PROFILE FOR MANAGEMENT OF THE HABITATS AND RELATED ECOLOGICAL AND CULTURAL RESOURCE VALUES OF MUA ISLAND

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EXECUTIVE SUMMARY

Mua Island, which occupies a total area of 17 001 ha, is the largest island in the Near Western Island Group and the second largest island in the Torres Strait, and along with the other islands of Mabuiag and Badu, is formed on continental igneous basement rock with a diverse range of landforms including broad residual granite plains, alluvial terraces and beach ridges. The island is well watered with the larger catchments draining to the west flowing perennially. The highest point on the island is Banks Peak reaching 376m.

A total of 62 vegetation communities, within 23 broad vegetation groups and 44 regional ecosystems are recognised across the island. This represents approximately 58% of regional ecosystems recorded across the broader Torres Strait Island landscape and 19% of all regional ecosystems within the Cape York Peninsula Bioregion. The Mua flora is the richest in the Torres Strait region. As of May 2011, the total known flora is 676 species however this number is likely to be increased with additional systematic surveys. This is made up of 19 ferns, one cycad, two conifers and 654 flowering plants. The flora comprises 609 (90%) native species, with 67 (10%) naturalised species. The Mua flora supports approximately 51% of the known flora for the Torres Strait Islands. One hundred and twenty seven families are represented.

The 10% of naturalised species listed excludes plants of town gardens and inhabited community areas, however it incorporates many species which may occur on the disturbed margins of native vegetation. This figure compares to 5% for Badu, 6.7% for Iama, 30% for Boigu, 15% for Torres Strait Islands (Stanton *et al.* 2009), 7.4% for Cape York Peninsula (Neldner and Clarkson 2005) and 9.8% for Queensland (Bostock and Holland 2010).

There are 18 species listed as threatened according to Commonwealth (EPBC Act) and State (NC Act) legislation. These comprise:

- Three Vulnerable species on the EPBC Act.
- One Endangered, eight Vulnerable and eight Near-Threatened listed species on the NC Act.

One species of terrestrial orchid (*Habenaria vatia*) is nominated for Vulnerable status on the NC Act, with three orchids *Dendrobium x superbiens* (Vulnerable), *Dendrobium biggibum* (Vulnerable) and *Dendrobium johannis* (Vulnerable) potentially occurring on the island.

Other key features of the flora species include:

- The cycad (*Cycad badensis*) is endemic to Torres Strait and the islands of Mua and Badu.
- The curved vein orchid (*Habenaria vatia*) is a Mua and Torres Strait endemic only known from a single location on Mua Island.
- The closed burr orchid (*Cadetia clausa*) is a local and Torres Strait endemic which is only known from Mua Island

- A tree *Gnetum gnemon* (DGF10776+DJS) is a new record for Australia, also recorded from Badu.
- A tree *Manilkara kanosiensis* (DGF 9168 + DJS) collected on Mua Peak is not previously known from the Australian rainforest flora. The tree is otherwise restricted to Papua New Guinea (PNG) where it is assigned conservation significance of Endangered by the International Union for Conservation of Nature (IUCN) due to threats to its habitat imposed by logging.
- An unidentified Annonaceae shrub has been tentatively identified as a *Meiogyne* sp. (DGF+ DJS), (L. Jessup pers. comm.). It is not otherwise known from the mainland rainforest flora although could well be a PNG species.
- The occurrence of a rainforest shrub *Ellatostachys rubrofructus* is the only known record for Australia. It otherwise occurs in PNG.
- Evergreen notophyll vine forest on Mua Peak is the only known Australian record of the slender epiphytic vine (*Secamone auriculata*)**.** It may also occur in PNG and Indonesia.
- An additional 93 species are considered regionally significant, the majority in evergreen rainforests of upland granites and on swampy riparian zones. The majority of these plants are disjunct occurrences and representing the limits of geographical range.
- A diverse orchid flora with 21 species recorded.

As for the majority of Torres Strait Islands there is a considerable lack of systematic survey of fauna habitats on the island. A desktop review of reports and databases identified 229 fauna species that have been reported on Mua Island. This comprises eight frog, 40 reptile, 158 bird and 23 mammal species. Of these, one reptile, one bird and five mammal species are introduced. An additional six species have been identified by the Protected Matters Search Tool as possibly occurring. This can be compared with the 384 terrestrial fauna species that have been reported for the broader Torres Strait Island group (see **Appendix E**) which includes 14 frog, 67 reptile, 263 bird and 40 mammal species. Fifteen conservation significant species are reliably reported for the island with an additional three species whose occurrence is considered likely or possible based on knowledge of habitat suitability and regional distribution. There are also an additional 44 migratory species considered to have significance at federal level that are reported or predicted to occur on the island.

Within the 23 broad vegetation groups (or management units) identified on the island, a number of issues for future management are regularly identified as necessary for the future biodiversity maintenance and ecological health of the island. These include:

- Maintenance of traditional burning regimes or specific requirement for protection from fire.
- Monitoring of landscapes threatened by changing burning regimes.
- Monitoring for the introduction or continued spread of a number of exotic species, both fauna and flora, throughout the landscape.
- Management of existing exotic weed infestations.

- A requirement for further survey work to document the poorly known faunal assemblage on the island.
- Continued collection of floristic information, specifically those plants that are important as a traditional resource and species significant to biodiveristy.
- Further survey and documentation of the complex and diverse cultural landscape on the island.

It is important that any future surveys on Mua be undertaken as collaborative research with the Mualgal and to include study of traditional ecological knowledge and ethno-taxonomy. Furthermore all mapping and assessment work must comply with any research protocols and must be approved by the Mualgal PBC, and involve and be quided by the Land and Sea Rangers.

ACKNOWLEDGEMENTS

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1.0 Introduction

Mua (also known as Moa Island) represents one of seven islands within the broader Torres Strait Island group selected for the development of an island specific biodiversity management profile. The profile aims to document the biodiversity features, landscape processes, and cultural values (from both a landscape and site specific perspective) that are intrinsic to the island and develop management actions to ensure preservation or enhancement of those features. In the process of developing this plan, those sites and landscape features of specific cultural importance to the Mua (Mualgal) people are recognised and the recommendations contained within are pertinent to the management of values of importance from both a traditional cultural and western scientific perspective. It is intended that the specific management recommendations detailed within this management profile will be directly incorporated into the developing 'Mua Island Working on Country Work Plan' for specific action.

1.1 Cultural Setting

The population of Mua at the 2006 census consists of 406 Indigenous and 36 non-Indigenous people split between the two settlements of Kubin (southern side) and St Pauls (eastern side). Land tenure is DOGIT (Deed of Grant in Trust) with Native Title determined on 12/02/1999. The Registered Native Title Body Corporate[1] (RNTBC or PBC in abbreviated form) is the Mualgal (Torres Strait Islanders) Corporation who hold the title of the land on behalf of the traditional owners. The Mualgal, the people of Mua, speak Kala Lagaw Ya (dialect of Western-Central Torres Strait Language).

1.2 Geographic Setting

Mua Island (shown in **Figure 1**) is the largest island in the Near Western Island Group and the second largest island in the Torres Strait. It is located approximately 75 km north of Bamaga and 100 km south of the Papua New Guinea mainland. Along with the other islands of Mabuiag and Badu, it is formed on continental igneous basement rock. The island, with an area of 17 001 ha, is characterised by numerous rocky knolls with Banks Peak forming the highest peak at 376m. The Mua Island recording station is the second wettest in the Torres Strait Island group with a mean annual rainfall of 1 797mm (BOM 2008a) compared to Badu which is the wettest at 1 983 mm and Dauan which is the driest recording station at 1 082mm (BOM 2008c). The island is well watered with a number of permanent to semi-permanently flowing streams of which Kai and Tutalia are the largest draining to the islands west and north-west respectively. The two main settlements of Kubin and St Pauls are located on the south-west and east facing island coastlines respectively and are separated by a formed road. The islands airstrip is located at Kubin.

[1] Registered Native Title Body Corporate – the organisation that is recognised as holding native title in trust for the benefit of the native title holders. It contacts native title holders and administers business between them and outsiders, such as government, industry and developers.

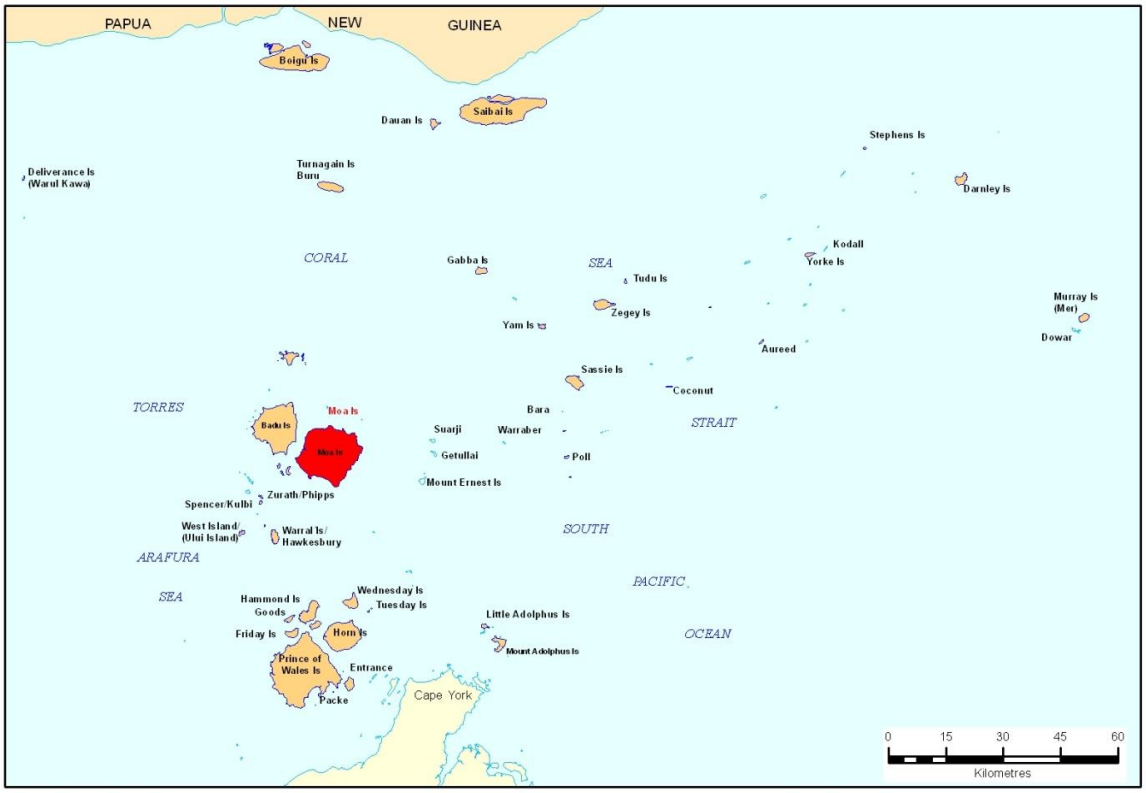


Figure 1. Location of Mua Island

1.3 Geological Context

Mua Island is topographically diverse, dominated by the high point of Banks Peak in the north-east, rising to 376m, with a rugged east and south facing coastline dominated by rocky coastal headlands,and an expansive coastal plain which forms a broad enclave behind the islands north-eastern coastline.

The geomorphology of Mua Island has been heavily influenced by the intrusion of the Badu Granite (Cub) into the Torres Strait Volcanics (Ct) in the Late Carboniferous period. This intrusion altered the mineral structure of the earlier volcanic rocks through extreme heating (hornfelsing) which hardened them significantly. This hardened igneous rock forms the rugged rim of low hills and headlands that forms Mua's east and south-east coastline, being extremely resistant to weathering, with resultant soils being infertile and skeletal in nature. The Badu granite in contrast, being topographically elevated, coarse grained in structure and susceptible to water penetration along fractures and crystalline surfaces, is susceptible to both physical and chemical breakdown, and its resultant weathering has shed significant quantities of coarse granitic sand across the coastal plain in the islands north-east. Despite evidence of rapid sedimentation, the large proportion of the coastal plain in the islands north- east is clearly an erosional feature, formed on deeply weathered granite protruding as numerous core stones above the surface of what is otherwise a flat, leached residual. Relict alluvial terraces, which comprise coarse granite sand, being the only remnants of the former depositional landform are limited to marginal areas of the erosional plain.

The drainage features and watercourses of Mua are the best developed of all the islands in the Torres Strait. Tutalia, Kai and Double Creeks are the largest of these watercourses, originating from wet elevated terrain in the Mua Peak area and draining across the coastal plain towards the west and north-west. The development of these features is due to a large catchment area, and the relatively high rainfall that occurs in the upper parts of this catchment, which directly captures trade wind driven cloud throughout the winter months (May – September). Alluvial plains comprising finer silt and sand, the result of ongoing alluvial process, are also distributed along the islands foot slopes and coastal margins.

In contrast to Badu Island, coastal dunes are relatively restricted in distribution and extent. The most prominent occurrences are prograding ridge/foredune complexes which fringe the islands beaches, most extensively developed in the islands east and north-east. There are also a number of older, highly degraded ridges and sand sheets which are scattered well inland across the broad coastal plain in the islands north, strandline remnants of an earlier marine high stand that occurred approximately 5 000 years ago in the Quaternary period.

2.0 Methods

This document provides a compendium of information that has been compiled from a range of sources, and supplemented with information gathered from consultation with both technical experts and the Mualgal. Numerous surveys relevant to flora, fauna and cultural heritage matters have contributed to this document and these are referenced throughout the body of the report. In short, steps taken during preparation of this document are:

1. Compilation of desktop resources which includes but is not limited to Stanton *et al.* (2009), Queensland Herbarium's Herbrecs Database, Queensland Museum fauna record extracts, Birds Australia database extract, Wildnet database extracts, Conics Land Use Management Plan for Mua (Kubin and St Paul's) (Conics 2009), and various technical papers relating to both flora and fauna (see references section).
2. Presentation of this information at a workshop in Cairns, where biodiversity information was presented to a range of technical experts for discussion and further input. A list of workshop attendees is provided in **Appendix A.**
3. An island-based consultation with Mua Island Rangers on Mua Island (20^{th} - 25^{th} March, 2011) including a consultation session with the broader island community.

3.0 Aims and Objectives

The aim of this document is to compile and annotate existing information relating to:

1. The extent, values and condition of island habitats and the plants and animals which occur in them.
2. Island-scale ecological processes, that is, the environmental and human factors which are influencing habitats, plants and animals.

3. The cultural interactions with these processes, that is, the ways that Mualgal interact with the natural environment including identification of values, and
4. The establishment of management actions. Management actions are intended to be used by island rangers and managers to assist in updating Land and Sea Ranger Work Plans to facilitate effective management of the island's ecological and cultural values.

Owing to the long term occupancy of the islands (>4 000yrs) (McNiven & Wright 2008), the apparent stability of the majority of landscapes, and general lack of detailed ecological information pertaining to these landscapes, it is assumed that maintaining the existing landscape condition and process (in all but a few cases) is the safest management option. Habitat maintenance has therefore been a primary consideration during the compilation of this document. The specific actions that are adopted and the direction of island-scale ecological management will however be ultimately up to the discretion of the Mualgal Rangers and the Mualgal, who are represented by their registered native title body corporate, the Mualgal (Torres Strait Islanders) Corporation.

4.0 Legislative and Policy Considerations

Biodiversity (plants, animals and their habitats) is regulated at state and national levels by a range of legislative mechanisms which classify animal species, plant species and habitats according to their rarity, population size, distribution and threats. The legislative classification is generally used as a way to assign significance to a particular species or ecological value. If an animal, plant or vegetation type is listed on any of the Australian or Queensland government legislation, it is subject to rules which protect it from being destroyed or harmed. For example, if a certain orchid species is listed on the legislation it would mean that the orchid could not be collected from the bush and sold at a nursery without the necessary authorisation and permits. Similarly, if an animal such as a bat species or bat colony, which was listed as threatened on the legislation, lived in a rock shelter where a housing development was proposed, then detailed studies would be required to determine how the bats would be affected by the development. A description of relevant components of the major legislation mechanisms that require consideration for Mua is provided briefly below.

Nature Conservation Act 1992: *The Nature Conservation Act* (NC Act) is a legislative mechanism of the Queensland Government that is regulated by the Department of Environment and Heritage Protection (EHP). The *Nature Conservation (Wildlife) Regulation* 2006 is subordinate to the NC Act and defines five classes that are:

- Extinct in the Wild.
- Endangered.
- Vulnerable.
- Near-Threatened.
- Least Concern.

These classes collectively relate to native species and are protected wildlife (plants and animals).

Vegetation Management Act: The *Vegetation Management Act 1999* (VMA) is a state regulated planning initiative that underpins the regional management of vegetation in Queensland. Under the VMA, conservation significance to particular vegetation groups termed regional ecosystems (REs) are assigned on a consistent state-wide basis. The classification of regional ecosystems is based on a hierarchical system with a three-part code defining bioregion, followed by land zone, and then vegetation. Thirteen bioregions are classified in Queensland with the Torres Strait Islands being a sub-province of the broader Cape York Peninsula bioregion.

Land zones are geological and geomorphic categories that describe the major geologies and landforms of Queensland. The system is based primarily on geology, with geologic age considered an important determinant. The classification of Land Zone generally utilises available geological information (Neldner *et al*. 2005) although field inspection is utilised as a supplementary measure where geological mapping is inadequate.

The status of REs is based on their pre-clearing and remnant extent, and is gazetted under the VMA and listed in the Regional Ecosystem Description Database (REDD) maintained by the DERM. The Vegetation Management Status (VMS) of a regional ecosystem is described in accordance with the following:

Endangered regional ecosystem: a regional ecosystem that is prescribed under a regulation and has either:

- less than 10% of its pre-clearing extent remaining; or
- 10% to 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10 000 hectares (ha).

Of Concern regional ecosystem: means a regional ecosystem that is prescribed under a regulation and has either:

- 10% to 30% of its pre-clearing extent remaining; or
- more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10 000 ha.

Least Concern regional ecosystem: means a regional ecosystem that is prescribed under a regulation and has more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is more than 10 000 ha.

Hence, the majority of vegetation scheduled under the VMA as 'of concern' on Mua (e.g. welchiodendron dominant RE3.12.4) is classified as such because on a regional level (Cape York Peninsula) more than 30% of the original habitat extent remains although the total area of the habitat is less than 10 000ha. The regional ecosystem mapping available for Mua Island provides accurate information on the legislative significance of vegetation on the island offering an information planning resource for the Mua Island communities, the TSIRC and the TSRA. For example, if a radio tower

was proposed for a mountain top which supported a regional ecosystem (vegetation type) that was 'Endangered' or 'Of Concern', then clearing of this vegetation without authorisation is in breach of the VMA. Liaison with regulators to determine the conditions that must be met for clearing to be authorised must be undertaken. EHP also assigns a Biodiversity Status (BS) to REs, a non-statutory indicator of a regional ecosystems susceptibility to elements of degradation.

Land Protection (Pest and Stock Route Management) Act 2002: The *Land Protection (Pest and Stock Route Management) Act 2002* (LPA) provides a framework and powers for improved management of weeds, pest animals and the stock route network. The Act provides for designation of threat classes to species of plant and animal considered not native to Queensland (exotic or invasive) and which degrade natural resources, threaten conservation of biodiversity, threaten remnant vegetation, reduce rural production and interfere with human health and recreational activities. Exotic species that pose a threat are declared under one of the following three categories:

- Class 1 Pest: a pest that has potential to become a very serious pest in Queensland in the future.
- Class 2 Pest: a pest that has already spread over substantial areas of Queensland, but its impact is considered sufficiently serious to warrant control.
- Class 3 Pest: a pest that is commonly established in parts of Queensland but its control by landholders is not warranted unless the plant is impacting, or has potential to impact on a nearby environmentally sensitive area (ESA).

For example, if a Class 2 weed such as Gamba grass (*Andropogon gayanus*) was found on Mua, there is a requirement under the Act for landowners to take reasonable steps to control and manage the weed.

The Back on Track Species Prioritisation Framework: The 'Back on Track (BOT) species prioritisation framework' is a non-legislative Queensland Government initiative that prioritises Queensland's native species as a means to guide their conservation, management and recovery. The assessment method utilises multiple criteria allowing identification of those species that are threatened and facing population declines, and those species that have a high potential for recovery. The BOT methodology classifies four priority levels for action to remediate declining Queensland wildlife being 'critical priority (CR)', 'high priority (H)', medium priority (M)' and 'low priority (L) '.

***The Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):** The EPBC Act, an initiative of the Australian Government, provides recognition of four classes of wildlife and habitat being those which are:

- Extinct in the wild
- Critically endangered
- Endangered
- Vulnerable

Plant and animal species and habitats scheduled under these categories are referred to collectively as 'Threatened Wildlife'. The EPBC Act also provides for protection of those species which are considered migratory under international conventions which include:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
- China-Australia Migratory Bird Agreement (CAMBA);
- Japan-Australia Migratory Bird Agreement (JAMBA); and
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Interference or destruction of plants, animals or areas of habitat for species listed as threatened under the EPBC Act requires specific authorisation from the regulator who is likely to provide conditions under which the interference can take place. Interference (such as removal of protected orchid species) without authorisation is in breach of the EPBC Act.

5.0 Vegetation

As described in the following sections, the classification of vegetation includes both nomenclature of individual species and the classification of groups of plants, the latter often forming unique assemblages that can be consistently recognised across islands (e.g. Mua), island groups (Near Western Torres Strait Islands) or bioregions (Cape York Peninsula Bioregion).

5.1 Vegetation Groups and Mapping

The hierarchy of vegetation classification used in the Torres Strait Islands is described below with relationships illustrated in **Figure 2.** At the highest level, the classification of plant assemblages is based on vegetation structure considering the dominant life form (tree or grass), height of the tallest strata, and canopy closure. The structural classification used by the Queensland Government is included within **Appendix B**. Vegetation structural groupings (i.e shrubland etc) are used to define ***Broad Vegetation Groups*** (BVGs) which provide the broadest level of vegetation classification recognised in vegetation mapping produced for the Torres Strait Islands (Stanton *et al.* 2009). BVGs may be an amalgamation of a number of more specific plant groupings known as ***Vegetation Communities.*** Vegetation communities (VCs) can be described as 'a unit of vegetation that demonstrates similarities in both structure and floristic composition'. VCs are useful to describe fine scale variation in floristic composition that may occur due to the consistent dominance of a particular plant species or suite of plant species. REs as described in **Section 4** comprise a group of vegetation communities, although unlike BVGs, consider regional distribution and geology within the classification. REs must be considered due to their legislative implications although in this document, for specific habitat management purposes, BVGs provide a more readily usable management grouping. As such they have been used to define habitat management units within this document.

Vegetation Classification on Mua Island: For management purposes, the islands vegetation is classified into broad vegetation groups (BVGs), herein referred to as habitats, as derived from Stanton *et al.* (2009). The spatial extent and relative contribution of these groupings is provided in **Table 1**,

descriptions of component vegetation communities and associated regional ecosystems provided in **Table 2.** Further characterisation of habitat types is provided in the following text.

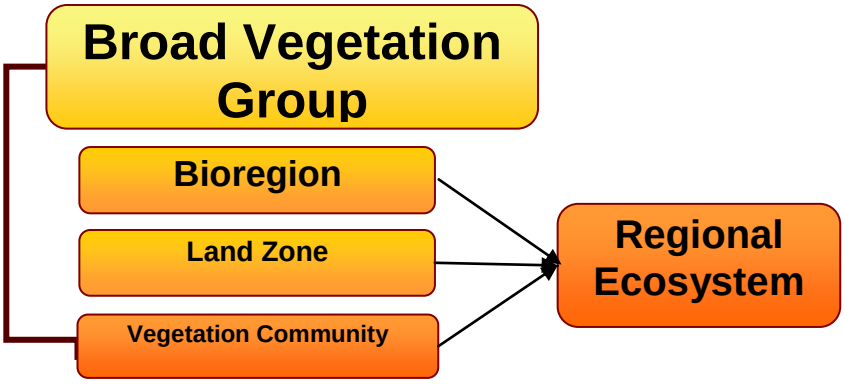


Figure 2. Diagrammatic illustration of the hierarchy and relationship between components of the vegetation classification system used in the Torres Strait Island vegetation mapping study (Stanton *et al*. 2009).

Table 1. Broad vegetation groups and relative contributions to Mua island vegetation.

Broad Vegetation Group/ Habitat**	Component Vegetation Communities**	Area (ha)	Contribution %
Evergreen/Semi-evergreen vine forest and vine thicket	1i, 1j, 1e, 1f, 1g	477	2.8
Deciduous / Semi deciduous vine forest and vine thicket	2b, 2o, 2p, 2u, 2v	265	1.6
Swamp and riparian forest and forest complexes	3a, 3b, 3c, 3d, 3e	418	2.5
Welchiodendron dominant closed to open forests and woodlands	4a, 4b, 4c	1625	9.6
Eucalypt and Corymbia dominant open forests and woodlands	5a, 5b, 5c, 5d, 5i, 5m	4782	28.2
Acacia dominant open forests and woodlands	6c	7	0.05
Melaleuca dominant open forests	7a, 7b, 7c, 7d, 7e	196	1.2
Lophostemon dominant woodland and open forest	8b	44	0.3
Asteromyrtus/Neofabricia dominant open forests	9a	229	1.3
Pandanus dominant woodland and shrubland	11a	7	0.05
Melaleuca dominant shrublands and woodlands	13a, 13b, 13c, 13d, 13e, 13f, 13i, 13j	3891	22.9

Broad Vegetation Group/ Habitat**	Component Vegetation Communities**	Area (ha)	Contribution %
Shrublands and shrubland complexes	14a, 14c, 14e, 14i, 14p, 14q, 14r	1656	9.8
Coastal Dune Complexes	16b, 16c, 16d, 16k	57	0.3
Grasslands and grassland complexes	17a, 17c, 17d, 17g, 17h, 17i	1093	6.5
Rock pavement and pavement complexes	18c, 18d	70	0.4
Samphire grasslands	26a	59	0.3
Samphire herblands and shrublands and salt pans	25b	58	0.3
Mangrove forest, woodland and shrubland complexes	24a	1647	9.7
Regrowth	RE	32	0.2
Exotics	Exotics/Bamboo	5	<0.05
Cleared Areas	Cl	372	2.2
Total		**17001**	**100**

Table 2. Descriptions of component vegetation communities and association with regional ecosystems currently recognised on Mua Island (from Stanton *et al*. 2009).

