographic variations in species composition.

Response to desiccating winds is the major determinant of structure in most communities, and the taller ones in particular tend to be very dense and uniform in height. Open woodland with a low understorey is uncommon within the WPA, occurring only in sheltered and mature situations.

RESULTS - COMMUNITY DESCRIPTIONS

(H1) Herbfields, including marsupial lawns

Close-cropped grassy herbfields are concentrated near Waterhouse Point, occupying small, flat areas of sand close to the shore. The matted grass *Distichlis distichophylla* extends out onto some beaches and is often invaded along the leading edge by the exotic *Euphorbia paralius*. *Senecio lautus* and *Cakile maritima* are locally abundant just behind beaches, often on the edges of herbfields.

Herbs include *Plantago* spp, *Selliera radicans*, *Scaevola hookeri*, *Acaena novae-zelandiae*, *Pratia irrigua*, *Goodenia lanata*, *Centrolepis fascicularis* and *Hydrocotyle* sp. Detailed study should reveal many more.

(G) Grassland

Very small grasslands occur in the northern area in low lying situations normally occupied by graminoid heath. The largest one observed, near Herbies Landing, is dominated by tussocks of *Stipa stipoides*, but none were studied in detail. Kirkpatrick (1977) noted grassy heath containing *Danthonia*, *Deyeuxia*, *Stipa* and *Themida* (with *Leucopogon parviflorus* as the only constant shrub) near Waterhouse Point.

(W) Wetland

Most lagoons are partially or completely colonised by several species, some of which extend out beyond the area of permanent inundation. Dominants vary from one wetland to another and may include *Myriophyllum elatinoides*, *Baumea arthropphylla*, *Isolepis fluitans*, *Villarsia reniformis* and *Typha* species. Less abundant species include *Triglochin procera*, *Schoenoplectus pungens*, *Lilaeopsis polyantha*, *Potamogeton australiensis* and *Lepilena cylindrocarpa*.

Wet herbfields surrounding many permanent and ephemeral lagoons have been included in this community, since they cannot usually be distinguished at mapping scale. Common herbs include *Acaena novae-zelandiae*, *Apium prostratum*, *Centaureum australe*, *Cotula coronopifolia*, *Hydrocotyle muscosa*, *Gonocarpus micranthus*, *Villarsia reniformis*, *Centrolepis aristata*, *Selliera radicans*, *Mitrasacme distylis*, *Gnaphalium* and *Plantago* spp. (some of these observations come from Kirkpatrick & Harwood 1981).

(Hs) Swampy heath

Heaths rich in reedy monocots, particularly *Leptocarpus tenax*, are common in damp swales near the wetlands and lagoons in the northern area where they are closely intermingled with Hc and Hx communities. In the southern area of active dune formation, flat bottomed blowouts and inter-dune valleys usually retain enough moisture to support a cover of monocots, including *Leptocarpus tenax*, *Gahnia radula*, *Isolepis* and *Juncus* species, *Lepidosperma gladiatum* and *L. concavum*, *Dianella tasmanica* and *D. revoluta* var. *breviculmis*. *Poa* sp and *Ammophila arenaria* also occur with *Scleranthus biflorus* and *Pimelea humilis*. *Leptospermum lanigerum* occurs along hidden watercourses with *Banksia marginata* and other Tall Coastal Scrub (Ld) species on the better drained valley margins. The Hs which occupies swampy blowouts just behind the beach in the southern area has not been studied.

In the northern area Hs is dominated by *Leptocarpus tenax* and usually contains *Lepidosperma concavum*, *Sprengelia incanata*, *Melaleuca gibbosa*, *Epacris lanuginosa*, *Comesperma retusum*, *Hakea teretifolia* and *Gahnia radula*. Herbaceous plants include *Burchardia umbellata*, *Brachyscome cardiocarpa*, *Drosera pygmaea*, *Patersonia occidentalis* and *Utricularia dichotoma*.

(Hx) Graminoid heaths

Heaths dominated by *Lepidosperma concavum* and *Lomandra longifolia* occur throughout the reserve on better drained sites. *Xanthorrhoea australis* is the most spectacular member of this community but is not always present. *Xanthorrhoea* shows a marked preference for the crests of old dunes and outcrop ridges, which it often shares with *Allocasuarina verticillata*, but is also seen in mixed heath in low areas. Almost pure stands of *Xanthorrhoea* are seen on the tops of small stabilised dunes in farmland just east of the Reserve in the southern area. Hx is uncommon in the south inside the Reserve, occurring only in a few openings in the banksia scrub east of the active dunes. *Pteridium esculentum* is included in Hx and in some forest edge situations it replaces most other heath species.

Species lists made on Hardwicks Hill indicate considerable diversity in this community with heath over-topped in places by scattered *Allocasuarina verticillata*, *Acacia sophorae*, *Banksia marginata* and *Bursaria spinosa*. The heath is dominated by *Xanthorrhoea australis*, *Lomandra longifolia*, *Lepidosperma concavum* and *Hibbertia sericea*, in constant association with epacrids (*Astroloma humifusum*, *Epacris impressa*, *E. lanuginosa*, *Acrotiche serrulata*, *Brachyloma ciliatum* and *Leucopogon virgatus*) and also *Platylobum triangulare*, *Baeckea ramosissima*, *Bossiaea prostrata* and *B. cinerea*, *Acacia suaveolens* and *A. myrtifolia*, *Hibbertia procumbens*, *Leptospermum scoparium* and *Gompholobium huegelii*. Monocots include *Leptocarpus tenax*, *Lepidosperma laterale*, *Dianella revoluta*, *Xanthorrhoea bractata*, *Patersonia fragilis*, *Hypolaena fastigiatum*, *Burchardia umbellata*, *Stipa* sp and *Diplarrena moraea*.

(Hc) Heath

This community shares many species with Hx and the two are inseparable over much of the central area north of the homestead. *Banksia marginata*, as 2 - 3 m scattered shrubs and *Allocasuarina monilifera* to 1.5 m are diagnostic for the Hc community, while *Xanthorrhoea australis* is generally absent and *Lepidosperma concavum* and *Lomandra longifolia* are much reduced, though constantly present. A large area of relatively uniform heathland between the hills above Herbies Landing and Ransons Beach serves as the type area, although there are small incursions of *Xanthorrhoea* heath. *Banksia marginata* is consistently present as

emergent shrubs and there are a few *Eucalyptus amygdalina* small trees on the scrubby margins. The heath contains *Allocasuarina monilifera*, *Hibbertia sericea*, *H. prostrata*, *Platylobium triangulare*, *Baeckea ramosissima*, *Gompholobium huegelii*, *Dillwynia glaberrima*, *Aotus ericoides*, *Comesperma retusum* and *Cassytha glabella*. The ground cover includes epacrids *Epacris impressa*, *Leucopogon virgatus*, *Acrotriche serrulata*, *Astroloma humifusum* and *Monotoca elliptica*; orchids such as *Diuris* and *Thelymitra* species; small herbs such as *Gonocarpus teucrioides*, *Centaurium australe*, *Drosera peltata* subsp. *auriculata* and *Pimelea humilis*; and monocots such as *Patersonia fragilis* and *Burchardia umbellata* and *Stipa* species.

A similar heath community lies between the woody coastal heath near Croppies Point and the mixed *Xanthorrhoea* heath occupies the ridge tops. In this area *Acacia suaveolens* and *A. verticillata* are part of the woody shrub assemblage, as well as the prostrate *Kennedia prostrata*, *Viola hederacea* and *Wahlenbergia* sp. added to the list above. Shrubby species such as *Melaleuca gibbosa*, *Pultenaea daphnoides* and *Leptospermum scoparium* occur within some heaths, with *Hakea teretifolia* and *Melaleuca ericifolia* occurring in wetter areas.

Heaths occurring along the boundary line and just outside the Reserve in the southern area are very different, but not extensive enough to be mapped. They occur in sheltered areas, often in open eucalypt woodland and contain species such as *Epacris impressa*, *Hibbertia procumbens*, *Patersonia occidentalis*, *Tetratheca pilosa*, *Kennedia prostrata*, *Calytrix tetragona* and *Ricinocarpus pinifolius*. *Ricinocarpus* is a plant of limited distribution on the east and north coasts and occurs mainly outside reserves.

(Hw) Woody coastal heath

Hw is found within about 200 m of the shore and is dominated by species which in less exposed situations would grow taller than the 2 m heath limit and would be called Ld. Between South Croppies Point and Waterhouse Point wind-pruning produces a ribbed surface on densely inter-grown shrubs growing on sand-covered rocky substrate. North-east of Herbies Landing Hw forms parallel vegetation strips 1 - 2 m tall, interspersed with low-growing graminoid heath. There are also suggestions of this 'striped heath' structure near Croppies Point, but not so extremely developed.

The principal species are *Banksia marginata*, *Acacia sophorae* and *Leucopogon parviflorus*, with *Melaleuca ericoides* in wetter areas. Near Croppies Point *Pultenaea daphnoides* is important and *Persoonia juniperina* was observed. Open areas carry smaller species such as *Melaleuca gibbosa*, *Pimelea serpyllifolia*, *P. curviflorus* and *P. humilis*, *Astroloma humifusum*, *Acrotriche serrulata* and *Epacris impressa*. *Lepidosperma gladiatum* reaches over 1 m, while *Lepidosperma concavum* and *Lomandra longifolia* are smaller. Constant small plants and herbs, particularly on track edges, are *Helichrysum apiculatum*, *Scaevola hookeri*, *Hypericum* sp., *Stylidium graminifolium* *Brachyscome* sp., *Viola hederacea*, *Gonocarpus* sp. and *Acaena* sp. Certain species are restricted to the seaward edge of Hw and Ld categories, notably the shrubs *Correa alba*, *Myoporum insulare*, *Phyllanthus gunnii* and *Leucophyta brownii* (South Croppies Point). Sprawling *Tetragonia implexioma* can occur in Hw and also extends inland, particularly in unstable dune country.

(Acs/Lu) Dune heath

This is a particular variant of coastal woody heath Hw, consisting almost entirely of the two species *Acacia sophorae* and *Leucopogon parviflorus*. It is found near the coast south of Little Waterhouse Lagoon where it is the first coloniser of active sand dunes. While Hw occurs in exposed situations on rocky coastlines (both on dolerite and granite) Acs/Lu is able to gain hold in highly unstable sand. *Helichrysum paraliu* and *Olearia lepidophylla* are occasional associates.

(L) Wet tea tree scrub

Narrow belts of 2 - 3 m tea tree occur along water lines within the heath country north of the homestead, where the species may be *Leptospermum scoparium*, *L. lanigerum*, *Melaleuca squarrosa* and/or *M. gibbosa*, often with *Hakea teretifolia* and *Gleichenia dicarpa*. In damp valleys between active dunes between Little Waterhouse Lake and Blackmans Lagoon *Leptospermum lanigerum* may be the only woody plant associated with Hs monocots.

(Ku) *Kunzea ambigua* shrubbery

This shrubbery (to 2 m) beneath *Allocasuarina verticillata* was seen only on two small hills just north of Croppies Point Road, 2.5 km E of the Point.

(Ld) Tall coastal scrub

Tall coastal scrub is widespread in the Reserve in areas with some shelter from desiccating winds and a stable substrate. It is best developed south of South Croppies Point just to the east of the active dunes and in a slightly different form near Waterhouse Point and Ransons Beach. *Banksia marginata*, *Leucopogon parviflorus*, *Acacia sophorae* and *Allocasuarina verticillata* are diagnostic species, though not all occur at each locality, *Dodonaea viscosa* is common and *Bursaria spinosa* may be present. Hx or Bracken is usually associated with any breaks in the cover. In the northern area *Pomaderris oraria* occurs in the fringes of Ld, with *Muehlenbeckia adpressa*,

Tetragonia implexicoma, *Cassytha glabella* and occasionally *Platylobum formosum* twining through the woody species to make stands even more dense.

In the southern area behind the dunes the tall scrub can become a dense dwarf forest, dominated by very large *Banksia marginata*, with eucalypts and she-oaks in the best inland sites and she-oak on the crests of a few high ridges closer to the sea.

(M) Tall melaleuca

In the wettest areas capable of supporting trees, Ld scrub gives way to well defined belts of tall paperbarks - *Melaleuca ericifolia* in most cases, but there are a few stands of *Melaleuca squarrosa* in the south between Forester Lodge and the coast. Here melaleuca belts are usually surrounded by Ld with *Allocasuarina verticillata* and eucalypts on raised ground with good drainage. South of Ransons Beach extensive swamps have cores of *Melaleuca ericifolia* fringed by 2 m *Melaleuca squarrosa*, *Leptospermum spp.* and tall *Acacia mearnsii*.

TREES

(Ca) *Allocasuarina verticillata*

Somewhat restricted in its distribution, she-oak particularly favours ridge-crests, both dolerite and granite outcrops and stabilised inland dunes. Thus they show a preference for slightly more fertile soils with good drainage. They have high drought tolerance but less for desiccating winds.

On many ridges trees reach 12 m and form a closed canopy with minimal understorey, in contrast with the dense surrounding scrub. *Allocasuarina verticillata* ,however, may also dominate open woodland with graminoid heath or be scattered through dense scrub.

(Ba) *Banksia marginata*

Banksia marginata as 2 m shrubs is a constant component of the heathlands where its small size may be an indicator of high fire frequency and low soil fertility. It reaches its maximum development in the dense shrubberies of the southern area, where 12 m trees are both emergent and dominant in the stabilised areas behind and between active dunes. These *Banksia* forests are a handsome and distinctive community, well represented in the WPA.

(Acs) *Acacia sophorae*

Acacia sophorae, alone or with *Leucopogon parviflorus* is the primary coloniser of active dune slopes and as such is the dominant species in the 3 km wide strip of active dune sand along the coast south of Little Waterhouse Lagoon. It is not always successful in stabilising the sand, as seen in a number of blow outs and the eroded tops of some very high dunes with dying remnants of vegetation. The 'calcified forests' just south of Little Waterhouse Lagoon probably result from calcareous deposits around acacia roots. Further erosion has revealed this root encasement.

In more stable situations *Acacia sophorae* is also an important component of woody coastal heath and shrubberies, where again this species exhibits high tolerance to wind, drought and infertile sandy soils. There are suggestions that it is finally overgrown by *Banksias* and *Eucalypts* as shelter and soil profiles are improved.

Eucalypts

Eucalypts are minor contributors to the plant communities in the WPA. Speculatively these could be the last colonisers awaiting a rise in soil fertility and shelter provided by more hardy species. In the northern area *Eucalyptus amygdalina* (Ea), *E. ovata* (Eo) and *E. viminalis* (Ev) occupy sites of good soil fertility and moisture retention at the base of the dolerite ridge of Hardwickes Hill and are scattered through the tall shrubberies to the east. Distribution is closely tied to that of *Allocasuarina verticillata*, but eucalypts are less tolerant of dry soils.