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
1i	Evergreen mesophyll vine forest + *Horsfieldia australiana, Syzygium bamagense* + *Acmena hemilampra* subsp. *hemilampra* + *Buchanania arborescens.*	Sandy alluvial channels and overflows	3.3.5c	LC	NCAP
1j	Tall evergreen notophyll vine forest + *Syzygium angophoroides* + *Acmena hemilampra* subsp. *hemilampra* + *Acacia auriculiformis* + *Syzygium forte* subsp. *forte* + *Podocarpus grayae*	Sandy alluvial channels and overflows	3.3.5c	LC	NCAP
1e	Mesophyll/notophyll vine forest + *Myristica insipida* + *Maranthes corymbosa* + *Cryptocarya cunninghamii* + *Dysoxylum latifolium* + *Calophyllum sil* +/- *Arenga australasica.*	Granite footslopes and scree slopes	3.12.36a	OC	OC

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
1f	Complex notophyll vine forest + *Manikara kanosiensis.* + *Calophyllum sil* + *Argyrodendron polyandrum* + *Palaquium galactoxylon* + *Acmenospermum claviflorum* + *Licuala ramsayi.*	Upper mountain peaks on granite	3.12.36a	OC	OC
1g	Evergreen notophyll vine thicket + *Calophyllum sil* + *Syzygium branderhorstii* + *Diospyros hebecarpa* + *Schefflera actinophylla* + *Podocarpus grayae* + *Licuala ramsayi.*	Upper wind exposed mountain peaks on granite	3.12.36b	OC	OC
2b	Semi deciduous vine forest/thicket + *Canarium australianum* + *Terminalia subacroptera* + *Bombax ceiba* var*. leiocarpum* + *Cochlospermum gillivraei* + *Cleistanthus peninsularis* + *Ficus virens* var. *sublanceolata.*	Rocky boulder/ talus footslopes on rhyolite and granite	3.12.21a	LC	NCAP
2o	Semi deciduous notophyll vine forest + *Acacia auriculiformis* + *Barringtonia calyptrata* + *Maranthes corymbosa* + *Syzygium forte* subsp*. forte* + *Bombax ceiba* var*. leiocarpum* + *Canarium australianum.*	Rocky boulder/ talus footslopes slopes on rhyolite and granite	3.12.35c	OC	OC
2p	Semi deciduous vine thicket (windsheared) + *Bombax ceiba* var. *leiocarpum* + *Premna serratifolia* + *Acacia crassicarpa* + *Manilkara kauki* + *Drypetes deplanchei* + *Terminalia subacroptera* +/- *Arenga australasica.*	Coastal dunes	3.2.2a	LC	OC
2u	Semi-deciduous vine forest + *Manilkara kauki* + *Terminalia* spp*.* + *Sterculia quadrifida* + *Premna serratifolia* + *Acacia crassicarpa* + *Drypetes deplanchei* + *Millettia pinnata.*	Coastal Dunes	3.2.2b	LC	OC
2v	Semi-deciduous vine thicket + *Acacia polystachya* and *Terminalia subacroptera.*	Rhyolite hillslopes	3.12.21a	LC	NCAP
3a	*Lophostemon suaveolens* + *Melaleuca quinquenervia* + *Syzygium angophoroides* + *Asteromyrtus brassii* + *Dillenia alata* swamp forest complex	Swampy alluvial depressions and dune swales	3.3.9	LC	NCAP
3b	Medium to tall *Melaleuca leucadendra* +/- *Melaleuca argentea* + *Syzygium forte* subsp*. forte* + *Dillenia alata* open forest.	Alluvial drainage channels	3.3.10	LC	NCAP
3c	Tall *Melaleuca dealbata* / *Melaleuca leucadendra* open forest/*Acacia* sp*.* open forest / Mesophyll vine forest complex.	Swampy depressions on mangrove margins	3.3.6	OC	OC
3d	Evergreen mesophyll vine forest / Sclerophyll vine forest complex + *Syzygium forte*	Sandy alluvial channels and terraces	3.3.5c/ 3.3.6	LC/OC	NCAP/OC

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
	subsp*. forte* + *Syzygium bamagense* + *Horsfieldia australiana* +/- *Melaleuca leucadendra* +/- *Lophostemon suaveolens.* (1i/3b- 50/50)				
4a	*Welchiodendron longivalve* + *Acacia polystachya* +/- *Terminalia subacroptera* +/- *Canarium australianum* +/- *Bombax ceiba* var. *leiocarpum* open to closed forest.	Rocky hillslopes on granitoid rocks	3.12.4a	OC	OC
4b	*Welchiodendron longivalve* low woodland, low open woodland and tall open shrubland.	Granite and rhyolite footslopes	3.12.4a	OC	OC
4c	Low *Welchiodendron longivalve* + *Melaleuca dealbata* open forest.	Alluvial fans and footslopes on granite	3.3.69/ 3.12.4a	OC/OC	End/OC
5a	*Corymbia novoguinensis* +/- *Corymbia stockeri* subsp. *peninsularis* woodland and open forest.	Sandy alluvial terraces	3.5.5	OC	OC
5b	*Corymbia clarksoniana* + *Corymbia nesophila* +/- *Corymbia tessellaris* +/- *Corymbia stockeri* subsp*. peninsularis* +/- *Welchiodendron longivalve* woodland and open forest.	Alluvial plains and granite footslopes	3.3.20c / 3.12.8	LC	NCAP
5c	*Corymbia clarksoniana* + *Melaleuca stenostachya* + *Melaleuca viridiflora* +/- *Asteromyrtus symphyocarpa* +/- *Parinari nonda* +/- *Asteromyrtus brassii* woodland.	Alluvial plains	3.3.22	LC	NCAP
5d	Low *Corymbia clarksoniana* + *Melaleuca viridiflora* + *Welchiodendron longivalve* + *Asteromyrtus brassii* + *Acacia leptocarpa* woodland and shrubland complex.	Rhyolite hillslopes	3.12.38	OC	OC
5i	*Corymbia clarksoniana* +/- *Corymbia novoguinensis* +/- *Livistona muelleri* woodland and open forest.	Sandy alluvial deposits and stabilised sand dunes	3.3.22/3.2.7	LC	NCAP
5m	Low *Corymbia* spp*. (C. stockeri, C. nesophila, C. clarksoniana)* + *Melaleuca stenostachya* +/- *Melaleuca viridiflora* +/- *Asteromyrtus symphyocarpa* woodland.	Degraded sand dunes and coarse grained alluvial deposits	3.2.8	OC	OC
6c	Low *Acacia crassicarpa* + *Terminalia subacroptera* + *Sterculia quadrifida* + *Manilkara kauki* + *Syzygium suborbiculare* open forest and woodland.	Chenier sand ridges	3.2.5a	LC	NCAP
7a	Low *Melaleuca cajuputi* subsp*. platyphylla* open forest.	Swampy alluvial plains and dune swales	3.3.70	OC	OC
7b	*Melaleuca saligna* open forest.	Coastal dunes and alluvial channels	3.2.4d/ 3.3.14	OC/LC	OC/NCAP
7c	Tall *Melaleuca dealbata* + *Corymbia clarksoniana* open	Alluvial plains	3.3.69	OC	OC

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
	forest.				
7d	Melaleuca *quinquenervia +/- Melaleuca saligna +/- Melaleuca cajuputi* subsp*. platyphylla +/- Lophostemon suaveolens* open forest.	Coastal dune fields	3.2.4b	OC/LC	OC/NCAP
7e	Low *Melaleuca dealbata +/- Melaleuca saligna +/- Lophostemon suaveolens* open forest	Alluvial flats and dune swales	3.3.14 / 3.2.3	LC	NCAP
8b	Low *Lophostemon suaveolens +/- Asteromyrtus brassii +/- Acacia crassicarpa +/- Melaleuca saligna +/- Deplanchea tetraphylla* open forest and swamp forest.	Sandy alluvial plains	3.3.9	LC	NCAP
9a	*Asteromyrtus brassii + Syzygium angophoroides + Acmena hemilampra* subsp*. hemilampra +/- Acacia crassicarpa +/- Melaleuca quinquenervia* open forest.	Relict sandy terraces	3.5.32	OC	OC
11a	*Pandanus* sp*. +/- Melaleuca cajuputi* subsp. *platyphylla +/- Acacia leptocarpa +/- Melaleuca acacioides* shrubland and low woodland.	Alluvial Plains	3.3.62	OC	OC
13a	*Melaleuca viridiflora +/- Pandanus* sp*.* shrubland and low woodland.	Alluvial plains and degraded sand dunes	3.3.42a	LC	NCAP
13b	*Melaleuca cajuputi* subsp*. platyphylla +/- Pandanus* sp*.* shrubland.	Swampy drainage depressions	3.3.42c	LC	NCAP
13c	*Melaleuca viridiflora + Asteromyrtus symphyocarpa +/-Asteromyrtus brassii + /- Banksia dentata +/- Melaleuca saligna +/- Leucopogon ruscifolius* shrubland.	Sandy alluvial plains and residual surfaces	3.3.42a / 3.5.15b	LC	NCAP
13d	*Melaleuca saligna + Melaleuca viridiflora + Asteromyrtus symphyocarpa +/- Asteromyrtus brassii +/- Corymbia* spp*. +/- Banksia dentata* low woodland.	Sandy alluvial plains and residual surfaces	3.3.48b / 3.5.15a	LC	NCAP
13e	*Melaleuca acacioides* shrubland.	Alluvial plains on saline margins	3.3.51	OC	OC
13f	Low *Melaleuca viridiflora + Corymbia clarksoniana* woodland.	Alluvial plains and sandy residual surfaces	3.3.42a 3.5.15a	LC	NCAP
13i	*Melaleuca stenostachya* shrubland +/- *Melaleuca viridiflora* low woodland.	Granite footslopes	3.12.16c	LC	NCAP
13j	*Melaleuca acacioides +/- Melaleuca viridiflora* open shrubland.	Alluvial plains	3.3.51	LC	NCAP
14a	Dwarf *Welchiodendron longivalve + Alyxia spicata +/- Melaleuca viridiflora +/- Acacia* spp*. +/- Asteromyrtus brassii* shrubland.	Coastal headlands on rhyolite	3.12.31x1a	OC	OC
14c	*Welchiodendron longivalve* shrubland.	Rocky granite hillslopes and knolls	3.12.20	OC	OC
14e	Low open shrubland with	Degraded	3.2.19	LC	NCAP

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
	Baeckea frutescens, Melaleuca viridiflora and *Asteromyrtus brassii.*	coastal dunes			
14i	*Asteromyrtus brassii* + *Melaleuca saligna* + *Baeckea frutescens* + *Leucopogon yorkensis* + *Leucopogon ruscifolius* +/- *Lophostemon suaveolens* shrubland and low shrubland.	Sandy residual plains	3.5.19a	LC	NCAP
14p	*Asteromyrtus brassii* + *Petalostigma pubescens* + *Melaleuca viridiflora* + *Acacia crassicarpa* + *Corymbia clarksoniana* shrubland.	Skeletal soils on rhyolite	3.12.38	OC	OC
14q	Low *Cycas* sp. open shrubland.	Beach ridges	3.2.5c	LC	NCAP
14r	*Acacia crassicarpa* + *Pandanus* sp. + *Melaleuca viridiflora* +/- *Parinari nonda* +/- *Banksia dentata* +/- *Lophostemon suaveolens* shrubland.	Alluvial plains	3.3.42	LC	NCAP
16b	Low groved notophyll vine thicket/ grassland and herbland complex (2z/17j - 80/20).	Prograding beach ridges	3.2.2a/ 3.2.25	LC/OC	NCAP/OC
16c	Coastal dune swale shrubland / Low open forest complex + *Cochlospermum gillivraei* + *Canarium australianum* + *Terminalia subacroptera* + *Acacia crassicarpa* + *Melaleuca saligna* + *Melaleuca acacioides* (14t/7b – 70/30).	Beach ridge / Dune swale complex	3.2.5c / 3.2.4a	LC/OC	NCAP/OC
16d	Coastal dune shrubland and vine forest complex (14t/2aa – 70/30).	Beach ridge deposits	3.2.5a / 3.2.2a	LC	NCAP
16k	Coastal foredune grassland, herbland, woodland and vine thicket complex (17j/17d/10b/2aa – 50/20/20/10).	Coastal foredunes	3.2.24/3.2.6a/ 3.2.2a	OC/OC/LC	OC/OC/ NCAP
17a	Tall *Ischaemum australe* +/- *Imperata cylindrica* +/- *Themeda triandra* +/- *Mnesithea rottboellioides* +/- *Heteropogon triticeus* grassland.	Alluvial plains	3.3.62	OC	OC
17c	Open to closed tussock grassland with emergent shrubs.	Rocky headlands	3.12.29	OC	OC
17d	Medium to tall *Mnesithea rottboellioides* + *Heteropogon triticeus* + *Cymbopogon* spp. +/- *Imperata cylindrica* +/- *Themeda triandra* grassland.	Coastal dunes and foredunes	3.2.24	OC	OC
17g	*Imperata/Themeda* grassland complex with emergent shrubs.	Alluvial plain	3.3.57	OC	End.
17h	*Imperata cylindrica* + *Themeda triandra* grassland / *Welchiodendron longivalve* open forest and woodland complex (17f/4a – 90/10).	Granite hills	3.12.30/3.12.4	OC	OC
17i	Low sedgeland with emergent	Sandy residual	3.5.15b	NOC	NOC

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
	shrubs and trees	plains			
18c	*Welchiodendron longivalve* +/- *Acacia polystachya* closed shrubland / Low deciduous shrubland/rock pavement complex (18a/14c – 50/50).	Rocky granite slopes and knolls	3.12.34c	OC	OC
18d	*Corymbia stockeri* subsp. *peninsularis* + *Welchiodendron longivalve* + *Psydrax banksii* + *Dodonaea polyandra* + *Ficus* sp. rock pavement complex.	Rocky granite slopes and knolls	3.12.34c	OC	OC
24a	Mangrove closed and open forest, woodland and shrubland complexes (24d/24c – 80/20).	Estuarine muds (periodically inundated)	3.1.1/ 3.1.2	LC	NCAP/OC
25a	Dwarf halophytic shrubland and saltpan.	Hypersaline Alluvium	3.1.6	LC	NCAP
25b	Salt pan.	Hypersaline Alluvium	3.1.6	LC	NCAP
26a	Closed *Sporobolus sp.* grassland.	Saline Alluvial Plains	3.1.5	LC	NCAP
26b	*Sporobolus* sp. Grassland / Chenopod forbland and herbland complex (26a/25a - 50/50).	Saline Alluvial Plains	3.1.5/ 3.1.6	LC	NCAP

** VMS =Vegetation Management Status. ** BDS = Biodiversity Status: OC = Of Concern Regional Ecosystem, LC = Least Concern Regional Ecosystem, End. = Regional Ecosystem with a Biodiversity Status that is Endangered, NCAP = regional ecosystem with a biodiversity status that is considered to be 'No Concern at Present'*

In total, Mua Island is represented by 44 REs, 58% of all regional ecosystems represented in the Torres Strait Island group and 19% of all REs within the Cape York Peninsula Bioregion.

5.2 Flora Species

An overview of the Mua flora has been compiled from analysis of; Queensland Herbarium data (Herbrecs 2008, 2011), Wannan and Bousi (2003), 3D Environmental survey data (Stanton *et al*. 2009), and flora field survey data of Fell and Stanton (2011).

The Mua flora is the richest in the Torres Strait region. As of May 2011, the total known flora is 676 species. However this number is likely to be increased with additional systematic surveys. It is made up of 19 ferns, one cycad, two conifers and 654 flowering plants. The flora comprises 609 (90%) native species, with 67 (10%) naturalised species. The island supports approximately 51% of the known flora for the Torres Strait Islands.

The 10% of naturalised species listed excludes plants of town gardens however it incorporates many species which may occur on the disturbed margins of native vegetation. This figure compares to 5% for Badu, 6.7% for Iama, 30% for Boigu, 15% for the Torres Strait Islands (Stanton *et al.* 2009), 7.4% for Cape York Peninsula (Neldner and Clarkson 2005) and 15.6% for Queensland (Bostock & Holland 2007). A comparison of the island flora in relation to other Torres Strait Islands and regional floras is provided in **Table 3**.

Table 3. Summary of the native vascular flora of Mua Island in relation to Badu, Mer, Erub, Boigu, Mabuiag and Iama Islands (Fell 2010), Torres Strait Islands (Stanton *et al.* 2009), Cape York Peninsula (Neldner & Clarkson 1995 in Neldner 1998), Great Barrier Reef Continental Islands (Batianoff & Dilleward 1997), and the Queensland Flora (Bostock & Holland 2010).

Islands/Regions	Families Species	Ferns	Pines & Cycads	Flowering Plants	Total
Mua	Families	10	3	127	127
	Species	17	3	652	676
Erub	Families	1	0	82	83
	Species	1	0	280	281
Mer	Families	3	0	78	82
	Species	7	0	291	299
Badu is.	Families	11	2	117	130
	Species	18	2	572	592
Mabuiag Is.	Families	2	1	101	104
	Species	4	1	429	434
Boigu Is	Families	3	0	62	65
	Species	4	0	226	230
Iama Is.	Families	2	0	78	80
	Species	2	0	266	268
Torres Strait Is. (Combined)	Families	5	1	158	174
	Species	39	2	1,289	1,331
Cape York Peninsula	Families[2]	30	5	183	218
	Species	157	6	3,173	3,338
GBR Continental Islands[3]	Families	25	5	165	195
	Species	97	7	2,091	2,195
Qld Flora[4]	Species	392	68	9,246	9,706

5.2.1 Flora Species with Biodiversity Significance

An assessment of significant flora species draws from the data sources identified above and seeks to provide details sufficient to document additional flora and habitats which should be considered a priority and focus for management actions. With consideration of the existing Torres Strait Region Back on Track Species Prioritisation program (EHP 2009) and ongoing assessments of the status of Queensland flora by the Queensland Herbarium, additional and complementary species management criteria have been assessed. Species have been categorised into broad significance categories (i.e. National, State, Regional and Cultural) based on criteria which include legislative status, keystone/focal, threatened or sensitive, restricted, otherwise noteworthy or of cultural interest value.

There are 18 species listed as threatened according to Commonwealth (EPBC Act) and State (NC Act) legislation. These comprise:

- one Endangered and three Vulnerable species on the EPBC Act.
- eight Vulnerable and eight Near-Threatened listed species on the NC Act (**Table 4**).

One species of terrestrial orchid (*Habenaria vatia*) is nominated for Vulnerable status on the NC Act, with another orchid *Dendrobium x superbiens* (Vulnerable) potentially occurring on the island.

Other significant flora species include:

[2] Cape York flora utilises Henderson (2002).
[3] Batianoff and Dilleward (1997) identify 552 continental islands along the east coast of Queensland within the Great Barrier Reef Marine Park (GBRMP), a total land area of about 1,627 km2.
[4] Bostock and Holland (2010).

- The cycad (*Cycad badensis*) which is endemic to the islands of Mua and Badu.
- The closed burr orchid (*Cadetia clausa*) is a local and Torres Strait endemic which only known from Mua Island.
- A tree identified as *Gnetum gnemon* (DGF10776+DJS) is a new record for Australia, also recorded from Badu. The species is otherwise known from Papua New Guinea (PNG).
- A tree Sapotaceae (DGF 9168 + DJS) is not previously known from the Australian rainforest flora. It has been identified as *Manilkara kanosiensis* (L. Jessup pers. comm.), a tree otherwise known from PNG where it is listed as Endangered by the International Union for Conservation of Nature (IUCN).
- An unidentified Annonaceae shrub has been tentatively identified as a *Meiogyne* sp. (DGF + DJS), (L. Jessup pers. comm.). It is not otherwise known from the mainland rainforest flora although could well be a PNG species.
- The occurrence of a rainforest shrub *Ellatostachys rubrofructus* is the only known record for Australia. It otherwise occurs in PNG.
- Evergreen notophyll vine forest on Mua Peak is the only known Australian record of the slender epiphytic vine (*Secamone auriculata*)**.** It may also occur in PNG and Indonesia.
- An additional 93 species are considered regionally significant, the majority in evergreen rainforests of upland granites and on swampy riparian zones. The majority of these plants are disjunct occurrences and representing the limits of geographical range.
- Two species, *Manilkara kanosiensis* and *Intsia bijuga* are listed as Endangered and Vulnerable respectively by the IUCN based on threats to their habitats in PNG and Malesia.
- The island has a diverse orchid flora with 21 species recorded.

Table 4. Endangered, Vulnerable and Near-Threatened flora species reported or predicted to occur on Mua Island.

Species	National EPBC	State NC Act	Broad Habitat	Source of Record/s
Known to Occur				
Archidendron hirsutum (Mimosaceae)	-	NT	Rainforest	Herbrecs, 3D Survey
Arenga australasica (Arecaceae)	V	V	Rainforest, dune thickets.	3D survey
Cadetia wariana (Orchidaceae)	-	NT	Rainforest	Herbrecs
Costus potierae (Costaceae)	-	E	Rainforest/woodland margins, open forests	3D survey
Cycas badensis (Cycadaceae)	-	V	Open forests, woodlands, grasslands.	Herbrecs, 3D
Diospyros sp. (Bamaga BP Hyland 2517)	-	V	Rainforest and Welchiodendron forests.	Wannan & Bousi (2003), 3D Survey.
Dischidia littoralis (Apocynaceae)	V	V	Rainforest	Herbrecs, 3D
Eremochloa ciliaris (Poaceae)	-	NT	Woodlands and shrublands.	Herbrecs
Germainia capitata (Poaceae)	V	V	Open forests and woodlands.	Herbrecs
Globba marantina (Zingiberaceae)	-	V		Herbrecs
Hoya annulata (Apocynaceae)	-	NT	Rainforest	Herbrecs, 3D Survey
Hoya revoluta (Apocynaceae)	-	NT	Rainforest	Herbrecs, 3D Survey
Neololeba atra (Poaceae)	-	NT	Rainforest and	3D Survey

Species	National EPBC	State NC Act	Broad Habitat	Source of Record/s
			Welchiodendron forest.	
Pandanus zea (Pandanaceae)	-	NT	Rainforest	3D Survey
Psydrax reticulata (Rubiaceae)	-	V	Shrublands, rock pavements, Welchiodendron forests.	3d Survey
Secamone auriculata (Apocynaceae)	-	V	Rainforest	Herbrecs, 3D Survey
Sterculia shillinglawii subsp. shillinglawii (Sterculiaceae)	-	NT	Rainforest	3D Survey
Syzygium buettnerianum (Myrtaceae)		NT	Rainforest	Herbrecs, 3D Survey
Nominated for Vulnerable on NC Act				
Habenaria vatia (Orchidaceae)		V (nominated)	Melaleuca low open woodlands.	Paul Forster pers. comm.
Predicted to Occur				
Dendrobium x superbiens (Orchidaceae)	V	V	Rock pavements.	EPBC Search
Dendrobium biggibum (Orchidaceae)	V	V	Melaleuca low open woodlands.	Suitable habitat
Dendrobium johannis (Orchidaceae)	V	V	Melaleuca low open woodlands.	Suitable habitat

National Significance

Two species listed on the EPBC Act are known to occur.

Vulnerable

Arenga palm (*Arenga australasica)*: Arenga is a multi-stemmed palm up to 20 m tall with a sometimes-clumping habit comprising numerous basal suckers. The pinnate leaflets are glossy dark green on the upper surface and pale greyish below. It occurs in a series of highly disjunct populations in north-eastern Queensland and the Northern Territory in rainforest and coastal thickets protected from fire. In Queensland it is known from the Torres Strait to south of Innisfail with scattered populations on Cape York Peninsula and within the Wet Tropics Bioregion. In Torres Strait it is also known from Dauan and Iama Islands. The palm is restricted to vine forest and vine thicket habitat on granite hills, alluvium and dunes where it may be locally abundant. Populations on dunes are potentially threatened by inappropriate fire regimes.

Dischidia littoralis* (Apocynaceae)*: An epiphytic, succulent vine with white latex previously known only from Mt Cornwallis on Dauan Island in evergreen notophyll vine forest amongst granite boulder fields. It also occurs on the islands of Indonesia and Irian Jaya and is common and widespread in Papua New Guinea (Forster & Liddle 1993, 1996). On Mua *Dischidia littoralis* is restricted to a small area of evergreen notophyll vine forest on granite between 300 and 400m altitude. Population size is currently unknown. Individuals and habitat have been previously impacted by construction of radio telecommunications towers. Threatening processes include tower maintenance activities and potential proliferation of weeds such as Brazilian joyweed (*Alternanthera brasiliana*) which are establishing on the margins of the habitat.

***Germainia capitata* (Poaceae):** A perennial, tufted grass to 90 cm tall known in Australia from two disjunct localities north of Bundaberg and Torres Strait. Torres Strait populations are known from Mua (Wannan & Bousi 2006) and Badu where it inhabits situations experiencing seasonal inundation supporting *Eucalyptus* and *Melaleuca* species woodlands and open forests. These habitats are widespread and in good condition indicating that the Vulnerable status may be a reflection of threatening processes in the disjunct southern populations. The grass also is reported as widespread in Papua New Guinea, Malaya, Thailand, Vietnam, and China (Sharp & Simon 2002).

State Significance

Three species are listed on the Amended Regulations of the *Queensland Nature Conservation Act (NC Act) 1992.*

Endangered

***Costus potierae* (Costaceae):** A multi-stemmed shrub with multiple cane like stems arising from a ginger like underground rhizome, and red cone like flowers. Endemic to Queensland being known from small populations in the Wet Tropics bioregion and Torres Strait. Known in the Torres Strait from three populations on Badu, Mua and Dauan where it is common in its habitat. It occurs in the understorey of grassy Eucalyptus woodland and Melaleuca open forest on alluvial flats often adjacent to riparian and swamp forests. Populations appear stable however they may be impacted by feral pig digging, and inappropriate fire regimes. Environmental weeds such as leucaena (*Leucaena leucocephala*) and para grass (*Brachiaria mutica*) have the potential to impact on local populations in the vicinity of St Pauls community.

Photograph 1 & 2. Flowering specimen showing red bracts (left); Typical population in grassy woodland on alluvium (right).

Vulnerable

***Cycas badensis* (Cycadaceae):** *Cycas badensis* is endemic to the Torres Strait and listed as Vulnerable under State legislation. This species is restricted Mua and Badu where it is locally known as *busamargh*. Mer Island hosts a disjunct population of the New Guinea species (*Cycas scratchlyeana*) and populations recently recorded from Prince of Wales and Mabuiag are awaiting identification at the Queensland Herbarium. Traditional use of Cycads as a food resource is documented from other northern Australian regions and Papua New Guinea (Bradley 2005).

The cycad has been recorded from a number of habitat types on Mua including grasslands on dunes, Eucalyptus and Corymbia woodlands and open forests, Welchiodendron forests, and rainforest margins. Populations appear robust but they are potentially threatened by Inappropriate fire regimes within grassland habitats on dunes.

Photograph 3 & 4. Cycad population on coastal dune south of Saveka Point, St Pauls.

Dischidia littoralis* (Apocynaceae)*: see above

***Germainia capitata* (Poaceae):** see above

***Diospyros* sp. (Bamaga BP Hyland 2517) (Ebenaceae)**: A low shrub 1-3m restricted to evergreen and semi deciduous vine forests and thickets. A bioregional endemic reaching its northern limits of distribution on Torres Strait Islands (continental). Its occurrence on Mua, Badu, Dauan, Prince of Wales, and Naghir is limited to restricted pockets of suitable habitat where the plant may be locally common. As for *Psydrax reticulata*, despite a need for a reassessment of its conservation status, it should be considered a regionally significant taxon given it is endemic to the bioregion and at the limit of its geographical range. The habitat is restricted in size but in good condition.

Globba marantina* (Zingiberaceae*): *Globba marantina* is a perennial herbaceous ginger which is distributed exclusively, but widely, south of extreme southern India from Sri Lanka to the Solomon Islands (Williams *et al*. 2004). On Mua it occurs on the margins of closed forest (Wannan & Bousi 2004). The ginger is known to be widely utilised throughout its tropical distribution. Information regarding its traditional use on Mua requires further investigation, as does details on population and habitat preference. Populations in the vicinity of St Pauls community may be impacted by environmental weeds such as leucaena and para grass.

***Psydrax reticulata* (Rubiaceae)**: Shrub to small tree to 6m which is common throughout vine thickets, shrublands and rock pavements on the majority of continental islands of Torres Strait and near the tip of Cape York Peninsula. A bioregional endemic reaching its northern limits of distribution on Torres Strait continental islands with records from Mua, Badu, Dauan, Zuna, Warral, Prince of Wales, Wednesday, and Naghir. On Mer the plant is a common component of shrublands of exposed rhyolite hills and rock pavements which are in good condition. Despite the need for a reassessment of its conservation status toward delisting, it should be considered a regionally significant taxon given it is endemic to the bioregion and at the limit of geographical range.

Photograph 5 & 6. Typical habitat and form of *Psydrax reticulata* on exposed rocky pavements, and characteristic stiff, opposite leaves.

Secamone auriculata* (Apocynaceae*): A slender epiphytic, succulent vine with white latex known only from Mua Peak on Mua Island from a 1987 Budworth collection in evergreen notophyll vine forest. The species may also occur in Papua New Guinea. The Mua population is limited to a restricted area of evergreen notophyll vine forest on granite between 300 and 400m altitude. Population size is currently unknown. Individuals and habitat have been previously impacted by construction of radio telecommunications towers. Threatening processes include tower maintenance activities, and potential proliferation of weeds such as Brazilian joyweed (*Alternanthera brasiliana*), which is establishing on the margins of the habitat.

Near-Threatened

***Archidendron hirsutum* (Mimosaceae):** A partly deciduous tree to 25m inhabiting rainforest as a canopy or subcanopy associate. Populations on Badu are restricted to footslope rainforest (1d) and welchiodendron forests with optimum development of the vine forest species understorey (4a) which are in good condition. The tree is more common on Mua where the rainforest habitat is better developed on footslope and upland granite situations (1e, 1f, 2o, 3d, 4a). Cape Laceflower is endemic to the Cape York bioregion where it occurs between Lockerbie and the McIlwraith Range. The Badu populations are disjunct and represent the northern limit of distribution.

***Chrysophyllum roxburghii* (Sapotaceae):** The tree occurs in Cape York Peninsula, known only from well developed alluvial rainforest on the Claudie River, and east of Coen in the

McIlwraith Range, with a disjunct southern limit of distribution near Isabella Falls (Hyland *et al.* 2001). In Torres Strait it is limited to well developed rainforest on Mua and Dauan Islands (granitic substrates) and in disturbed vine forest on basalt on Mer. These are highly disjunct occurrences of a species which also occurs in Asia, Malesia, Solomon Islands and Africa. Whilst not known to be eaten on Mua, the fruit is considered edible in parts of Asia and Africa. Population size in not known. Individuals and habitat may have been previously impacted by construction of radio telecommunications towers on Mua Peak. Threatening processes include tower maintenance activities and potential proliferation of weeds such as Brazilian joyweed (*Alternanthera brasiliana*) which is establishing on the margins of the habitat.

Cadetia wariana (*Orchidaceae*): A small epiphytic or lithophytic (on rocks and ground roots) orchid known from north-eastern Queensland, Cape York Peninsula (McIlwraith Range) and Mua Island. Inhabits rainforest edges, usually growing on trees close to watercourses and on humid slopes forming dense mats on rocks and rough-barked trees. Also known as *Sarcocadetia wariana.* Population size in not known.

***Eremochloa ciliaris* (Poaceae):** A slender grass inhabiting Eucalyptus woodland habitats. Known from a number of collections on Badu and on Mua where it occurs in woodland and shrubland habitats on alluvial outwash. It also occurs in far northern Cape York Peninsula. The species is poorly known and targeted survey is required to assess its abundance, distribution and conservation status. The habitat for this species is in good condition.

***Hoya annulata* (Apocynaceae):** A slender epiphytic vine with milky exudate known only from a small area on Cape York Peninsula, Mua Island and Papua New Guinea. On Mua it is restricted to an area of evergreen notophyll vine forest on granite between 300 and 400m altitude. Population size is currently unknown. Individuals and habitat have been previously impacted by construction of radio telecommunications towers. Threatening processes include tower maintenance activities and potential proliferation of weeds such as Brazilian joyweed (*Alternanthera brasiliana*), which is establishing on the margins of the habitat.

***Hoya revoluta* (Apocynaceae):** An epiphytic, succulent vine with white latex previously known only from Mt Cornwallis on Dauan Island in evergreen notophyll vine forest amongst granite boulder fields. It also occurs on the islands of Indonesia, Irian Jaya and is common and widespread in Papua New Guinea (Forster & Liddle 1993, 1996). Shares similar habitat to *Hoya annulata*, *Dischidia littoralis* and *Secamone auriculata* in evergreen notophyll vine forest on granite between 300-400m altitude. Population size is currently unknown. Individuals and habitat may have been previously impacted by construction of radio telecommunications towers. Threatening processes include tower maintenance activities and potential proliferation of weeds such as Brazilian joyweed (*Alternanthera brasiliana*) which is establishing on the margins of the habitat.

***Neololeba atra* (Poaceae):** A native bamboo known from Torres Strait, Cape York and North Eastern Qld in the understorey of rainforest habitats. Also occurs in New Guinea, the

Moluccas, northern Sulawesi and the Philippines. On Badu it is typically associated with the understorey of Welchiodendron vine forests (VC 4a). Known also in the Torres Strait from Mua (1i, 2o, 3d), Badu (4a), Dauan (7a), Mer (2j), Iama, Erub, and Naghir. Populations on Mua are considered restricted but robust with no apparent threatening processes.