In the northern areas *Eucalyptus amygdalina* (Ea) takes on a stunted mallee form with multiple decortivating stems and relatively large leaves and resembles *Eucalyptus nitida* which occurs on Flinders Island (S. Harris pers. comm.). Seedlings are rare and time did not permit identification based on juvenile foliage. Further north (e.g. Blackmans Lagoon Road) the stringy barked eucalypts are typical *Eucalyptus amygdalina*.

Eucalyptus paniciflora occurs as far north as Big Waterhouse Lake and occurs with Eo and Ev along the eastern edge of the *Banksia* shrubbery behind the dunes where shelter and stability are assured.

THE RESERVATION AND CONSERVATION STATUS OF VEGETATION COMMUNITIES AND THE FLORA OF WATERHOUSE PROTECTED AREA

Stephen Harris and Alasdair Wells

PLANT COMMUNITIES

Kirkpatrick (1977) listed the area as the highest priority for reservation of six heathland floristic communities as well as coastal Themeda grassland.

Table 1 Reservation of heath communities in the Waterhouse Protected Area

Heath Community	Degree of Reservation
<i>Gompholobium huegelii</i> - <i>Epacris lanuginosa</i> (15)	poorly reserved (Freycinet)
<i>Danthonia</i> spp. - <i>Leucopogon parviflorus</i> (24)	poorly reserved (Freycinet)
<i>Bossiaea prostrata</i> - <i>Melaleuca gibbosa</i> (25)	unreserved
<i>Astroloma humifusum</i> - <i>Melaleuca gibbosa</i> (28)	unreserved

Of the communities previously listed, heath communities number 23 and 29 have since been found to be well reserved (Kirkpatrick *et al.* 1995). Kirkpatrick and Harris (1995) recorded 16 coastal floristic communities in the WPA. Only two are poorly reserved with the remainder well reserved.

Table 2 Reservation of coastal communities in the Waterhouse Protected Area

Coastal Community	Degree of Reservation
<i>Leucopogon parviflorus</i> - <i>Lepidosperma concavum</i> - <i>Oxalis perennans</i> heath	poorly reserved
<i>Olearia axillaris</i> shrubland	poorly reserved

Williams (1989) stated that..."The Waterhouse Protected Area is important for the regional conservation of coastal forest communities on Quaternary calcareous deposits, particularly for *Eucalyptus pauciflora* and *Allocasuarina verticillata*. Future management planning for the area should consider the regional conservation significance of these communities". Of the wetlands previously recommended by Kirkpatrick and Harwood (1981) for reservation for species and community conservation, the following were recommended:

species conservation: 530, 536

community conservation: 530, 536, 538

Tall dense stands of *Melaleuca ericifolia* and *M. squarrosa* occur in monospecific stands with a largely dry understorey, so they do not fit any of the melaleuca swamp forest communities of Pannell (1992).

Table 3 Conservation code of plant species in the Waterhouse Protected Area

Plant species	Conservation code
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<i>Cladium mariscus</i>	k (i possibly r1)
<i>Scoenoplectus pungens</i>	no code (was r2)
<i>S. validus</i>	r2u
<i>Bolboscoenus caldwellii</i>	r1u
<i>Xanthorrhoea bracteata</i>	k (i possibly r2u)
<i>Gnaphalium indutum</i>	r2
<i>Stylidium despectum</i>	r2
<i>Stylidium perpusillum</i>	r2
<i>Pomaderris oraria</i> ssp. <i>oraria</i>	Rr1

The first listed community is found where coastal vegetation integrates with heath, most commonly on stable sands. The *Olearia axillaris* shrubland is a Bass Strait coastal community which typically occurs on sand dunes behind the zone of sand binding grasses. The WPA is the site of ongoing studies into heathland and wetland plants (Mary Cameron, pers. comm. Queen Victoria Museum) and rock plate flora (Louise Gilfedder, pers. comm.). It is likely that these studies will considerably improve our knowledge of the flora reserve.

THE WETLAND VEGETATION OF LITTLE WATERHOUSE LAKE

Stewart Blackhall

A survey of vegetation in the Little Waterhouse Lake and surrounding area was conducted to compare with data collected in 1979 by Kirkpatrick and Harwood (1981). Little Waterhouse Lake was one of the many wetlands covered in this landmark study and was considered to be important for the conservation of several species and the community of *Schoenoplectus* (formerly *Scirpus*) *pungens*. Based largely on the recommendations of Kirkpatrick and Harwood, the area was included on the list of areas declared as *Wetlands of International Importance* in 1983. The intention of this study was to re-survey the area to determine what changes had occurred since 1979 and to confirm that the reasons for listing were still valid.

RESULTS

Table 1 below compares the species list in Kirkpatrick and Harwood (1981) with those observed during this study.

Table 1 Wetland plant species showing percentage cover densities at Little Waterhouse Lake and surrounding area in 1993 (Blackhall), compared with a 1981 species list (Kirkpatrick and Harwood 1981).

Species in Zones	1981	1993
<u>Zone 1 - Sedgeland</u>		
<i>Crassula helmsii</i>	5-25	40
<i>Eleocharis acuta</i>	0-5	10-15
<i>Triglochin procera</i>	5-25	<5
<i>T. striata</i>	0-5	
<i>Potamogeton australiensis</i>		<5
<i>Potentilla anglica</i>	0-5	
<i>P. anserina</i>		5
<i>Selliera radicans</i>	5-25	5
<i>Sanctorus anthereum</i>		<5
<i>Schoenus nitens</i>		10
<i>Schoenoplectus pungens</i>		40
<i>Baumea arthropphylla</i>	25-50	
<i>Baumea juncea</i>		20
<i>Juncus articulatus</i>	0-5	20
<i>J. caespiticus</i>	0-5	
<i>J. pallidus</i>		<5
<i>Cirsium vulgare</i>		15
<i>Holcus lanatus</i>	0-5	<5
<i>Senecio</i> sp		5
<i>S. lautus</i>		<5
<i>S. nitens</i>	0-5	
<i>Centrolepis strigosa</i>		<5
<i>Rorrippa nasturtium-aquaticum</i>		5
<i>Leontodon taraxicum</i>		<5
<i>Salix</i> sp	trace	5
<i>Atriplex hastata</i>	trace	
<i>A. prostrata</i>		<5
<i>Bromus diandra</i>		<5
<i>Carex fascicularis</i>	0-5	

<i>C. pumila</i>		5
<i>Actites megalocarpa</i>		5
<i>Isolepis cernua</i>		5
<i>Acaena novaezealandiae</i>		<5
<i>Juncus krausii</i>	0-5	5
<i>Lepidosperma concavum</i>		<5
<i>Hydrocotyle muscosa</i>	5-25	
<i>H. pterocarpa</i>	0-5	
<i>Pratia platycalyx</i>	5-25	
<i>Lilaeopsis polyantha</i>	0-5	
<i>Centella cordifolia</i>	0-5	
<i>Epilobium</i> spp.	0-5	
<i>Agrostis avenacea</i>	0-5	
<i>Bolboschoenus caldwellii</i>	0-5	
<i>Isolepis cernuus</i>	0-5	
<i>I. nodosus</i>	0-5	
<i>Schoenoplectus pungens</i>	5-25	
<i>S. validus</i>	0-5	
<i>Myriophyllum propinquum</i>	5-25	
<i>Typha latifolia</i>	25-50	
<i>Lobelia alata</i>	0-5	
<i>Cardamine heterophylla</i>	0-5	
<i>Mimulus repens</i>	0-5	
<i>Villarsia reniformis</i>	0-5	
<i>Cassytha glabella</i>	trace	
<i>Ranunculus rivularis</i>	0-5	
<i>Danthonia</i> spp.	0-5	
<u>Zone 2 - Grassland</u>		
<i>Eleocharis acuta</i>		5
<i>Potamogeton australiensis</i>		20
<i>Salix</i> sp		5
<i>S. cinerea</i>		<5
<i>Crassula helmsii</i>		<5
<i>Myriophyllum variifolium</i>		10
<i>M. salsugineum</i>		15
<i>Ranunculus amphitricus</i>		<5
<i>Rorrippa nasturtium-aquaticum</i>		<5
<i>Baumea rubiginosa</i>		20
<i>Lepilaena cylindrocarpa</i>	0-5	5
<i>Isolepis fluitans</i>		5
<i>Montia australis</i>		20
<i>Villarsia reniformis</i>		20
<i>Typha orientalis</i> (?)		25
<i>Hydrocotyle muscosa</i>		10
<i>Triglochin striata</i>		5
<i>T. procera</i>		20
<i>Schoenoplectus pungens</i>		5
<i>Scirpus caldwellii</i>	0-5	
<i>S. pungens</i>	0-5	
<u>Zone 3 - Fernland</u>		
<i>Potamogeton australiensis</i>	5-25	15
<i>P. ochreatus</i>	0-5	
<i>Myriophyllum elatinooides</i>	50-75	
<i>M. salsugineum</i>		30
<i>Triglochin procera</i>	0-5	20
<i>T. striata</i>		5
<i>Baumea rubiginosa</i>		5
<i>Crassula helmsii</i>		10
<i>Eleocharis acuta</i>		10
<i>Rorrippa nasturtium-aquaticum</i>		5

<i>Chara</i> sp.		5
<i>Hydrocotyle muscosa</i>		<5
<i>Lepilaena cylindrocarpa</i>	5-25	
<i>Wolffia australiana</i>	trace	
<i>Ruppia maritima</i>	0-5	

DISCUSSION

There are numerous differences between the species lists, some of which can be explained by sampling methods employed by the two studies. For example, some of the species are very small and cryptic and may have been overlooked at this time of year, i.e. November compared to Kirkpatrick and Harwood's sampling in January. There could also possibly be some mis-identifications, although any doubtful specimens have been referred to the Tasmanian Herbarium. Finally, differences between the two lists could reflect a change in the species composition over time. It will be difficult to determine what combination of the above factors best describes the true situation.

As for the percentage cover values of the various communities, the results were not always clear-cut either. The original surveys were done in a subjective manner that is difficult to repeat, and many of the cover values estimated are different even when the species remained the same. However, there were positive outcomes. The *Schoenoplectus pungens* population is still present and appears to be covering a larger area. This species is classified as rare in Tasmania (Flora Advisory Committee 1994) and is only reserved in the Bass Strait Islands. *Schoenoplectus validus* is listed as u r2 and *Bolboschoenus caldwellii* as u r1. Neither were found on this trip, but I will continue the search when they are more likely to be in flower.

The introduced willow *Salix* sp, appears to have increased from a 'trace' to an occurrence of two species estimated to constitute up to about 5 - 10 of the shoreline vegetation. This increase represents a threat to the area and some management steps should be taken to prevent further spread.

ORCHIDS OF THE WATERHOUSE PROTECTED AREA

Hans Wapstra and Annie Wapstra

RESULTS

Grid references from Tasmap (1:25 000) topographical maps are shown for each species record.

Southern part - coastal dune system

Microtis arenaria (formerly *M. biloba*) occurred in reasonable numbers in damp swales at the foot of active dunes in two spots, in the far south (414 627) and south west of Little Waterhouse Lake (504 747). The slender onion orchid *M. parviflora* was found in three more stable and vegetated spots. It was found on the edge of a swamp (472 667) adjacent to "Marengo" and near Big Waterhouse Lake (519 732 & 522 735).

Northern part - sandy heath and swamps

Coastal sandy heaths and swamps are usually rich in orchids but few were noted during this survey.

Microtis arenaria was reasonably common in damp spots and on swamp edges in four localities (543 763, 547 763, 552 763 & 543 774). The swamp onion orchid *M. orbicularis* is commonly found semi-submerged in permanent swamps in the north east, but was noted only in two (538 768 & 561 777). The yellow onion orchid *M. atrata* is usually found together with *M. orbicularis* but was found in one locality only (538 768).

Only two species of leek orchids were found. A surprise find was *Prasophyllum aff. suttoni* along a ridge running east from Homestead Road just north of the Big Waterhouse Lake turn-off. About 15 plants were scattered in sandy heath over half a kilometre (540 762 to 545 762), and a few plants further north (550 766). Only one plant of the austral leek orchid *P. australe*, often common on the edges of coastal swamps, was found in early bud stage at 543 774.

Sun orchids, *Thelymitra sp.*, usually common in heaths and damp areas, were very poorly represented in the study area during the survey. One specimen of the great sun orchid *T. aristata* was noted at (543 774) and 3 specimens of the spotted sun orchid *T. ixioides* grew near a water hole at 552 763.

The genus *Diuris* was represented by 1-2 specimens of tiger orchid *D. sulphurea* in heath at 552 763, 540 780 and 543 789. The large genus *Caladenia* was represented by two specimens of the green-comb spider orchid *C. dilatata*, one at 536 784, the other at 538 765. In a survey of the area in February 1993 the duckbill orchid *Cryptostylis subulata* was found in the edge of a lagoon on South Croppies Road (535 754) but was not present in other swamps inspected.

Mary Cameron mentioned that in spring in previous years the waxlip orchid *Glossodia major* was common in the heaths but no withered leaves or plants were noted in this November.

DISCUSSION

The results of the November 1993 survey were extremely disappointing in the number of species found and the abundance of each. Most species were represented by 1 to 3 specimens, except for onion orchids *Microtis sp.* which tended to be locally numerous. Unfortunately the timing of the study was not ideal for orchid searches as many species would have completed flowering.

There may be a number of reasons for the paucity of orchid records obtained in November. Firstly, 1993 was an extremely dry year which has affected the emergence of many orchids in Tasmania. Many known good orchid spots with a number of species and an abundance of plants have produced fewer species and very few plants. It appears that the WPA may have suffered the same fate. Secondly, the survey was conducted 4-6 weeks after the peak flowering time of most species. Yet, most orchids wither but remain standing for many weeks after flowering and are easily detected. Several species produce ground leaves without inflorescences in poor years and the absence of these was notable. Observations in February 1993, which was an excellent orchid year state wide, support the conclusion that the orchid flora of the WPA is impoverished. The most likely

reason is the past history of use of the area, especially heavy grazing. Fire frequency may have had some localised negative impacts on orchid abundance and diversity.

NOTES ON THE VEGETATION AND MANAGEMENT OF WATERHOUSE ISLAND

Stephen Harris

HISTORICAL PERSPECTIVE

These notes result from only a brief inspection of Waterhouse Island in November 1993. A list of the flora was compiled and comments made about the islands conservation and reservation status. The condition of the island, in particular its native vegetation, is assessed and some historical references quoted.

In 1802, the Baudin expedition anchored near Waterhouse Island and it was observed to have numerous seals and seabirds. On 19 March, Baudin made the following entry in his journal:

"This island is a good height in its northern section and is much lower lying to the South. In general it is sparsely-wooded, and what trees there are not very tall and grow only on the East coast. The entire western part is dry and arid. One can distinguish several great black boulders there which stand out in perfect contrast to the yellowish colour of the soil. The island does not appear to me to merit the name it bears, for it does not seem to offer the faintest possibility of finding water on it."