Pandanus zea (Pandanaceae): Commonly known as corn cob pandan on account of the shape of its fruiting parts, this pandan has characteristic long slender prop roots. In the Torres Strait it is restricted to upland evergreen notophyll vine forest and thicket on the crests and windsheared upper slopes of Mua Peak and along swampy alluvial riparian zones in evergreen vine and swamp forest. It is also known from Cape York in the well developed rainforests, usually on alluvial situations at Lockerbie, and the Iron Range/Claudie River south to the McIlwraith Range. Endemic to the Cape York Peninsula bioregion with Mua populations being disjunct and representing the northern limit of ditribution.

Sterculia shillinglawii subsp. shillinglawii (*Sterculiaceae*): Commonly known as tulip sterculia this large canopy rainforest tree is very restricted in Queensland occurring in a few scattered rainforest habitats in the Claudie River area and Lockerbie near Bamaga. It also occurs in PNG and New Britain. The Mua Island occurrences are restricted to the best development of rainforest, being evergreen notophyll vine forest on the upper granite slopes and crests of Mua Peak, in semi deciduous vine forests inhabiting lower granitic footslopes, and swampy alluvial vine forest on riparian zones. Populations appear robust and free of threatening processes.

Syzygium beuttnerianum (*Myrtaceae*): Commonly known as New Guinea satinash, this is a rare tree in Australian territory and is restricted to the best developed lowland rainforest areas of Cape York Peninsula (Lockerbie near Bamaga and Iron Range/Claudie River), and Mua Island. It also occurs in PNG where it is considered a major exportable hardwood (Conn & Damas 2011). It is a large tree of the canopy with buttressing, a cylindrical bole, and characteristic brownish, slightly rough, scaly or papery outer bark. The pink flowers produced in terminal clusters are prolific and attractive rendering the tree worthy of cultivation as an ornamental tree of parks and gardens (Hyland *et al.* 2003). The Mua Island occurrences are disjunct and restricted to the best development of rainforest, that is; evergreen notophyll vine forest on the upper granite slopes and crests of Mua Peak; and swampy alluvial vine forest on riparian zones. Population size is not known. Habitats appear in good condition although the Mua Peak site has been impacted in the past by clearing and construction of a telecommunication tower.

Nominated for Vulnerable Status

***Habenaria vatia* (Orchidaceae)**: This small terrestrial orchid is endemic to Torres Strait with a single population recorded from Mua Island in open woodland of Melaleuca and Pandanus (Jones 2006, Qld Herbarium 2011).

Regional Significance

The classification of regionally significant species takes into account factors such as disjunct occurrence, endemism (at the bioregional, bioiprovince, and island scales), limits of geographic distribution, and local rarity in the landscape. The presence of a number of habitats which are endemic to Mua and the Torres Strait Islands, together with high habitat diversity, has contributed to the presence of numerous species which are either disjunct and/or at the limits of their geographic range. The 74 species recognised are listed below in **Table 5.**

Table 5. Summary of regionally significant flora species, Mua Island.

Species	Comments
Acmena hemilampra subsp. hemilampra (Myrtaceae)	A large tree to 25m. In Torres Strait the occurrences are disjunct representing northern limit of Australian distribution. Occurs in riverine and swamp forest habitats on Badu (3e, 3g, 6g) and on Mua (1i, 1j, 3a, 9a). Also known from eastern Australian rainforests and in southern Papua New Guinea (PNG).
Acmenospermum claviflorum (Myrtaceae)	A tree of the canopy and subcanopy. On Mua it inhabits evergreen notophyll vine forest on granites where it is common. In Torres Strait the occurrences are disjunct representing northern limit of Australian distribution.
Acronychia imperforata (Rutaceae)	A small tree of the understorey. Rare in Torres Strait with Mua populations in vine forest of swampy alluvium and foothills being disjunct and representing northern limit of distribution.
Acronychia sp. (Batavia Downs J.R. Clarkson 8511) (Rutaceae)	A tree of the understorey and sub canopy. Mua populations in vine forest of swampy alluvium and foothills. Scattered disjunct populations on Torres Strait Islands representing northern limits of distribution.
Actephila venusta (Euphorbiaceae)	A low understorey shrub 1-2m. A northern Australian endemic known from NT and Cape York Peninsula (CYP). Disjunct occurrences on a number of Torres Strait continental islands i.e. Mabuiag, Badu, Mua, Prince of Wales, and Dauan represent the northern limit of distribution.
Aglaia brownii (Meliaceae)	A small tree of the subcanopy. On Mua it inhabits evergreen notophyll vine forest on granites where it is rare. This is the only known occurrence in Torres Strait. A disjunct population representing the northern limit of its Australian distribution. Also occurs in WA, NT, CYP and PNG.
Aglaia euryanthera (Meliaceae)	A small tree of the understorey and subcanopy. On Mua it is restricted to evergreen notophyll vine forest on granites where it rare. A disjunct population representing northern limit of Australian distribution. Also occurs in CYP and PNG.
Aglaia sapindina (Meliaceae)	A small tree of the understorey and subcanopy. On Mua it is restricted to evergreen notophyll vine forest on granites where it is rare. This is the only known occurrence in Torres Strait. A disjunct population representing the the northern limit of its Australian distribution. Also occurs in NT, CYP, NEQld and PNG.
Aglaia tomentosa (Meliaceae)	A small tree inhabiting the understorey of well developed rainforests. Rare on Mua and restricted to the best development of rainforest (1e, 2o, 3c). Occurs on Badu in 1d rainforest and in Welchiodendron forest with robust thicket species understorey (4a). Also recorded in Torres Strait from Prince of Wales (2q), Dauan (1a) and Hammond (2r, 4a). Occurs in rainforests from between Cooktown and Innisfail and north to PNG, Solomons, Malesia and SE Asia. Mua populations are highly disjunct representing part of the northern limit of Australian distribution.
Alstonia scholaris (Apocynaceae)	A large canopy tree known from CYP and NEQld south to central Qld. Also widespread in PNG and Asia. Restricted on Mua to best development of vine forest on steep granite slopes and on foothills. Otherwise rare in Torres Strait Islands. Mua population is disjunct.
Anthocarapa nitidula (Meliaceae)	A canopy tree known from CYP, NEQld south to NSW. Also occurs in PNG. Restricted on Mua to best development of vine forest on steep granite slopes. Otherwise rare in Torres Strait Islands. Mua population is disjunct.
Argyrodendron polyandrum (Sterculiaceae)	A canopy tree known from CYP, NEQld. Also occurs in PNG. Restricted on Mua to best development of vine forest on steep granite slopes. Otherwise very rare in Torres Strait. Mua population is disjunct.

Species	Comments
Aristolochia acuminata (Aristolochiaceae)	A vine recorded on a number of islands including Mer, Dauan, Iama, and Gabba, and from SE Asia, PNG and the Solomons. Torres Strait populations are disjunct representing the northern limits of Australian distribution. The species is food plant for the larval stages of the Cape York Birdwing and Red Bodied Swallowtail Butterflies (Common & Waterhouse 1981).
Arytera divaricata (Sapindaceae)	A small tree which occurs in vine forest areas. The Torres Strait Island occurrences are part of a number of disjunct populations and the northern limit of the species distribution in Australia.
Asplenium laserpitiifolium (Aspleniaceae)	An epiphytic and lithophytic fern known from NE Qld south from McIlwraith range to Rockingham Bay, and north through India, Asia Malesia and Pacific Islands. Disjunct population occurs in evergreen rainforest on Mua Peak.
Atalaya australiana (Sapindaceae)	A shrub or small tree to 10m inhabiting rainforest, vine thicket understorey and margins of Welchiodendron forests on rhyolite hills (2o, 4a). A Qld endemic known from Iron Range to Chillagoe in vine thickets and open forests. Known elsewhere in Torres Strait from Gebar, Naghir (2t, 2u), Erub (2k, 17b), Muralug (16d), Badu (4a) and Friday (16e). Mua populations are disjunct and representing part of northern limits of distribution.
Berrya javanica (Sparmanniaceae)	A small tree known from CYP and NT through to Asia and Malesia. Rare and restricted in Torres strait to Erub, Prince of Wales (PoW) and Mua. Mua populations are disjunct.
Breynia sp. (Black Mountain, B. Hyland 25658RFK) (Phyllanthaceae)	A northern Qld endemic restricted to Cooktown area and CYP. Mua population in vine forest and thicket is disjunct representing northern limit of distribution.
Bridelia finalis (Phyllanthaceae)	A small tree to 10m endemic to CYP bioregion known from deciduous vine thickets. Not recorded elsewhere in Torres Strait to date. Mua populations in vine forest and thicket are disjunct representing northern limit of distribution. Population size unknown.
Bromheadia pulchra (Orchidaceae)	A terrestrial orchid with erect flattened cane like stems. Known from CYP in open swampy wet heath sites between Hopevale and Bamaga. Disjunct Mua occurrence in Melaleuca shrubland on poorly drained sands is unique to Torres Strait. Also occurs in PNG and Indonesia.
Calophyllum australianum (Clusiaceae)	A canopy tree endemic to Qld. Mua populations in evergreen notophyll vine forest on granite are disjunct and the northern limit of its distribution.
Canarium vitiense (Burseraceae)	A canopy tree infrequently recorded from Torres Strait in only the best development of rainforest. Recorded only from Mua and PoW. Occurs from Fiji and PNG through to Wet Tropics.
Clausena brevistyla (DGF8987a+) (Rutaceae)	A small tree in rainforest understorey. Disjunct occurrence on Mua. Rare in Torres strait with distribution extending south through Cape York Peninsula, Wet Tropics and into SE Qld and northern NSW. Also in PNG.
Cleistanthus apodus (Phyllanthaceae)	A small tree found on Mua in riparian rainforest. Rare in Torres Strait with a distribution from CYP to the Ingham area.
Commersonia sp. (DGF8919a) (Byttneriaceae) *possibly C. bartramia*	A small tree of rainforest margins. Rare in Torres Strait being only recorded on Mua. Otherwise found in PNG and south through CYP to northern NSW.
Corymbia tessellaris (Myrtaceae)	A tree to 30m. Rare and restricted in Torres Strait recorded only from Mua and PoW on alluvial sites. Populations are disjunct. Occurs in southern PNG and south through Cape York Peninsual to NSW.
Cryptocarya bamagana (DGF8989+) (Lauraceae)	A small tree endemic to the CYP bioregion. Rare in Torres Strait being only recorded from riparian rainforest on Mua. Disjunct Mua occurrence represents northern limit of distribution.
Cryptocarya brassii (Lauraceae)	A small tree known from CYP and in southern PNG. Rare in Torres Strait being only recorded from riparian rainforest on Mua and possibly Badu.
Cryptocarya hypospodia (Lauraceae)	A large canopy tree only recorded in Torres Strait from disjunct populations on Mua Island in riparian and foothill rainforest.
Dictyoneura obtusa (Sapindaceae)	A rainforest shrub rare in Torres Strait and restricted to Mua Island in riparian and evergreen rainforest on granites.
Diospyros sp. (Kuranda L.J.Webb+ 7265A) (Ebenaceae)	A shrub endemic to northern Qld. Restricted to a few rainforest habitats in Torres Strait including Mua Island.
Dysoxylum latifolium (Meliaceae)	A canopy tree only recorded in Torres Strait from Mua Island in foothill rainforest. Known from CYP to Cardwell and in NT, WA, PNG and Solomons.
Elaeocarpus arnhemicus (Eleocarpaceae)	A tree restricted to a few scattered rainforest habitats across Torres Strait.
Elattostachys rubrofructus (Sapindaceae)	The disjunct Mua Island occurrence of this small rainforest tree is the only record south from PNG.
Ellatostachys microcarpa (Sapindaceae)	A small rainforest tree endemic to northern Qld. In Torres Strait it is only known from Saibai and Mua, representing the northern limit of distribution.

Species	Comments
	Occurs in CYP from Bolt Head south to Cairns.
Erythroxylum sp. (Mosquito Creek J.R. Clarkson 9991+) (Erythroxylaceae)	A shrub to 2-5m in height. Found on Mua within Welchiodendron forests on rhyolite hills. Endemic to the CYP bioregion where it is known from the north eastern coast. Reaching its northern limit of distribution on Mabuiag. Other disjunct occurrences in Torres Strait include PoW, Hammond, Badu and Friday Islands.
Euonymus australiana (Celastraceae)	A shrub 2-4m. Uncommon in understorey of better developed examples of vine forest. The Mua populations are restricted to vine forest on Mua Peak and alluvial zones. In the Torres Strait it is also known from Badu, Dauan and Mabuiag. The occurrence is highly disjunct and represents the most northern limit of distribution of a bioregional endemic.
Everistia vaccinifolia (sens. lat.) (Rubiaceae)	A compact shrub 2-4m with rigid stems and small leaves. Rare on the island where it is restricted to understorey of Welchiodendron forests on rhyolite hills.
Flacourtia sp. Shiptons Flat (L.W.Jessup + GJ.D3200) (Flacourtiaceae)	A small tree endemic to the CYP bioregion. Populations on Mua, Mer and Erub are disjunct and represent the northern limits of distribution. It occurs in the understorey of vine thicket and forest.
Garcinia dulcis (Clusiaceae)	A tree reaching the canopy of well developed rainforest. Very restricted and rare in Torres Strait being only known from Mua in evergreen notophyll vine forest on granite and riparian forests. Occurs in CYP south to the McIlwraith Range and in PNG.
Gardenia sp. (DGF10787+) (Rubiaceae)	A shrub recently collected from Mua Peak and not previously known from Torres Strait. Requires identification.
Gnetum gnemon (Gnetaceae) *Badu record (DGF10206 + DJS) Mua record (DGF10803 + DJS)*	A tree to 10m recorded from evergreen notophyll vine forest on steep granite slopes. Also recorded on Badu in a patch of swamp forest on poorly drained alluvium. Gnetum is a PNG genus previously not recorded for Australia. Its Badu swamp forest habitat is impacted by feral pig digging. Population size on Mua is not known. The habitat is in good condition and self maintaining.
Gomphandra australiana (Stemonuraceae)	A tree to 10m in well developed rainforest. Very restricted and rare in Torres Strait being only known from Mua in evergreen notophyll vine forest on granite and riparian forests. Occurs in CYP south to the McIlwraith Range and in PNG.
Haplostichanthus fruticosus (Annonaceae)	A shrub to 2m found in the understorey of vine thicket and vine forest, and Welchiodendron forests on rhyolite slopes. The species is endemic to the CYP Bioregion with a distribution from the McIllwraith Range in the south to Mabuiag Island in the north. The Mua occurrence is disjunct representing part of its northern most limit of distribution. In Torres Strait it was previously known from Badu Island (Jessup 2007), however it also occurs on Dauan (Stanton *et al.* 2009). The fruits are globular and red 7-8mm diameter and bird dispersed.
Helicia australasica (Proteaceae)	A small rainforest tree restricted and rare in Torres Strait being only known from Mua and Badu in evergreen notophyll vine forest on granite and riparian forests. Occurs in CYP south to the McIlwraith Range and in PNG.
Horsfieldia australiana (Myristicaceae)	A tree to 30m with strongly perfumed flowers. Disjunct populations on Mua restricted to moist alluvial situations in Melaleuca open forests and evergreen rainforests (1c, 3c, 3d). Also known from Badu, in CYP from Lockerbie south to the McIlwraith Range, and in the NT and PNG. Mua populations are disjunct and representing part of the northern limit of Australian distribution.
Humata pectinata (Davalliaceae)	An epiphytic and lithophytic fern. Extremely rare in Australia known only from Mua Island, and the McIlwraith Range. Also occurs in PNG and Asia. On Mua it inhabits evergreen notophyll vine forest on granite.
Intsia bijuga (Caesalpiniaceae)	A canopy tree rare and restricted in Torres Strait to a few scattered populations on Dauan, Iama and Mua. Mua populations are disjunct and found in tall evergreen notophyll vine forest of steep granitic slopes and in rainforest of narrow riparian zones. Due to heavy logging regimes in other Pacific and Asian countries, the species has been assigned a 'Vulnerable' status by the IUCN.
Lecanopteris sinuosa (Polypodiaceae)	This fern is widespread through the Malay Peninsula to Malesia and Vanuatu. Very rare in Australia being only known from Mua and near Bamaga.
Licuala ramsayi var. tuckeri (Arecaceae)	The licuala fan palm is rare in Torres Strait being restricted to the understorey of well developed swampy riparian forests on alluvium on Badu and Mua, and to upland evergreen rainforest on Mua. It is the northern variety of *Licuala ramsayi* which is endemic to northern CYP and the Torres Strait. The Mua occurrence is disjunct and represents part of the northern limit of Australian distribution. The habitat is in good condition and self-maintaining.

Species	Comments
Luisia atacta (Orchidaceae)	An orchid which is rare in Torres Strait being found on Mua in evergreen notophyll vine forest on granite. Occurs in CYP and PNG.
Macaranga involucrata var. mallotoides (Euphorbiaceae)	A rainforest shrub. Rare in Torres Strait being only found on Mua and PoW in evergreen notophyll vine forest on granite. Occurs in CYP and PNG.
Mallotus mollisimus (Euphorbiaceae)	A rainforest shrub. Rare in Torres Strait found on Mua in evergreen notophyll vine forest on granite.
Mallotus resinosus (Euphorbiaceae)	A rainforest shrub. Rare in Torres Strait. Found on Mua in evergreen notophyll vine forest on granite.
Manilkara kanosiensis (DGF9168+DJS) (Sapotaceae)	A rainforest canopy tree. Rare in Torres Strait being only found on the upper slopes of Mua Peak in evergreen notophyll vine forest on granite. The species is otherwise known from PNG where it is an uncommon tree known from districts subject to intensive logging. Because of threats to this species within PNG, it has been assigned the international conservation status of 'Endangered' by the IUCN. Its occurrence on Mua is highly significant.
Maniltoa lenticellata var. lenticellata (Caesalpiniaceae)	A tree with compound alternate leaves. On Mua it is rare and only known from vine forest understorey of closed forest. Occurs north from the Nesbit River in north-east CYP to Papua New Guinea (PNG). Disjunct occurrences are known on well-developed evergreen and semi deciduous vine forest on rhyolite and granite substrates on Badu, Dauan, PoW and Mabuiag Islands. The habitat is in good condition and self-maintaining.
Meiogyne cylindrocarpa subsp. trichocarpa (Annonaceae)	A rainforest canopy and subcanopy tree. Rare in Torres Strait being only found on Mua in evergreen notophyll vine forest on granite. Occurs in CYP and PNG.
Meiogyne sp. (Mua Island DG Fell + DJ Stanton) (Annonaceae)	A undescribed rainforest shrub. Rare in Torres Strait being only found on Mua in evergreen notophyll vine forest on granite.
Melodorum scabridulum (Annonaceae)	A vine. Rare in Torres Strait. Known on Mua in evergreen notophyll vine forest on granite.
Miliusa traceyi (Annonaceae)	A shrub to tree to 8m. On Mua it occurs in Welchiodendron forests and vine thickets. Endemic to northern Australia where it is known from seasonal vine thickets and forests in the NT and CYP. This species is a common component of Welchiodendron forests and vine thickets on the majority of the continental islands of Torres Strait. These occurrences are disjunct and in combination represent the species northern limits of distribution. The habitat is in good condition and self-maintaining.
Mischocarpus stipitatus (Sapindaceae)	A rainforest shrub and subcanopy tree. Rare in Torres Strait being only found on Mua in evergreen notophyll vine forest on granite. Occurs in CYP and PNG.
Neolitsea brassii (lauraceae)	A rainforest shrub. Rare in Torres Strait being only found on Mua in evergreen notophyll vine forest on granite. Occurs in CYP and PNG.
Nephrolepis bisserata (Nephrolepidaceae)	A fern. Rare in Torres Strait being only found on Mua and Dauan in evergreen notophyll vine forest on granite.
Nervilia holochila (Orchidaceae)	A terrestrial orchid known from Kimberley, NT, and in NE Qld rom CYP to Bowen. Known from scattered locations across Torres Strait Islands. Inhabits rainforest margins.
Nervilia peltata (Orchidaceae)	A rarely seen terrestrial orchid known from the NT, and in NE Qld from CYP to Hinchinbrook Island. Known from Mua where it inhabits open forests, woodlands and vine thickets. Inhabits rainforest margins..
Palaquium galactoxyllon(DGF9181+) (Sapotaceae)	A rainforest canopy tree. A rainforest canopy tree. Rare in Torres Strait being only found on Mua in evergreen notophyll vine forest on granite. Occurs in CYP and PNG.
Pararistolochia linearifolia (Aristolochiaceae)	A vine found in open forest habitats. Endemic to CYP. Rare in Torres Strait in grassy open forests and woodland habitats.
Philodota imbricata (Orchidaceae)	An epiphytic orchid known from NT, and in NE Qld from CYP to Townsville. Known from scattered locations across Torres Strait Islands however it is rare and restricted. Inhabits rainforest and Welchiodendron forest and margins. Also north to PNG and Indonesia.
Pimeleodendron amboinicum (Euphorbiaceae)	A rainforest canopy and subcanopy tree. Rare in Torres Strait being only found on Mua in evergreen notophyll vine forest on granite. Occurs in CYP and PNG.
Podocarpus grayae (Podocarpaceae)	A tree 10-25m inhabiting the subcanopy and occasionally the canopy of riparian rainforest on alluvium. The habitat is restricted in Torres Strait being only found on Mua, and on Badu where it is less extensive. The species also occurs in CYP where it is restricted to well developed rainforest of the north-east. The distribution extends to PNG. The disjunct populations on Mua and Badu represent the northern limit of Australian distribution of a relict species. The riparian habitat on Mua is linear with sharp transition to adjoining woodlands maintained by fire. These margins appear stable, however high intensity fires have the potential to impact on the habitat of

Species	Comments
	Podocarpus. Damage by feral pigs may impact on seedling regeneration.
Polyalthia australis (Annonaceae)	A small tree rare in Torres Strait. Mua populations in evergreen notophyll vine forest are disjunct. Occurs in CYP.
Polyscias australiana (Araliacea)	A shrub rare in Torres Strait. Mua populations in evergreen notophyll vine forest are disjunct. Occurs in CYP.
Pouteria chartacea (Sapotaceae)	A small tree rare in Torres Strait. Mua populations in evergreen notophyll vine forest and riparian swamp forest are disjunct. Occurs in CYP and NE Qld.
Psydrax graciliflora (Rubiaceae)	A small tree rare in Torres Strait. Mua populations in semi deciduous vine forest vine forest are disjunct. Occurs in CYP and NE Qld.
Psydrax lamprophylla forma latissima (Rubiaceae)	A small tree rare in Torres Strait. Mua populations in evergreen notophyll vine forest are disjunct. Occurs in CYP and NE Qld.
Rhodamnia australis (Myrtaceae)	An understorey shrub to small tree 3-6m. A northern Australian endemic known from CYP and the NT. The occurrences on Mua in swampy riparian forest (3a) and in Badu in the understorey of Welchiodendron forests (4a) are disjunct and represent part of its northern limit of geographical range. In Torres Strait it also occurs on Mabuiag (1d, 2x), and Iama.
Sarcolobus hullsii (Apocynaceae)	A slender vine rare in Torres Strait. Torres strait populations restricted to Mua in evergreen notophyll vine forest on granite. Occurs in CYP and PNG.
Scindapsis altissima (Araceae)	An epiphyte rare in Torres Strait. Mua populations in evergreen notophyll vine forest are disjunct. Occurs in CYP, NE Qld and PNG.
Smilax blumei (Smilacaceae)	A vine rare in Torres Strait. Mua populations in evergreen notophyll vine forest are disjunct. Occurs in CYP and PNG.
Strychnos sp. (DGF8997+) (Loganiaceae)	A small tree rare in Torres Strait. Mua populations in evergreen notophyll vine forest are disjunct. Occurs in CYP and NE Qld.
Syzygium bamagense (Myrtaceae)	A large rainforest tree endemic to CYP. Rare in Torres Strait. Mua populations in riparian vine forest are disjunct. Occurs in CYP.
Syzygium branderhorstii (Myrtaceae)	A culturally significant fruit tree. Rare in its natural habitat in Torres Strait. Mua populations in evergreen vine forest are disjunct. Occurs in CYP and PNG.
Syzygium bungadinnia (Myrtaceae)	A tree to 20m restricted on Mua to evergreen notophyll vine forest on sheltered gullies and slopes, and swampy riparian forest. An endemic to the CYP bioregion occurring from Iron Range in the south to the Torres Strait Islands. The Mua occurrence is part of a number of highly disjunct populations in Torres Strait, which represent the northern limits of distribution. Known also from Mabuiag, Badu, Mer, Erub and Dauan. Fruit is edible.
Syzygium fibrosum (Myrtaceae)	A small rainforest tree. Rare in Torres Strait. Mua populations in evergreen and semi deciduous vine forest are disjunct. Occurs in CYP and NE Qld.
Syzygium forte subsp. potamophilum (Myrtaceae)	A rainforest tree of riparian zones. Rare in Torres Strait. Mua populations in riparian swamp forest are disjunct. Occurs in CYP.
Syzygium puberulum (Myrtaceae)	A rainforest shrub. Rare in Torres Strait restricted to Mua, Dauan and Mer.. Mua populations in evergreen vine forest on granite hills are disjunct. Occurs in CYP and PNG.
Terminalia complanata (Combretaceae)	A rainforest canopy tree. Rare in Torres Strait. Mua populations occurring in evergreen and semi deciduous vine forest are disjunct. Occurs in CYP and PNG.
Terminalia sericocarpa (Combretaceae)	A rainforest canopy tree. Rare in Torres Strait. Mua populations occurring in evergreen and semi deciduous vine forest are disjunct. Occurs in CYP and NE Qld.
Ternstoemia cherryi (Orchidaceae)	A rainforest tree that is very rare in the Torres Strait, found only on Mua Island evergreen notophyll vine forests on granite. Also known from CYP.
Tetrastigma sp. (DGF10786+) possibly T. pisicarpum (Vitaceae)	A vine previously known only from Lockerbie rainforests near Bamaga. Rare in Torres Strait recorded in evergreen notophyll vine forests on granite.
Triflorensia australis (Rubiaceae)	An understorey shrub 2-4m found on Mua in notophyll vine forest on sheltered gullies and slopes and in Welchiodendron dominant forests. Known from Badu, Mabuiag, Mer, Dauan, and Prince of Wales Islands. The Mua occurrence is part of a number of highly disjunct populations which represent the northern limit of distribution. Also occurs in the NT.
Uvaria rufa (Annonaceae)	A scrambling shrub or liana known from vine forest and thicket habitats between Coen and Thailand. Occurrences on Mua (4a) as well as Mer, Erub, Mabuiag, Badu, Prince of Wales and Iama are disjunct and restricted. Fruit is edible.
Voacanga grandiflora (Apocynaceae)	A shrub to small tree with large leaves and a copious milky sap. In Torres Strait it is restricted to vine forest habitats on Mua (2v, 3d), and Badu (4a) with an unconfirmed record from Erub. Occurs on the north eastern part of CYP and in PNG and Malesia. The Mua occurrence is disjunct.

5.2.2 Introduced Plants

Information on weed species has been sourced from Stanton *et al.* (2009), Queensland Herbarium specimen data, field data of Fell (2009, 2010), and personal communication with Barbara Waterhouse from Department of Agriculture Forestry and Fisheries (DAFF). A total of 67 naturalised species occur on the island which represents 10% of the islands total flora assemblage. The majority of species are associated with heavily disturbed and developed areas within and surrounding the St Pauls and Kubin communities and fringing disturbed sites such as major roads and tracks, dumps, airfield, recreation areas and old settlement sites. Remnant vegetation throughout the island is generally free of weeds, however a number of species pose potential threats.

Declared Weeds

Three species occur on the island which are declared on the LP Act and have the potential to degrade the islands natural and cultural resources.

Singapore daisy - *Sphagneticola trilobata* (Class 3)

Singapore daisy is a vigorous creeping ground cover that has become established on Badu in a number of locations in and around the community. The plant will out-compete most native plants in natural habitat and is a significant threat to riparian and swampy habitats across the island. Control of existing populations is the highest priority management action.

Rubber vine - *Cryptostegia grandiflora* (Class 2)

Rubber vine is an aggressive shrub like vine which is a major weeds problem in northern Queensland. It has been observed as a garden plant in a number of house yards around Kubin where it is valued for its attractive purplish mauve flowers. The plant has not been recorded outside the community area. It has wind-blown seeds which have the potential to spread in adjoining native vegetation.

Prickly pear - *Opuntia stricta* (Class 2)

A few scattered plants of prickly pear occur along the foreshore of St Pauls with plant parts thought to have been washed up on the shore and establishing. This cactus was probably introduced into the St Pauls community as a garden plant and for its red edible fruits. It has not spread into adjoining vegetation. However there remains a potential for it to do so. Control of any scattered infestations is recommended.

Yellow Bells – *Tecoma stans* (Class 3)

A shrub or small tree to 5 m high native of tropical America, but now present through the Americas to south-western Argentina, and in northern and eastern Australia. Seeds are wind

dispersed with papery wings. It is an ornamental which is widespread on numerous islands in the Torres Strait that threatens a range of natural communities, particularly open grassland and shrubland habitats on sand dunes and more fertile soils. At present on Mua, the species is restricted to disturbed areas around settlements.

Environmental Weeds Present

Remnant vegetation throughout the island is generally free of environmental weeds although species such as stinking passionflower (*Passiflora foetida*), mint weed (*Hyptis suaveolens)*, red Natal grass (*Melinis repens*) and Townsville stylo's (*Stylosanthes spp.*) may be established along access tracks and any disturbed sites. Community areas of Kubin and St Pauls support considerable numbers of exotic plants. The major weeds which occur on the island and which are currently or have the potential to threaten environmental and cultural values are summarised below.

Leucaena (*Leucaena leucocephala*)

Leucaena is an exotic tall shrub to small tree up to about 6 m tall with fine bipinnate leaflets. The weed is present on a number of islands in the region including Boigu, Saibai, Badu, Erub, Ugar, Thursday and Horn Islands. The weed is entrenched within the St Pauls and Kubin community areas with dense infestations in house yards, and along roadsides. Given the abundance of the plant and its roadside occurrence there is a very high likelihood that it will be dispersed to other parts of the island by mechanical means such as machinery and associated soil movement, and vehicles. Outlying infestations recently located by the rangers are currently a focus for weed management efforts. The weed poses a significant threat to cultural and natural values of the island.