Leschenault, on the same voyage, recorded in his own journal:

"I landed also on Waterhouse Island and at various places on the north coast of Van Diemen's Land. All the islands about which I am speaking are small and uninhabited. However, they are interesting from the large number of seals which inhabit them. On Waterhouse Island I saw herds of several hundred which, having undoubtedly not yet been hunted, made no attempt to flee at my approach. I noted several which were as large as an ox. These amphibious quadrupeds, which have a terrifying appearance, are nevertheless neither to be feared nor difficult to kill. Nature has not equipped them with the means of attack or self defence when they are surprised on land, and they can escape only with difficulty. Moreover, the English, who are continually hereabouts, hunting these animals for their skins and the oil which they extract from them, need only bash them on the head with strong lead clubs. This continual destruction will soon bring about a considerable reduction in the numbers of these animals".

The island today is mostly cleared and has been farmed since at least 1870 when much of it was purchased by William Barrett. Descriptions of the island at that time suggest that wildlife was still varied and abundant and that the northern (eastern) end had a cover of sheoak and tea tree. The present managers purchased the island in 1977 when much of the island was in a degraded state. The leasees wrote (PWS file 02-32-75) in 1986 that at the time of their resumption of the island, 95% of the tea tree had disappeared and erosion had become a major problem. Mutton birds, penguins and Cape Barren geese were the most visible wildlife.

In a brief reconnaissance survey of the flora in 1993 by the author and A. Reimer, a total of 67 plant species were observed of which 30 were introduced. This brief list could probably be doubled with a more thorough survey. The island basically comprises an elongated low plateau which is thoroughly converted to exotic, mainly pasture species and weeds of dry soils. A steep slope, cliffed in places, is the principal refuge for the native species. Two species are noteworthy: *Olearia phlogopappa* var *salicifolia* is listed as rare and unreserved by Kirkpatrick *et al.* (1991) although the Flora Advisory Committee (1994) have cautiously listed the taxon as indeterminate because the species is rarely identified to variety level. The record of the introduced *Matthiola incana* is the first record of this species being naturalised in Australia. It occurs in at least one location on the dry soils of the steep coast, in a situation probably reminiscent of its native coastal habitat on the Isle of Wight in Europe. Other species recorded are common throughout the northeast and the Furneaux island group.

Herds of deer were observed at the time of this reconnaissance and despite fences being erected right around the plateau, stock were still obviously escaping onto the steep slopes and the Crown Land outside the fenced area.

Erosion and exotic animal browsing are still a problem. Many of the native plant species are restricted to quite small areas such as very steep rocky sections or small bluffs and overhangs where stock cannot get to graze these plants.

A wide variety of trees and shrubs have been deliberately introduced and may be seen at the house and between the house and the jetty. Some of these plants are dying or are stressed (e.g. Norfolk Island Pine) and others have the potential to become pests (e.g. *Coprosma repens*).

MANAGEMENT RECOMMENDATIONS

1. If deer are to be retained on the island then fencing must be made deer-proof.
2. Windbreaks and shelter-belts could be grown from sheoaks and Oyster Bay pines which would be hardy.
3. Shining coprosma (*Coprosma repens*) and African boxthorn (*Lycium ferocissimum*) should be eliminated from the island.

MAMMALS OF THE WATERHOUSE PROTECTED AREA

Michael Driessen, Greg Hocking and Mark Holdsworth

INTRODUCTION

Tasmania contains 34 native extant terrestrial mammals; two monotremes, nineteen marsupials and thirteen eutherian species. The greatest diversity of mammal species occurs in north-eastern Tasmania with all but one species being present (Rounsevell *et al.* 1991). The sole exception is the broad-toothed mouse which has only been recorded from buttongrass moorlands in western Tasmania.

No previous surveys of mammals in the WPA area are known and only two species of mammal were listed on the TASPAS Biological Records Scheme as being present in the reserve. One was a record of the Tasmanian devil and the other was an alleged but unconfirmed sighting in 1957 of the now considered extinct Tasmanian thylacine.

METHODS

The survey of mammals present in the WPA was undertaken over 5 days from the 22 - 26 November 1993. Trapping transects were established in sites representative of the range of plant communities described by Corbett (this study) and observed fire age. A total of 100 Mascot traps (200 x 200 x 560 mm), 158 Elliot traps (100 x 90 x 330) and 2 harp traps (for bats) were set on each of four nights in a variety of habitats (Table 1). Mascot and Elliot traps were either set in single lines or in two parallel lines separated by road. Where traps were set along a road two Mascot and/or Elliot traps were set on either side of the road every 100 m. All mascot traps were baited with peanut butter and bread. About half the Elliot traps were baited with peanut butter and bread and the other half were baited with peanut butter, sunflower seed and proprietary budgerigar seed mixture. Spotlight surveys were undertaken from vehicles along roads and tracks within the WPA and some adjacent farmland over two nights using standardised methods (Driessen and Hocking 1992). Presence of scats and tracks were also used as indicators of species presence.

Table 1 The number of nights each type of trap was set in each vegetation type.

Vegetation Type	Mascot	Elliot	Bat
Coastal Scrub	184	167	7
Coastal Heath	52	385	-
Tall Melaleuca	40	80	-
Dune Heath	48	-	-
Pine Forest	20	-	-
Marram Grass	20	-	-
Pasture	36	-	1
Total	400	632	8

RESULTS

The results of mammal trapping are given in Tables 2 and 3. A total of 40 animals, representing 8 species, were captured in Mascot traps; a success rate of 10%. The most commonly caught species in mascot traps were

brush-tail possums (48%) and Tasmanian bettongs (18%). Three species were caught 47 times in Elliot traps at a success rate of 7%. House mice comprised 72% (n=47) of all captures in Elliot traps.

Table 2 Total number of captures of mammals using Mascot traps by vegetation type.

(ECH=echidna, SQ=spotted-tailed quoll, DEV= Tasmanian devil, SBB=southern brown bandicoot, BP=brush-tail possum, BET=Tasmanian bettong, VFR=velvet furred rat, BIR=black rat)

Vegetation Type	Species Code								Trap Nights
	ECH	SQ	DEV	SBB	BP	BET	VFR	BIR	
Coastal Scrub	1	2	2	2	6	1	4	2	184
Coastal Heath	-	-	-	-	-	-	-	-	52
Tall Melaleuca	-	-	-	-	5	5	-	-	40
Dune Heath	-	-	-	-	3	-	-	-	48
Pine Forest	-	-	-	-	2	1	-	-	20
Marram Grass	-	-	-	-	1	-	-	-	20
Pasture	-	1	-	-	2	-	-	-	36
Total	1	3	2	2	19	7	4	2	400

Table 3 Total number of captures of mammals using Elliot traps by vegetation type.

Vegetation Type	Species			Trap Nights
	swamp antechinus	velvet furred rat	house mouse	
Coastal Scrub	-	5	13	167
Coastal Heath	3	5	20	385
Tall Melaleuca	-	-	1	80
Total	3	10	34	632

Spotlight survey results are given in Table 4. Because of differences in sightability due to habitat differences, comparisons of the WPA spotlight survey results with other areas of the State must be treated with caution. Spotlight counts of the Tasmanian bettong and the Tasmanian devil appear to be higher than other areas of the State, whereas the brush-tail possum counts appear to be lower. Counts of other mammal species do not differ markedly.

Table 4 Comparison between the number of mammals spotlighted (per 10 km) at Waterhouse Protected Area with spotlight surveys conducted annually by the Parks and Wildlife Service throughout the State and in north-east Tasmania.

Mammal Species	Waterhouse Protected Area	North-east Tasmania	Statewide
Tasmanian pademelon	8.8	8.5	8.2
Bennetts wallaby	7.5	4.6	5.6
Tasmanian bettong	0.8	0.1	0.1
Brush-tail possum	1.9	3.9	6.5
Wombat	1.5	2.0	0.9
Eastern quoll	0.2	0.3	0.3
Tasmanian devil	1.0	0.5	0.4

Echidna	0.2	-	-
European rabbit	1.5	0.9	1.6
Total distance travelled (km)	48	5850	17010

During the survey of the WPA a total of 16 native mammal species were recorded; one monotreme, eleven marsupials and four eutherian species (Table 5). A further five species were not observed in the WPA but are considered likely to be present based on (a) habitat requirements, (b) the size of required habitats in the WPA, (c) the proximity of known populations to the WPA, (c) the observability of each species, including trapability and behaviour and (d) historic records in or near the WPA. They are; the platypus, the white-footed dunnart, the little pygmy possum, the long-nosed potoroo and the New Holland mouse. More survey time is required to confirm the presence or absence of these species. For the eastern pygmy possum and six species of bat there is insufficient information known about habitat preferences to predict their presence in the WPA study area. Five species; the dusky antechinus, the eastern barred bandicoot, the sugar glider, the long-tailed mouse, and the forester kangaroo, occur in the north-east of Tasmania but are considered unlikely to occur in the WPA due to unsuitable or limited habitat. Hence, an observed minimum of 16 (47%), a predicted 21 (62%) and an outside probability of 28 (82%) out of a possible 34 Tasmanian mammals may occur in the WPA. This is a high level of species diversity especially when the total area of the reserve is taken into consideration. In addition to having a high species diversity, the WPA also has four of Tasmania's five endemic species; the Tasmanian devil, the eastern quoll, the Tasmanian pademelon and the Tasmanian bettong. With the exception of the eastern quoll all are common within the reserve. More work is required to establish the status of the eastern quoll in the WPA.

The WPA contains three, possibly four, of Tasmania's six species which are considered to be potentially vulnerable and/or require monitoring. They are the spotted-tailed quoll, the eastern quoll, the Tasmanian bettong and possibly the little pygmy possum. The WPA is likely to contain the only mammal species which is considered to be rare in Tasmania, the New Holland mouse. The WPA contains extensive areas of apparently suitable habitat and the species has been recorded to the west and east of the reserve. However, despite extensive trapping, the species was not recorded during this study.

Table 5 List of native Tasmanian mammal species recorded in north-eastern Tasmania (based on Rounsevell *et al.* 1991) and in the Waterhouse Protected Area (this study).

('x' = present, 'l' = likely to be present, '-' = not recorded or absent. '?' = insufficient knowledge of habitat requirements and general distribution. See text for details).

SPECIES	NE TAS	WPA
MONOTREMES		
Platypus <i>Ornithorhynchus anatinus</i>	x	l
Echidna <i>Tachyglossus aculeatus</i>	x	x
MARSUPIALS		
Swamp antechinus <i>Antechinus minimus</i>	x	x
Dusky antechinus <i>Antechinus swainsonii</i>	x	-
Spotted-tailed quoll <i>Dasyurus maculatus</i>	x	x
Eastern quoll <i>Dasyurus viverrinus</i>	x	x
Tasmanian devil <i>Sarcophilus harrisii</i>	x	x
White-footed dunnart <i>Sminthopsis leucopus</i>	x	l
Southern brown bandicoot <i>Isodon obesulus</i>	x	x
Eastern barred bandicoot <i>Perameles gunnii</i>	x	-
Wombat <i>Vombatus ursinus</i>	x	x
Sugar glider <i>Petaurus breviceps</i>	x	-
Ringtail possum <i>Pseudocheirus peregrinus</i>	x	x
Brushtail possum <i>Trichosurus vulpecula</i>	x	x
Little pygmy possum <i>Cercartetus lepidus</i>	x	l

Eastern pygmy possum <i>Cercartetus nanus</i>	x	?
Tasmanian bettong <i>Bettongia gaimardi</i>	x	x
Long-nosed potoroo <i>Potorous tridactylus</i>	x	1
Forester kangaroo <i>Macropus giganteus</i>	x	-
Bennetts wallaby <i>Macropus rufogriseus</i>	x	x
Tasmanian pademelon <i>Thylogale billardierii</i>	x	x

EUTHERIANS

Goulds wattled bat <i>Chalinolobus gouldii</i>	x	?
Chocolate wattled bat <i>Chalinolobus morio</i>	x	x
King River eptesicus <i>Eptesicus regulus</i>	x	?
Large forest eptesicus <i>Eptesicus darlingtoni</i>	x	?
Little forest eptesicus <i>Eptesicus vulturinus</i>	x	x
Great pipistrelle <i>Falsistrellus tasmaniensis</i>	x	?
Lesser long-eared bat <i>Nyctophilus geoffroyi</i>	x	?
Goulds long-eared bat <i>Nyctophilus gouldi</i>	x	?
Water rat <i>Hydromys chrysogaster</i>	x	x
Broad-toothed mouse <i>Mastacomys fuscus</i>	-	-
Long-tailed mouse <i>Pseudomys higginsii</i>	x	-
New Holland Mouse <i>Pseudomys novaehollandiae</i>	x	1
Velvet furred rat <i>Rattus lutreolus</i>	x	x

SPECIES DESCRIPTION

The following describes briefly all native and exotic mammal species recorded during the survey. This is followed by discussion of those species which are present in north-east Tasmania but not recorded from the WPA.

Monotremes

Family Tachyglossidae

Echidna (*Tachyglossus aculeatus*) - Several individuals were observed in the WPA, including one individual which was caught in a mascot trap. This species occurs in all vegetation types throughout the WPA and is considered to be common.

Marsupials

Family Dasyuridae

Swamp antechinus (*Antechinus minimus*) - Three individuals were trapped in coastal heath about 1.5 km west of Ransons Beach. It is of note that the heath had not been burnt for at least ten years, whereas most trapping with Elliot traps occurred in more recently burnt areas. The species is believed to be uncommon in the WPA.

Spotted-tailed quoll (*Dasyurus maculatus*) - Three individuals were trapped during the study; one at Big Waterhouse Lake; one at Little Waterhouse Lake; and one approximately 1 km east of Herbies Landing. The species occurs throughout the north-east of Tasmania and the forest and scrub habitats within the WPA appear good areas for this species.

Eastern quoll (*Dasyurus viverrinus*) - Only one individual of this species was recorded in the WPA and this was on the border of the park adjacent to farmland. Some footprints were reported further inside the study area (M. Holdsworth, pers comm). As this species is readily trapped and no individuals were trapped in 400 trap nights it therefore suggests that this species is surprisingly uncommon in the WPA.

Tasmanian devil (*Sarcophilus harrisi*) - An adult female devil was trapped on Hardwicks Hill and a young male was trapped near Little Waterhouse Lake. Five individuals were observed while spotlighting along the roads into Big and Little Waterhouse Lakes. Scats were readily observed along tracks throughout the park including the dunes. This species is widespread and locally abundant in the north-east of the state. The population of devils in the WPA appears to be high and this is probably a result of the large population of prey species (wallaby and wombat) and availability of carrion (from stock and game) in adjacent farmland.

Family Peramelidae

Southern brown bandicoot (*Isoodon obesulus*) - Two brown bandicoots were caught in coastal scrub south of One Tree Hill. This shy species is not readily trapped or observed on spotlight surveys. Team members reported bandicoot diggings in woodland and heathy scrub areas which almost certainly were made by this species. The southern brown bandicoot is probably well distributed throughout the coastal heath and scrub where there is good ground cover.

Family Vombatidae

Wombat (*Vombatus ursinus*) - Wombats and their scats were seen throughout the WPA including the dunes and are considered to be common.