Calotrope (*Calotropis gigantea*)

A few scattered individuals of this bushy shrub occur along the foreshore areas of the St Pauls community, and on beachfronts to the south of Saveka Point. The plant has milky sap which exudes from broken leaves and stems. Another species *Calotropis procera* is a recognised environmental weed in northern Queensland and the Northern Territory with an ability to form dense thickets on alluvial flats. It is likely that the species on Mua has been present for many years with no noticeable spread. Given its toxicity and potential for spread, any Calotrope plants should be considered undesirable and controlled as appropriate.

Brazilian joyweed (*Alternanthera brasiliana*)

This is a purple leaved perennial ground herb often used in garden areas. This herb has the ability to grow in low light conditions spreading along the ground by adventitious roots. It is considered a threat to rainforest habitats where it may gradually displace native groundcovers and prevent germination of trees, shrubs and vines. The occurrence of this plant on Banks Peak around the telecommunication infrastructure is likely to have been associated with the movement of construction equipment from the St Pauls area. It occurs over a small area of

approximately 5 square metres on the edge of the rainforest. Control of this infestation by hand weeding or with targeted herbicide use is a very high priority.

Tropical kudzu (*Pueraria montana var. lobata*)

Kudzu is a robust and aggressive tropical legume with large hairy trifoliate leaves and a large edible underground tuber. Kudzu is originally from Asia, and is naturalised in New Guinea, other parts of Malesia and the Pacific Islands where it is utilised as a forage crop, a food resource, and for medicinal purposes. It is now naturalised in Cape York Peninsula, north-eastern Queensland and southwards as far as north-eastern New South Wales usually growing on disturbed sites and agricultural land, and sometimes on rain forest margins. On mainland Queensland the vine is a Class 2 declared weed and is listed as noxious in NSW. The IUCN has listed kudzu among the world's 100 worst invasive species (IUCN Global Invasive Species Database 2002) and it is a severe problem in the USA and Japan.

Kudzu has been present in Queensland since at least 1941 and its origin is unclear. The Torres Strait recorded occurrences are from Dauan, Mua, Hammond and Erub Islands (Herbrecs Data 2011). Torres Strait Islanders consider it to be native and there is some evidence that it has a long history of use and transportation as a source of food, possibly originating in Asia but then taken south through Indonesia and across the Pacific (Csurhes 2008). On Mer the tuber is a traditional food resource known as 'Weskapu'.

The declared status of kudzu does not apply in the Torres Strait. Recent studies (Csurhes 2008), have raised doubts as to the botanical identity of the plant given that Torres Strait Islands populations do not appear to be invasive and appear far less aggressive than kudzu in South East Queensland. However on the evidence of recent field observations (D. Fell pers. obs. March 2011), Kudzu was affecting native vegetation by climbing and smothering forest edges, and is therefore considered as an emerging threat to forest ecosystems on Mer. Further observations are required to monitor the spread of Kudzu on Mua and its impact on native vegetation.

Praxelis (*Praxelis clematidea*)

Praxelis is a highly invasive erect, branched, unpleasant-smelling herb first observed on Badu and Mua in 1999 by Barbara Waterhouse who notes that it is thought to have been introduced as a contaminant of building materials or equipment (DERM 2011). It is a native of South America, and known to spread rapidly by wind-blown seeds along roadsides. It can spread into native bushland forming dense monospecific stands that exclude other vegetation. Praxelis is known to invade grasslands, woodlands and rock pavements in the Mareeba and Mt Molloy districts and therefore is considered a serious threat to similar habitats on Mua.

Other Environmental Weeds

Other common weeds which are prominent around the community areas include legumes such as stylo's (*Stylosanthes* spp.), siratro (*Macroptilium atropurpureum),* phasey bean (*Macroptilium lathryioides*), beggar weed (*Desmodium tortuosum*), velvet bean (*Mucuna pruriens* var*. utilis*), centro (*Centrosema molle*), streaked rattlepod (*Crotalaria pallida* var. *obovata*), sensitive seed (*Mimosa pudica* var*. unijuga*), alyce clover (*Alysicarpus vaginalis*), coffee bush (*Senna occidentalis*) and ringworm shrub (*Senna alata*). The latter forms very dense infestations in the St Pauls community area although has not spread into adjoining bushland.

Herbaceous weeds such as tridax daisy (*Tridax procumbens*), sida (*Sida acuta*), snake weed (*Stachytarpheta jamaicensis*), and mint weed (*Hyptis suaveolens*) also occur throughout disturbed areas and, in combination with the aforementioned, may be rapid colonisers of any disturbed areas. Sprawling ornamental shrubs such as Rangoon creeper (*Quisqualis indica),* coral vine (*Antipogon leptopus*), clerodendrum (*Clerodendrum* sp.) and cassia (*Senna* sp.) which are prominent in community areas have been known to invade native vegetation on other continental islands in the region.

Grassy weeds are widespread throughout the disturbed areas of St Pauls and Kubin and some species pose a threat to grasslands and grassy woodland habitats. The most problematic grasses are annual mission grass (*Cenchrus pedicellatum subsp. unispiculum*), para grass (*Brachiaria mutica*), and the robust *Themeda intermedia*.

Robust swards of annual mission grass occur around the northern margins of the St Pauls community and have a very real potential to spread along tracks and road into the extensive grasslands to the west of the community. It is an aggressive robust annual grass capable of inducing habitat change through altering fire behaviour and is known from Badu, Mabuiag, Masig, Poruma and Horn Islands. The invasion of annual mission grass is listed as a Key Threatening Processes under the EPBC Act, threatening biodiversity in northern savannas by competing with native annual grass species and rapidly occupying disturbed areas. It has the ability to remain green until the late dry season providing fuel for fires which occur later and are hotter than normal seasonal fires (DEWHA 2011).

Para grass is a South American grass which infests wetlands, creeks and swampy sites with a potential to out compete native grasses and sedges and modify wetland ecosystems. Heavy infestations of para grass are also prominent in drainage lines just west of St Pauls.

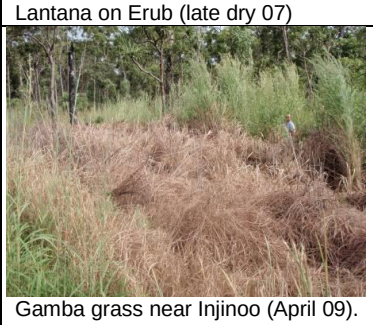
A small infestation of *Themeda intermedia* is also known from the western outskirts of St Pauls. This is a very robust and aggressive looking grass that should be a focus of ongoing control efforts.

Other less problematic introduced grasses which occur in the community areas include: Mossman River grass *(Cenchrus echinatus*), Rhodes grass *(Chloris gayana*), purpletop Rhodes grass *(Chloris virgata*), couch *(Cynodon dactylon*), crowsfoot *(Eleusine indica*), red Natal grass *(Melinis repens*), button grass *(Dactyloctenium aegyptium*), and itchgrass *(Rottboellia cochinchinensis*).

Weed Threats

Weeds not recorded on Mua which are capable of causing long-term changes to biodiversity are listed in **Table 6**.

Table 6. Weed threats.

Species	Comments	Photograph[5]
Lantana (*Lantana camara*)	Lantana is a Class 3 Declared Weed and listed as Weed of National Significance (WONS). It is currently widespread on Mer, Erub and Ugar and poses a potential threat to Mua. Ongoing monitoring and prompt control of any infestations is recommended.	 Lantana on Erub (late dry 07)
Gamba grass (*Andropogon gayanus*)	Gamba grass is a Class 2 Declared Weed that has not yet been recorded in Torres Strait. However, it is considered a serious potential threat. Together with annual mission grass it is listed as a Key Threatening Processes under the EPBC Act. The species has recently been listed as a WONS species. It is widespread in the Bamaga district of northern CYP (Fell *et al*. 2009). The grass is an aggressive colonist which develops a standing biomass of 5-7 times that of native species resulting in extremely intense fires (Rossiter *et al*. 2003).	 Gamba grass near Injinoo (April 09).

5.2.3 Flora with Cultural Significance

The information on useful plants of Mua Island currently available to the authors is insufficient to provide any detailed account. Further fieldwork by the Land and Sea Rangers coupled with review of literature is required with the information to be incorporated into an appropriate Traditional Ecological Knowledge (TEK) system. This includes information on uses, seasonality, habitat, distribution, abundance, phenology, and most importantly the relationships to story and culture. The flora species list provided in **Appendix C and D** offers a foundation for a more formal assessment of useful plant species.

6.0 Fauna (Animals)

As for the majority of Torres Strait Islands there is a considerable lack of systematic survey of fauna habitats on the island. Avifauna (birds) have been the most well studied component of Torres Strait's terrestrial fauna. Other records are incidental, or part of broader regional surveys targeted towards particular groups (e.g. Draffan *et al.* 1983, Clarke 2004, Garnet *et al*. 2000, Hall 2008, Helgen 2004). Recent surveys on Mua (Conics 2008b, 2008c) while limited, represent the most comprehensive data available for the island. In addition, there is little available information on the cultural significance of terrestrial fauna species. Some data on this topic can be found in the *Reports of the Cambridge Anthropogical Expedition to Torres Straits* (Haddon 1901-1935). Systematic collecting across the range of habitats is however likely to greatly increase the number of known species and further contribute to the identification and development of management strategies. It is therefore

[5] All photographs D.Fell & D. Stanton unless otherwise noted.

recommended that surveys become an identified ranger work activity, supported by relevant specialists.

A desktop review of reports and databases identified 229 fauna species that have been reported for Mua Island (**Appendix E**). This includes eight frog, 40 reptile, 158 bird and 23 mammal species. Of these, one reptile, one bird and five mammal species are introduced. An additional six species have been identified by the Protected Matters Search Tool as possibly occurring. This can be compared with the 384 terrestrial fauna species that have been reported for the broader Torres Strait Island group (see **Appendix E**) which includes 14 frog, 67 reptile, 263 bird and 40 mammal species.

6.1 Culturally Important Fauna Species

Although the current information on useful animals of Mua Island available to the authors is insufficient to provide any detailed account, the familiarity of Torres Strait Islanders' with the natural world was noted over 100 years ago by the English anthropologist Alfred Cort Haddon (1912:230):

> *'[they] are good field naturalists and have names for a large number of plants and animals. A considerable number of plants are utilised in one way or another, more so than we have mentioned in these Reports. Although the land fauna is deficient in forms of economic importance, the natives have names for animals which are not of value to them, and are acquainted with their habits; their knowledge of the natural history of marine animals being very extensive. The uses and properties of most of the plants are known to them'.*

The region's birds, mammals and reptiles also have cultural significance for Torres Strait Islanders. Many feature in local myths and legends, and some are clan totems. The calls of some birds are recognised as omens, foretelling events such as weather, the arrival of a ship or the death of a relative (e.g. Haddon 1908:260-261), others are 'calendar species' which alert people to the fact that a particular food resource is now available. Feathers from birds such as herons (*Egretta sacra* and *Ardea* spp.) and the cassowary (*Casuarius casuarius* – obtained from Papua New Guinea traders) continue to be used for traditional head dresses.

Further fieldwork by the Land and Sea Rangers coupled with review of literature is required, with incorporation of this information into an appropriate TEK system. This includes information on uses, habitat, distribution, abundance, and most importantly the relationships to story and culture. The fauna species list provided in **Appendix E** and **E1** of this report provides a foundation to incorporate language names and habitats.

6.2 Fauna Habitat Values

There has been very limited fauna work conducted on Mua Island with very few documented records of even common species (*eg* DERM 2010f) and the faunal values of the island remain poorly known. Conics (2008b) states that disturbance to the island's ecology is largely constrained to the immediate township areas, which are contained within relatively small distinct catchments. Mua Peak (Banks' Peak) and north-westerly flowing catchments are areas of high environmental value with little current

development impacts other than powerline and road infrastructure. Watercourses outside of the townships display negligible disturbance, no erosion and maintain high water quality. It is likely that further survey work will discover species as yet unrecorded for the island, particularly in less accessible areas.

The reported frog fauna is eight species (**Appendix E**), all of which are widespread, common species. The frog fauna of the Torres Strait is somewhat depauperate based on known records, and the majority of species are confined to larger islands such as Mua and/or islands close to Cape York Peninsula. A few additional species may yet be found, particularly in the swampy interior of the island.

The reptile assemblage, 40 species (**Appendix E**), is comparatively large (Ingram 2008) and Mua Island appears to be the southern limit for emerald monitor and, with Badu Island, the northern limit for a few Australian species. It is likely that more species will be recorded should further survey work be undertaken. The rock pavements and vine forest are likely habitats for additional reptile species.

Most of the bird species recorded in the Torres Strait are highly mobile and many are migratory, including many species that are not listed as Migratory under the EPBC Act. It is likely that any additional species reported for Mua Island will be highly mobile species. Mua Island has the highest number of bird species reported for any of the Torres Strait Islands, and the most terrestrial vertebrate species overall. Draffan *et al*. (1983) note that the number of bird species found on islands is a function of the area of forest and woodland rather than the area of the island itself. Mua Island is the second largest of the Torres Strait Islands and has the highest peak and a variety of habitat types. Mua Island is therefore, one of the Torres Strait Islands most likely to support as yet unreported species and may harbour some less mobile species.

Thirty-four native mammal species are reported or predicted for the Torres Strait (**Appendix E**), though the likelihood of some of these species actually occurring is considered doubtful and the identification of other species is questioned. Regardless, the native mammal fauna of the Strait is dominated by bats, with 20 reported species. Seven rodents are reported, though only one, grassland melomys *Melomys burtoni*, is widespread. No dasyurids (quolls) or possums and gliders are reported, and current records of macropods are limited to islands to the south. Given the size and location of Mua Island it is expected that some native mammals will be added to the species list other than bats through further survey work, particularly a targeted trapping program.

6.3 Animal (Fauna) Species with Conservation Significance

In this report fauna of conservation significance include:

- Species listed as Critically Endangered, Endangered or Vulnerable under the Commonwealth's EPBC Act including those listed as Migratory.
- Species listed as Endangered, Vulnerable or Near-Threatened under *Queensland's* NC Act.
- Species considered of 'critical' or 'high' priority under the Back on Track framework (DERM 2011a).

Other species may be assessed as being significant at the regional scale (i.e. Torres Strait) by the study team based on criteria such as local rarity, state and bioregional endemism, limits of distribution and disjunct occurrences.

6.3.1 Critically Endangered, Endangered, Vulnerable and Near-Threatened Species

The following section provides an overview of those species that are known to occur, or potentially occur on Mua Island. Twenty-five of the 384 species reported or predicted for the Torres Strait are listed as Critically Endangered, Endangered, Vulnerable or Near-Threatened under the EPBC Act and/or NC Act. Fifty-eight species are listed as Migratory under the EPBC Act (see **Appendix F**). The islands of the Torres Strait have been inadequately surveyed for fauna so records and predictions from throughout the Strait are included to aid in the identification of additional likely species for Mua Island. **Table 7** lists the 15 conservation significant species whose reported occurrence is considered on Mua Island based on habitat suitability and regional distribution. Profiles for known species are provided in **Section 6.3.2** and for likely species in **Appendix F.** An additional three species are predicted to occur on Mua Island by the EPBC Protected Matters search tool.

Table 7. Threatened[1] fauna species reported or predicted[2] to occur on Mua Island.

Scientific Name[3]	Common Name	Status[4]			Comments[6]
		EPBC Act	NC Act	BoT[5]	
SPECIES REPORTED					
Crocodylus porosus	Salt-water crocodile	M	V		Unpublished record.
Lepidodactylus pumilis	Slender chained Gecko		NT		Museum and published records.
Emoia atrocostata	Littoral whiptail-skink		NT		Database record.
Varanus prasinus	Emerald monitor		NT		Museum, database & published records.
Tadorna radjah	Radjah shelduck		NT		Database & published records.
Ephippiorhynchus asiaticus	Black-necked stork		NT		Database record.
Accipiter novaehollandiae	Grey goshawk		NT		Published & unpublished records.
Erythrotriorchis radiatus	Red goshawk	V	E	high	Database & published records (same unconfirmed 1919 record).
Esacus magnirostris	Beach stone-curlew		V	high	Database & published records.
Numenius madagascariensis	Eastern curlew	M	NT		Database & published records.
Sternula albifrons[7]	Little tern	M	E	high	Published record.
Dobsonia magna[8]	Bare-backed fruit-bat		NT		Database & published records.
Nyctimene cephalotes	Torresian tube-nosed bat		NT		Database record.
Hipposideros cervinus	Fawn leaf-nosed bat		V	high	Museum, database & unpublished records.
Taphozous australis	Coastal sheathtail bat		V	high	Museum & database records.
SPECIES PREDICTED[2]					
Pteropus conspicillatus	Spectacled flying-fox	V	LC	high	Predicted by the EPBC Protected Matters Search Tool –

Scientific Name[3]	Common Name	Status[4]			Comments[6]
		EPBC Act	NC Act	BoT[5]	
					occurrence considered unlikely.
Saccolaimus saccolaimus nudicluniatus	Bare-rumped sheathtail-bat	CE	E	high	Predicted by the EPBC Protected Matters Search Tool – occurrence uncertain.
Xeromys myoides	Water mouse	V	V	high	Predicted by the EPBC Protected Matters Search Tool – occurrence considered possible.

1. Listed as Vulnerable, Near-Threatened or Migratory under the EPBC Act 1999 and/or the NC Act 1992 or of critical or high priority under the Back on Track prioritisation framework (DERM 2011a).
2. Predicted by the EPBC Protected Matters Search Tool maintained by DSEWPC (2011g). Only noted if not recorded from another source.
3. Nomenclature follows the Australian Faunal Directory (DSEWPC 2011d).
4. Status: V = Vulnerable, NT = Near-Threatened, M = Migratory, LC = Least Concern (Common).
5. BoT = Back on Track priority species.
6. Known from Museum records, published literature (*eg* Storr 1973; Draffan *et al*. 1983; Ingram 2008), WildNet database and/or reports and other grey literature (*eg* Conics 2008b, c). These sources are not necessarily mutually exclusive. Salt-water crocodile known from unpublished 2011 survey record (Terry Reis).
7. Listed under the EPBC Act as *Sterna albifrons* (Bonn Convention, CAMBA, JAMBA, ROKAMBA).
8. Listed under the NC Act as *Dobsonia moluccensis*.

Additional Species Possibly Occurring

The EPBC Protected Matters Search Tool predicts the possible presence of spectacled flying-fox, bare-rumped sheathtail-bat and water mouse on Mua Island (**Table 7**). Spectacled flying-fox is an obvious and easily identified species and its occurrence is the least likely, unless occasional individuals occur within large numbers of black flying-fox *Pteropus alecto* and are overlooked. Any valid assessment of the possible presence of bare-rumped sheathtail-bat and water mouse requires specialised survey techniques to be conducted.

The local community report the presence of freshwater turtles in a number of ponds around St Pauls. There are two freshwater turtle species known from the Torres Strait, an Australian Museum specimen of northern long-necked turtle (*Macrochelodina rugosa)* from Saibai Island and a Queensland Museum record of Jardine River turtle (reported in Conics 2008a) for Erub Island. Trapping surveys should be conducted to identify the species present on Mua Island, which could be, or include, Jardine River Turtle. Species profiles for those EVNT species known or expected to occur are provided in **Section 6.3.2.**

6.3.2 Profiles of Species listed as Endangered or Vulnerable under the EPBC Act and/or NC Act known from Mua Island

Salt-water Crocodile (*Crocodylus porosus*)

EPBC Act: Migratory (Bonn Convention); **NC Act:** Vulnerable

Listed as estuarine crocodile under the Queensland *Nature Conservation (Wildlife) Regulation* 2006.

The salt-water crocodile occurs in tidal rivers, coastal floodplains and swamps, extending hundreds of kilometres inland along major drainage systems, but is also seen regularly in the open ocean (Webb *et al.* 1983; Read *et al*. 2004; Wilson &Swan 2010). The species is found from India through south-east Asia to the western Pacific and northern Australia (Wilson & Swan 2010). In Australia the species is most common in large areas of productive wetlands and estuaries (Fukuda *et al*. 2007). In Queensland, salt-water crocodiles are mainly found in coastal areas north of the Fitzroy River, with only infrequent sightings to the south (QPWS 2007). The highest densities in Queensland are found in north-west Cape York Peninsula (Read *et al*. 2004; EPA 2007). Salt-water crocodile is known from Mabuiag (Watson 2009), Saibai, Thursday (OZCAM 2011) and Boigu islands (Schaffer 2010). The species is likely to occur throughout the Torres Strait. Although as yet undocumented, salt-water crocodile is present on Mua Island (Terry Reis *pers. obs*.) and is well known to the local community. On Mua Island salt-water crocodiles are most likely in mangroves and along the shoreline, though at least one individual is present in a freshwater waterbody at Kubin airfield (Garrick Hitchcock *pers. comm*.).

This species is potentially long lived (> 50 years) and mature males can reach lengths greater than six metres. The species generally feeds on a variety of vertebrates including fish, crustaceans, turtles and birds. Large individuals have the ability to take large prey such as water buffalo (*Bubalus bubalis)* and pigs (*Sus scrofa)* (Ehmann 1992; EPA 2007). Crocodiles are essentially sedentary patrolling a well defined home range. Large movements are generally restricted to dispersing males (Tucker *et al*. 1997).

Reproductive activity commences at the onset of the wet season during which large nests of vegetable matter are constructed and guarded by the female for the 100 day incubation period (Ehmann 1992). Nests are constructed above flood levels in exposed grasslands, estuarine rainforest and islands within swamplands (EPA 2007). Recent hatchlings may remain under the females guard for up to 5 weeks before dispersing.

Populations have recovered since the species was protected in 1974, particularly in the Northern Territory (Fukuda *et al*. 2007). Surveys in Queensland have shown a strong population bias towards hatchling and sub-adult animals which, given that the species is long-lived, suggests Queensland's salt-water crocodile population is still in a recovery phase (QPWS 2007). It has been suggested that a significantly slower recovery in Queensland is due to more extensive destruction or modification of habitat by urban development, intensive agriculture and, to a lesser extent, commercial fishing (QPWS 2007). However, Fukuda *et al*. (2007) conclude that variations in crocodile densities are mostly attributable to differences in habitat quality and environmental factors, rather than land use and management practices.

The salt-water crocodile is still threatened by drowning in fishing nets (Ehmann 1992) with juveniles more likely to become entangled. This does not appear to pose a major threat to the species (EPA 2007). A lack of suitable nesting habitat appears to be the most significant limiting factor for the

recovery of the species in Queensland (Read *et al*. 2004). On Mua Island the salt-water crocodile may be threatened by clearing of mangroves, entanglement in fishing nets and by direct human persecution but currently such threats are likely to be minor.

Red Goshawk (*Erythrotriorchis radiatus*)

EPBC Act: Vulnerable; **NC Act:** Endangered

Red goshawk is also considered of 'High' priority under the Back on Track species prioritisation framework (DERM 2011a).

The red goshawk occurs in woodlands and forests, particularly tall forests in areas of high rainfall (Woinarski 2007), and ideally with intact forest or woodland, a mosaic of vegetation types and permanent water, particularly riverine forests, and a large and diverse bird population (prey species). The species avoids both very dense and very open habitats (Marchant and Higgins 1993; DERM 2009a). The red goshawk is endemic to Australia and is found in north-western, northern and eastern Australia in coastal and subcoastal areas. The species is resident but very sparsely distributed, with home ranges of 120 km^2 and 200 km^2 for females and males, respectively (Debus & Czechura 1988; Marchant & Higgins 1993; Olsen 1995). Nests are restricted to trees taller than 20 metres and within one kilometre of a watercourse or wetland (Garnett & Crowley 2000).

In the 1990s the total population was estimated at 330 pairs (Garnett & Crowley 2000) but there may be as many as 100 pairs just on Melville and Bathurst Islands in the Northern Territory (BirdLife International 2011b). There have also been reliable reports along major rivers in central Australia (Aumann 2001), greatly extending its known distribution to the south. The population may be fewer than 1,000 mature individuals but is thought to be stable (Garnett & Crowley 2000; BirdLife International 2011b).

Most recent records for Queensland birds are in existing national parks or state forests (DERM 2009a). Northeast Queensland (north of 20°S) and eastern Cape York Peninsula are thought to be the strongholds for the species in eastern Australia (DERM 2009a). The only record of occurrence in the Torres Strait is from Mua, an uncertain 1919 record (Draffan *et al*. 1983) which is replicated (Wayne Martin of DERM *pers. comm*. 2011) as a historical WildNet record (DERM 2010f). There is considerable doubt about the presence of the species on Mua Island.

The main cause of the decline of the species in eastern Queensland is widespread clearance of native forests and woodlands for agriculture (DERM 2009a). The species is also threatened by fragmentation of habitat, loss of, or disturbance to, nesting sites, fire, egg-collecting, shooting, loss of prey species, and possibly secondary poisoning (Marchant & Higgins 1993; Garnett & Crowley 2000; DERM 2009a). Continuing clearance is affecting more northerly populations. Fragmentation may result in unproductive territories and uncleared riparian strips that are surrounded by cleared land exposing nests to storm damage and other disturbance, particularly as the species usually nests in the tallest trees (BirdLife International 2011b). Should red goshawk be present on Mua Island it is

likely to be threatened by any future fragmentation and clearing of forest, though currently threats would be minor.

Beach Stone-curlew (*Esacus magnirostris*)

NC Act: Vulnerable

Beach stone-curlew is also considered of 'Critical' priority under the Back on Track species prioritisation framework (DERM 2011a).

Formerly known as beach thick-knee and as *Burhinus neglectus*. The beach stone-curlew generally occurs singularly or in pairs, and occasionally in small groups of up to six birds. The species is exclusively coastal, occurring on all types of beaches, especially near river mouths, on mudflats, near mangroves, and occasionally on coastal lagoons. It is typically more common on islands than the mainland (Lane 1987; Marchant & Higgins 1993). The species is mainly nocturnal or crepuscular (active at dawn and dusk) and adult birds appear to be sedentary. The species feeds predominately on crabs and other marine invertebrates in the intertidal zone and a single egg is laid in a scrape in the sand, often in the same area year after year (Clancy 1986; Marchant & Higgins 1993).

Beach stone-curlews are found around eastern and northern Australia from Nambucca Heads in New South Wales (and occasionally south to Victoria) to Port Cloates in Western Australia and extend into New Guinea, the Solomon Islands and Indonesia (Marchant & Higgins 1993). The species occurs on Mua Island (Draffan *et al*. 1983; Ingram 2008). Draffan *et al*. (1983) report the species from 33 Torres Strait Islands in total, in every area except the north-west. Storr (1973) considered the species to be moderately common on reefs and low islands in the Torres Strait.

This species is still found in locations where human activity is high but the lack of young birds in such areas indicates that reproduction is being affected by human disturbance (Freeman 2003). Breeding success may also be significantly reduced from predation by cats (*Felis catus*), dogs (*Canis lupus)* and feral pigs. Much of the species' habitat in Australia, particularly on islands, is secure. However, because beach stone-curlews occur at low densities and occupy linear habitats, the potential for local extinctions to become regional ones is increased (Garnett & Crowley 2000). On Mua Island the species may be threatened by feral and domesticated species and disturbance by humans, particularly when nesting.

Little Tern (*Sternula albifrons*)

EPBC Act: Migratory; **NC Act:** Endangered

Listed under the EPBC Act as *Sterna albifrons* (Bonn Convention, CAMBA, JAMBA, ROKAMBA).

The Little Tern is also considered of 'High' priority under the Back on Track species prioritisation framework (DERM 2011a).

The little tern is found along a variety of coastal areas, including open beaches, lagoons, estuaries, river mouths, lakes, bays, harbours and inlets, especially those with exposed sandbanks. They feed primarily on small fish, crustaceans and other invertebrates and nest on open sandy beaches. Nesting occurs mainly from September to January but in northern Australia nesting also occurs from April to July. Little terns breed in small colonies (Pringle 1987; Higgins & Davies 1996).

The species occurs in Europe, Asia and Australasia and in Australia occurs along the coastal regions of eastern Australia, south to Tasmania, and across northern Australia, west to northern parts of Western Australia (Higgins & Davies 1996). The little tern is mainly a summer visitor to northern Australia, including Torres Strait, though there is a winter-breeding population in the Gulf of Carpentaria (Blakers *et al*. 1984). In the Torres Strait Draffan *et al*. (1983) reports the species from 13 islands, describing it as an uncommon summer visitor throughout the Torres Strait. Little tern is reported by Ingram (2008) as occurring on Mua Island, but no detail is provided. A flock of 57 birds was observed just south of St Pauls in March 2011 (Terry Reis *pers. obs*.).

The little tern in Australia is both increasing in abundance and expanding its distribution. The species has a naturally high rate of breeding failure, with ground-nesting making it vulnerable to natural events that contribute to low success, such as loss of eggs and chicks through native predators, flooding of nesting sites (including high tides), and adverse weather conditions (Garnett & Crowley 2000). Little terns are also threatened by human disturbance at nesting colonies, encroachment of vegetation in colonies (Blakers *et al.* 1984), nest predation by rats, gulls and feral pigs, and by degradation of estuaries, pesticide residues in fish, and oil-fouling of both birds and beaches (Garnett & Crowley 2000). On Mua Island the species is likely to be threatened only if breeding occurs there.

Fawn Leaf-nosed Bat (*Hipposideros cervinus*)

Status: NC Act Vulnerable

Fawn Leaf-nosed Bat is also considered of 'High' priority under the Back on Track species prioritisation framework (DERM 2011a).

Fawn leaf-nosed bats occur in rainforest, gallery forest and open eucalypt forest. The species roosts in caves and mines in colonies mostly of 20 to 100 individuals and occasionally of up 900 individuals. Individuals are occasionally found roosting in buildings. Foraging occurs below the canopy and the species also forages around buildings and in open areas. Fawn leaf-nosed bats eat a variety of insects and move along well established pathways, often creeks and gullies (Churchill 2008; Pavey & Burwell 2008).

A single young is born in November or December but otherwise the breeding biology is little known. The maternity colony is the same cave as the roost site. Fawn leaf-nosed bats are widespread in Malaysia, Indonesia, the Philippines, New Guinea and the western Pacific. In Australia it is restricted to Cape York Peninsula, north of Coen (Churchill 2008; Pavey & Burwell 2008). In the Torres Strait the fawn leaf-nosed bat is known from Thursday Island (WildNet database record) and there is a

Queensland Museum record (reported in Conics 2008b) and four WildNet records (DERM 2010f) for Mua Island. The species is likely throughout much of the island in forests and woodlands, particularly along creeks with intact riparian vegetation.

Fawn leaf-nosed bats are threatened by roost destruction. It is believed that roost disturbance, habitat alteration and predation by cats also threaten this species (DERM 2011b). These threats would be relevant on Mua Island.

Coastal Sheathtail Bat (*Taphozous australis*)

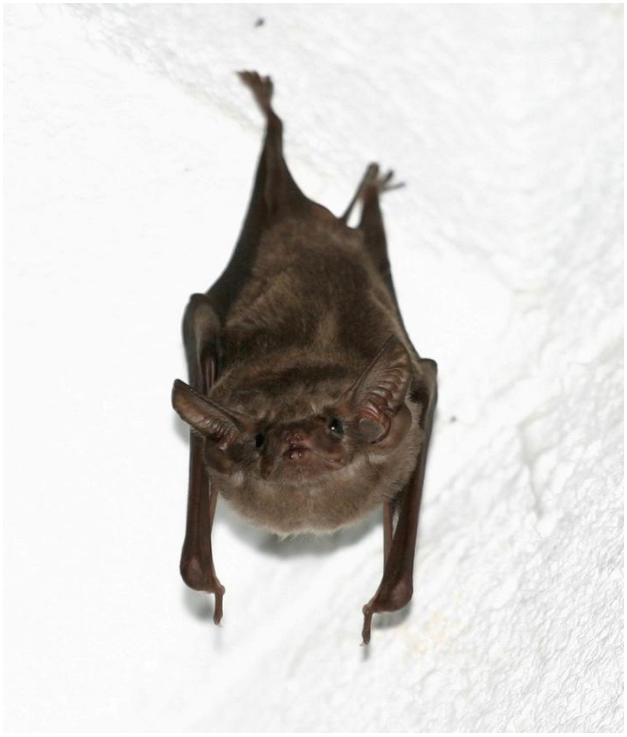
Status: NC Act Vulnerable

The coastal sheathtail bat is also considered of 'High' priority under the Back on Track species prioritisation framework (DERM 2011a).

The coastal sheathtail bat is seldom found more than a few kilometres from the ocean, where it roosts in sea caves, rock fissures, boulder piles and, occasionally, in buildings (Churchill 2008; Richards 2008). Colonies are usually of two to 25 individuals, though up to 100 have been recorded. The species is often found on islands and will forage on nearby mainland (Churchill 2008). Foraging occurs in a wide range of habitats, including open eucalypt forest, coastal heathlands, grasslands, sand dune scrub, monsoon forests and mangroves (Duncan *et al*. 1999; Churchill 2008). Little is known of its breeding biology but most births probably occur from September to November (Churchill 2008; Richards 2008).

The coastal sheathtail bat occurs from Shoalwater Bay on the central Queensland coast north to Torres Strait and extralimitally in New Guinea (Duncan *et al*. 1999; Churchill 2008). In the Torres Strait there are 15 Australian Museum specimens from Possession Island (OZCAM 2011), two WildNet records (DERM 2010f), a Queensland Museum specimen (reported in Conics 2008b) from Mua, and observations and Anabat recordings from Pulu (Watson 2009). There are possible Anabat recordings for Mabuiag (Conics 2009b) but Pulu is in such close proximity to Mabuiag that individuals would move between islands readily. In March 2011 at least 20 individuals were present in the church at St Pauls on Mua Island (Terry Reis *pers. obs*.).

Major threats to the species probably include loss of foraging habitat from coastal development and roost disturbance, particularly in the southern part of their range (Duncan *et al*. 1999). On Mua Island the coastal sheathtail bat would be threatened by disturbance to any roosts and maternity sites and by loss of foraging habitat including mangroves, forest, woodland and shrubland.



Photograph 7. Coastal sheathtail bat roosting in the St Pauls Church (photograph by T. Reis).

Water Mouse (*Xeromys myoides*)

EPBC Act: Vulnerable, **NC Act:** Vulnerable

Water mouse is considered of 'High' priority under the Back on Track species prioritisation framework (DERM 2011a).

The water mouse (also known as the false water-rat) is nocturnal and lives in mangroves, saltmarsh, sedges lakes near foredunes and coastal freshwater swamps. It is a capable swimmer but prefers to follow the receding tide to forage for crustaceans, molluscs and flatworms. During the day, or when foraging areas are inundated, the water mouse shelters in a nest, termitarium-like mounds up to 60 cm high, in tunnels in natural and human-made banks, and in mud structure associated with hollow tree trunks. The nests, regardless of type or structure, primarily serve as diurnal refuges and reproductive sites. Nests often occupy naturally elevated ground and utilise the bases of fallen trees or logs for support of the nest structure (Van Dyck 1996; Gynther & Janetzki 2008).

Generally, there is only one sexually active male present in a nest and nests may be used by successive generations over a number of years. Once constructed, nests are continuously added to, with the larger mounds or nests having potential to provide significant historical information about populations and habitats over time (Van Dyck 1996).

The water mouse is patchily distributed in the Northern Territory, and from the Gold Coast to Proserpine in Queensland (Menkhorst & Knight 2004). The species has been recently recorded from New Guinea (Hitchcock 1998). The species is predicted to occur on Mua Island by the EPBC

Protected Matters Search Tool but confirmation of its occurrence is likely to require a reasonable level of targeted survey work.

The species is threatened by swamp and mangrove reclamation, feral predators, changes to water tables, offshore pollution, the spread of weeds and the impacts of grazing (Woinarski 2007; Gynther & Janetzki 2008). On Mua Island the species would be dependent on mangroves and samphire herblands and would be threatened by their destruction.

6.3.3 Species listed as Near-Threatened under the NC Act

Jardine River Turtle (*Emydura subglobosa*)

NC Act: Near-Threatened

The Jardine River turtle is found in watercourses and lagoons across northern Australia, from Cape York Peninsula to the north-eastern Kimberleys of Western Australia. The species is also widespread in New Guinea (Ehmann 1992; Wilson & Swan 2010) where it is mostly found in forest sinkholes and swamps (Georges *et al*. 2008). The species is omnivorous, eating molluscs, snails, fruit and other vegetable matter (Wilson & Swan 2010). In New Guinea it nests from September to February (Ehmann 1992), burying its eggs in the forest floor, often at the base of trees (Georges *et al*. 2008).

Freshwater turtles are threatened by habitat destruction by feral pigs (Doupé *et al*. 2008), predation by feral predators (Ehmann 1992), illegal collection and modification and pollution of habitat (Cogger *et al*. 1993). In New Guinea the Jardine River turtle is also hunted for food (Georges *et al*. 2008). Should the species be present on Mua Island it would be threatened by pigs and possibly hunting.

Slender Chained Gecko (*Lepidodactylus pumilis*)

NC Act: Near-Threatened

The slender chained gecko is found in southern New Guinea, the Torres Strait and the tip of Cape York (Covacevich *et al*. 1982; Ehmann 1992). In the Torres Strait there is a WildNet database record from Mer Island (DERM 2010d), and a Queensland Museum specimen (reported in Conics 2008b) and a record by Ingram (2008) from Mua Island. There are also Australian Museum specimens from Saibai, Masig, Mer, Hammond and Prince of Wales islands (OZCAM 2011) and it is likely the species occurs more widely through the region than is yet documented. No detail is available on the abundance or distribution of the species on Mua Island but it could be widely distributed.

The species is arboreal and occurs in open and closed forests and coastal habitats (Ehmann 1992; Wilson & Swan 2010) and in human dwellings (Wilson 2005). The female lays two eggs per clutch under bark or within closed-in vegetation. Nesting is often communal and takes place during the warmer wet months (Ehmann 1992).

Threats to the species are unknown. Ehmann (1992) states the species is common and secure. However, the species is not known from any national park or other reserve affording protection (Covacevich *et al*. 1982). The slender chained gecko may be threatened by loss of habitat due to clearing and/or rising sea levels and storm surges as a result of climate change and by competition with house gecko *Hemidactylus frenatus*, in both natural habitats and on buildings (Case *et al*.1994; Buden 2007; Hoskin 2010). House gecko is present on Mua Island (Ingram 2008) but is unlikely to pose a threat to any possible population of slender chained gecko unless the introduced species spreads into natural habitats.

Littoral Whiptail-skink *(Emoia atrocostata)*

NC Act: Near-Threatened

The littoral whiptail-skink is found on rocky shores and in foreshore vegetation, including mangrove forests. It shelters in rock recesses and crevices, in tree root crevices and in logs. It readily swims in tidal pools and can remain submerged for short periods (Heatwole 1975; Ehmann 1992). Cogger (2000) states that the species also occurs in lowland forests, coastal scrubs and grasslands near beaches but Hediger (1933-34 in Heatwole 1975) states that it is never found more than 100 m from the sea.

The littoral whiptail-skink is widespread from Japan, through south-east Asia and into the south-west Pacific. It is found on the tip of Cape York Peninsula and islands of the Torres Strait (Ehmann 1992; Wilson 2005). Cogger (2000) considers its distribution poorly known and despite references to its occurrence on Torres Strait Islands there is no available record for any island except Boigu Island (Wilson 2005; Schaffer 2010). Ingram (2008) refers to a WildNet record from Mua but the species was not returned by a search of the database in 2010 (DERM 2010f). *Emoia* species are efficient rafters and colonise islands on floating debris (Wilson 2005) and it is likely to occur on Torres Strait Islands other than Boigu. If not already present on Mua Island there is an on-going likelihood of colonisation.

The female lays two eggs in moist, rotting leaves or in a cool, moist rock crevice. Breeding occurs through most of the year (Ehmann 1992).

Ehmann (1992) states the littoral whiptail-skink is abundant and secure. It is a common mangrove species in some areas and is especially abundant on rocky foreshores (Cogger 2000). Threats are unknown, however small reptiles, including littoral whiptail-skink, are eaten by cats on Christmas Island. However, the species made up a very small percentage of known prey (Tidemann *et al.* 1994), possibly due to cats spending little time foraging in foreshore habitats. On Mua Island the Littoral whiptail-skink would be threatened by loss of mangroves due to clearing or storm damage.

Emerald Monitor (*Varanus prasinus*)

NC Act: Near-Threatened

The emerald monitor is an arboreal species, living in the upper canopy of rainforest, monsoon forest (Wilson 2005), palm forest, mangroves (Greene 1986; Cogger 2000), cocoa plantations (Greene 1986), vine thickets (Schaffer 2010) and around lagoons (Cogger 2000). The species uses its prehensile tail to forage among slender branches and outer foliage (Wilson & Swan 2010) and eats mainly katydids and other small arthropods and occasionally rodents (Greene 1986). Emerald monitors lay eggs in termite mounds in trees (Greene 1986; Ehmann 1992).

The emerald monitor is widespread in New Guinea. In Australia it is restricted to several islands in the Torres Strait, south to Mua Island, where it is known as Wyniss (Wilson & Swan 2010). The species is known from Boigu (Clarke 2004a; Schaffer 2010); Mua (Whittier & Moeller 1993; Wilson 2005; Ingram 2008; DERM 2010f), Badu (Borsboom 2007 in Conics 2009a) and Mer islands (DERM 2010d; OZCAM 2011) and there are unconfirmed records from Mabuiag Island (Conics 2009b). Mua Island is the southern limit of the species (Ingram 2008) but the species is likely to be widespread in a variety of wooded habitats.

Ehmann (1992) states the emerald monitor is very sparse but secure. However, this assessment includes *Varanus keithhornei* of the McIlwraith and Iron Ranges of Cape York Peninsula (Wilson & Swan 2010), which has been elevated to species status, having formerly been considered conspecific with *V. prasinus* (Covacevich & Couper 1994). The emerald monitor is one of the most poorly known monitors (Greene 1986) and threats to the species in Australia are unknown. However, in Papua New Guinea the species is targeted by the pet trade, though the threat is considered low (Allison 2006). The emerald monitor is highly desired by reptile keepers and illegal collecting could become a threat in the Torres Strait. The species would be threatened by habitat clearance. Given its known diet the emerald monitor does not appear susceptible to mortality through attempted ingestion of cane toads (*Rhinella marina)* as per many other species of varanid (*eg* Shine 2010). On Mua Island, current threats are likely to be minor.

Radjah Shelduck (*Tadorna radjah*)

NC Act: Near-Threatened

The radjah shelduck prefers shallow brackish waters, typically coastal and including estuarine mudflats, tidal creeks and mangrove swamps (Blakers *et al*. 1984; Pringle 1985). In the dry season the species congregates on permanent swamps and lagoons and artificial waterbodies such as sewage farms (Pringle 1985; Marchant & Higgins 1990). They are rarely found more than 20 metres from a waterbody (Frith 1977; Marchant & Higgins 1990). Breeding occurs in the wet season, mostly between December and February in north-east Queensland. Nests are placed in large hollow branches in trees in, or close to, water (Frith 1977).

Radjah shelducks occur in eastern Indonesia, New Guinea and tropical Australia, with occasional records further south (Blakers *et al*. 1984; Pringle 1985). The species has disappeared from the Kimberleys and more southern Australia but remains common with no sign of decline through most of its current Australian distribution (Garnett & Crowley 2000). In the Torres Strait the radjah shelduck is

known from Mua (Draffan *et al*. 1983; Ingram 2008), Badu (Draffan *et al*. 1983) and Boigu islands (Clarke 2004b; DERM 2010a). Draffan *et al*. (1983) reports the species from a further five Torres Strait Islands, all in the south-western group of islands and including Horn and Thursday islands. A single bird was observed at the Kubin sewage ponds on Mua Island in March 2011 (Terry Reis *pers. obs*.).

The species is threatened by reclamation of habitat for agricultural activities and infrastructure (Marchant & Higgins 1990) as well as indiscriminate shooting (Pringle 1985) but despite the decline of some sub-populations the species is not considered to be threatened nationally (Garnett & Crowley 2000) and may be increasing in some areas (Pringle 1985). There is no detail provided for the records of radjah shelduck for Mua Island, though Draffan *et al*. (1983) refers to the species as a nomadic visitor in the Torres Strait. Threats to the species on Mua Island are likely to be minor.

Black-necked Stork (*Ephippiorhynchus asiaticus*)

NC Act: Near-Threatened

The black-necked stork occurs in swamps, estuarine mudflats and other littoral habitats and on floodplains, in irrigated crops and occasionally open grassy woodland. The species is most frequently associated with open freshwater rather than saline habitats (Pringle 1985; Marchant and Higgins 1990).

The black-necked stork occurs from Pakistan through south-east Asia to New Guinea and Australia. It is widespread in northern and eastern Australia and occurs through much of Queensland (Marchant and Higgins 1990), though is not abundant anywhere. The sparse distribution of the species is probably due to the requirement of large areas of freshwater swamps for the maintenance of even one pair (Pringle 1985). Black-necked stork has been recorded on Boigu (Draffan *et al*. 1983; Clarke 2004b; DERM 2010a) and Badu islands (Draffan *et al*. 1983; DERM 2010g). Ingram (2008) refers to a WildNet record from Mua but the species was not returned by a search of the database in 2010 (DERM 2010f), though it is likely to occur. Draffan *et al*. (1983) reports the species from a further seven Torres Strait Islands, all in the south-western group of islands and including Horn, Prince of Wales and Thursday islands.

The black-necked stork feeds on a variety of aquatic prey items including crustaceans, fish, amphibians, reptiles and arthropods. The species is very sparsely distributed throughout its range and it appears that the maintenance of even one pair may require large areas of freshwater swamps. Breeding is very poorly known, although they nest in tall trees, both alive and dead, in or near freshwater swamps (Pringle 1985; Marchant & Higgins 1990; Dorfman *et al*. 2001).

Although the black-necked stork is thought to be threatened by disturbance and habitat loss it has not been greatly affected by the intensification of land-use in eastern Australia (Garnett & Crowley 2000). Nonetheless, the species is threatened by the use of chemicals including herbicides and insecticides near wetlands, the loss of suitable nesting trees, disturbance of waterbodies by livestock, loss of

wetlands due to agriculture and development, and possibly by ingestion of Cane Toads (Garnett & Crowley 2000; Dorfman *et al*. 2001; NSW NPWS 2002; Clancy 2010). In New South Wales collision with powerlines is the greatest known cause of mortality (Clancy 2010). In the Torres Strait the species is most likely to be threatened by disturbance during foraging and at nest sites and possibly hunting.

On Mua Island the black-necked stork is most likely in swampy areas in the central portion of the island, especially when they are subjected to flooding. The species may also occur around mangroves and on estuarine mudflats. Threats to the species on Mua Island are likely to be minor. Breeding is unlikely as Storr (1973) considered it a non-breeding dry season visitor to northern Cape York Peninsula.

Grey Goshawk (*Accipiter novaehollandiae*)

NC Act: Near-Threatened

The grey goshawk occurs in woodland and forest in coastal and subcoastal northern and eastern Australia. It prefers areas of mature forest with dense canopy, though it will forage in open country, and also uses plantation forests and mangroves (Marchant & Higgins 1993). In northern Australia it is more typical of riverine forest (Debus 1998). Prey includes mammals, birds, reptiles, frogs and invertebrates. Breeding is poorly known but nesting occurs in wooded areas, often near permanent water. The breeding season varies with location and in Queensland mostly occurs from July to November and the nest is usually high in the canopy of a tall tree (Marchant & Higgins 1993).

The species was formerly considered to extend beyond Australia through New Guinea north to the Moluccas and east to the Solomons (Marchant & Higgins 1993). The grey goshawk is now regarded as being restricted to Australia, with extralimital birds now considered to be either *A. hiogaster* or *A. griseogularis* (Christidis & Boles 2008). In the Torres Strait the grey goshawk is known from Mua (Draffan *et al.* 1983; Conics 2008b, c), Badu (Draffan *et al.* 1983; Conics 2009a) and Red Wallis islands (Storr 1973). On Mua Island the species is most likely in vine forests and the taller open forests and woodlands and is considered resident (Draffan *et al*. 1983).

The grey goshawk remains common in tropical and subtropical Australia (Debus 1998) but there has been a slight decrease in populations since European settlement (Olsen 1998). The species is threatened by loss of habitat and human persecution (Blakers *et al*. 1984; Olsen 1998). On Mua Island threats to the species are currently likely to be minimal. It would be threatened by any future habitat loss.

Eastern Curlew (*Numenius madagascariensis*)

EPBC Act: Migratory (Bonn Convention, CAMBA, JAMBA, ROKAMBA);

NC Act: Near-Threatened

The eastern curlew is mostly confined to coastal habitats, particularly estuaries, harbours and coastal lagoons. They mainly forage on open intertidal mudflats, sandflats and saltmarsh, often near mangroves, and occasionally on ocean beaches. Roosting occurs on sandy spits and islets, in mangroves and saltmarsh, and along high water mark on beaches (Pringle 1987; Higgins & Davies 1996). The species usually feeds individually or in small groups (Pringle 1987), though large numbers may congregate at high tide roosts (Lane 1987).

Eastern curlews breed in eastern Siberia during the northern hemisphere summer and arrive in north-eastern Australia as early as late July, but most individuals arrive in eastern Australia by late August and September (Ueta *et al*. 2002). Birds begin to depart to return to breeding grounds around March and April (Lane 1987). However, a significant percentage of the Australian population remains through the Australian winter, particularly in northern Australia (Pringle 1987; Driscoll & Ueta 2002). In Australia eastern curlews occur in suitable habitat on all coasts (Higgins & Davies 1996). In the Torres Strait Draffan *et al*. (1983) reported them from 18 islands, including Mua, Badu, Mer, Erub and Boigu, and there is a single WildNet record from Mabuiag (DERM 2010e) and an unpublished record from Iama (Conics 2008a). The species is likely, at least on passage, on any island that has suitable foraging habitat. Only one individual was observed among many hundreds of waders at St Pauls on Mua Island in March 2011 (Terry Reis *pers. obs*.).

The Australian eastern curlew population is estimated at 19,000 and numbers have fallen significantly in some southern areas. In Tasmania populations have declined by 65% (Reid & Park 2003). It is unknown as to whether these declines are a result of overall population decline or a change in non-breeding range. Eastern curlews are easily disturbed by people at foraging and roosting sites (Higgins & Davies 1996; Taylor & Bester 1999) and are often the first species in a high-tide roost to take to flight if disturbed, relocating to alternative roosts often some considerable distance away (Lane 1987). Eastern curlews will take off when humans approach to within 30-100 m (Taylor & Bester 1999) and sometimes are disturbed within 250 m of approach (Higgins & Davies 1996). Pollution may have also reduced food availability (Higgins & Davies 1996).

Draffan *et al*. (1983) provide no detail on local numbers and the two WildNet records (DERM 2010f) are more likely to be a reflection of a lack of formal survey work rather than an accurate indication of their numbers on Mua Island. The species is most likely to be threatened by disturbance when foraging and such a threat would only be significant during passage to northern hemisphere breeding grounds.

Bare-backed Fruit-bat (*Dobsonia magna*)

NC Act: Near-Threatened (listed as *D. moluccensis*)

The bare-backed fruit-bat is found in rainforest, gallery forest and woodlands and occurs in New Guinea and associated islands and south to Cooktown on Cape York Peninsula (Churchill 2008; Hall 2008). Churchill (2008) states that the species is found in the Torres Strait, without further detail.

Duncan *et al*. (1999) reports the species for Mua Island and Ingram (2008) and Conics (2008b) both report WildNet records for the island.

The bare-backed fruit-bat is the only species of mega-bat in Australia known to regularly roost in caves (Hall 2008). The species also roosts in boulder piles, disused mines, abandoned buildings, dark rainforest thickets and large tree hollows. Colonies are usually 100 individuals or less. The species feeds on fruits and blossom. A single young is born between September and November (Churchill 2008; Hall 2008).

The species is eaten by humans in New Guinea but this is not reported for Australia (Hall 2008). Duncan *et al*. (1999) state that no large scale decline has been observed in Australia, although shooting has caused small losses of numbers and the species has been regularly killed on barbed wire. There has been some loss of habitat through clearing and the species may be threatened by changes to vegetation through historical changes to fire regime. On Mua Island the species is most likely to be threatened by disturbance at roost sites.

Torresian Tube-nosed Bat (*Nyctimene cephalotes*)

NC Act: Near-Threatened

In Australia the Torresian tube-nosed bat is known only from three specimens from Mua Island. Another tube-nosed bat of uncertain identification, possibly *N. cephalotes*, has been collected from central eastern Cape York (Duncan *et al*. 1999). Churchill (2008) considers these records from Torres Strait and Cape York dubious and questions both the taxonomy and identification of species within the genus. The Torresian tube-nosed bat is widespread in New Guinea and specimens are known from the coast immediately adjacent to Torres Strait (Duncan *et al*. 1999).

The specimens from Mua were caught on the edge of rainforest and open grassy woodland, and the species is found in lowland rainforest in Papua New Guinea (Bonaccorso 1999). It may also inhabit mangroves as there are records from south coastal New Guinea (Duncan *et al*. 1999). No threat is known at present, but removal of rainforest or mangrove habitat would pose a serious threat if the Australian distribution of this species is limited to Torres Strait and Cape York Peninsula (Duncan *et al*. 1999).

6.3.4 Migratory Species

One terrestrial reptile, salt-water crocodile, and 57 bird species listed as Migratory under the EPBC Act have been recorded from the Torres Strait Islands. Salt-water crocodile is also listed as Vulnerable under the NC Act and its life history has been discussed in **Section 6.3.1**. Two of the birds, eastern curlew and little tern, are also listed as Near-Threatened and Endangered respectively, and their life histories have been discussed in **Sections 6.3.2** and **6.3.1**. They will also be included in the discussion hereunder as the species are discussed in groups based on behavioural traits and habitat use.

The 57 known Migratory bird species consist of 47 non-passerines and 10 passerines. The majority (37 species) belong to the Order Charadriiformes which includes oystercatchers, stone-curlews, pratincoles, plovers, sandpipers and terns. These birds may be separated into two groups; waders and terns. **Table 8** lists migratory species both reported, and predicted, to occur on Mua Island.

Table 8. Migratory[1] species reported or predicted[2] to occur on Mua Island.

Scientific Name[3]	Common Name	Comments[4]
SPECIES REPORTED		
Crocodylus porosus[5]	Salt-water crocodile	Unpublished record.
Hirundapus caudacutus[6]	White-throated needletail	Unpublished record.
Apus pacificus	Fork-tailed swift	Published record.
Ardea modesta[7]	Eastern great egret	Database & published records.
Egretta sacra	Eastern reef egret	Database, published & unpublished records.
Plegadis falcinellus	Glossy ibis	Database record.
Pandion cristatus[8]	Eastern osprey	Database, published & unpublished records.
Haliaeetus leucogaster	White-bellied sea-eagle	Database & published records.
Pluvialis fulva	Pacific golden plover	Database, published & unpublished records.
Pluvialis squatarola	Grey plover	Database & published records.
Charadrius mongolus	Lesser sand plover	Database & published records.
Charadrius leschenaultii	Greater Sand Plover	Database, published & unpublished records.
Limosa limosa	Black-tailed godwit	Database record.
Limosa lapponica	Bar-tailed godwit	Database & published records.
Numenius minutus	Little curlew	Published record.
Numenius phaeopus	Whimbrel	Database, published & unpublished records.
Numenius madagascariensis[9]	Eastern curlew	Database & published records.
Xenus cinereus	Terek sandpiper	Database & published records.
Actitis hypoleucos[10]	Common sandpiper	Database & published records.
Tringa brevipes[11]	Grey-tailed tattler	Database, published & unpublished records.
Tringa incana[12]	Wandering tattler	Published record.
Tringa nebularia	Common greenshank	Database & published records.
Tringa stagnatilis	Marsh sandpiper	Unpublished record.
Arenaria interpres	Ruddy turnstone	Database record.
Calidris tenuirostris	Great knot	Database record.
Calidris canutus	Red knot	Database record.
Calidris ruficollis	Red-necked stint	Published record.
Calidris acuminata	Sharp-tailed sandpiper	Database & published records.
Calidris ferruginea	Curlew sandpiper	Database record.
Glareola maldivarum	Oriental pratincole	Published record.
Onychoprion anaethetus[13]	Bridled tern	Published record.
Sternula albifrons[14]	Little tern	Published record.
Hydroprogne caspia	Caspian tern	Database, published & unpublished records.
Chlidonias leucopterus	White-winged black tern	Database record.
Sterna sumatrana	Black-naped tern	Published & unpublished records.
Thalasseus bengalensis[15]	Lesser crested tern	Published & unpublished records.
Cuculus optatus[16]	Oriental cuckoo	Database & published records.
Merops ornatus	Rainbow bee-eater	Database & published records.
Coracina tenuirostris melvillensis	(Melville) Cicadabird	Database & published records. Subspecies not recorded.
Rhipidura rufifrons	Rufous fantail	Database & published records.
Symposiarchus trivirgatus[17]	Spectacled monarch	Database, published & unpublished records.
Hirundo rustica	Barn swallow	Published record. Unconfirmed.
SPECIES PREDICTED		
Gallinago hardwickii	Latham's Snipe	Predicted by the EPBC Protected Matters

Scientific Name[3]	Common Name	Comments[4]
		Search Tool – considered likely to occur.
Monarcha frater	Black-winged monarch	Predicted by the EPBC Protected Matters Search Tool – considered likely to occur.
Myiagra cyanoleuca	Satin flycatcher	Predicted by the EPBC Protected Matters Search Tool – considered likely to occur.

1 Listed as Migratory under the EPBC Act 1999.

2. Predicted by the EPBC Protected Matters Search Tool maintained by DSEWPC (2011g). Only noted if not recorded from another source.

3. Nomenclature follows the Australian Faunal Directory (DSEWPC 2011d).

4. Known from Museum records, published literature (*eg* Storr 1973; Draffan *et al*. 1983; Wilson 2005; Ingram 2008), WildNet database and/or reports and other grey literature (*eg* Conics 2008b). These sources are not necessarily mutually exclusive. Salt-water Crocodile, White-throated Needletail and Marsh Sandpiper known from unpublished 2011 survey records (Terry Reis).

5. Listed as Vulnerable under the NC Act.

6. Also listed under the EPBC Act (ROKAMBA) as *Chaetura caudacuta*.

7. Listed under the EPBC Act (CAMBA, JAMBA) as Great Egret *Ardea alba*. Australian birds elevated to full species level as *A. modesta* (Kushlan & Hancock 2005; Christidis & Boles 2008).

8. Listed under the Bonn Convention as Osprey *Pandion haliaetus*. Australian birds have been elevated to species level as *P. cristatus* (Wink *et al*. 2004; Christidis & Boles 2008).

9. Listed as Near-Threatened under the NC Act.

10. Also listed under CAMBA and ROKAMBA as *Tringa hypoleucos*.

11. Also listed under the Bonn Convention and JAMBA as *Heteroscelus brevipes*.

12. Also listed under the Bonn Convention and JAMBA as *Heteroscelus incanus*.

13. Listed under the EPBC Act as *Sterna anaethetus* (CAMBA, JAMBA).

14. Listed under the EPBC Act (Bonn Convention, CAMBA, JAMBA, ROKAMBA) as *Sterna albifrons*. Listed under the NC Act as Endangered.

15. Listed under the EPBC Act (CAMBA) as *Sterna bengalensis*.

16. Listed under the EPBC Act (CAMBA, JAMBA, ROKAMBA) as *Cuculus saturatus*. Australian birds elevated to full species level as *A. optatus* (Christidis & Boles 2008).

17. Listed under the EPBC Act (Bonn Convention) as *Monarcha trivirgatus*.

Additional possible Migratory species

Of the other 13 species of Migratory bird known from the Torres Strait (**Appendix E**), sanderling (*C. alba)*, common noddy (*Anous stolidus)*, common tern (*Sterna hirundo)*, roseate tern (*Sterna dougallii*) and black-faced monarch (*Monarcha melanopsis)* are expected to occur on Mua Island on a regular basis. The remaining eight species are all possible as sporadic (not annual) visitors except for double-banded Plover (*Charadrius bicinctus)*, which is considered very unlikely based on known movements.