Family Petauridae

Ringtail possum (*Pseudocheirus peregrinus*) - Unlike brushtail possums, ringtails have less reliance on tree hollows, building stick nests or 'drays' in the canopy of tall scrub. Although no ringtails were sighted during the survey, three drays were recorded in paperbark, *Melaleuca ericifolia* in Tall Melaleuca vegetation 1.5 km west of Ransons Beach. The extensive stands of tall paperbarks (*Melaleuca* spp) and tea tree (*Leptospermum* spp.) throughout the WPA, and particularly around the lagoon areas in association with eucalypts, are likely to contain significant populations of this once uncommon species.

Family Phalangeridae

Brushtail possum (*Trichosurus vulpecula*) - Brushtail possums were regularly trapped and observed in the WPA and are considered to be common in Coastal Scrub. However, spotlight counts of this species were significantly lower in the WPA compared to other areas of the State (Table 5). The lower density of possums in the WPA compared with other areas of the State is probably due to habitat differences. The vegetation of the WPA is largely native bush. Highest densities of possums occur where there is a mosaic of pasture, crops and native bush.

Family Potoroidae

Tasmanian bettong (*Bettongia gaimardi*) - Seven bettongs were trapped during the survey. Five were trapped in Tall Melaleuca vegetation 1.5 km west of Ransons Beach, one in Coastal Scrub on Hardwicks Hill and one in Pine Forest near Blackmans Lagoon. Bettong diggings were readily observed under *Allocasuarina verticillata* stands, indeed all captures and sightings were associated with this tree species. Although bettongs are largely limited to areas of Coastal Scrub and Tall Melaleuca, it is considered to be common in these areas. Spotlight counts of Tasmanian bettongs appear to be high in the WPA compared to other areas of the State (Table 5).

Family Macropodidae

Bennetts wallaby (*Macropus rufogriseus*) - Bennetts wallabies were frequently seen at night and also during the day. This species was recorded in all habitats within the WPA and is considered to be abundant.

Tasmanian pademelon (*Thylogale billardierii*) - Pademelons were frequently seen within the WPA and are considered to be common in Coastal Scrub, Tall Melaleuca and where there is sufficient cover in Coastal Heath.

Eutherians

Family Vespertilionidae

Large forest vespadelus (*Eptesicus vespadelus*) and **Chocolate wattled bat** (*Chalinolobus morio*) - Only three individuals, 2 large forest vespadelus and 1 chocolate wattled bat, were trapped in Coastal Scrub near Big Waterhouse Lake. Weather conditions were not conducive for bat observations, however, several unidentified bats were observed while spotlighting. Little is known about the distribution patterns of Tasmania's eight bat species (Rounsevell *et al.* 1991) but it is possible that all eight species could occur in the WPA.

Family Muridae

Water rat (*Hydromys chrysogaster*) - No water rats were observed during the survey but footprints were found on sand flats at the mouth of lake creek. This species is likely to be common within the WPA, frequenting

permanent creeks, streams lagoons and along coastlines. The species is known to occur at Bridport (Rounsevell *et al.* 1991).

Velvet furred rat (*Rattus lutreolus*) - There were 14 captures of this species in coastal scrub and heath and it is considered to be common in all areas of WPA except bare dunes and marram grass.

Exotic Species

House mouse (*Mus musculus*) - This species is probably the most abundant mammal species present in the WPA. It was frequently trapped in coastal heath and scrub.

Black rat (*Rattus rattus*) - Two individuals were trapped in coastal scrub adjacent to the picnic area at Blackmans Lagoon. This species is also likely to occur in association with shacks and adjacent farm buildings.

Cat (*Felis catus*) - Several cats were seen in and around the WPA. A short-tailed shearwater was found on Waterhouse Island which showed the characteristic signs of being eaten by a cat (J. Bayly-Stark pers comm).

Rabbit (*Oryctolagus cuniculus*) - Rabbits were frequently sighted in the WPA together with their diggings and scats.

Species Not Recorded From The WPA

The following species were not recorded in the WPA but occur within the north-east region. An attempt has been made to assess their status in the WPA (Table 5) based on (a) habitat requirements, (b) the size of required habitats in the WPA, (c) the proximity of known populations to the WPA, (c) the observability of each species, including trapability and behaviour and (d) historic records in or near the WPA.

Platypus (*Ornithorhynchus anatinus*) - No individuals of this species were recorded during the survey. However, it is known to occur in nearby river systems (Rounsevell *et al.* 1991), so it is possible the species occurs in permanent water bodies such as Blackmans Lagoon or Big Waterhouse Lake.

White-footed dunnart (*Sminthopsis leucopus*) - No dunnarts were recorded during the survey but the species can be difficult to trap or observe. They have been recorded in habitats similar to those occurring in WPA and are known from nearby areas (Rounsevell *et al.* 1991).

Eastern barred bandicoot (*Perameles gunnii*) - No barred bandicoots were recorded during the survey and is unlikely to occur beyond the margins of WPA boundary with pasture. The habitat of this species is grasslands and grassy woodlands which are virtually absent from the WPA. Trapping was conducted adjacent to pasture on the edge of the park specifically in an attempt to catch this species, with no success. There were no signs of bandicoot diggings in the surrounding pastures, however, TASPAWS has a record of an eastern barred bandicoot in pasture about 300 m outside the reserve, north of Marengo (Grid Reference: 547690E, 5466620N).

Sugar glider (*Petaurus breviceps*) - *Banksia marginata* and *Acacia spp.*, are important sources of food for this species (Henry and Suckling 1984; Slater 1987) and the WPA contains an abundance of both. However, the area does lack large areas of mature eucalypts which are used for food and, most importantly, for shelter in tree hollows.

Little pygmy possum (*Cercartetus lepidus*) and **eastern pygmy possum** (*Cercartetus nanus*) - No pygmy possums were recorded during the survey. However, given the habitat preference of the little pygmy possum for coastal scrub and heathland, and sightings of the species from nearby areas (Rounsevell *et al.* 1991), it is reasonable to expect this species to occur in the WPA. The eastern pygmy possum has a widespread distribution but is mainly associated with wet forests (Rounsevell *et al.* 1991) and it is therefore unlikely to occur in the WPA.

Long-nosed potoroo (*Potorous tridactylus*) - No potoroos were recorded during the survey. This was surprising given that the WPA contained extensive areas of apparently suitable habitat and that the species is easily trapped. The species is known to occur in nearby areas (Rounsevell *et al.* 1991) and one can only assume it is uncommon in the WPA.

Forester kangaroo (*Macropus giganteus*) - Robinson (in Plomley 1966) recorded this species in the Waterhouse area around 1830. However, this species has since suffered a massive reduction in range due to loss of habitat and hunting. No forester kangaroos were recorded during the survey and it is unlikely to still occur in WPA due to limited areas of suitable habitat.

New Holland mouse (*Pseudomys novaehollandiae*) - This species was not recorded during the survey. Trapping was primarily aimed at determining the presence of this species. However, despite extensive areas of apparently suitable habitat and 385 trap nights in coastal heath, none were recorded. Based on previous studies of this species in Tasmania (Hocking 1980, Pye 1991) this level of trapping should be sufficient to capture the species if it were present. Several studies have shown that this species prefers habitat recently disturbed by fire (Posamentier and Recher 1974, Hocking 1980, Pye 1991). At least three of the sites trapped contained heath recently (< 3 years) burnt. However, no information is available on fire history prior to this time. It is possible that the New Holland mouse has become extinct in the area because of some previous absence of fire. Further trapping is required over a greater area in the WPA to establish if the species is present. The presence of this species in the WPA will have implications for management in relation to fire.

RECOMMENDATIONS

More Research

At least five species of mammal which were not recorded during the survey have a high probability of occurring in the WPA. Their presence or absence needs to be confirmed. Highest priority is to establish whether the New Holland mouse occurs in the reserve or not because (a) this will have important implications for fire management and (b) it is probably Tasmania's rarest mammal. The failure to trap the long-nosed potoroo in what appeared to be ideal habitat also requires further investigation.

Reserve Status

The WPA has high conservation values for mammals because of high species diversity and it contains four of Tasmania's five endemic species. Although most of the past management practices and land uses do not appear to have been detrimental to the mammal fauna diversity, it is likely that populations have been placed under pressure. An improved reserve status combined with the formulation and implementation of an appropriate management plan would provide greater protection to the fauna of the area.

Fire

Fire plays an important role in the ecology of many Tasmanian mammal species in terms of altering habitat and food regimes. Firing is important for maintaining the habitat of the New Holland mouse and the Tasmanian bettong. Fire also stimulates the sporulation of underground fungi which are important food sources for mammals such as bettongs and potoroos. Within the WPA a mosaic of vegetation types with different ages since firing should be the goal of management.

The failure to record the New Holland mouse in an extensive area of apparently suitable habitat may be linked to past firing regimes. If the presence of the New Holland mouse is confirmed in or near the WPA, then it may be necessary to develop a specific firing plan in heathlands to maintain suitable habitat for this species.

Phytophthora

The root-rot fungus *Phytophthora cinnamomi* occurs within the WPA. The continued spread of this fungus will reduce the plant species diversity in the reserve and there is potential for mammals to be adversely affected. By killing plant species, particularly flowering plant species such as those in the family Proteaceae, *Phytophthora* may be reducing available food sources and simplifying habitat. The spread of this disease should be controlled.

Feral species

Four exotic mammal species were recorded in the WPA, they were the house mouse, black rat, feral cat and European rabbit. Although no native mammal species is threatened by exotic species in the WPA, they do provide added pressure on their populations through competition and predation.

Little can be done about the house mouse which occurs widely in the reserve. Some degree of control can be achieved for black rats by minimising disturbance to native habitat and keeping clean and tidy picnic and shack areas. Some local control of cats can be achieved by trapping and shooting, but this has only a short-term effect. Control of feral cats should be done on a state-wide basis by introducing suitable legislation for responsible pet ownership.

Marram Grass

Marram grass habitat is unsuitable for supporting native mammal species. The possibility of introducing native species into areas of marram grass should be investigated.

BIRDS OF THE WATERHOUSE AREA

Sally Bryant and Mark Holdsworth

METHODS

Bird surveys are useful tools for gaining an insight into the diversity and ecological importance of a region. Large areas can be assessed relatively quickly to provide a basic species list which can then be used to identify important ecological and conservation features e.g. breeding sites, migratory routes and foraging grounds. This bird survey was conducted over 5 days in November with observations from the authors and other members of the survey team equating to more than 200 observation hours throughout the entire WPA. Areas adjacent to the WPA, including Waterhouse and Little Waterhouse Islands, were also surveyed because of their importance as seabird breeding sites and their potential influence on community compositions, breeding activity and foraging patterns within the protected area.

Species were recorded by sight and or call while walking transects through a range of habitats identified from the PWS vegetation map (Corbett this report). Limited information on nocturnal birds was obtained from spotlight surveys being conducted for other fauna. Surveys to detect the ground parrot *Pezoporus wallicus* followed the standardised call census technique described by Bryant (1991). Notes were made on species abundance, nesting behaviour, nest sites, disturbance to nesting sites and management issues relating to the WPA. Conditions during most of the survey period were not ideal being clear but very windy. Species taxonomy follows that of Christidis and Boles (1994).

RESULTS

A total of 87 species were identified either in or immediately adjacent to the WPA (Appendix A). This list was considered a reasonably good assessment of the area with the exception being marine species due to limited time surveying at sea. The area specifically contained 75 breeding or resident native bird species, 2 irregularly recorded in Tasmania, 4 regular non-breeding migrant and vagrants and 6 introduced species. Only 6 of Tasmania's 14 endemic species were identified; these being the Tasmanian native hen, yellow wattlebird, green rosella, yellow-throated honeyeater, black-headed honeyeater and Tasmanian scrubwren.

Breeding records included nest contents and nest site description for the black swan, Cape Barren goose, Pacific black duck, little penguin, short-tailed shearwater, black-faced cormorant, Tasmanian native hen, white-fronted chat, brown quail, pied oystercatcher, sooty oystercatcher, Pacific gull, silver gull, Caspian tern, striated fieldwren, tawny-crowned honeyeater and Richards pipit.

There were 30 species of high conservation significance identified in the Waterhouse area, including 7 listed on the national *Endangered Species Protection Act 1992* and the Tasmanian *Threatened Species Protection Act 1995* (Table 1). The little and fairy tern are known to breed in only a few coastal areas throughout Tasmania (Rounsevell 1983), hence the WPA is a significant site for both these species. Other species in Table 1 are migratory birds listed under international agreements such as the Japan Australia Migratory Bird Agreement (JAMBA) or the China Australia Migratory Bird Agreement whereby both countries are responsible for a high level of protection of seasonal breeding or feeding grounds.

Table 1: Bird Species of high conservation significance identified in or adjacent to the Waterhouse Protected Area.

Common Name	Nat. / Tas.	Other Status
little tern	E / E	JAMBA / CAMBA
shy albatross	- / V	
black-browed albatross	- / V	
light mantled sooty albatross	- / V	
white headed petrel	- / V	

hooded plover	V / M	
fairy tern	- / R	
Australian pelican	- / -	Naturally Rare
Australian kestrel	- / -	Naturally Rare
Caspian tern	- / -	Naturally Rare / JAMBA
Latham's snipe	- / -	Requires Monitoring / JAMBA
Australasian shoveler	- / -	Requires Monitoring
swamp harrier	- / -	Requires Monitoring
little penguin	- / -	Requires Monitoring
Australasian gannet	- / -	Requires Monitoring
Australian bittern	- / -	Insufficiently Known
Australian hobby	- / -	Insufficiently Known
blue-billed duck	- / -	Insufficiently Known
sooty shearwater	- / -	Insufficiently Known / JAMBA
short-tailed shearwater	- / -	JAMBA
great egret	- / -	JAMBA / CAMBA
cattle egret	- / -	JAMBA
ruddy turnstone	- / -	JAMBA
sharp tailed sandpiper	- / -	JAMBA / CAMBA
curlew sandpiper	- / -	JAMBA / CAMBA
pectoral sandpiper	- / -	JAMBA
red-necked stint	- / -	JAMBA / CAMBA
white-throated needletail	- / -	JAMBA
grey plover	- / -	JAMBA
greenshank	- / -	JAMBA

National status according to the *Endangered Species Protection Act 1992*, Tasmanian status according to the *Threatened Species Protection Act 1995*, other status as listed by the Vertebrate Advisory Committee (1994) or international agreements JAMBA, CAMBA.

DISCUSSION

The WPA and surrounding area contains a variety of marine, coastal, wetland, open woodland and heathland habitats interfaced by agricultural and cleared land. The absence of old-growth dry forest and woodland explains the absence of some species particularly hollow nesting birds like owls and parrots. Similarly, the dry vegetation types do not provide suitable habitat for species which favour wet forest communities, e.g. scrubtit and strong-billed honeyeater. A number of species were common throughout the WPA and in adjacent areas, the most conspicuous being the Pacific gull, silver gull and grey currawong. The forest raven, laughing kookaburra, masked lapwing and Australian magpie favoured the more developed areas around the settlement but were also identified within the reserve.