6.3.5 Species of Regional Significance

There are a number of reptile species that appear to be at their northern limits on Mua Island and/or its very close neighbour Badu Island. These are zigzag velvet gecko (*Oedura rhombifer)*, dwarf mulch-skink (*Glaphyromorphus pumilis)* and northern death adder (*Acanthophis praelongus)*. Northern death adder was considered to extend into New Guinea (Cogger 2000) but now populations of death adder in New Guinea are regarded as different from all Australian species (Wüster *et al*. 2005).

Scrub python (*Morelia kinghorni)*, formerly considered conspecific with amethyst python (*M. amethistina)* (and still recognised as such by the *Australian Faunal Directory* (DSEWPC 2011d)), is listed by Conics (2008b) as occurring on Mua Island, based on an Australian Museum record. However, OZCAM (2011) refers to the specimen as *M. amethistina* despite recognition by the Australian Museum of *M. kinghorni*. Harvey *et al*. (2000) described *M. kinghorni* as a full species, a taxonomy that has since been accepted by others (*eg* Freeman & Freeman 2009; Wilson & Swan 2010). Specimens of both *M. kinghorni* and *M. amethistina* are listed for Masig Island, north-east of Mua Island, by the Australian Museum (OZCAM 2011). Wilson and Swan (2010) no longer include *M. amethistina* as a species occurring in Australian territory and apparent discrepancies in distribution may be due to a delay in recognition of the changed taxonomy. The exact identity of any *Morelia* species on Mua should be ascertained whenever possible in order to resolve the distributional limits of the two species. However, differentiation of the two species may be difficult in the field.

Mua and Badu islands are the northernmost Torres Strait Islands of any size south of Boigu and Saibai islands near the Papua New Guinea coastline. Ingram (2008) considered that most of the reptile species have been present since Mua became an island and therefore Mua and Badu may have some distributional significance in terms of Australian reptiles. Although this is not considered a matter of any priority, distribution is an important consideration in the assessment of conservation significance of any species and any additional information on the distribution of reptiles in Torres Strait may prove useful in the longer term.

Mua Island supports, or has supported, a number of mammal species of very limited distribution in the Torres Strait. Short-beaked echidna (*Tachyglossus aculeatus*) is known from Mua, Horn (McNiven & Hitchcock 2004) and Possession islands (WildNet record). There is archaeological evidence of agile wallaby (*Macropus agilis)* on Mua Island (McNiven & Hitchcock 2004; Ingram 2008) and the species is known from Mai and Friday islands (McNiven & Hitchcock 2004). Ingram (2008) also reported the recent presence of an unidentified macropod on Mer Island in 1974. Southern brown bandicoot *Isoodon obesulus* is listed as a survey record by Conics (2008b) and northern brown bandicoot *I. macrourus* is stated in the same report to occur commonly in grassland on Mua Island. It is unclear if both species occur. McNiven & Hitchcock (2004) report that bandicoots were a food item on Mua Island, but are uncertain as to the genus or species, referring to *Echymipera* and/or *Isoodon* spp. Regardless, the presence of bandicoots on Mua is regionally significant as they are not reported from any other Torres Strait Islands (see **Appendix E** for details of islands included). Delicate mouse (*Pseudomys delicatulus*) (Ingram 2008) is similarly known only from Mua Island within the Torre Strait. Although it is suggested that bandicoots and wallabies were translocated to Mua Island (McNiven & Hitchcock 2004; Ingram 2008), efforts should be made to clarify what species do occur and to determine their abundance and distribution. Systematic survey of mammals should be a priority on Mua Island.

6.4 Pest Fauna Species

Exotic (introduced) fauna species reported for Mua Island are Asian house gecko, house sparrow (*Passer domesticus)*, brown rat, dog, pig and horse (*Equus caballus)*. One or two cats were present near St Pauls in March 2011 (Terry Reis *pers. obs.*).

House gecko is considered a threat to native species through competition in both natural habitats and on buildings (Case *et al*. 1994; Hoskin 2010). There are records of native arboreal geckoes on Mua Island, *Gehyra* and *Lepidodactylus* spp. Some of these are similar in appearance to Asian house gecko and also inhabit buildings. Local information on geckoes is therefore unlikely to be reliable in regards to species and an assessment of the level of threat posed by house gecko requires survey effort. This could be combined with other, higher priority, reptile surveys.

Draffan *et al*. (1983) reported that house sparrow may be extirpated on Mua Island, however at least three birds were present in Kubin in March 2011 (Terry Reis *pers. obs*.). Regardless, house sparrow is unlikely to pose any threat to native species on Mua Island and no action is required for the species.

Conics (2008b) reported the exotic brown rat (*Rattus norvegicus)* as being present, though the species is not listed in their fauna survey results. The report states that the species was introduced to St Pauls and occupied the IBIS store prior to eradication efforts. It is also referred to as another recent introduction to the St Pauls community, having been introduced via supplies brought to the island on barges. The presence and identification, assuming none were caught during the Conics survey, of any *Rattus* species on Mua Island should be clarified as a matter of urgency and eradication measures should be implemented. Black rat is likely to be a greater environmental threat than brown rat given that the latter species is less likely to occur away from human settlements (Watts & Aplin 2008).

Dingoes (*Canis lupus dingo)* were present in the Torres Strait, including on Mua Island, when Europeans first arrived and are possibly responsible, in part, for the extinction of macropods (McNiven & Hitchcock 2004). Domestic dogs (*C. l. familiaris)* are currently present on Mua Island in large numbers (Conics 2008b) and may be a significant risk for a number of native species. Dogs are a threat to ground nesting birds such as beach stone-curlew and are a disturbance factor for waders, terns, radjah shelduck and black-necked stork.

Although house cats in Australian suburbs have been shown to kill mainly introduced rats and mice, native wildlife are also killed, including mammals, birds, reptiles and frogs. Cat predatory behaviour appears largely opportunistic, though small mammals are preferred. Therefore, should house cats have access to relatively undisturbed habitats it is likely that they would have a substantial impact on native fauna, particularly mammals (Barratt 1997). Mua Island has three species of native rodent, a comparatively large number for the generally depauperate Torres Strait, and further survey work may identify additional native ground-dwelling mammals. Cats would kill native rodents and would also prey on small birds, reptiles and frogs. A cat was found near St Pauls eating a juvenile bandicoot (*Isoodon* sp.) in March 2011 (Terry Reis *pers. obs.*).

Pigs present a threat directly to frogs, reptiles and birds through predation. Ground-dwelling birds are particularly vulnerable. They also have indirect impacts through habitat destruction and degradation. Feral pigs are present on the island and although hunted on a regular basis, Conics (2008b) report damage by pigs within all habitat areas. Any wetland or riparian area is especially susceptible to damage by pigs.

Conics (2008b) report that horses on Mua Island are constrained by fences. However, individuals were observed in unfenced areas and tracks and dung were recorded in many areas in March 2011 (Terry Reis *pers. obs*.). Large numbers of horses are capable of substantial habitat modification and destruction and there is a likelihood of individuals establishing a feral population, should one not already exist. Control measures are required.

6.5 Threats to Fauna and Habitat

The major threats to fauna in any location are loss, degradation and fragmentation of habitat. These processes may be due to deliberate clearing or may be the result of inappropriate fire regimes, damage by feral and domestic herbivores, storm damage and weed invasion. Weed invasion may not simply alter the plant species assemblage but can also alter vegetation structure, *eg* weeds can choke out ground cover, reducing suitability for ground-dwelling species, and increase fire frequency and intensity, thus altering plant species composition and physical structure even further.

Exotic predators, such as dogs and cats, pose a threat to native fauna, either directly through predation or by disturbance. At this stage the most significant potential threats to native fauna on Mua Island are the possible introduction of the exotic cane toad and the presence and potential spread of rats (*Rattus* spp.). Cane toads would have dramatic impacts on the varanid (goanna) and snake fauna and, given the small size of the island, could lead to local extinctions. Rats are an even greater potential threat given their agility and generalist diet. Should exotic rats be present an extermination or control program is recommended.

Hunting may pose a threat to some species. Species likely to be targeted include varanids (goannas), pythons, waterfowl, pigeons and black flying-fox (*Pteropus alecto)*. Hunting should be regulated so as to be sustainable.

6.6 Future Priorities

It is important that the faunal values of Mua Island be more comprehensively identified so that the most important conservation elements are managed appropriately. In addition to general systematic survey methods for the compilation of the fauna species assemblage for the island, the following actions are recommended:

High Priority

- Trapping survey targeting ground-dwelling mammals
- Trapping survey targeting freshwater turtles.

Medium Priority

- Identification of roosts and maternity sites for coastal sheathtail bat
- Identification of roosts for bare-backed fruit-bat
- Population estimate for beach stone-curlew to allow monitoring of breeding success
- Identification of any breeding areas for terns, particularly little tern.
- Identification of the most important foraging and high roost sites for waders
- Survey of rocky shores and mangroves for littoral whiptail-skink
- Survey of the rocky screes and pavements of the upper slopes
- Survey for slender chained gecko and identification of any overlap in habitat use with House Gecko.

Low Priority

- Trapping survey for water mouse. The *Draft Recovery Plan for the Water Mouse* (DERM 2009b) included the following key recovery actions:
  - *Identify habitats supporting populations of the water mouse and map the current distribution*
  - *Confirm current distribution of the water mouse*
  - *Conduct surveys and ecological assessments of potential water mouse habitat*
  - *Describe key biological and ecological features of the water mouse and its habitat*
  - *Determine whether genetic variation exists across populations of the water mouse*.
- Mist-netting of tube-nosed bats, *ie* clarification of the taxonomic status of *Nyctimene cephalotes* and its relative abundance and distribution compared to eastern tube-nosed bat (*N. robinsoni).*
- Survey for grey-headed flying-fox within any black flying-fox camps.

There is an Australian Museum specimen of ring-tailed gecko (*Cyrtodactylus* sp.) for Badu Island (OZCAM 2011), about two km from Mua Island at its closest point. Until recently ring-tailed geckos in Australia were considered to be the widespread species *C. louisiadensis*, which occurs in New Guinea. They are now considered to be an endemic species C. *tuberculatus* (Wells 2002; Wilson & Swan 2010). Wells (2002) also proposed a second species *C. abrae* for the population at Iron Range on Cape York Peninsula, though this has yet to be adopted (*eg* Wilson & Swan 2010). The Ring-tailed geckos on Badu Island, therefore, are of taxonomic interest and may prove to be of conservation significance. Any future survey on Mua Island should search for possible new species such as ring-tailed gecko.

7.0 The Role of Fire in Savanna Landscapes

Most Cape York Peninsula, and hence Torres Strait Island plant communities will burn if enough fuel is present. The exceptions are rainforest communities, communities of rocky areas and some wetland areas such as mangroves and the deeper permanent swamps. We know from the historical record and anthropological studies that the landscape of Cape York Peninsula when Europeans arrived was the product of traditional burning practices and land use that had changed little over many thousands of years and had led to stability in the nature of the plant communities and the way they were distributed across the landscape.

The loss of traditional burning practices in recent times has led to a loss of that stability as vegetation types that had evolved under particular fire regimes were subjected to new regimes[6]. In many areas this destabilisation has led to widespread loss of plant communities and inevitably will be found to have led to serious loss of the species of plants and animals that depend upon them.

In the history of the indigenous occupation of Cape York Peninsula and Torres Strait Islands, there were dramatic changes in plant communities as the climate shifted under a rapid succession of global ice ages, but these changes happened over thousands of years. It is clear from the nature of recent changes however that these changes have been greater in the periods of as little as fifty years than occurred in those millennia prior to European arrival. It is not the change itself that is the problem but its rapidity. Species cannot evolve rapidly enough to accommodate it and the inevitable result will be the loss of species.

The reasons that the indigenous people of northern Australia used fire have been well documented (Russell Smith *et al*. 2009). They included managing to favour various species of food plants, to protect sacred places, to attract game or drive them towards the spears of hunters and to create open landscapes that made travel easy and ambush by enemies difficult. Above all however, they burnt for their own safety. As people who used fire in their daily lives they had to burn to manage the fuel around them, thus avoiding situations where a stray spark landing in heavy fuel could threaten their lives.

In Torres Strait, the ongoing use of fire is evident on the majority of islands and there is no doubt that it has been fundamental in shaping and modifying vegetation cover and influencing habitat diversity across the islands. McNiven (2008) notes the ethnographic record of Haddon (1935) where fire use formed an integral part of garden preparation and land cleaning in the late 1800's, and evidence of fire is also in the pollen and phytolith record (Rowe 2006; Parr & Carter 2003).

The fire dependence of the non-rainforest communities is related largely to the regeneration strategies of the species within them. Some have woody fruits which have to be cracked by heat to release the seed and most require bare ground and sunlight for those seeds to germinate and grow. Many perennial grasses begin to decline and die after several years without fire. Some species will only

[6] Fire regimes are defined by the frequency of fires and their season of occurrence, both of which have relationship to their relative severity

generate from seed and others are capable of resprouting after fire. Of those species that will germinate and grow through heavy litter, all still require sunlight to survive and most will not persist under a wildfire regime of infrequent hot fires.

In post - European northern Australia, altered fire regimes have led to massive loss of open forest and woodland habitats in the high rainfall areas, particularly the north east coast of Cape York Peninsula. In that area fire has disappeared completely because of the complexity of the landscape, with numerous streams and rainforest areas which have made it impossible for individual fires to spread very far. The result has been widespread development of a dense understory of shrubs and trees which is preventing the regeneration of the canopy. The end result will be the replacement of open forest areas with rainforest related vegetation. In areas of shallow soils dominated by shrubs, there has been a progressive loss of species as they reach the end of their life cycle and die without replacement.

The land management imperatives that now arise as a result of the influences discussed above are to maintain fire in those plant communities that will still support it in order to stabilise them against further change, and to ensure that the prevailing fire regime is one of numerous small cool fires rather than widespread late dry season fires.

8.0 Profiles for Mua Island Habitats

The following section presents a summary of current knowledge, management requirements and recommended management actions for the habitats that occur on Mua Island. The information presented has been derived from prior and recent field survey efforts, review of previous reports, input from experts at technical workshops, and consultation with island rangers and indigenous community members.

8.1 Evergreen/Semi-evergreen Vine Forest and Vine Thicket

8.1.1 Status of Ecological Knowledge

The occurrence of evergreen / semi-evergreen vine forest is restricted to upper mountain tops, hillslopes and footslopes in the mountainous north-eastern portion of the island, as well as minor occurrences on well drained riparian landforms. Its distribution is controlled both by topography and geology, favouring locations on coarse grained biotite granite due to favourable weathering properties, as well as coarse sandy alluvial deposits on well drained stream terraces. In the presence of permanently available soil or atmospheric moisture, these habitats represent the maximum development of vine forest in the island group. The location of evergreen vine forest on Mua Island is shown in **Figure 3.**

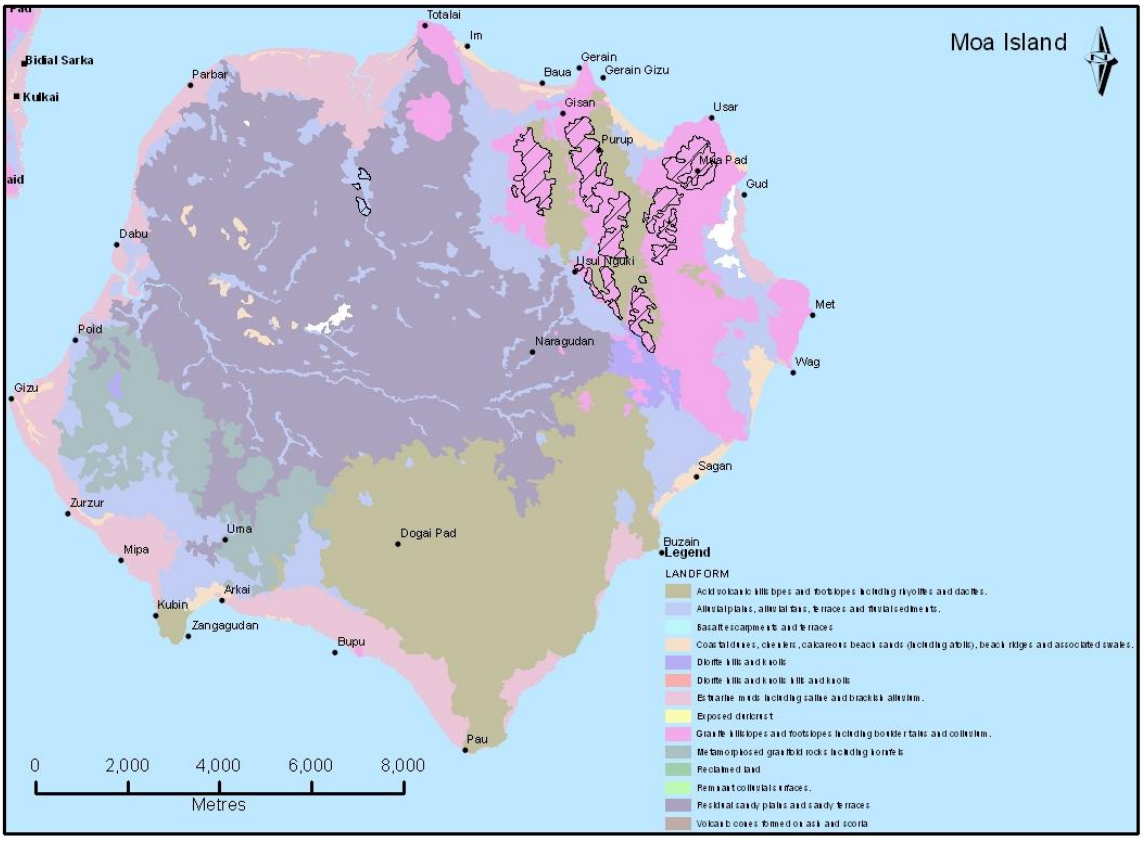


Figure 3. The location of evergreen vine forest on Mua Island (place names after Lawrie, 1970).

Evergreen Notophyll Vine Forest on Granite

The best development of the habitat occurs on Banks Peak where it forms complex notophyll vine forest (VC1f). This habitat is considered significant in the national and regional context. The micro-climatic and edaphic conditions provide a permanently moist 'upland' habitat exhibiting important floristic evidence of biological connectivity with Cape York Peninsula and neighbouring Papua New Guinea. Canopy heights in this community vary depending on exposure, although canopies observed on sheltered leeward slopes attain heights of greater than 30m. The sub-dominant stratum form a number of poorly differentiated layers which tend to merge in places, and it is these layers that present the greatest life form complexity. On steep wind exposed slopes on the eastern escarpment of Banks Peak, windshearing of the canopy reduces its height to an even 6-8m forming Vegetation Community 1g.

Photograph 8 (left) . Notophyll vine forest (VC1f) at the summit of Banks Peak, and **Photograph 9.** Windsheared notophyll vine thicket (VC1g) on the upper slopes of Banks Peak.

On the steep sheltered foot slopes of Banks Peak with a southerly aspect, weathering of the granite has produced a well-drained and relatively fertile sandy loam soil which has favoured development of one of the few mesophyll vine forest communities in the island group. The canopy height of this community ranges from 23m to 35m with notable species recorded including *Sterculia shillinglawii* subsp. *shillinglawii* (Near-Threatened), *Arenga australasica* (Vulnerable), *Licula ramsayi* var. *tuckeri*, *Syzygium beuttnerianum*, *Anthocarapa nitidula* and *Pandanus zea* (Near-Threatened).

Photograph 10. *Arenga australasica* forming a shrub layer in mesophyll vine forest.

Evergreen Notophyll Vine Forest on Alluvium and Drainage Channels

Mua provides for the only representation of evergreen vine forest on alluvial features in the broader Torres Strait Island group. This can be attributed to the abundant supply of coarse sandy sediment coupled with the perennial nature of many of the larger stream systems.

Maximum development of the forest is on the lower reaches of Tutalia Creek where it forms tall mesophyll gallery vine forest (VC1i) on the sandy channel levees. Canopy heights of 40m were regularly observed in this community with typical species including *Horsfieldia australiana, Syzygium bamagense* and *Acmena hemilampra* subsp. *hemilampra,* although *Maranthes corymbosa* and *Buchanania arborescens* are prominent in some localities. The sub-canopy assemblage includes *Licuala ramsayi,* and *Pandanus* spp. with scattered *Arenga australasica.*

Peripheral to the main flood channel, although retaining canopy height, forest complexity decreases with notophyll leaf sizes predominant (VC1j) on which maximum development of riparian rainforest occurs. Canopy dominance in this forest is shared between *Acmena hemilampra* subsp. *hemilampra* and *Syzygium angophoroides* with *Acacia auriculiformis*, *Syzygium forte* subsp. *forte*, *Calophyllum sil* and *Buchanania arborescens* also prominent.

Photograph 11 (left). Evergreen mesophyll vine forest (gallery) on the lower reaches of Tutalia Creek, and **Photograph 12.** Evergreen notophyll vine forest –outer flood plain of Tutalia Creek.

8.1.2 Ecological / Cultural Considerations

Habitat Condition: This habitat has been largely unaffected by human occupation due to its geographic distribution, mostly (with exception to vine forest on alluvium) restricted to areas of steep, rugged topography which is enclosed within a broad buffer of non-flammable vegetation. The vegetation margins are stable, constrained by both topography and local edaphic condition and largely show no evidence of anthropogenic alteration. At the clearing for the telecommunications tower on Banks Peak, Brazilian joyweed has been introduced and forms a moderate level infestation that extends for a distance under the forest canopy. This weed requires immediate eradication.

Fauna: The fauna assemblage associated with this habitat is poorly sampled and virtually unknown. This habitat lacks any previous structured fauna sampling effort, and considering the extent of this habitat, represents a major gap in faunal knowledge. It is also considered that the mountain top forests are those most likely to present the possibility of new fauna species or species records. Vine forest provides potential habitat for the bare-backed fruit bat, the cave dwelling 'fawn leaf-nosed bat' , Toressian tube nosed bat, reptiles including the emerald monitor, and birds including grey and red goshawks.

Flora: The habitat supports high species diversity and is habitat to numerous significant species (see **Section 5.2.1**). These include Papua New Guinea species such as *Gnetum gnemon* and *Elattostachys rubrofructus* which are the only records for Australia. The habitat also supports a rich orchid and fern flora together with a number of threatened slender Apocynaceae vines.

Cultural Perspectives: The habitat hosts an abundant array of cultural resources particularly food trees. Specific cultural significance is unknown and requires further investigation.

8.1.3 Management Implications

A small area of this unique mountain top ecosystem has been destroyed during the development of telecommunication infrastructure on Banks Peak. Ongoing maintenance of this area is required to prevent further degradation, including an urgent need to eradicate the infestations of Brazilian joyweed before it penetrates into the adjoining closed forest. Field observations suggest that the margins of the clearing around the telecommunication towers are periodically sprayed. Any such activity has consequences for the significant flora species such as *Hoya annulata, Hoya revoluta* and *Dischidia littoralis* which occur on forest margins. Infrastructure maintenance activities and upgrades have potential to impact on the adjoining vegetation and along the walking track access between the heli pad and the towers.

This habitat is otherwise robust, buffered from the impacts of footslope fires and as such, requires little action in terms of active management. Informal observation of habitat condition including health of canopy (monitoring for dieback) should be undertaken on a regular annual to bi-annual basis whenever Banks Peak is accessed. Observations relating to any changes to habitat condition should be documented so that the risk these changes pose to long-term habitat stability can be assessed and appropriate management responses formulated.

The mountain top rainforest is possibly the least known and sampled habitat on the island in terms of faunal assemblage. The habitat should be subject to targeted fauna survey and trapping, particularly to gain greater insight into the habitats mammal assemblage. It will however be a difficult habitat to survey due to limited accessibility and will require concerted effort. Documentation of all animals observed (including invasive/exotic species) should be undertaken with photographs and collections (preserved in freezer) where possible for future formal identification by authorities or agencies. The habitat supports numerous threatened, cultural and regionally significant flora species some of which are poorly known, or possibly not known to science.

Data collection and collections and pressings of plant species within this habitat can be undertaken on an opportunistic basis. It will also be important to identify plants which have cultural significance to the local community, and the specimen collection program should include plants of cultural/resource significance and local plant names compiled in an appropriately stored reference collection. Scientific names for plant species can be applied when the opportunity arises.

8.1.4 Summary of Recommended Management Actions

The information provided in **Table 9** below aims to summarise the key issues, actions and priorities so as to aid the transfer of information into the Mua Island Working on Country Plan. Priority categories are adapted from the Draft Plan of Management for Pulu Indigenous Protected Area (Hitchcock *et al.* 2009) as follows:

Immediate Priority Actions – Actions required for management issues which have potential to significantly alter or damage the islands' natural or cultural values in the short term (0-5years).

High Priority Actions – Actions required for management issues which have potential to result in significant damage of the islands natural or cultural values within the medium term (5-15 years) or where lack of knowledge significantly hampers the ability to manage a habitat effectively.

Moderate Priority Actions – Actions required for management issues which have potential to result in significant damage to the islands' natural or cultural values within the long term (>15 years) or where there is a knowledge gap that does not detract significantly from the ability to manage a habitat effectively.

Table 9. Summary of management actions for evergreen vine forests.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known and documented.	The design and implementation of a structured fauna survey and trapping program is considered a high priority requirement for action. The survey needs to utilise collaborative research and should initially target mammal species which are poorly documented.	High
Plant Surveys	Flora composition is documented although limited to rapid surveys. There is considerable potential for new records and a range of significant species to be recorded from within this habitat.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and prepare plant pressings. Update island species list as new information becomes available.	High
Traditional Ecological Knowledge	TEK within this habitat is poorly known. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	No major issues identified. The habitat is mostly protected in rocky gullies and hillsides.	No specific management actions required. Management of surrounding flammable vegetation country by early dry season mosaic burning to limit impact of late season wildfires on those	No Action Required.

Management Category	Context/Issue	Actions	Priority
		areas fringed by woodland habitats.	
Threatened Species Management	Flora: Numerous conservation significant species are known to occur within this habitat. The ecology of these species is poorly documented. Edge effects associated with the telecommunication towers have the potential to impact on individuals of a number of threatened flora species. Outside of this area the habitat is robust with no immediate threats recognised. Fauna: Composition of fauna within this habitat is poorly known.	Flora: Carry out surveys to determine populations of threatened flora on the margins of the clearing around infrastructure. Incorporate this information toward developing a set of management guidelines for the telecommunications tower site. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: Known weed infestations are limited to infestations of Brazilian joyweed, and snake weed at the telecommunications tower on Banks Peak. Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna by feral cats and dogs.	Flora: Active control and eradication of Brazilian joyweed is an urgent management requirement. Informal monitoring for new weed infestations particularly on habitat edges and along access tracks should be undertaken on an annual or bi annual basis. Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting.	Immediate High
Monitoring	Observations relating to any changes to habitat condition should be documented so that the risk these changes pose to long-term habitat stability can be assessed and appropriate management responses formulated.	Carry out informal observation of habitat condition including health of canopy (monitoring for dieback) and presence of invasive weed species, on a regular annual to bi-annual basis. Observations should be made at major points of access (helipad and tower) in respect to canopy health. There is some potential for the introduction of *Phytopthora cinnamomi* (a root fungi) on workers boots and equipment. Hence any areas of dieback in habitat should be marked with a GPS and subject to ground investigation. Specific management actions undertaken will be dependent on results of ground investigations.	High

8.2 Deciduous / Semi Deciduous Vine Forest and Thicket

8.2.1 Status of Ecological Knowledge

Deciduous/semi-deciduous vine forest is associated with rocky granite knolls and with a limited number of occurrences on coastal dune systems. The distribution of deciduous vine thicket on Mua Island is shown on **Figure 4.**

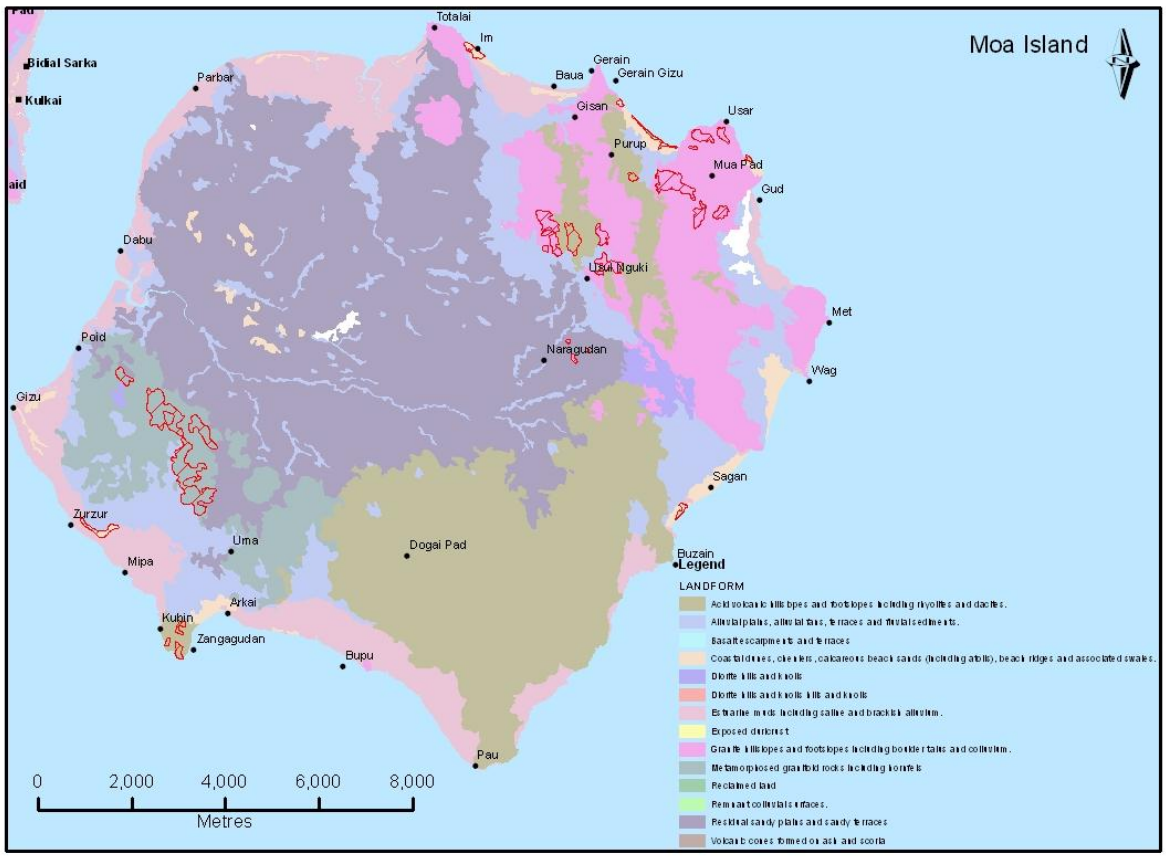


Figure 4. Location of deciduous vine thicket and forest on Mua (place names after Lawrie, 1970)

Semi - Deciduous Vine Forest on Granite

Semi deciduous vine thickets on granite occur sporadically across the island. The best development of these, represented by VC2o, occurs in the vicinity of Kubin. This is a tall community with a canopy height range of 23 to 35m and a diverse floristic assemblage which includes species such *Maranthes corymbosa, Buchanania arborescens, Cryptocarya exfoliata*, *Acacia auriculiformis*, *Syzygium forte* subsp*. forte, Barringtonia calyptrata, Gmelina dalrympleana* and *Bombax ceiba* var*. leiocarpum.* The 'Near-Threatened' listed species *Archidendron hirsutum* is a prominent species in the shrub and sub-canopy layers. The community occupies rocky boulder slopes, providing a physical barrier to penetration of fire into the forest margins.