Lake and Wetland Complexes

The lower reaches of the WPA are dominated by three large freshwater bodies (Blackmans Lagoon, Little Waterhouse Lake and Big Waterhouse Lake) as well as a number of smaller permanent and ephemeral ponds. Collectively, these water bodies with their associated reed beds, marshland and wet herbfields, provide significant habitat for waterfowl. The dominant waterfowl identified were black swan, Pacific black duck, chestnut teal, musk duck, hoary-headed grebe, little-pied cormorant, little-black cormorant and great cormorant. Grey teal, blue-billed duck, Eurasian coot and blue-winged shovellers were also present on the larger waterways but less numerous. Around foreshores purple swamphen, Tasmanian native hen, white-faced heron and tawny grassbirds were common. Black swan were recorded breeding in the marshland extending from Big Waterhouse Lake to Lake Creek. Other species such as tree martin and welcome swallow were observed regularly above the waterways foraging for insects. Latham's snipe and brown quail were flushed on several occasions from grassland and marshland near lagoons and several Australian bittern, typically a cryptic species, were observed flying over the reed beds on Little Waterhouse Lake and Blackmans Lagoon. While no estimate of abundance was made of the Australian bittern population, their regular observation during the survey suggest they are potentially common throughout the WPA and that this area may contain a significant Tasmanian population.

Marine and Coasts

Pacific and silver gull were common throughout coastal areas while black-faced cormorant were regularly observed on rocky shelves and at sea. Pied oystercatchers and sooty oystercatchers were common but not numerous at Ransons Beach, Waterhouse Beach, Waterhouse Point and Herbies Landing. Crested terns and

Caspian terns were also sighted off the northeast coastline in low numbers. Two beach washed specimens of short-tailed shearwaters confirmed the species presence in the area and rookeries were observed but unoccupied on Waterhouse Island. White-fronted chats were commonly observed in sparse vegetation along sand dunes around Waterhouse Beach and were observed breeding on Little Waterhouse Island.

A flock of 18 red-capped dotterel, 15 red-necked stint and 1 greenshank were observed feeding in the shallows of a small spit on Waterhouse Beach inland from the mouth of Lake Creek. It is likely these sheltered inlets with their sand flats are important for a variety of small waders both on a daily and seasonal basis.

The nationally vulnerable hooded plover was sighted on several sandy beaches throughout the WPA, usually grouped in pairs suggesting breeding activity. Observations were on Ransons Beach (2 pairs), Waterhouse Beach (2 pairs) and further inland at Blackmans Lagoon (1 individual). This equates to 2.1 birds km of beach which is noticeably higher than the statewide density of 1.18 birds km but similar to the regional density of 2.29 birds km recorded during a species survey in 1992 (Holdsworth & Park 1993). Only a small percentage of the beaches on the northeast coast were surveyed during the 1992 study and this study, however, the beaches bordering the WPA are considered high quality habitat and likely to contain many breeding pairs. The population estimate of hooded plover for the entire WPA is potentially between 30 - 40 birds or 15 - 20 pairs.

Two sightings of particular interest were of a flock of 23 grey plover, a species rarely seen in such numbers, observed at Ransons Beach and of fairy terns, classified as Rare, feeding off Waterhouse Point.

Heathland

Dry graminoid heaths predominate throughout much of the WPA extending from the crests of old dunes and outcrop ridges to open plains merging on Banksia scrub. The most common birds observed in the heathland complex were the striated fieldwren, tawny-crowned honeyeater and Richards pipit. Although the tawny-crowned honeyeater was also observed in scrub vegetation, coastal heath is considered its preferred habitat. Eastern spinebill were regularly heard on the fringe of heathland probably attracted to the nectar and insects of the flowering *Xanthorrhoea* spikes. The swamp harrier and brown falcon were frequently observed hovering and foraging across heathland and pasture and were most likely feeding on the abundant population of house mouse (see Driessen *et al.* this report). It is likely that swamp harriers nest in the marsh region around Big Waterhouse and Little Waterhouse Lakes but no nests were found.

Coastal Scrub and Woodland

Corbett (this report) describes the ecotones from wet tea tree scrub, tall coastal scrub to tall melaleuca as the major tree vegetation types in the WPA. Here the diversity of birds is greatest where cover and a denser ground layer provide refuge from potential predators, a variety of food sources and vegetation thickets for nesting. Seven species of honeyeater were observed in this complex including three Tasmanian endemics (*): New Holland honeyeater, crescent honeyeater, tawny-crowned honeyeater, yellow-throated honeyeater*, black-headed honeyeater* little wattlebird and yellow wattlebird*. The grey fantail, grey shrike-thrush, brown thornbill, green rosella (endemic), Tasmanian scrub wren (endemic), superb fairy-wren, golden whistler, common bronzewing and brush bronzewing, dusky woodswallow and four species of cuckoo (Horsefields bronze cuckoo, shining bronze cuckoo, pallid cuckoo and fan-tailed cuckoo) were also common throughout the woodland complexes. Interestingly, the beautiful firetail was noted only in marginal habitat near One Tree Hill, yet more suitable habitat for this species is widespread throughout the WPA. Interestingly, satin flycatchers were also observed at the One Tree Hill site which was considered atypical for this species.

A flock of up to 30 yellow-tailed black-cockatoo were present in the WPA for the duration of the survey and are most likely regular visitors, feeding on the seeds of *Allocasuarina* spp and *Banksia marginata*. Although not observed directly, black-cockatoos were suspected of shearing off the flowering spike of *Xanthorrhoea australis* and extracting an unidentified species of grub within the stalks core. Of the raptors only the Australian kestrel, brown falcon, brown goshawk and southern boobook owl were recorded in the woodland complexes, the Australian kestrel being a naturally rare species in Tasmania (Vertebrate Advisory Committee 1994). Only the southern boobook owl, which is common and widespread throughout Tasmania, is likely to be a resident within the limited woodland areas of the WPA due to the paucity of nest hollows.

Notable absences and species adjacent to the WPA

A number of species anticipated to be in the WPA were not identified during the survey. The white-bellied sea-eagle, a large conspicuous bird, was not recorded although local knowledge shows this species to be widely distributed and common along the northeastern coastline. Anecdotal evidence suggests that sea-eagles may have once bred in the area, most likely on the edge of the major lagoons (David Steane pers. comm.), however, the history of burning and grazing may have caused desertion of traditional nest sites. Similarly, it was surprising that the wedge-tailed eagle was not observed during the survey, as although it is unlikely to be resident due to limited forest, it is often observed foraging throughout the region.

The ground parrot was not detected in the area either by call surveys or flushing, however, the habitat is suitable and the species was historically widespread throughout the area (Bryant 1991). In August 1993 a ground parrot was recorded in Mount William National Park, in the far northeast of the state, in very similar heathland habitat to that of the WPA (Holdsworth, pers. obs.). Hence, if this species does not exist now it may be capable of re-colonising the WPA in the future. The dusky robin, Tasmanian thornbill, striated and spotted pardalotes are found in most woodland areas throughout the state but were not observed during this study. The habitat is perhaps marginal for the dusky robin but not so for the two species of pardalote or the Tasmanian thornbill which are generally common species throughout the northeast region.

Weather conditions were not conducive for good night observations and it is likely that the ubiquitous tawny frogmouth occurs in suitable habitat within the WPA area. Similarly, the reed beds and marshlands surrounding the lagoons appear suitable for crane (*Porzana spp.*) and Lewins rail, although neither of these cryptic species were observed during the survey.

Improved pasture and grassland adjacent to the WPA contained skylark, yellow-rumped thornbill, mountain duck and scarlet robin, however, none of these species were observed within the WPA. A number of introduced species such as the house sparrow, starling, blackbird and European goldfinch were largely restricted to the farmland and developed areas around homesteads and outbuildings.

Waterhouse Island and Little Waterhouse Island

Although not included in the WPA the close proximity of Waterhouse Island and Little Waterhouse Island is likely to have a major influence on the compliment of marine and coastal birds in the protected area. Waterhouse Island is predominantly cleared for grazing and has become a significant breeding site for the Cape Barren goose (about 20 pairs, Pemberton 1995). The island also has a small breeding colony of short-tailed shearwater estimated to be 7200 to 8500 pairs (Skira *et al.* 1995). Nigel Brothers (PWS) surveyed Waterhouse Island in 1986 and recorded, in addition to the geese and shearwaters, a small colony of little penguin <200 pairs and 10 pairs of white-faced storm-petrel (Pemberton 1995). During this survey a large population of brown quail were observed in the ungrazed areas of the southern side of the island.

Three pairs of Cape Barren goose were observed breeding on Little Waterhouse Island with young ranging in size from 'stripeys' (newly hatched) to 'runners' (near flying). Australian pelicans were observed flying over the WPA and a pair were observed roosting on Little Waterhouse Island. At the time of inspection (25 November) little penguins were incubating eggs, with a population estimate of around 30 pairs for the island. Pacific gulls (10 pairs), silver gulls (~ 50 pairs), sooty oystercatchers (4 pairs), Caspian tern (1 nest) and white-fronted chat (1 nest) were also recorded breeding on the island. Approximately 40 black-faced shag nests were situated on the north-eastern side of the island but breeding was completed and the birds had departed. Brothers in December 1986 observed <20 pairs of little penguin, 1 pair of Caspian tern, 50 pairs of Pacific gull, 40 pairs of silver gull and up to 500 black-faced shag roosting on the Little Waterhouse Island (Brothers 1986). Several desiccated Pacific gulls and a black-faced cormorant were identified entangled in fishing net and line.

MANAGEMENT RECOMMENDATIONS

A number of important management issues were identified for the WPA.

Fire Management

The flammable nature of the heathland and grasslands, combined with the historic fire practices of adjacent landholders and the popular recreational use of the area, makes the WPA a high risk area for wildfire. The objective of fire management for the area should be to reduce the instances of wildfires through the provision of fire breaks and protection burns at an appropriate frequency as well as manage the heathland complexes by burning at appropriate frequencies. The diversity of bird species within the WPA can be protected and even increased if burning is used to protect old growth vegetation, as well as maintain heathlands by creating a mosaic of different habitats of varying ages. A fire management plan which incorporates mosaic burns in winter or autumn (outside the breeding season) should be prepared for the WPA to balance the competing demands of conservation and protection.

Phytophthora

The presence *Phytophthora cinnamomi* in the WPA could potentially cause significant dieback of heathland and woodland communities thus impacting on bird species abundance and diversity through the altered floristic mix. For instance, a reduction in the amount of heathland flowers could reduce the viability of predominantly nectivorous honeyeaters (tawny-crowned and eastern spinebill). All management and recreational activities should be designed to minimise the spread of this pathogen.

Vehicles on Beaches

Wheel tracks from four-wheel drive vehicles, dune buggies, quad bikes and motorcycles were observed on all major beaches. This recreational activity is in direct conflict with the protection of coastal birds and almost certainly causes the annual destruction of eggs and chicks of hooded plover, red-capped dotterel, pied oystercatcher and fairy tern. The relatively low abundance of hooded plover within otherwise ideal habitat indicates that vehicular activity may already be having a significant impact. Vehicles should be prohibited from accessing all beaches during the breeding season (August to March inclusive), except at authorised boat ramps at Herbies Landing, Blizzards Landing and Ransons Beach.

Land Tenure of Little Waterhouse Island

Little Waterhouse Island is currently non-allocated Crown Land, however, the island is a significant seabird breeding site and as such should be proclaimed a Nature Reserve under the *National Parks and Wildlife Act 1970*. Considering the entire island is utilised by nesting seabirds, it is strongly recommended that access to the island be prohibited during breeding seasons to reduce disturbance.

Reducing Tracks

The ever increasing spread of vehicle tracks through the sandy soil facilitates the movement of predators and increases the risk of fire and spread of *Phytophthora*. A review of the necessity of roads and tracks should be undertaken with a view to closure and/or diversion to maximise the conservation benefits.

Shooting of Waterfowl

Currently the WPA is used for duck shooting during open seasons, however, residents adjacent to the area and personal observations during the survey confirmed that shooting of waterfowl also occurs outside the season. Education, interpretation and enforcement needs to be improved within the area to reduce the incidence of unauthorised shooting. A review of this practice in the reserve should be undertaken in the near future considering the sanctuary of waterfowl and to increase protection for non-target species such as bittern.

Feral Pests and Domestic Pets

To protect ground dwelling and nesting species, pets should be strictly prohibited from the WPA. Adjacent landholders should be encouraged not to allow domestic cats to stray and to have them de-sexed. Feral cats should be trapped and humanely destroyed on a regular basis.

Marine Debris

Four dead Pacific gulls and one black-faced cormorant entangled in fishing line and hooks were observed on Little Waterhouse Island. Given the importance of the region to amateur fishers, interpretative material could be erected about responsible disposal of fishing gear and rubbish. The WPA coastline could be a valuable research site for monitoring the levels of fishing and plastics pollution and to measure the effectiveness of abatement strategies.

RESERVATION STATUS

It is strongly recommended that the status of the WPA be upgraded to State Reserve as the area contains unique features such as coastal dunes, lagoons and heathland complexes important to a variety of bird species including many nationally and state threatened species and others of high conservation significance. The relatively large area and the central positioning of the WPA makes it an important 'reservoir' for many avian species in the northeast region. A State Reserve status will also ensure that management of the area's assets is taken more seriously including a financial commitment.

FROGS OF THE WATERHOUSE PROTECTED AREA

Peter Brown

The Waterhouse Protected Area (WPA) consists largely of stabilised dunes and heathland interspersed with substantial areas of mobile dunes which continue to encroach to the east. Prior to its present reserved status the area was leased mainly for agistment grazing to midlands farmers for winter feeding for stock. It was largely the heavy grazing pressure over those years up to the 1960's which exacerbated the windblown dune movements. Since the grazing has stopped, there has been an extensive stabilisation program with planting of marram grass, which continues to the present time.

Types of water bodies

The entire WPA is dotted with large and small wetlands, both ephemeral and permanent. There are three major permanent water bodies, these being Big Waterhouse Lake, Little Waterhouse Lake and Blackmans Lagoon, each of which is greater than 20 ha. They are all deep water lagoons with vegetated margins but mostly open water. There are also a number of smaller deep water bodies with open water varying in size from less than 0.25 ha up to 5 ha. There are also substantial heavily vegetated wetlands, some of which have no open water and which are occasionally in excess of 50 ha, but mostly under 5 ha, many of which dry out in the summer.

Finally, there are a number of drains, especially south of Blackmans Lagoon, initially created to increase the freshwater inflow to Blackmans Lagoon. These are well vegetated in the Reserve, but less so in the agricultural land where the aquatic vegetation is browsed by stock.

METHODS

Wetlands throughout the WPA were investigated for evidence of frogs. In addition, a number of ponds and lagoons on farmland adjacent to the protected area were also searched for comparative purposes. A pro-forma sheet was designed with the first part seeking basic information including size of wetland, grid reference, nearest named location, date, name of observer, whether it was weedy or open water and whether it was photographed. The frog information sought included species name, life stage (adult, spawn or tadpole). If adult frog, whether it was seen or heard, and an estimated abundance scoring based on four categories, i.e. 1, 2-10, 11-100, 100+.