Communities of lesser structural development include vegetation community 2v, comprising predominantly *Terminalia subacroptera* and *Acacia polystachya,* which occupies exposed headlands and escarpments on rhyolites; and VC2b which forms a thicket type characterised by a variable range of deciduous forest trees. In the latter case, fire continues to play a major role in the distribution of forest boundaries, which may demonstrate a dynamic relationship to adjacent grassland and woodland communities.

Photograph 13 (left). Semi-deciduous vine forest community (VC2o) to the north of Kubin, and **Photograph 14.** The migrating boundaries of vine thicket demonstrated with a relict turkey mound engulfed by fire generated grassland. The thicket in the background occupies a suppressed exposure of granite boulders which affords some fire protection.

Vine Thicket on Coastal Dunes

Vine thicket on dune landforms is limited in extent, scattered on foredunes along the island's coastline. In the predominant expression (VC2u), Canopy height is typically 12m with characteristic species including being *Mimusops elengi, Sterculia quadrifida* and *Terminalia subacroptera. Manilkara kauki* is always present. On the broad prograding dune complex to the south of St Pauls (Sagan), the vine thicket forms a groved morphology with *Bombax ceiba* forming a prominent emergent. The type is notable for the prominence of *Arenga australasica* in the sub-canopy and shrub layer. Examination of the community in November 2007 suggested that the habitat suffers from regular fire incursion, blown landward from regularly burnt grassy foredune communities.

Photograph 15 (left). A linear fringe of littoral rainforest on a retreating beach ridge in the islands north-east. Dune regression is pronounced in the steep cutaways. **Photograph 16.** Vegetation community 2p on Mua's east coast at Sagan. The vine thicket suffers occasional fire incursion, blown landward from the foredune, which threatens populations of *Arenga australasica.*

8.2.2 Ecological / Cultural Considerations

Habitat Condition: The rocky substrates on which large areas of this habitat occur offers protection from fire. The majority of habitats on rocky knolls have retreated to a degree that fire no longer has a significant impact on habitat margins which generally form sharply defined boundaries with savannah woodland communities on lower slope locations. Whilst the majority of habitats observed are in excellent condition, the seasonal loss of leaf cover, facilitating light penetration to the forest floor,

provides opportunities for the establishment of exotic species. The most imminent weed threat to this habitat is posed by lantana (*Lantana camara),* a class 3 exotic species that is well adapted to establishing in forest canopy gaps. Lantana has yet to be recorded from the island, however infestation would significantly alter the ecology of this habitat.

Littoral thickets associated with dune systems, lack the inherent stability of vine thicket habitats associated with rockier substrates and these are influenced by the mobility of the sandy substrate which may be destabilised by wind, anthropogenic disturbance including access tracks, exotic animals or fire. For this reason, littoral thickets should be considered highly sensitive habitats and protected from more destructive elements of human disturbance as far as is practical. Littoral habitats at Sagan have been subject to repetitive firing which has resulted in severe attrition of the margins and in this location, only fragmented remnants of a once more extensive habitat exist.

Fauna: The fauna assemblage associated with this habitat is poorly sampled and further structured survey effort and opportunistic sampling/observation would greatly improve the current knowledge of baseline fauna assemblage. Vine thicket provides potential habitat for the bare-backed fruit bat, the cave dwelling fawn leaf-nosed bat, the coastal sheathtail bat and emerald monitor. Littoral thickets also provide important nesting habitat for the beach-stone curlew and the eastern curlew.

Flora: The habitat supports high species diversity and provides habitat for a number of significant species (refer **Section 5.2.1**).

Cultural Perspectives: The habitat, particularly littoral dune forest, provides an extensive repository of cultural resources, including a number of important food trees such as wongai (*Manilkara kuaki)*, cedar bay cherry (*Eugenia reinwardtiana),* mipa *(Terminalia subacroptera),* yam *(Dioscorea transversa),* peanut tree *(Sterculia quadrifida),* and ballart *(Exocarpos latifolius).*

8.2.3 Management Implications

Vine thicket on rocky slopes is relatively robust although, it remains at threat via introduction of exotic species, particularly lantana. Littoral thickets on dunes are restricted in occurrence, although one of the few examples at Sagan is being severely impacted by recurrent hot fires. In the context of management of littoral foredune systems as a whole, the dunes are recent landform elements in the process of stabilisation through vegetation succession from forbland to shrubland to vine thicket. A repetitive hot fire regime can interrupt the stabilisation process resulting in foredune erosion. It is understood that burning at Sagan is undertaken regularly to maintain its use as a sports field although a few simple management actions can limit the impact of fire on the thickets. Mosaic or back burning in early dry seasonal periods along the margins of littoral forest can avoid the impact of fires that are lit in hotter periods. Early season burns should be considered around all littoral thicket patches at Sagan, and other areas where the impact of fire is noted. Prevention of hot wildfire incursion can be considered a fundamental requirement for management of littoral rainforest and vine thicket habitats. The expansion of smaller vine thicket copses in degraded forest habitats can similarly be facilitated by back burning or fire exclusion on habitat margins. Recreational access, and collection of timber

resources for firewood or carving all have similar potential to degrade the habitat through dune destabilisation and potential vector for introduction of pest species.

8.2.4 Summary of Recommended Management Actions

Table 10. Summary of management actions for deciduous and semi-deciduous vine thickets.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known.	Design and implement a structured fauna survey and trapping program utilising collaborative research. Survey should prioritise the most extensive tracts of rainforest for survey due to the extent of this habitat. Maintain focus on ethno-taxonomy to feed into TEK.	High
Plant Surveys	Flora composition is poorly documented and limited to rapid surveys in dry season. There is a potential for new records for the island of significant species particularly during the wet season when canopy trees are in full foliage and when vines and herbs are robust.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	TEK within this habitat is poorly known and/ or documented. Plant and animal lists provided in the Appendices provide a good foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	The littoral vine thicket habitats may be impacted by late season wildfires which have considerable potential to cause retreat of vine thicket margins and penetrate for some distance within ground covers. The incursion of exotic species, particularly lantana, may considerably alter the flammability of deciduous vegetation rendering it susceptible to incursion by severe late season fires.	Management of surrounding country by dry season mosaic burning to limit impact of late season wildfires. Consider back burning along the margins of littoral vine thicket communities (e.g. Sagan) to limit impacts of late season wildfires	Immediate
Threatened Species Management	Flora: The ecology of this habitat, where it occurs on granite, is poorly documented, however the habitat is presently robust and self-maintaining. Threats to significant flora species are from introduction of weeds. In littoral forests, populations of arenga palm, and a range of other significant species may be subject to impacts by late season fires. Fauna: Composition of fauna within this habitat is poorly known.	Flora: Carry out ongoing surveys as identified above. Monitor habitats for weed incursions (see monitoring). Carry out actions relating to fire management to maintain threatened species populations in littoral thickets. Fauna: Further baseline information required (see fauna	High High

Management Category	Context/Issue	Actions	Priority
		surveys) before discrete management actions can be fully defined. The location of populations of beach stone curlew should be identified within this habitat and critical areas protected from recreational activities where possible.	
Invasive Species Management	Flora: There are few existing weed infestations within this habitat although there is a risk of introduction of a number of weed species into the habitat including praxelis, lantana, mintweed, red Natal grass and butterfly pea. Fauna: The composition of invasive fauna within this habitat requires further study. There is considerable potential for impacts on fauna by feral cats and dogs.	Flora: No active weed control is currently required. Carry out monitoring for new weed infestations particularly on habitat edges on an annual or bi-annual basis. Focus should be maintained on littoral vine thicket habitats where the risk of weed incursion is particularly high. Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting and consultation with community members. Develop a trapping/ structured control program based on results.	Moderate Immediate
Monitoring	Observations relating to any changes to habitat condition should be documented so that the risk these changes pose to long-term habitat stability can be assessed and appropriate management responses formulated.	Carry out informal monitoring of selected locations for infestation of weed species on a six monthly basis including observations taken late in the wet season at maximum growing season. Weeds such as praxelis, butterfly pea, siratro, lantana and mintweed should be a focus for monitoring efforts. Lantana also poses a considerable threat to habitat stability. Establishment of formal monitoring and photographic sites in selected littoral (dune) vine thicket habitats near Sagan that have been previously impacted by recreational usage and fire (. This will provide evidence for the effectiveness of imposed fire and recreational management regimes). Monitoring sites can be marked with a star picket with photographs taken towards designated directions.	High
Cultural Heritage	Inappropriate fire regimes and vehicular recreational access to littoral vine thicket habitats has considerable potential to destabilise dune landforms and lead to degradation of cultural sites and values.	Carry out cultural heritage surveys and manage sites as required.	Immediate.
Other Actions	Vehicular recreational access to littoral vine thicket habitats has considerable potential to destabilise dune landforms and lead to habitat	Designate a single recreational access point for vehicles and close all alternative access points to usage. Ensure the reasons for	Immediate

Management Category	Context/Issue	Actions	Priority
	degradation. Beach access also greatly increases the risk of exotic weed species introduction and spread.	these actions are communicated to the broader Mua Island community.	

8.3 Swamp Forest and Riparian Forest Complexes

8.3.1 Status of Ecological Knowledge

Swamp forests can be divided, based on geomorphic association, into those developed in drainage depressions, and riparian vegetation associated with alluvial channels. Both habitat types depend on seasonal water flows for replenishment of both nutrient and soil moisture levels, with drainage depressions remaining ponded for extended periods. Seasonal water logging of soils is an ecological control in common with all of these communities. The distribution of swamp forest habitats is shown in **Figure 5.**

Swamp Forest on Alluvial Channels

This is a diverse grouping, ranging from luxuriantly developed gallery rainforest/ swamp forest complexes to mixed sclerophyll open forests. Development depends largely on hydrology, as well as sediment supply with development aided by thick deposits of freely draining sandy alluvium, typically on channel levees. Maximum habitat development habitat is typified by VC3d which represents a complex of tall vine forest and *Melaleuca leucadendra* dominant swamp forest, which occurs in broad sandy drainage channels throughout the central parts of the island. Canopy heights in this habitat may attain 40m with vine forest elements dominated by *Horsfieldia australiana, Syzygium bamagense* and *Acmena hemilampra*.

Communities developed on permanently waterlogged sites (VC3a) are generally lower in stature (18 – 25m) and comprise a mix of rainforest and sclerophyll species including *Lophostemon suaveolens, Melaleuca quinquenervia, Syzygium angophoroides* and *Asteromyrtus brassii.* Ground cover is typically occupied by sedges including *Gahnia sieberiana, Lomandra banksii* and *Lindsaea ensifolia* subsp. *ensifolia* and some evidence of fire incursion may be present within the habitat.

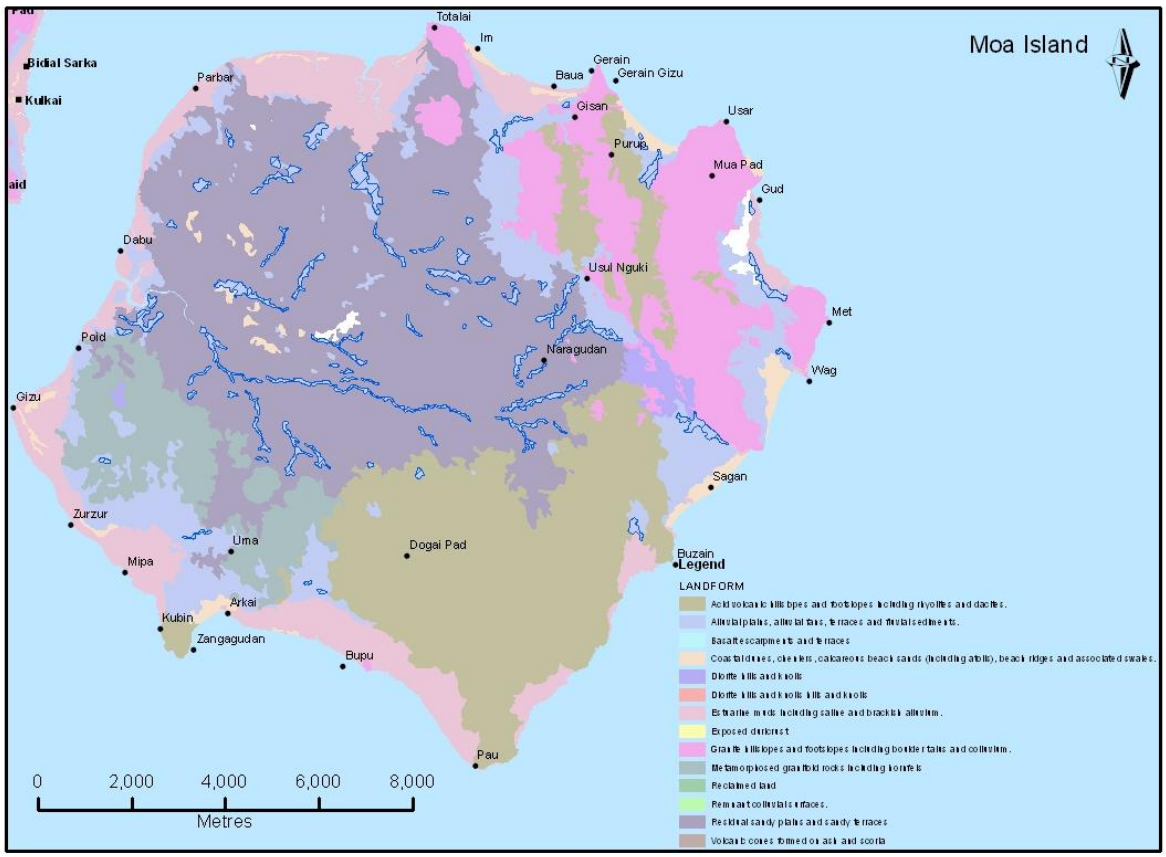


Figure 5. Location of swamp forest habitats (place names after Lawrie, 1970)

Photograph 17. Riparian forest complex on sandy drainage channel to the south of St Pauls settlement.

Swamp Forest on Drainage Depressions

Some extremely well developed swamp forest complexes are located in drainage depressions behind mangroves in the vicinity of St Pauls settlement. This forest, represented by VC3c, is a complex of tall mesophyll vine forest and melaleuca dominant open forest contributing roughly equal proportions to total canopy cover. Typical heights of this forest range from 35m to 40m. The canopy of the tall open forest component is dominated by *Melaleuca dealbata* and *Melaleuca leucadendra,* with a well developed mix of swamp tolerant vine forest species in the sub-canopy, including *Dillenia allata Gmelina dalrympleana, Horsfieldia australiana, Calophyllum sil, Acacia polystachya* and *Pandanus*

zea. The vine forest component, which occupies slightly elevated sandy rises, is dominated by *Syzygium angophoroides, Acacia auriculiformis*, *Buchanania arborescens* and *Syzygium bamagense* in the upper stratum. The community is notable for the prominence of *Arenga australasica* (Vulnerable) and *Pandanus zea* (Near-Threatened) in the lower structural layers. The swamp forest communities also provide habitat for *Costus poteriae* (Endangered – NC Act) with a number of populations found on the interface between swamp forest and eucalyptus dominant woodland habitats.

Photograph 18 (left) . *Pandanus zea* in the lower structural layers of tall *Melaleuca leucadendra / Melaleuca dealbata* dominant swamp forest and **Photograph 19.** Vine forest component with tall specimen of *Syzygium bamagense* and *Arenga australasica* in the lower structural layers.

8.3.2 Ecological / Cultural Considerations

Habitat Condition: With the exception of some degraded habitats located in the vicinity of the St Pauls, swamp forest habitats are universally in good condition. They are largely free from exotic weeds and from most other forms of anthropogenic disturbance with the exception of minor disturbance by feral pigs in some locations. These habitats, particularly riparian forests, act as natural firebreaks and can be utilised as such during prescribed burning events. The greatest threat to the integrity of these habitats comes from exotic weed invasion along the community margins. Degraded habitats in the vicinity of St Pauls were observed to be heavily infested with para-grass (*Brachiaria mutica)* which had totally displaced native ground covers. Lantana (*Lantana camara*), a species that has colonised extensive areas of similar habitat throughout much of coastal Queensland and dramatically altered habitat ecology, is also suited to the habitat and considered a potential threat if introduced. Singapore daisy (*Sphagneticola trilobata*), a highly invasive herbaceuous weed that is capable of widespread conversion of groundcover is also a significant threat to these habitats. Damage by feral pigs was noted in well developed swamp forests to the north of St Pauls settlement, having potentially significant impacts on populations of the Endangered *Costus poteriae.*

Fauna: The fauna assemblage associated with this habitat is poorly sampled, and further structured survey effort and opportunistic sampling/observation would greatly improve the current knowledge of baseline fauna assemblage. The habitat may be particularly important to a range of amphibian

species and surveys undertaken across a range of seasonal conditions would greatly expand the current knowledge base.

Flora: Several populations of the Endangered *Costus poteriae* have been observed on the island. The species relies on the habitat formed on the interface between swamp forest and adjacent woodland communities. This interface is in a meta-stable state and may respond rapidly to landscape scale changes in ecological process such as weed invasion and changing fire regimes. As such, the islands known populations of costus are reliant on a continuation of the current ecological regimes. The ecology of the species is poorly known and requires further study. The grass *Germainia capitata* (Vulnerable EPBC Act & NC Act) is also likely to occur on the margins of this habitat. Other significant species known from the habitat are:

- *Acmena hemilampra* subsp*. hemilampra (*Myrtaceae*)*
- *Horsfieldia australiana* (Myristicaceae)
- *Licuala ramsayi var. tuckeri* (Arecaceae)
- *Podocarpus grayae* (Podocarpaceae)
- *Rhodamnia australis* (Myrtaceae)
- *Syzygium bamagense* (Myrtaceae)

Cultural Perspectives: The cultural values of these habitats are unknown although, by nature, they would host a diverse array of cultural resources including food species.

8.3.3 Management Implications

A high moisture content over extended seasonal periods is the primary factor controlling the distribution of these habitats. As such, they are relatively stable within their respective niches, although they may be subject to a range of threatening processes such as inappropriate fire regimes, weed invasion, and feral pig damage. Of these processes, weed invasion is the greatest concern with considerable potential to alter ecological function. Feral animals also have significant potential to impact these habitats and swamp forests provide a foraging resource for pigs. General observation relating to feral animal damage should be undertaken during routine ranger patrols with management actions guided by any observed increase in foraging activity. Control programs for feral pigs are warranted in the vicinity of badly impacted habitats.

Attention should be given to mapping populations of *Costus poteriae* whose distribution appears reliant on the niche created on the interface between swamp forest and adjacent woodland communities. This ecotone is unstable in the sense that it will be the first point of response to landscape scale changes in ecological process such as weed invasion, feral animal damage, and changing fire regimes. The spread of Singapore daisy and introduction of lantana to the margins of these habitats may have a devastating impact on populations of the species through either direct displacement or by altering the response of the habitat to fire. Exotic weeds may also severely degrade the usefulness of these habitats as a traditional resource base. Costus habitat requires long

term monitoring to gauge the effectiveness of management regimes in respect to maintenance and possible expansion of current population sizes.

Fire regimes in adjacent woodland habitats should be tailored to prevent accumulation of fuel levels that promote severe late dry season fires. Severe fires have potential to degrade the margins of swamp forest habitats and their management should be considered in the context of broader landscape scale management regimes.

8.3.4 Summary of Recommended Management Actions

Table 11. Summary recommendations for management of swamp and riparian forest habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known. The habitat may be particularly valuable to a range of frogs and reptiles. It provides specific habitat and foraging grounds for a range of bird species.	Design and implement a structured fauna survey and trapping program utilising collaborative research. General nocturnal and diurnal searches for frogs reptiles and birds taking photographic records of those species observed. Maintain focus on ethno-taxonomy to feed into TEK.	High
Plant Surveys	Flora composition is poorly documented and limited to rapid surveys in dry season. Riparian and swamp forests are productive habitats with considerable potential to host a number of significant plant species not previously recorded on the island.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	TEK within this habitat is poorly known and / or documented. Plant and animal lists provided in the Appendices provide a foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	The majority of riparian and swamp forest habitats are fire sensitive. Repetitive hot fires burnt into the margins of fire sensitive vegetation can impact on forest structure and species diversity. Open swamp forests may possess a dense grassy ground cover which is highly flammable under severe conditions. Extremely hot fires may cause considerable damage to fragile ground cover grasses and forbs and result in canopy scorch of canopy trees.	Mosaic burning of adjacent woodland habitats starting early in the season will limit impacts of severe late dry season fires. Non-flammable riparian forest areas provide suitable fire breaks to compartment prescribed burns, and should be used as such where appropriate. Ensure fire tolerant swamp forest areas do not burn under severe climatic conditions when the substrate is extremely dry, to prevent structural damage to the forest. Early seasonal burns may eliminate the risk of incursion by severe wildfire.	High
Threatened Species	Flora: Populations of threatened flora species, particularly on the	Flora: Carry out ongoing surveys to identify and map populations of	High

Management Category	Context/Issue	Actions	Priority
Management	habitat margins, are threatened by weed infestation and severe late season fires. Fauna: Composition of fauna within this habitat is poorly known.	significant species. Maintain landscape scale mosaic burning or back burn along the edge of known *Costus poteriae* populations to prevent incursion by severe late season fires. Place monitoring sites in the vicinity of known populations to gauge the effectiveness of management actions. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	High
Invasive Species Management	Flora: There are few existing weed infestations within this habitat although there is a high risk of introduction of a number of weed species. Brazilian joy-weed and Singapore daisy are perhaps the most imminent existing threat to the ecology of swamp forest habitats. Lantana is a potential threat if introduced. Fauna: The composition of invasive fauna within this habitat requires further study. There is considerable potential for impacts on native fauna by feral cats and dogs. Swamp forest and riparian habitats provide a favoured habitat for feral pigs which may cause significant damage to ground covers.	Flora: No active weed control is currently required. Undertake regular informal surveys of the margins of riparian habitats to check for exotic species incursion or damage. Mark informal survey locations in a track log to ensure adequate survey of all significant riparian areas is undertaken annually. Implement immediate weed control measures where infestation is identified. Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat and dog activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting and consultation with community members. Develop a structured control program based on results. Undertake informal monitoring of feral pig damage and install traps in areas where pig damage is noted to be severe.	Moderate Immediate
Monitoring	Permanent photographic monitoring points are required to assess the effectiveness of management measures aimed at maintaining populations of *Costus poteriae.*	Erect permanent photographic monitoring points at known populations of *Costus poteriae*. Undertake population counts to further supplement photographic monitoring. Erect a number of permanent photographic monitoring points in swamp forest habitats in the vicinity of the dunefield. This will allow an assessment of vegetation structure to determine if the noted floristic and structural changes have finalised.	High

8.4 Welchiodendron Dominant Closed to Open Forests and Woodlands

8.4.1 Status of Ecological Knowledge

An extensive closed to occasionally open forest community, largely restricted landforms developed on acid volcanic and granitic lithologies, where it occupies lower footslopes, sheltered hillslopes, and gully lines. General canopy heights range from 10 to 18m with *Welchiodendron longivalve* usually dominant, with other prominent canopy species including *Acacia polystachya, Terminalia sub-acroptera, Endiandra glauca, Canarium australianum, Dysoxylum oppositifolium, Sterculia quadrifida, Drypetes deplanchei* and *Bombax ceiba* var*. leiocarpum.* In some restricted locations, Welchiodendron is absent from the canopy which is dominated by *Acacia polystachya* although these areas are considered a localised ecological variation rather than a separate distinctive community. The habitat is generally protected from fire, occurring on rocky boulder slopes, which provide a physical barrier to fire incursion.

Photograph 20. *Welchiodendron longivalve* dominant open forest demonstrating the rocky nature of the substrate on which it occurs.

8.4.2 Ecological / Cultural Considerations

Habitat Condition: A robust habitat that is resistant to incursion of intense fire events and other elements of degradation including weed infestation. All habitats observed were in pristine condition. Welchiodendron is often used for firewood although harvesting is restricted to younger trees and shrubs and the process of fire wood harvesting has had limited impact on the habitat condition.

Fauna: Similar to other forest habitats on Mua, the fauna assemblage associated with this habitat is poorly sampled and as such, poorly known. Further structured survey effort and opportunistic sampling/observation would greatly improve the current knowledge of the baseline fauna assemblage. Caves and rock fissures within this habitat are likely to provide roosting sites for coastal sheathtail bats, Torresian tube-nosed bats, fawn leaf-nosed bats and Near-Threatened reptiles including the emerald monitor and slender- chained gecko.

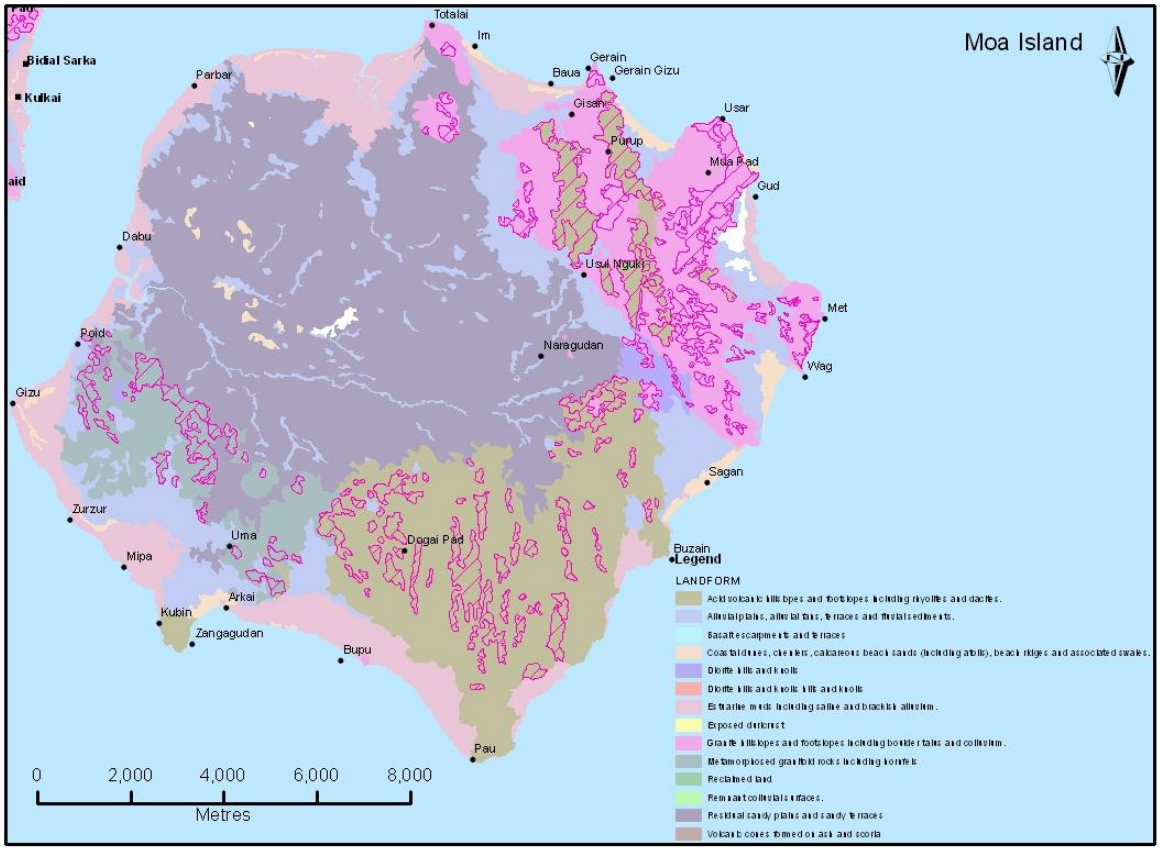


Figure 6. Occurrence of welchiodendron dominant forest (place names after Lawrie, 1970).

Flora: The habitat supports high species diversity particularly where a vine thicket understorey and subcanopy is well-developed. Significant species include:

- *Cycas badensis*
- *Archidendron hirsutum (*Mimosaceae*)*, *Neololeba atra* (Poaceae)
- *Actephila venusta* (Euphorbiaceae)*, Aglaia tomentosa* (Meliaceae), *Atalaya australasica* (Sapindaceae), *Everistia vaccinifolia* (sens. lat.) (Rubiaceae)*, Erythroxylum* sp. (Mosquito Creek J.R. Clarkson 9991+)(Erythroxylaceae)*, Haplostichanthus fruticosus* (Annonaceae), *Miliusa traceyi* (Annonaceae), *Triflorensia australis* (Rubiaceae), *Uvaria rufa* (Annonaceae)*, and Voacanga grandiflora* (Apocynaceae).