The normal procedure was to approach each water body and listen for frog calls before sampling it for tadpoles using a sweep net. Identification of tadpoles proved extremely difficult, especially in the *Limnodynastes* group, as it was known that all three Tasmanian species occur in the region and there is very little difference between the species in the tadpole stage. Searches were made for egg masses of these frogs, but due to the lack of recent rains, very few were found.

No attempt was made to identify the aquatic vegetation types, but it was noted that the floating vegetation in many of the lagoons was exceptionally dense, forming a complete mat across the wetland. Nor were any measurements of water temperature taken, but particularly in the shallow pools, the water was noticeably warm.

RESULTS

No rainfall was recorded during the entire period of the survey and it followed a considerable period without rain. Frog calling activity was in general at an extremely low level, for whilst in most waters there was an odd specimen of one or two species calling, at no time during the survey period were any frogs heard chorusing. In general there was more calling at night than during the daytime.

A total of 57 waters or areas of lagoons were investigated with most containing either adult frogs or tadpoles. Five species of frogs were confirmed in the WPA during the period of this survey. A sixth species, the Spotted Marsh frog, is known to occur in the area, from previous work, but no conclusive evidence was found of it on

this survey. Tadpoles which may have been of this species were found at four sites and specimens were taken from one site for further investigation, however, they metamorphosed into banjo frogs. The species recorded at each site and grid references are provided in the table.

Species Description

Banjo frog (*Limnodynastes dumerili*) - A common frog in the WPA, located in 24 of the 57 water bodies. Adults of this species generally prefer large waters to small shallow pools, but some very large tadpoles were found in extremely shallow lagoons. This species was more vocal at night than in the daytime. One was found crossing a road at Blackmans Lagoon. Some specimens were collected from pitfall traps used for the reptile survey (see Brereton). Metamorphlings and fully grown tadpoles were caught in at least 12 sites and when present were often very common. In at least two cases the ponds were almost dry and it was estimated that in another week the tadpoles would have been dead.

Spotted marsh frog (*Limnodynastes tasmaniensis*) - Known to occur in the WPA (Wapstra, pers comm.) but not definitely confirmed to be present in this survey. Tadpoles and metamorphlings which may have been of this species were found in 4 lagoons. This species is well distributed through the coastal wetlands of northeastern Tasmania.

Striped marsh frog (*Limnodynastes peroni*) - A frog with a very limited distribution in Tasmania. Its stronghold is in northwestern Tasmania and on King Island. A small population has for many years been known to occur in northeast Tasmania, in particular in the Waterhouse area. It was located in 7 of the lagoons investigated, mostly in the northern section of the WPA, but also in one substantial lagoon in the southern section. Of the six times it was heard calling, only twice was it heard during the daytime, and four times after dark. As stated before, tadpoles of the *Limnodynastes* group are difficult to separate but in one small deep lagoon, three large brown unblotched tadpoles were found which were almost certainly of this species. This species is not so widely distributed through the area as the banjo frog, but it was found in several waters in far from ideal conditions. It will most probably be more widely distributed and more common than this survey suggests.

Green & gold frog (*Litoria raniformis*) - Adults were found at 9 locations, mostly around Blackmans Lagoon which possibly has the densest population in Tasmania. The only green and gold frogs found more than 2 km away from Blackmans Lagoon were in a permanent deep lagoon approximately 2 km east of Hardwickes Hill. In previous visits to the WPA after rain, this species was located calling in many other locations. During the survey week more than 200 frogs of this species were seen. All were approximately the same age, about two thirds grown. No fully adult frogs were seen. Calling was at a very low level, in fact they were only heard calling from two waters, and Blackmans Lagoon was not one of them. This species was especially numerous in the drains to the south of Blackmans Lagoon. On 25 November, a warm day, large numbers were disturbed whilst sunning themselves on the banks of the drains. It was noted that the species was absent where these drains crossed into farmland, the aquatic vegetation having been largely eaten by stock.

Brown tree frog (*Litoria ewingi*) - This species was the most widely distributed frog in the WPA. It was located in 41 of the 57 water bodies investigated. Adult frogs were found in 10 water bodies whilst tadpoles were found in 35. Most tadpoles were in or about to enter the metamorphling stage. Some small frogs with just vestigial tails were found. Some waters, although often quite small, had large populations of tadpoles, sometimes many hundreds or even thousands. They were also extremely variable in colour. Those in ponds with a light sandy coloured base were often almost transparent, whilst those in dark water were virtually black. Calling adults were far less active at night than would have been expected. Considering the wide and abundant distribution of tadpoles, surprisingly few adults were heard. One adult specimen found under old sawn timber had a bright iridescent green stripe down either flank. It was taken back to base to be photographed but in the meantime it had turned considerably darker and the green stripes had gone.

Brown froglet (*Ranidella signifera*) - Common and well distributed through WPA. It was found at 39 of the 57 sites. Adults were either seen or heard calling at 22 sites and tadpoles were found at 20. There is a slight possibility that some of the tadpoles were *L. tasmaniensis*, but no adults of this species were found in WPA, nor are there any records from previous visits. Some of these tadpoles were found in the smallest of pools, on one occasion little more than the foot holes of cattle. It was noted that tadpoles of this species usually have a mottled pattern above, similar to that of a flathead fish. They are very much bottom living tadpoles unlike those of most other species, notably the brown tree frog whose tadpoles are mid-water swimmers.

Table 1 Frogs recorded in the Waterhouse Protected Area

Key to Species

- 1 Banjo frog
- 2 Spotted marsh frog (2) = possibly tadpoles of this species
- 3 Striped marsh frog
- 4 Green and gold frog
- 5 Brown tree frog
- 6 Brown froglet

Site No.	Grid Reference	Area (Ha)	Species
1	444619	<1	(2), 5, 6,
2	411627	< 1	6
3	415626	< 1	(2), 5, 6
4	411624	< 1	6
5	415627	<1	(2), 6
6	415629	< 1	6
7	430636	1-5	5, 6
8	426626	5+	1, 5, 6,
9	437624	5+	5, 6
10	468638	1-5	(2), 5, 6
11	436610	1-5	1, 6
12	471667	5+	3
13	466663	<1	5, 6
14	446662	<1	6
15	493698	<1	4
16	491691	5+	4, 5
17	492693	5+	4, 5, 6
18	502704	1-5	6
19	501704	<1	6
20	500704	1-5	4
21	497704	<1	1
22	496704	1-5	4, 5
23	495702	5+	5, 6
24	502706	5+	1, 4, 5, 6
25	498709	5+	1, 4, 5, 6
26	504707	5+	1, 4
27	579732	<1	3, 5, 6
28	518731	5+	1
29	519731	<1	6
30	516734	1-5	5
31	516748	<1	1, 5, 6
32	516746	1-5	1, 5, 6
33	516745	1-5	1, 5, 6
34	515745	1-5	1, 3, 5, 6
35	536734	1-5	1, 3, 5, 6
36	536741	<1	1, 3, 5, 6
37	538754	<1	5
38	535754	1-5	1, 6
39	532754	<1	5, 6
40	525753	<1	3, 5
41	515751	5+	6
42	525762	<1	1, 6
43	546764	<1	5, 6
44	546760	1-5	5, 6
45	549766	1-5	5, 6
46	552763	5+	4, 5, 6
47	548773	5+	1, 6
48	538772	1-5	5
49	537771	<1	5
50	536774	<1	5, 6

51	541786	<1	5, 6
52	541787	<1	5, 6
53	537768	5+	1, 5, 6
54	544773	5+	1, 5, 6
55	541772	1-5	6
56	538768	5+	1, 5, 6
57	562798	<1	5, 6

REPTILES OF THE WATERHOUSE PROTECTED AREA

Raymond Brereton

METHODS

Reptiles were surveyed by active searching and pitfall trapping. Twenty six pitfall traps were installed in the WPA to survey reptiles. The pits consisted of 21 metal containers (25 cm in diameter x 45 cm deep) and five plastic buckets (20 l), buried with their rims flush with the soil surface. The pits were placed at five sites in different habitats (Table 1). There were three lines of five metal containers placed 5 m apart, one line of three metal containers, 5 m apart and one line of five plastic and one metal container, 5 m apart. Plastic fly wire drift fences, approximately 25 cm high were erected between and across the centre of buckets. The fences were held upright by pegs and gaps under the fence were blocked off by soil and plant material. Pitfall lines 1, 1a, 2 and 3 were operated for four nights between 22 and 26 of December 1993. Pitfall line 3 was operated for 3 nights between 23 and 26 December 1993. A range of habitats were sampled by active searching. Micro-habitats in or under fallen timber, dead grass clumps, ground litter, rocks and discarded building materials were searched.

Table 1 Location of pitfall traps and habitat type

Pit Line No.	Container Type & No.	Habitat	Location (grid ref.)
1a	5 metal	Graminoid heath (unburnt)	1.5 km W Ransons Beach (568 778)
1b	3 metal	Tall coastal scrub with <i>Allocasuarina verticellata</i> & <i>Melaleuca spp.</i>	1.5 km W Ransons Beach (568 779)
2	5 metal	Graminoid heath (burnt)	400 m S One Tree Hill (550 777)
3	5 metal	Swampy heath	1.5 km N of Hardwicks Hill (495 608)
4	5 plastic 1 metal	Wet herbfield	Blackmans Lagoon (543 761)

RESULTS

Pitfall trapping

The pitfall traps were operated for an equivalent of 80 trap nights. A total of five reptiles comprised of two species were captured, the mountain dragon *Tympanocryptis diemensis* and the three-lined skink *Bassiana duperryi*. (Table 2). Amphibians made up the bulk of the captures, 11 individuals of three species were trapped. They were the green and gold frog *Litoria raniformis*, banjo frog *Limnodynastes dumerili* and brown froglet *Ranidella signifera*.

The highest capture rate was in the fire damaged graminoid heath where three individuals, consisting of two *Tympanocryptis diemensis* and one *Bassiana duperryi*, were captured in 80 trap nights (4 % trapping success). A single *Bassiana duperryi* was trapped in swampy heath and another trapped in wet herbfield. No reptiles were trapped in unburnt graminoid heath or tall coastal scrub.

Active searching

An additional three species of reptiles from two families were encountered during active searching. They were Whites skink *Egernia whitei*, metallic skink *Niveoscincus metallicus* and tiger snake *Notechis ater* (Table 3). Eight reptiles were captured in graminoid heath and six were captured in tall coastal shrubbery. These habitats were on ridgetops with dolerite surface rock. The results for habitats actively searched are not directly

comparable because the search effort in each varied. Reptiles in habitats with surface rock are more readily located because of the abundance of sheltering sites beneath rocks. Compared with habitats in sandy heaths, grasslands or herbfields where sheltering sites are much harder to locate.

The scincid lizard, the blotched blue-tongue lizard *Tiliqua nigrolutea* was also recorded in the WPA by the mammal trapping team. Nine were trapped in mammal traps in 832 trap nights. One was trapped in an Elliott trap (532 trap nights) and eight were trapped in Mascot traps (300 trap nights). The species was trapped in a variety of habitats including dune heath, tall coastal shrubbery, heath and cleared pasture. None were trapped in tall melaleuca, radiata pines or marram grass.

Table 2 Trapping results from pitfall traps for reptiles and amphibians in the WPA

Species	Pitfall Line					Totals
	1a	1b	2	3	4	
Reptilia						
Agamidae						
<i>Tympanocryptis diemensis</i>			2			2
Scincidae						
<i>Bassiana duperryi</i>			1	1	1	3
Total captures	0	0	3	1	1	5
Amphibia						
Hylidae						
<i>Litoria raniformis</i>					4	4
Leptodactylidae						
<i>Limnodynastes dumerili</i>	1	4				5
<i>Crinia signifera</i>		1			1	2
Total captures	1	5			5	11

Table 3 Active search results showing species collected in each habitat type within the WPA.

Species	Habitat				
	Heath	Graminoid heath with <i>Allocasuarina verticillata</i>	Graminoid heath (fire damaged)	Tall coastal shrubbery with <i>Allocasuarina verticillata</i>	Wet herbfield adjacent to wetland
Agamidae					
<i>Tympanocryptis diemensis</i>			2		
Scincidae					
<i>Bassiana duperryi</i>		6		3	
<i>Egernia whitei</i>		3	2	2	
<i>Niveoscincus metallicus</i>	1			1	
Elapidae					
<i>Notechis ater</i>		1	1		1

DISCUSSION

Reptiles were encountered most often in heathy habitats with surface rock and also in fire damaged sandy heaths. In rocky habitats, this may have been partly due to the abundance of sheltering sites beneath rocks, these are readily searched. In the fire damaged areas reptiles may be more easily observed due to the open nature of the habitat and also these areas have a greater abundance of basking sites.

Four species of reptile appeared to be generally widespread in the WPA. They were: *Bassiana duperryi*, *Egernia whitei*, *Tiliqua nigrolutea* and *Notechis ater*. *Niveoscincus metallicus* was only located in heath and tall coastal shrubbery and *Tympanocryptis diemensis* was only recorded in fire damaged heath during this survey.

Overall reptile diversity and density was low. The pitfall trapping had only limited success, five individuals of two species in 80 trap nights (6 % trapping success). This was probably due in part to the weather, which was generally cool with moderate winds, although there were some sunny days.

Active searching was more successful with a total of five species being recorded, three species were additional to those trapped in the pits. An additional species, *Tiliqua nigrolutea* was observed in the area as well as being trapped in the mammal traps. A total of six species were recorded from the WPA during the survey.

The Bougainvilles skink *Lerista bougainvilli* has a very restricted distribution on the Tasmanian mainland and is known to occur at Waterhouse Point. Although none were recorded during this survey an individual was observed at the boundary between woody coastal heath and the foreshore in January 1993 (J. Slater, pers. comm). Only one other population of this species is known, at Cape Portland in the far northeast, although, it does occur on the eastern Bass Strait islands including Waterhouse Island (Rawlinson 1974).

A further eight species of reptiles may also occur in the WPA based on their known distribution and preferred habitats. They include six species of Scincid lizards, the she-oak skink *Cyclodomorphus casuarinae*, delicate skink *Lampropholis delicata*, ocellated skink *Niveoscincus ocellatus*, Tasmanian tree skink *Niveoscincus pretiosus*, grass skink *Pseudemoia entrecasteauxii*, glossy grass skink *Pseudemoia rawlinsonii*, and two species of Elapid snakes, the copperhead snake *Austrelaps superbus* and the white-lipped whip snake *Drysdalia coronoides*.

Niveoscincus ocellatus was recorded from Waterhouse Island during the survey along with *Niveoscincus metallicus* and *Egernia whitei*. *Niveoscincus metallicus* was also recorded from Little Waterhouse Island during the survey.

Pseudemoia rawlinsonii has been recorded from only three locations on mainland Tasmania, at Launceston, Round Hill and the North Esk River (Rounsevell *et al.* 1996). This species is listed as requiring monitoring (Vertebrate Advisory Committee 1994). *P. rawlinsonii* inhabits a variety of wetland habitats which are widespread in the WPA and it is possible that the species may occur here. Further survey work for reptiles is recommended considering the small number of species recorded during this survey. Particular efforts should be made to determine if *P. rawlinsonii* occurs in the WPA since it appears to contain suitable habitat. Efforts should also be made to determine the extent of *Lerista bougainvilli* in the WPA since this is one of the few areas in which it has been recorded on mainland Tasmania.

NOTES ON THE DISTRIBUTION OF TWO NATIVE FRESHWATER FISH SPECIES IN THE WATERHOUSE AREA

Hans Wapstra, Annie Wapstra and Peter Brown

The Table below shows the distribution and abundance of the dwarf galaxias *Galaxiella pusilla* and pygmy perch *Nannoperca australis* in the WPA. Specimens were collected during frog surveys using hand nets. The dwarf galaxias is listed as rare on the Tasmanian *Threatened Species Protection Act 1995*.

Date	<i>G. pusilla</i>	<i>N. australis</i>	Grid ref	Comment
24/11/93	none	one mature	516 734	Lagoon being invaded by sandblow & seemingly "dead". Open, few weeds, dead tea-tree.
24/11/93	many	none	518 731	Large very weedy lagoon, r.h.s. Big Waterhouse Lake Road before BW Lake.
24/11/93	many	many	519 731	Small dam with weeds & open water. Other side of road from above lagoon, probably connected during floods.
25/11/93	none	masses	495 702	Very shallow large swale swamp south of Blackmans Lagoon.
25/11/93	none	masses	500 704	South Drain Blackmans Lagoon, weedy.
25/11/93	none	many	501 704	Small sub drain alongside the main drain above.
25/11/93	present	present	493 698	Drain on 'Lowly' property, edge of WPA.
25/11/93	present	present	491 691	Part of very large shallow & weedy lagoon on 'Lowly' property.
25/11/93	none	masses	492 693 weedy.	Southern part/drain of same swamp,
25/11/93	none	some	548 694	Sheepwash Creek at Waterhouse Road bridge, flowing water.
23/11/93	some	none	471 667	Large very weedy lagoon ("Duck pond") adjacent to 'Marengo' property.
23/11/93	some	some	466 664	Swamp nearby, very overgrown with weed.
23/11/93	many	none	466 663	Very shallow grassy/weedy drain & associated flooded paddock area on 'Marengo' property.
23/11/93	very few	none	430 636	Permanent pond, very few weeds.
25/11/93	none	present	435 610	Pond with weedy margin.

FIELD TESTING TASPAWS - A BIOLOGICAL RECORDS SCHEME

Peter Cinquini

INTRODUCTION

The study of wildlife in the WPA required computing support for many of the projects, particularly those involving the collection of geo-referenced species list data. The WPA study presented an opportunity to field test a new version of the Tasmanian Parks and Wildlife Service's Biological Records Scheme (TASPAWS). Specifically to:

- Field test the new TASPAWS record booklets and forms.
- Assess the database software under field conditions.
- Introduce staff to the new TASPAWS system.

Features of the TASPAWS database

- Provides sophisticated error checking and verification of entered data.
- Centralised, making the data readily accessible by other researchers and planners in the future.
- Ability to attach project specific information.
- Will be integrated with the PWS GIS.

Several projects required special attributes. These were readily incorporated into TASPAWS with special field and computer forms designed for the trapping database (for general branch use), swift parrots and marine invertebrates. These project databases although developed as part of the Waterhouse survey, will continue to be utilised by their respective users.

Information Required by TASPAWS

For data to be acceptable to TASPAWS it must have the following information:

- The name of the recorder
- The date of the observation
- AMG grid reference along with its accuracy
- The method used to determine the grid reference
- A description of the general locality in a standard format
- The species observed

TASPAWS has a number of other fields that provide further information on the site and species observed. All these fields are described in the TASPAWS field booklet.

Facilities provided

Collectors of flora and fauna data involved in the WPA study were able to enter their information onto computer on-site. The following equipment and software were available at the camp site for the duration of the survey:

- Three networked Macintosh® computers and a printer in the shearers quarters.
- The TASPAWS database for data entry of species lists.
- A hand-held Geographical Positioning System (GPS).

RESULTS

Most projects involving the collection of species list data were TASPAWS compatible. Some elected to enter their data on-site while others entered data later at head office.

At Waterhouse it was possible to monitor TASPAWS much more carefully than otherwise would be possible. As a result many improvements were made to the database. One major enhancement performed on-site, enabled users to select the species code, usually an abbreviation of its scientific name, by entering part or all of its common name.

Performance

Although the computer network at Waterhouse made it possible for simultaneous data entry (more than one user), this did not prove feasible because for the second user, data entry was around 2.5 times slower. These conditions are difficult to monitor at head office because computers are dispersed but, within the confined spaces of the computing room at Waterhouse it was easy to observe the problems associated with multi-user access of the TASPAWS database. The cause of this could partially be blamed on the computing hardware but later tests proved that the main problem was the database software (Filemaker®) which finds it difficult to cope with a database of TASPAWS' complexity.

Reserve List

One of the primary objectives of most collectors was to obtain a list of the species found within the WPA. This is done by exporting all the hygienic data (data that passes all validation and verification checks) to a process that correlates the grid reference to state reserves.

CONCLUSIONS

The TASPAWS project at Waterhouse proved a very useful exercise. It tested the robustness of the system and demonstrated its current inadequacies, thereby clearly identifying areas requiring improvement.

TASPAWS also demonstrated that on-site data entry is a technical possibility and a worthwhile exercise. For large scale surveys like this there should be little reason why on-site data entry should not be an option. For those who entered their data on-site it meant less effort was required in interpreting their own or someone else's field data than would have been the case had it been entered later.

Multi-user access of TASPAWS proved too slow. If the use of TASPAWS within the department is to become more widespread then a decision to change database software from Filemaker® may have to be made unless an upgrade of the software solves this problem.

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APPENDIX A

Species List for the Waterhouse Area, Northeast Tasmania

Invertebrates

Austroleptis multimaculata
Calanoidea
Comanthus (cenolia) tasmaniae
Coscinasterias calamaria
Cyclopoidea
Engaeus cunicularius
Harpacticoidea
Heliocidaris erythrogramma
Hesperilla donnysa
Neoniphargus tasmanicus
Patiriella brevispina
Patiriella calcar
Patiriella exigua

Common Name**Freshwater Fish**

Galaxiella pusilla
Nannoperca australis
Pseudaphritis urvillii
Salmo trutta

Common Name

dwarf galaxias
 pygmy perch
 sandy
 brown trout

Frogs

Crinia signifera
Crinia tasmaniensis
Limnodynastes dumerili
Limnodynastes peroni
Limnodynastes tasmaniensis
Litoria ewingi
Litoria raniformis

Common Name

brown froglet
 Tasmanian froglet
 banjo frog
 Perons frog
 spotted marsh frog
 brown tree frog
 green and golden frog

Reptiles

Bassiana duperryi
Drysdalia coronoides
Egernia whitei
Niveoscincus metallicus
Notechis ater
Tiliqua nigrolutea
Tympanocryptis diemensis

Common Name

three-lined skink
 white-lipped whip snake
 Whites skink
 metallic skink
 tiger snake
 blotched blue-tongue lizard
 mountain dragon

Birds

Acanthiza chrysorrhoa
Acanthiza pusilla archibaldi
Acanthorhynchus tenuirostris
Accipiter cirrhocephalus cirrhocephalus
Accipiter fasciatus fasciatus
Alauda arvensis
Anas castanea
Anas gracilis gracilis
Anas rhynchotis rhynchotis
Anas superciliosa superciliosa
Anthochaera chrysoptera tasmanica
Anthochaera paradoxa

Common Name

yellow-rumped thornbill
 brown thornbill
 eastern spinebill
 collared sparrowhawk
 brown goshawk
 common skylark
 chestnut teal
 grey teal
 Australasian shoveler
 Pacific black duck
 little wattlebird
 yellow wattlebird

<i>Anthus novaeseelandiae</i>	Richards pipit
<i>Aquila audax fleayi</i>	wedge-tailed eagle (Tasmanian sub-species)
<i>Ardea novaehollandiae</i>	white-faced heron
<i>Ardea pacifica</i>	Pacific (white necked) heron
<i>Ardeola ibis</i>	cattle egret
<i>Arenaria interpres interpres</i>	ruddy turnstone
<i>Artamus cyanopterus cyanopterus</i>	dusky woodswallow
<i>Biziura lobata</i>	musk duck
<i>Botaurus poiciloptilus</i>	Australasian bittern
<i>Cacatua galerita galerita</i>	sulphur-crested cockatoo
<i>Cacomantis flabelliformis prionurus</i>	fan-tailed cuckoo
<i>Calamanthus fuliginosus</i>	striated fieldwren
<i>Calidris acuminata</i>	sharp-tailed sandpiper
<i>Calidris ferruginea</i>	curlew sandpiper
<i>Calidris melanotos</i>	pectoral sandpiper
<i>Calidris ruficollis</i>	red-necked stint
<i>Calyptorhynchus funereus xanthanotus</i>	yellow-tailed black cockatoo
<i>Carduelis carduelis</i>	European goldfinch
<i>Carduelis chloris</i>	European greenfinch
<i>Cecropis nigricans nigricans</i>	tree martin
<i>Cereopsis novaehollandiae</i>	Cape Barren goose
<i>Charadrius bicinctus</i>	double-banded plover
<i>Charadrius ruficapillus</i>	red-capped plover
<i>Chrysococcyx basalis</i>	Horsfield's bronze-cuckoo
<i>Chrysococcyx lucidus plagosus</i>	shining bronze-cuckoo
<i>Circus approximans</i>	swamp harrier
<i>Colluricincla harmonica harmonica</i>	grey shrike-thrush
<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike
<i>Corvus tasmanicus tasmanicus</i>	forest raven
<i>Coturnix ypsilophora ypsilophorus</i>	brown quail
<i>Cracticus torquatus cinereus</i>	grey butcherbird
<i>Cuculus pallidus</i>	pallid cuckoo
<i>Cuculus pyrrhophanus prionurus</i>	fan-tailed cuckoo
<i>Cygnus atratus</i>	black swan
<i>Dacelo novaeguinae novaeguinae</i>	laughing kookaburra
<i>Diomedea cauta cauta</i>	shy albatross
<i>Diomedea melanophrys melanophrys</i>	black-browed albatross
<i>Egretta alba</i>	great egret
<i>Elseyornis melanops</i>	black-fronted dotterel
<i>Ephthianura albifrons</i>	white-fronted chat
<i>Eudyptula minor</i>	little penguin
<i>Falco berigora</i>	brown falcon
<i>Falco cenchroides cenchroides</i>	Australian kestrel
<i>Falco longipennis longipennis</i>	Australian hobby
<i>Fulica atra australis</i>	Eurasian coot
<i>Gallinago hardwickii</i>	Latham's snipe
<i>Gallinula mortierii</i>	Tasmanian native hen
<i>Gymnorhina tibicen hypoleuca</i>	Australian magpie
<i>Haematopus fuliginosus fuliginosus</i>	sooty oystercatcher
<i>Haematopus longirostris longirostris</i>	pied oystercatcher
<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle
<i>Halobaena caerulea</i>	blue petrel
<i>Hirundapus caudacutus</i>	white-throated needletail
<i>Hirundo neoxena</i>	welcome swallow
<i>Hirundo nigricans nigricans</i>	tree martin
<i>Hydroprogne caspia</i>	Caspian tern
<i>Larus novaehollandiae novaehollandiae</i>	silver gull
<i>Larus pacificus pacificus</i>	Pacific gull
<i>Lichenostomus flavicollis</i>	yellow-throated honeyeater
<i>Malurus cyaneus cyaneus</i>	superb fairy wren
<i>Megalurus gramineus gramineus</i>	little grassbird

<i>Melanodryas vittata</i>	dusky robin
<i>Morus serrator</i>	Australasian gannet
<i>Myiagra cyanoleuca</i>	satin flycatcher
<i>Ninox novaeseelandiae leucopsis</i>	southern boobook
<i>Oxyura australis</i>	blue-billed duck
<i>Pachycephala pectoralis</i>	golden whistler
<i>Pachyptila belcheri</i>	slender-billed prion
<i>Pachyptila desolata</i>	Antarctic prion
<i>Pachyptila salvini</i>	lesser broad-billed prion
<i>Pachyptila turtur subantarctica</i>	fairy prion
<i>Pardalotus punctatus</i>	spotted pardalote
<i>Pardalotus striatus</i>	striated pardalote
<i>Passer domesticus</i>	house sparrow
<i>Pelecanoides urinatrix</i>	common diving-petrel
<i>Pelecanus conspicillatus</i>	Australian pelican
<i>Petroica multicolor boodang</i>	scarlet robin
<i>Petroica phoenicea</i>	flame robin
<i>Phalacrocorax carbo</i>	great cormorant
<i>Phalacrocorax fuscescens</i>	black-faced cormorant
<i>Phalacrocorax melanoleucos</i>	little pied cormorant
<i>Phalacrocorax sulcirostris</i>	little black cormorant
<i>Phaps chalcoptera</i>	common bronzewing
<i>Phaps elegans</i>	brush bronzewing
<i>Phoebastria palpebrata</i>	light-mantled sooty albatross
<i>Phylidonyris melanops crassirostris</i>	tawny-crowned honeyeater
<i>Phylidonyris novaehollandiae</i>	New Holland honeyeater
<i>Phylidonyris pyrrhoptera</i>	crescent honeyeater
<i>Platycercus caledonicus</i>	green rosella
<i>Pluvialis squatarola</i>	grey plover
<i>Podargus strigoides strigoides</i>	tawny frogmouth
<i>Polioccephalus poliocephalus</i>	hoary-headed grebe
<i>Porphyrio porphyrio melanotus</i>	purple swamphen
<i>Pterodroma inexpectata</i>	mottled petrel
<i>Pterodroma lessonii</i>	white-headed petrel
<i>Pterodroma macroptera</i>	great-winged petrel
<i>Puffinus gavia</i>	fluttering shearwater
<i>Puffinus griseus</i>	sooty shearwater
<i>Puffinus tenuirostris</i>	short-tailed shearwater
<i>Rhipidura fuliginosa albiscapa</i>	grey fantail
<i>Sericornis humilis</i>	Tasmanian scrubwren
<i>Stagonopleura bella</i>	beautiful firetail
<i>Sterna albifrons sinensis</i>	little tern
<i>Sterna bergii</i>	crested tern
<i>Sterna caspia</i>	Caspian tern
<i>Sterna nereis nereis</i>	fairy tern
<i>Strepera fuliginosa</i>	black currawong
<i>Strepera versicolor arguta</i>	grey currawong (clinking)
<i>Sturnus vulgaris</i>	common starling
<i>Tachybaptus novaehollandiae</i>	Australasian grebe
<i>Tadorna tadornoides</i>	Australian shelduck
<i>Thinornis rubricollis</i>	hooded plover
<i>Tringa nebularia</i>	greenshank
<i>Turdus merula</i>	blackbird
<i>Vanellus miles novaehollandiae</i>	masked lapwing
<i>Vanellus tricolor</i>	banded lapwing
<i>Zosterops lateralis lateralis</i>	silveryeye
Mammals	Common Name
<i>Antechinus minimus minimus</i>	swamp antechinus (Tasmanian)
<i>Bettongia gaimardi</i>	Tasmanian bettong
<i>Chalinolobus morio</i>	chocolate wattled bat
<i>Dasyurus maculatus</i>	spotted-tailed quoll
<i>Dasyurus viverrinus</i>	eastern quoll
<i>Felis catus</i>	cat

<i>Isodon obesulus affinis</i>	southern brown bandicoot
<i>Macropus rufogriseus rufogriseus</i>	Bennett's wallaby
<i>Mus musculus</i>	house mouse
<i>Oryctolagus cuniculus</i>	rabbit
<i>Pseudocheirus peregrinus viverrinus</i>	common ringtail possum
<i>Rattus lutreolus velutinus</i>	swamp rat
<i>Rattus rattus</i>	black rat
<i>Sarcophilus harrisii</i>	Tasmanian devil
<i>Tachyglossus aculeatus setosus</i>	echidna
<i>Thylogale billardieri</i>	Tasmanian pademelon
<i>Trichosurus vulpecula fuliginosus</i>	brush-tail possum
<i>Vespadelus vulturnus</i>	little forest eptesicus
<i>Vombatus ursinus</i>	common wombat

Non-vascular Plants

Achrophyllum dentatum
Barbula calycina
Marchantia foliacea

Vascular Plants

Acacia botrycephala
Acacia dealbata
Acacia gummii
Acacia mearnsii
Acacia melanoxylon
Acacia myrtifolia
Acacia sophorae
Acacia sp.
Acacia stricta
Acacia suaveolens
Acacia terminalis
Acacia verticillata
Acacia verticillata ovoidea
Acacia verticillata var.
Acacia verticillata verticillata
Acaena echinata var.
Acaena novae-zelandiae
Acaena pallida
Acianthus reniformis
Acrotriche serrulata
Actites megalocarpa
Adiantum aethiopicum
Agropyron scabrum
Agrostis avenacea
Agrostis sp.
Agrostis stolonifera
Aira caryophyllea
Allocasuarina littoralis
Allocasuarina monilifera
Allocasuarina paludosa
Allocasuarina verticillata
Alyxia buxifolia
Amperea xiphoclada
Amphibromus recurvatus
Anagallis arvensis
Angianthus eriocephalus
Angianthus preissianus
Aotus ericoides
Apium prostratum
Arthropodium minus
Asplenium flabellifolium

Celmisia saxifraga
Centaurium sp.
Centaurium spicatum
Centella cordifolia
Centrolepis aristata
Centrolepis fascicularis

Astroloma humifusum
Atriplex cinerea
Atriplex hastata
Azolla filiculoides
Baeckea ramosissima
Baeckea ramosissima subsp.
Banksia marginata
Baumea acuta
Baumea arthropphylla
Baumea juncea
Baumea tetragona
Beyeria viscosa
Blechnum minus
Blechnum nudum
Blechnum wattsi
Boronia parviflora
Boronia pilosa
Bossiaea cinerea
Bossiaea cordigera
Bossiaea obcordata
Bossiaea prostrata
Brachyloma ciliatum
Brachyloma depressum
Brachyscome cardiocarpa
Brachyscome graminea
Brachyscome sp.
Briza minor
Brunonia australis
Bulbine semibarbata
Burchardia umbellata
Bursaria spinosa
Cakile edentula
Cakile maritima
Caladenia caudata
Caladenia dilatata
Caladenia venusta
Calandrinia calyptrata
Callitriche sp.
Calocephalus brownii
Calochilus herbaceus
Calytrix tetragona
Cardamine gunnii
Cardamine heterophylla
Carex breviculmis
Carex fascicularis
Carex sp.
Carpobrotus rossii
Cassinia aculeata
Cassytha glabella
Cassytha pubescens
Casuarina monilifera
Casuarina stricta
Eriochilus cucullatus
Eryngium vesiculosum
Eucalyptus amygdalina
Eucalyptus ovata
Eucalyptus pauciflora subsp. pauciflora
Eucalyptus viminalis
Eucalyptus viminalis subsp. viminalis
Eucalyptus viminalis viminalis
Euphorbia paralias
Euphrasia diemenica
Exocarpos cupressiformis
Festuca littoralis
Centrolepis sp.
Cheilanthes sp.
Chenopodium glaucum ambiguum
Chorizandra cymbaria
Chorizandra enodis
Cirsium arvense
Cirsium vulgare
Clematis aristata
Clematis microphylla
Comesperma calymega
Comesperma ericinum
Comesperma retusum
Comesperma volubile
Correa alba
Cotula coronopifolia
Cotula reptans
Craspedia glauca
Crassula helmsii
Crassula sieberana
Cryptostylis subulata
Danthonia setacea
Danthonia sp.
Deyeuxia quadriseta
Deyeuxia sp.
Dianella revoluta
Dianella revoluta var.
Dianella tasmanica
Dichelachne sp.
Dichondra repens
Dicksonia antarctica
Dillwynia cinerascens
Dillwynia glaberrima
Dillwynia sericea
Diplarrena moraea
Disphyma crassifolium
Distichlis distichophylla
Diuris sulphurea
Dodonaea viscosa spatulata
Drosera auriculata
Drosera peltata auriculata
Drosera peltata subsp. auriculata
Drosera pygmaea
Ehrharta acuminata
Eleocharis acuta
Eleocharis pusilla
Eleocharis sphacelata
Empodisma minus
Epacris impressa
Epacris lanuginosa
Epacris obtusifolia
Epacris sp.
Epilobium sp.
Hydrocotyle pterocarpa
Hypericum gramineum
Hypericum japonicum
Hypericum sp.
Hypochoeris glabra
Hypochoeris radicata
Hypochoeris sp.
Hypolaena fastigiata
Hypolepis muelleri
Hypolepis rugosula
Hypoxis hygrometrica
Isolepis fluitans

Gahnia filum
Gahnia radula
Gahnia trifida
Galium australe
Galium ciliare
Galium gaudichaudii
Galium sp.
Gastrodia sesamoides
Gleichenia microphylla
Gleichenia sp.
Glossodia major
Gnaphalium candidissimum
Gnaphalium collinum
Gnaphalium indutum
Gnaphalium sp.
Gompholobium huegelii
Gonocarpus micranthus micranthus
Gonocarpus sp.
Gonocarpus tetragynus
Gonocarpus teucroides
Goodenia humilis
Goodenia lanata
Gratiola nana
Gynatrix pulchella
Hakea teretifolia
Helichrysum acuminatum
Helichrysum apiculatum
Helichrysum bicolor
Helichrysum dealbatum
Helichrysum paralium
Helichrysum reticulatum
Helichrysum scorpioides
Hemarthria uncinata
Hibbertia acicularis
Hibbertia empetrifolia
Hibbertia fasciculata
Hibbertia procumbens
Hibbertia prostrata
Hibbertia riparia
Hibbertia sericea
Hibbertia virgata
Holcus lanatus
Hovea linearis
Hydrocotyle hirta
Hydrocotyle javanica
Hydrocotyle muscosa
Lissanthe strigosa
Lobelia alata
Lolium rigidum
Lomandra longifolia
Lomatia tinctoria
Lotus australis
Luzula sp.
Lycopodium deuterodensum
Lythrum hyssopifolia
Medicago sp.
Melaleuca ericifolia
Melaleuca gibbosa
Melaleuca squarrosa
Mentha diemenica
Microlaena stipoides
Isolepis nodosa
Isolepis sp.
Juncus articulatus
Juncus bufonius
Juncus caespiticus
Juncus falcatus
Juncus holoschoenus
Juncus kraussii
Juncus pallidus
Juncus pauciflorus
Juncus planifolius
Juncus procerus
Juncus sarophorus
Juncus sp.
Kennedia prostrata
Lagenifera stipitata
Laxmannia orientalis
Laxmannia sessilifera
Lemna disperma
Leontodon leysseri
Leontodon sp.
Leontodon taraxacoides
Lepidosperma concavum
Lepidosperma elatius
Lepidosperma filiforme
Lepidosperma gladiatum
Lepidosperma gunnii
Lepidosperma laterale
Lepidosperma longitudinale
Lepilaena cylindrocarpa
Leptocarpus brownii
Leptocarpus tenax
Leptomeria drupacea
Leptorhynchos squamatus
Leptospermum lanigerum
Leptospermum scoparium var.
Lepyrodia muelleri
Leucopogon australis
Leucopogon collinus
Leucopogon ericoides
Leucopogon parviflorus
Leucopogon virgatus
Lilaeopsis brownii
Lilaeopsis polyantha
Lindsaea linearis
Linum sp.
Poa poiformis
Polypogon monspeliensis
Polystichum proliferum
Pomaderris apetala
Pomaderris elliptica
Poranthera microphylla
Potamogeton australiensis
Potamogeton ochreatus
Potamogeton pectinatus
Potentilla anglica
Potentilla sp.
Prasophyllum secutum
Pratia platycalyx
Pseudognaphalium luteo-album
Pteridium esculentum

Microsorium diversifolium
Microtis aff. unifolia
Microtis arenaria
Microtis atrata
Microtis orbicularis
Microtis parviflora
Mimulus repens
Mitrasacme distylis
Mitrasacme pilosa
Monotoca elliptica
Monotoca scoparia
Monotoca sp.
Muehlenbeckia adpressa
Myoporum insulare
Myriophyllum amphibium
Myriophyllum elatinoides
Myriophyllum pedunculatum
Myriophyllum propinquum
Myriophyllum sp.
Neopaxia australasica
Olearia axillaris
Opercularia sp.
Opercularia varia
Ophioglossum lusitanicum coriaceum
Oxalis corniculata
Oxalis corniculata subsp. corniculata
Oxalis perennans
Parapholis incurva
Patersonia fragilis
Patersonia occidentalis
Persoonia juniperina
Phragmites australis
Pimelea glauca
Pimelea humilis
Pimelea linifolia
Pimelea serpyllifolia
Plantago coronopus
Plantago lanceolata
Plantago sp.
Platylobium formosum
Platylobium formosum subsp.
Platylobium obtusangulum
Platylobium triangulare
Selaginella gracillima
Selaginella uliginosa
Selliera radicans
Senecio biserratus
Senecio lautus
Senecio odoratus
Senecio sp.
Sonchus megalocarpus
Sonchus oleraceus
Sonchus sp.
Sphaerolobium minus
Sphaerolobium vimineum
Spinifex sericeus
Spiranthes australis
Pterostylis sp.
Pterostylis tasmanica
Pultenaea daphnoides
Pultenaea daphnoides obcordata
Pultenaea dentata
Pultenaea paleacea sericea
Pultenaea stricta
Pultenaea tenuifolia
Pyrorchis nigricans
Ranunculus amphitrichus
Ranunculus rivularis
Restio complanatus
Restio tetraphyllum
Rhagodia candolleana
Rhagodia candolleana candolleana
Ricinocarpus pinifolius
Rumex crispus
Rumex sp.
Ruppia maritima
Salix sp.
Samolus repens
Sarcocornia quinqueflora
Scaevola hookeri
Schizaea fistulosa
Schoenoplectus pungens
Schoenus apogon
Schoenus brevifolius
Schoenus fluitans
Schoenus lepidosperma lepidosperma
Schoenus maschalinus
Schoenus nitens
Schoenus tenuissimus
Schoenus tesquorum
Scirpus caldwellii
Scirpus cernuus
Scirpus fluitans
Scirpus inundatus
Scirpus nodosus
Scirpus productus
Scirpus pungens
Scirpus sp.
Scirpus validus
Sebaea albidiflora
Xanthorrhoea australis
Xanthorrhoea bracteata
Xanthosia pilosa
Xyris operculata
Zoysia macrantha

APPENDIX B

A Plant Species List from a Brief Reconnaissance of Waterhouse Island, Northeast Tasmania, November 1993

S. Harris and A. Reimer

DICOTYLEDONES	Convolvulaceae	Rutaceae
Aizoaceae	<i>Dichondra repens</i>	<i>Correa alba</i>
<i>Carpobrotus aequilaterus</i>	Crassulaceae	Solanaceae
<i>Disphyma crassifolium</i>	<i>Crassula sieberana</i> ssp <i>sieberana</i>	<i>Lycium ferocissimum</i>
<i>Tetragonia implexicoma</i>	Fabaceae	<i>Solanum nigrum</i>
Apiaceae	<i>Acacia sophoraea</i>	MONOCOTYLEDONES
<i>Apium prostratum</i> var <i>filiforme</i>	<i>Melilotus indica</i>	Cyperaceae
Apocynaceae	<i>Vicia angustifolia</i>	<i>Isolepis nodosus</i>
<i>Alyxia buxifolia</i>	Geraniaceae	<i>Lepidosperma gladiatum</i>
Asteraceae	<i>Geranium solanderi</i>	Liliaceae
<i>Actites megalocarpa</i>	<i>Pelargonium australe</i>	<i>Bulbine semibarbata</i>
<i>Arctotheca calendula</i>	Myoporaceae	<i>Dianella tasmanica</i>
<i>Calocephalus brownii</i>	<i>Myoporum insulare</i>	Poaceae
<i>Carduus pycnocephalus</i>	Myrtaceae	<i>Ammophila arenaria</i>
<i>Hypochoeris radicata</i>	<i>Melaleuca ericifolia</i>	<i>Bromus diandrus</i>
<i>Olearia phlogopappa</i> var <i>salicifolia</i>	Oxalidaceae	<i>Bromus</i> sp.
<i>Senecio lautus</i>	<i>Oxalis perennans</i>	<i>Catapodium rigidum</i>
<i>Sonchus oleraceus</i>	Plantaginaceae	<i>Dactylis glomeratus</i>
Brassicaceae	<i>Plantago coronopus</i>	<i>Distichlis distichophylla</i>
<i>Lepidium foliosum</i>	<i>Plantago lanceolata</i>	<i>Holcus lanatus</i>
<i>Matthiola incana</i>	Polygonaceae	<i>Lolium loliaceum</i>
<i>Sisymbrium</i> sp.	<i>Muehlenbeckia adpressa</i>	<i>Poa poiiformis</i>
Campanulaceae	<i>Rumex</i> sp.	<i>Stipa stipoides</i>
<i>Lobelia alata</i>	<i>Rumex acetosella</i>	<i>Vulpia myuros</i>
<i>Wahlenbergia</i> sp.	Ranunculaceae	PTERIDOPHYTES
Caryophyllaceae	<i>Clematis microphylla</i>	Dennstaedtiaceae
<i>Cerastium glomeratum</i>	Rhamnaceae	<i>Pteridium esculentum</i>
<i>Polycarpon tetraphyllum</i>		PLANTED
<i>Silene gallica</i>		<i>Allocasuarina verticillata</i>
<i>Spergularia media</i>		<i>Callitris rhomboidea</i>
Chenopodiaceae		<i>Coprosma repens</i>
<i>Rhagodia candolleana</i>		<i>Cordyline australis</i>
		<i>Eucalyptus lehmanii</i>
		<i>Macrocarpa cupressiformis</i>
		<i>Melaleuca armillaris</i>

Sarcocornia quinqueflora

Pomaderris apetala