Cultural Perspectives: This is the most extensive closed forest habitat on Mua Island occurring from footslopes to hilltops. Apart from limited use as firewood, Welchiodendron is largely unutilised as a resource. The habitat may host a range of plant and animal resources.

8.4.3 Management Implications

This is a robust habitat requiring limited active management. Its broad distribution and general habitat integrity in the face of regular anthropogenic burning indicates that fire presents little risk to habitat quality and extent. The establishment of exotic species, such as lantana (*Lantana camara),* poses the greatest risk to habitat integrity in the long term. Minimal active management is required at present. General monitoring for invasive species should be a routine component of the ranger work program

and undertaken in areas in the vicinity of current disturbance, particularly around the township and dumping sites.

8.4.4 Summary of Recommended Management Actions

Table 12. Recommended management actions for welchiodendron dominant forests and woodlands.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known.	Design and implement a structured fauna survey and trapping program. The survey needs to utilise collaborative research and maintain focus on ethno-taxonomy to feed into TEK.	High
Plant Surveys	Flora composition is documented although limited to rapid surveys in the dry season. There is considerable potential for new records of significant species to be recorded from within this habitat.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	TEK within this habitat is poorly known / documented. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	No major issues identified. The habitat is mostly protected in rocky gullies and hillsides although it will possibly expand if burning pressure is taken off adjacent flammable woodland habitats.	No specific management actions required. Management of surrounding flammable vegetation by mosaic burning is required to maintain current habitat boundary position in the landscape.	Moderate
Threatened Species Management	Flora: Four threatened (including Near-Threatened) and 11 regionally significant species are known to occur within this habitat. While the ecology of these species is poorly documented, the habitat is robust with no immediate threats recognised. Fauna: Composition of fauna within this habitat is poorly known.	Flora: No management actions required. Carry out ongoing surveys as identified above. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: No existing weed issues have been identified however a number of species, Lantana in particular, known from disturbed areas pose a threat in the long term. Fauna: Composition of invasive fauna within this habitat is poorly known. There is potential for	Flora: No active weed control or management currently required. Carry out monitoring for new weed infestations particularly on habitat edges and along access tracks on an annual or bi-annual basis. Fauna: Assess cat / dog activity levels by installation/monitoring of sand pads on nearby tracks,	Moderate Immediate

Management Category	Context/Issue	Actions	Priority
	impacts on fauna by feral cats and dogs.	nocturnal spotlighting.	
Monitoring	Observations relating to any changes to habitat condition should be documented so that the risk these changes pose to long-term habitat stability can be assessed and appropriate management responses formulated.	Carry out informal observation of habitat condition including health of canopy (monitoring for dieback) and presence of invasive weed species, on a regular annual to bi-annual basis. Informal monitoring locations should be recorded in the track log of a GPS to ensure adequate seasonal coverage of at risk locations (near roadsides or disturbance areas) is undertaken on an annual basis.	High

8.5 Eucalypt and Corymbia Dominant Open Forests and Woodlands

8.5.1 Status of Ecological Knowledge

This is an extensive habitat type on Mua with 6 floristic variations occurring across footslopes and hillslopes, alluvial flats and sand dunes. All open forest and the majority of woodland communities observed are regularly burnt with ground layers in excellent condition. The location of eucalyptus dominant open forest and woodland is represented in **Figure 7.**

Hillslope Associations

Habitats associated with hillslopes are typically open forests and occasionally woodlands with the bloodwood species *Corymbia stockeri* and *Corymbia nesophila*, *Corymbia clarksoniana* and occasionally *Corymbia tessellaris* the dominant canopy constituents. At their maximum development, the canopy heights range from 25 to 33m with up to 50% projected canopy cover (PCC). Shrub layers are typically sparse, with *Welchiodendron longivalve, Cycas badensis, Livistona muelleri* and *Acacia spp.* being the dominant sub-canopy and shrub species. Well developed ground covers of Kangaroo Grass (*Themeda triandra)* are typical. The habitat also includes low mixed woodland of *Corymbia clarksoniana, Melaleuca viridiflora, Welchiodendron longivalve, Asteromyrtus brassii* and *Acacia leptocarpa* (VC5d) which is restricted to skeletal soils on hard white rhyolite escarpment fringing the islands south coast.

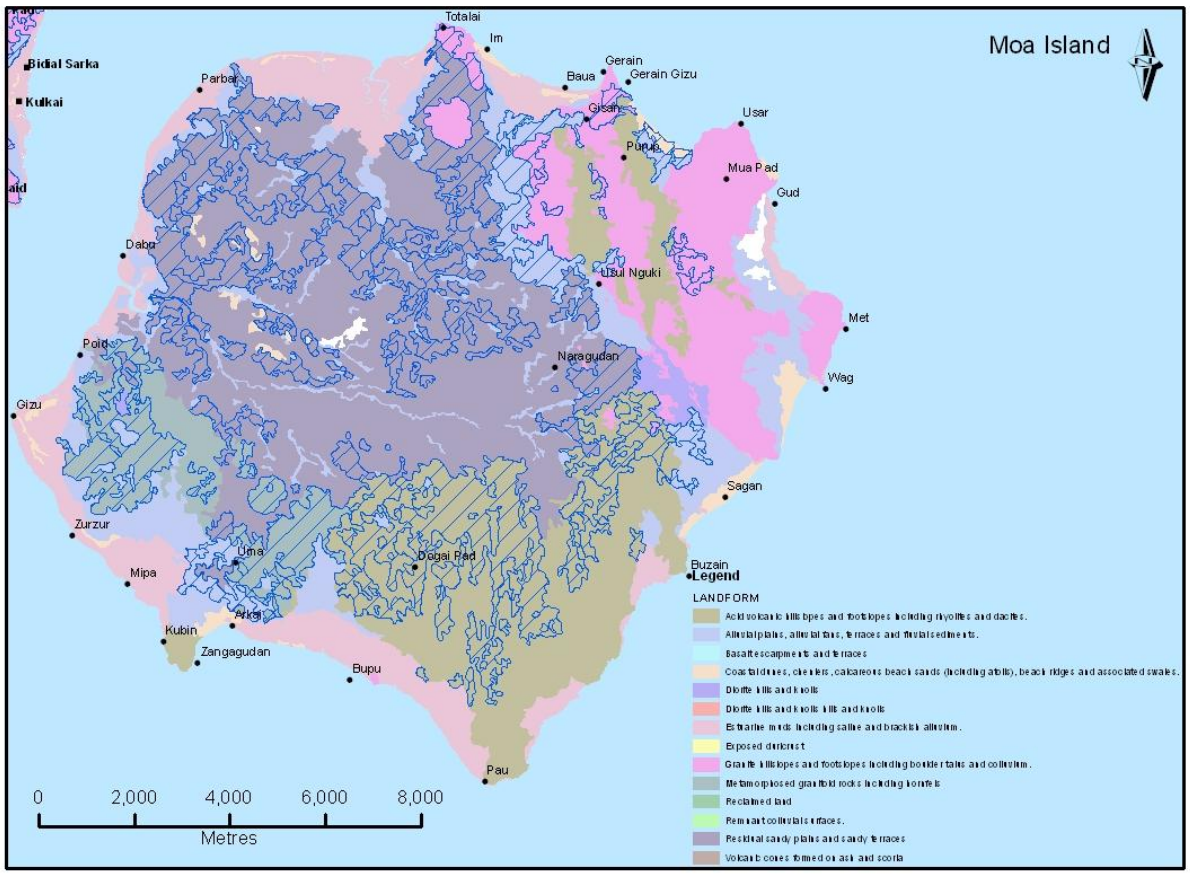


Figure 7. Occurrence of eucalyptus and corymbia dominant forest and woodland (place names after Lawrie, 1970).

Alluvial Flat and Residual Plain Associations

Vegetation composition and structure varies markedly dependent on soil drainage conditions although the best development is associated with well drained sandy terraces where canopy dominance shifts between *Corymbia novoguinensis* (VC5a) and *Corymbia clarksoniana* mixed with *Corymbia nesophila* and *Corymbia stockeri subsp. peninsularis* (VC5b). Typical canopy heights range from 18 to 25m. Sub-canopy layers are typically dominated by *Parinari nonda, Acacia crassicarpa, Welchiodendron longivalve* and ground cover is generally occupied by *Themeda triandra.* With decreasing soil drainage capacity, stature decreases and low woodland of *Corymbia stockerii subsp. peninsularis* (5m) or *Corymbia clarksoniana* (5c) predominate, generally with well developed sub-canopy layers of *Melaleuca viridiflora, Melaleuca stenostachya* or *Asteromyrtus symphyocarpa.*

Associations on Sand Dunes

Woodland communities on sand dunes are extremely limited in extent, with a single occurrence of *Corymbia novoguinensis* dominant woodland mapped adjacent to littoral vine thicket communities on the islands north coast. Management of this community requires special consideration given that it occurs adjacent to an extremely fire sensitive habitat.

Photograph 21 (left). Recently burnt woodland of *Corymbia stockeri subsp. peninsularis* and *Corymbia nesophila* on the road between Kubin and St Pauls, and **Photograph 22.** Woodland of *Corymbia novoguinensis* on a sandy alluvial terrace.

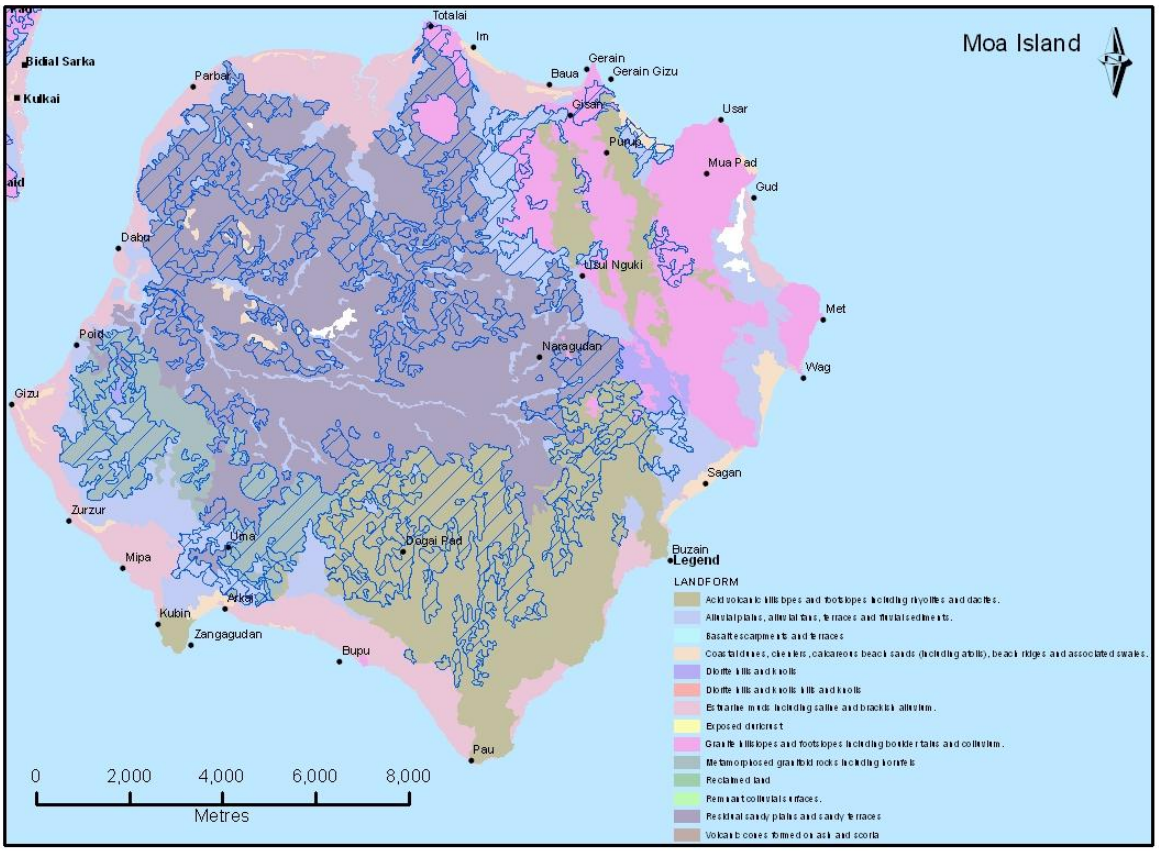


Figure 8. Occurrence of eucalyptus and corymbia dominant forest and woodland (place names after Lawrie, 1970).

8.5.2 Ecological / Cultural Considerations

Habitat Condition: All habitats examined are free from exotic weed species and in excellent condition with native ground cover predominating, typically kangaroo grass (*Themeda triandra*) and blady grass (*Imperata cylindrica)* with *Ischaemum australe* growning in wetter habitats. A combination of moderate fuel loads, native ground cover, and almost complete absence of exotic weeds are all indications of a well managed woodland habitat. Access tracks through otherwise undisturbed

woodlands often carry light infestations of Townsville lucerne (*Stylosanthes humilis)* providing an indication of the potential for exotic weeds to invade along designated access routes.

Fauna: Similar to other forest habitats, the fauna assemblage associated with this habitat has been subject to limited survey. Further structured survey effort and opportunistic sampling/ observation would greatly improve the current knowledge of the baseline fauna assemblage. Warranting particular attention are the mammals that utilise this habitat including bandicoots, rodents, and echidnas for which there have been no collections recorded for the island.

Flora: Eucalypt and Corymbia woodlands provide habitat for *Cycas badensis,* a species endemic to the Near Western Island Group. The species occurs in the shrub layers of the majority of eucalypt communities although it is most abundant in habitats associated with hillslopes, and is typically sparse in habitats associated with alluvial flats where the ground cover fuel load is highest. The habitat also supports populations of the grass *Germainia capitata* listed as Vulnerable under the EPBC Act and NC Act and *Eremochloa ciliata* (Near-Threatened).

Cultural Perspectives: This is the most extensive habitat on Mua occurring from coastal margins, and footslopes to hill-tops. Apart from obvious use as a traditional source of firewood, the cultural values and resource utilisation is largely unknown although the well managed nature of the landscape indicates fire was traditionally used in this habitat as a management tool. The purpose and timing of landscape burning remains unclear. The scarcity of shrubs in the lower layers of the majority of habitats is indicative of a frequent late season burning pattern, although this requires documentation.

8.5.3 Management Implications

Across the range of eucalypt woodland habitats, the major requirement for ongoing management is to maintain the current burning regimes. Woodland and open forest communities associated with fertile alluvial situations may require additional attention as some areas are subject to thickening of shrub layers. This process of shrubby thickening is likely to be extremely rapid with an irruption of shrubs across the broader habitat extent rather than gradual encroachment advancing from adjacent habitat margins, a process described by Russell-Smith *et al*. (2004). Rapid landscape scale changes in vegetation structure should be avoided as the consequences of such change are unknown, particularly when the current limited knowledge pertaining to the islands' ecology is considered. When burning is undertaken, it is important to create a mosaic of fire scars across the landscape to effectively reduce fuel loads. This will ensure that any hot late season fires will not have sufficient fuel to burn extensive areas of the landscape in any single fire event. Using the mosaic burning approach, any areas subject to shrubby thickening can be specifically targeted for late season fire events. In all cases, the location, purpose, conditions and timing (seasonal) of fire events, should be documented wherever possible. This will ensure traditional land management knowledge is available in a format that can be passed on to future generations as well as providing a knowledge base to inform future management actions. Further study on the ecology of the endemic *Cycas badensis* should also be considered as little is known in respect to its response to fire. Forster (2010) notes that factors affecting the survival of Cycads include:

- Insect pollination;
- Dispersal (seeds are large & take 12 months to become fully mature after falling to ground. Possible dispersal agents are flying foxes, rats, scrub fowls and pigs);
- Seedling survival (recruitment may be affected by pigs and fires); and,
- Adequate replacement of individuals (a constant mortality rate within size or age classes that leads to the attrition of individuals through time).

Observation of cycad growth stages in areas known to be subject to repetitive hot fire (such as on the foredune at Argan) indicates limited recruitment of established plants in the smaller size classes with the majority of plants being large individuals and a profusion of seedlings.

8.5.4 Summary of Recommended Management Actions

Table 13. Summary management recommendations for eucalyptus and corymbia dominant woodland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known.	Design and implement a structured fauna survey and trapping program. The survey needs to utilise collaborative research and maintain focus on ethno-taxonomy to feed into TEK.	High
Plant Surveys	Flora composition is documented although limited to rapid surveys in the dry season. Grasses, sedges and herbs poorly known. There is considerable potential for new records of significant species to be recorded from within this habitat.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	TEK within this habitat is poorly known/ documented. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	Eucalyptus dominant habitats have evolved in response to fire and maintenance of the traditional burning practice is fundamental to management of these communities. A reduction in prescribed traditional burning practice may lead to excessive shrubby thickening or a severe wildfire regime which may have significant adverse effects on forest ecological process.	A fire maintenance and fuel reduction program should be devised in consultation with the island community. The program should identify those areas that have not been fired for extended periods supplemented with field observation to document fuel loads and evidence of shrubby encroachment. Non-flammable vegetation boundaries (riparian forests and vine forest areas) can be used as fire breaks to compartment the burning program and ensure targeted areas are burnt on a rotational basis.	Immediate

Management Category	Context/Issue	Actions	Priority
		It is critical that burning of the woodland habitats begin early in the season and progressive burning is undertaken throughout the year to mosaic the habitats with fire scars. This will limit the potential for a destructive late season wildfire to burn out large portions of the island in a single event and threaten property. It is important to ensure traditional land management knowledge is available in a format that can be passed on to future generations as well as provide a knowledge base to inform future management actions.	
Threatened Species Management	Flora: The ecology of *Cycas badensis* should be investigated more thoroughly to determine population size, structure, health and long term population trends. Fauna: Composition of fauna within this habitat is poorly known.	Flora: Key requirements for assessing cycad populations include: Determination of locations and size of populations; and monitor population health of known populations to ascertain long-term population trends and inform management needs. Long term monitoring plots should be erected in cycas populations subject to a range of burning regimes including 1) areas subject to fire exclusion; 2) populations subject to regular burning regime (triennial or less frequent), and; 3) populations subject to repetitive hot firing events (annual). The response of the cycad population in terms of plant recruitment to various burning regimes should be documented over a period of several years. Any burning of cycad habitat should consider fuel loads and whether populations are coning or with seed ready for dispersal. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: No existing weed issues have been identified, however a number of species (lantana in particular, known from disturbed areas on other islands) pose a threat to long term habitat condition, particularly along riparian fringes. A range of environmental woods including siratro, stylo, and urena burr will invade eucalypt habitats, particularly where disturbance has occurred.	Flora: No active weed control or management is currently required although vigilance is required along access tracks to ensure any new introductions are rapidly identified and exterminated. Carry out monitoring for new weed infestations particularly on habitat edges and along access tracks on an annual or bi-annual basis.	Moderate

Management Category	Context/Issue	Actions	Priority
	Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna by feral cats and dogs.	Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting, and consultation with community members.	Immediate
Monitoring	The effectiveness of implemented burning regimes on eucalypt dominant habitats requires documentation to inform future land management initiatives. Long term monitoring plots are a fundamental tool used to assess the health of *Cycas badensis* populations.	Position permanent photographic monitoring points in areas where thickening of shrub layers is occurring to monitor the results and effectiveness of burning regimes. Carry out informal observation of habitat condition including the presence of invasive weed species, on a regular annual to bi-annual basis. Informal monitoring locations should be recorded in the track log of a GPS to ensure adequate seasonal coverage of at risk locations (near roadsides or disturbance areas) is undertaken on an annual basis. Implement long term monitoring plots to assess *Cycas badensis* populations as per previous recommendations.	High

8.6 Melaleuca Dominant Open Forests

8.6.1 Status of Ecological Knowledge

With the exception of a single open forest community, all melaleuca dominant forests are palustrine wetlands, occurring in seasonally wet drainage depressions and dune swales. The location of Melaleuca dominant open forests is provided in **Figure 9**. These swamp forests are not extensive, with restricted occurrences located mostly around the islands coastal fringe. Floristically, the vegetation communities are variable with canopy dominance shifting between *Melaleuca quinquenervia, Melaleuca dealbata, Melaleuca saligna* and *Melaleuca leucadendra. Melaleuca cajaputi* also forms an open forest community on swampy flats in the islands south west, occurring in association with pandanus dominant woodlands more typical of the more northern Torres Strait Islands of Saibai and Boigu. Ground cover is variable, often comprising purely leaf litter, although sedges, including *Leptocarpus sp., Restionaceae sp.* and swamp tolerant grasses such as *Ischaemum austral,* are locally prominent.

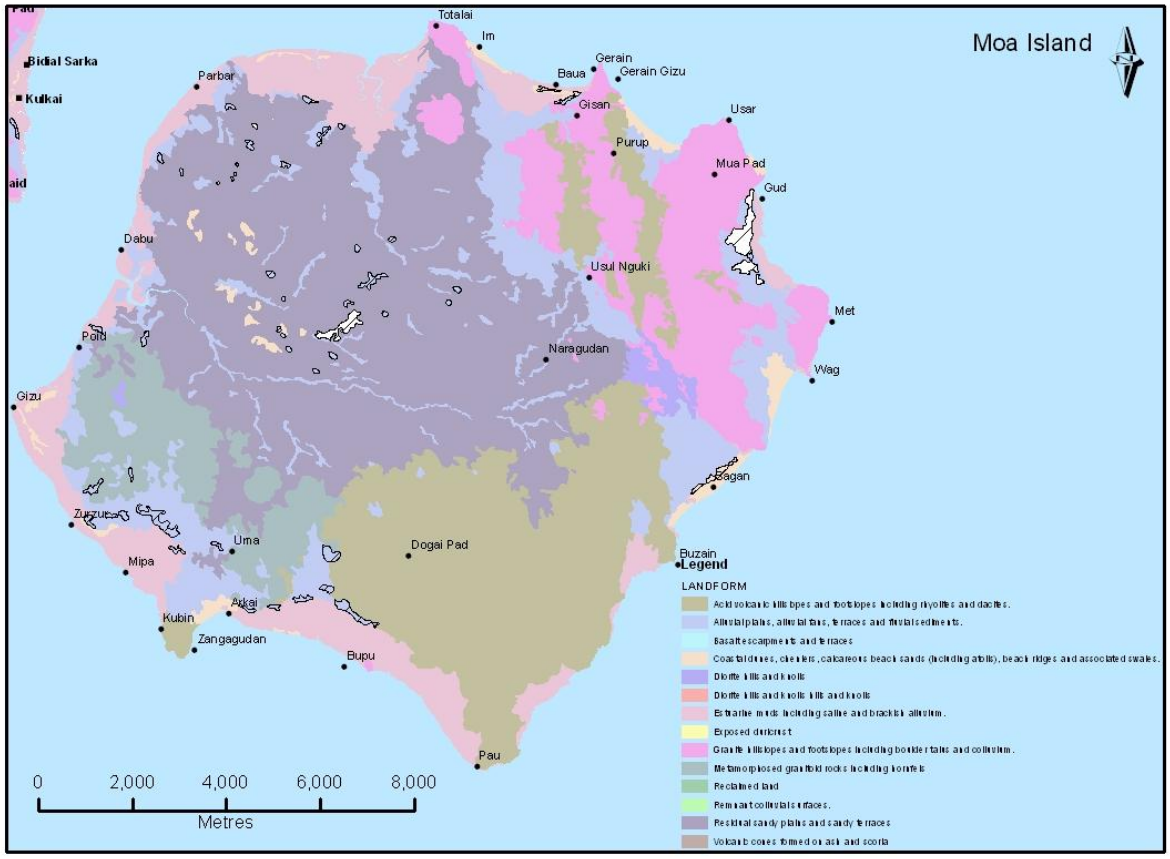


Figure 9. Distribution of melaleuca dominant open forest (place names after Lawrie, 1970).

Photograph 23. A broad dune depression occupied by *Melaleuca saligna* on the South coast of Mua and **Photograph 24.** A dune swale occupied by swamp forest of *Melaleuca quinquenervia* and *Melaleuca cajaputi* (VC7e).

Vegetation community 7c in the vicinity of 'Gud' represents the only variation of this BVG that is not a wetland ecosystem, and hence should be treated separately from both ecological and management perspectives. The habitat, representing a tall open forest of *Melaleuca dealbata* and *Corymbia clarksoniana*, occupies a well drained sandy alluvial fan on the coastal fringes north of St Paul's. At the time of survey, ground cover was heavily burnt, and it is apparent that this habitat is subject to a frequent hot fire regime. The habitat is also the most fragmented in the island group, with over 50% of

its original pre-clearing extent removed. This habitat is scheduled under the VMA as 'Of Concern' with a biodiversity status of 'Endangered'.

Photograph 25. Tall open forest of *Melaleuca dealbata* and *Corymbia clarksoniana* (VC7c) on the north of St Pauls settlement.

8.6.2 Ecological / Cultural Considerations

Habitat Condition and Threats: All habitats examined retain natural condition and are free from exotic species except for some minor fragmentation of *Melaleuca dealbata* habitats in the St Pauls area. The habitat formed by VC7c has been heavily fragmented with up 50% of its original extent remaining in the landscape. This habitat is threatened by weed invasion, being contained within a paddock which appears to be heavily utilised by horses. The most significant threat to wetland habitats, apart from foraging by feral pigs, is severe fire during periods when surface moisture levels are extremely low. Fires under such extreme conditions may result in ignition of organic soil layers (peat) resulting in death of the forest canopy.

Fauna: The fauna assemblage associated with this habitat is poorly known, although sampling within it has been extremely limited. The habitat may be particularly important to a range of amphibian and aquatic reptile species, and surveys undertaken across a range of seasonal conditions would greatly expand the current knowledge base. Vegetation community 7c, occurring on a broad alluvial plain, appears excellent habitat for bandicoots with numerous diggings observed.

Flora: The 'Vulnerable' ginger species *Costus poteriae* is known from the margins of this habitat as is the 'Vulnerable' grass species *Germainia capitata*. Wetland species have not been subject to detailed surveys.

Cultural Perspectives: The cultural significance and utilisation of this habitat is unknown.

8.6.3 Management Implications

The habitat requires careful management in relation to fire with severe fires during seasonally dry and hot conditions potentially causing forest structural damage, as well as risking damage to epiphyte populations which may include a range of significant orchid species. The best form of protection for this habitat is to subject the broader surrounding woodland habitats to a comprehensive program of mosaic burning specifically targeted to reduce fuel loads.

8.6.4 Summary of Recommended Management Actions

Table 14. Summary recommendations for management of melaleuca dominant swamp and open forest habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known.	Design and implement a structured fauna survey and trapping program which considers seasonal habitat variations. Considering the size and significance of these habitats on a regional scale, survey is strongly warranted. The program needs for assessment of amphibian and reptile populations and survey for freshwater fish species in favourable seasonal windows, should also be considered. The survey needs to utilise collaborative research and maintain focus on ethno-taxonomy to feed into TEK.	High
Plant Surveys	Flora composition is poorly documented and limited to rapid surveys in dry season. Ground covers, sedges and aquatic plants have been poorly documented.	Carry out additional floristic surveys concentrating on aquatic plants, ground and sedge covers, and epiphytes across a range of seasonal conditions. Focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	TEK within this habitat is poorly known and/ or documented. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis. It is important to ensure traditional land management knowledge is available in a format that can be passed on to future generations as well as to provide a knowledge base to inform future management actions.	High
Fire Management	Melaleuca dominant swamp forests have evolved with fire although they require careful management as fires under extreme conditions may result in ignition of peat soil profiles and destruction of canopy trees.	This habitat, including the open forest habitat 7c, should be subject to prescribed burning in the early dry season as forest fuel levels allow. Mosaic burning should be carried out in adjacent woodland habitats to specifically reduce fuel loads and prevent severe wildfire.	Moderate
Threatened Species Management	Flora: Populations of the threatened flora species *Costus poteriae* may be associated with the habitat margins as is the swampland grass species *Germainia capitata*. Swamp	Flora: Carry out ongoing surveys to identify populations of significant species, particularly epiphytes including orchids.	Moderate

Management Category	Context/Issue	Actions	Priority
	margins may be subjected to severe fire events as well as weed infestation. Fauna: Composition of fauna within this habitat is poorly known.	Back burn along the edge of known *Costus poteriae* populations early in the season to prevent incursion by severe late season fires, or ensure landscape scale mosaic burning of broader woodland habitats is maintained. Place monitoring sites in the vicinity of known populations to gauge the effectiveness of management actions. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined. This habitat requires robust seasonal (both wet and dry season) survey of amphibian and reptile populations.	High
Invasive Species Management	Flora: No existing weed issues have been identified however a number of species, lantana in particular, known to infest disturbed areas poses a threat to moist habitat margins. A range of environmental woods including siratro, stylo, and urena bur will invade the margins of these wetland habitats, particularly where disturbance has occurred. Fauna: These habitats provide a significant foraging resource for feral pigs and control programs are warranted in the habitat vicinity. General observation relating to feral animal damage should be undertaken during routine ranger patrols with management actions guided by any observed increase in foraging activity.	Flora: No active weed control or management currently required. Carry out monitoring for new weed infestations particularly on habitat edges and along access tracks on an annual or bi-annual basis. Fauna: Undertake regular assessment of feral pig numbers within these habitats and undertake a trapping program wherever problem areas are identified.	Moderate Immediate
Monitoring	No specific monitoring action required although general observations during a rangers activities will be required to identify problematic weed infestation early.	Undertake informal surveys of vegetation condition in swampland habitats to detect early infestations of exotic species. Woodland habitat VC7c near Gud is a likely nucleation point for infestation of lantana due to its well formed and drained soils. Checks of this habitat for lantana are required on a bi-annual basis with track logs recorded for future reference.	Moderate

8.7 Lophostemon suaveolens Dominant Open Forests

8.7.1 Status of Ecological Knowledge

A habitat type that is largely restricted to a broad sandy outwash flat to the south of Saveka Point, Sagan in the St Paul's Area. The habitat forms a low open forest with *Lophostemon suaveolens*

forming the dominant canopy, accompanied by species including *Melaleuca saligna, Asteromyrtus brassii* and *Acacia crassicarpa*. Ground covers are sparse, with *Lomandra banksii* prominent. There is limited evidence that fire impacts to any significant degree on this habitat.

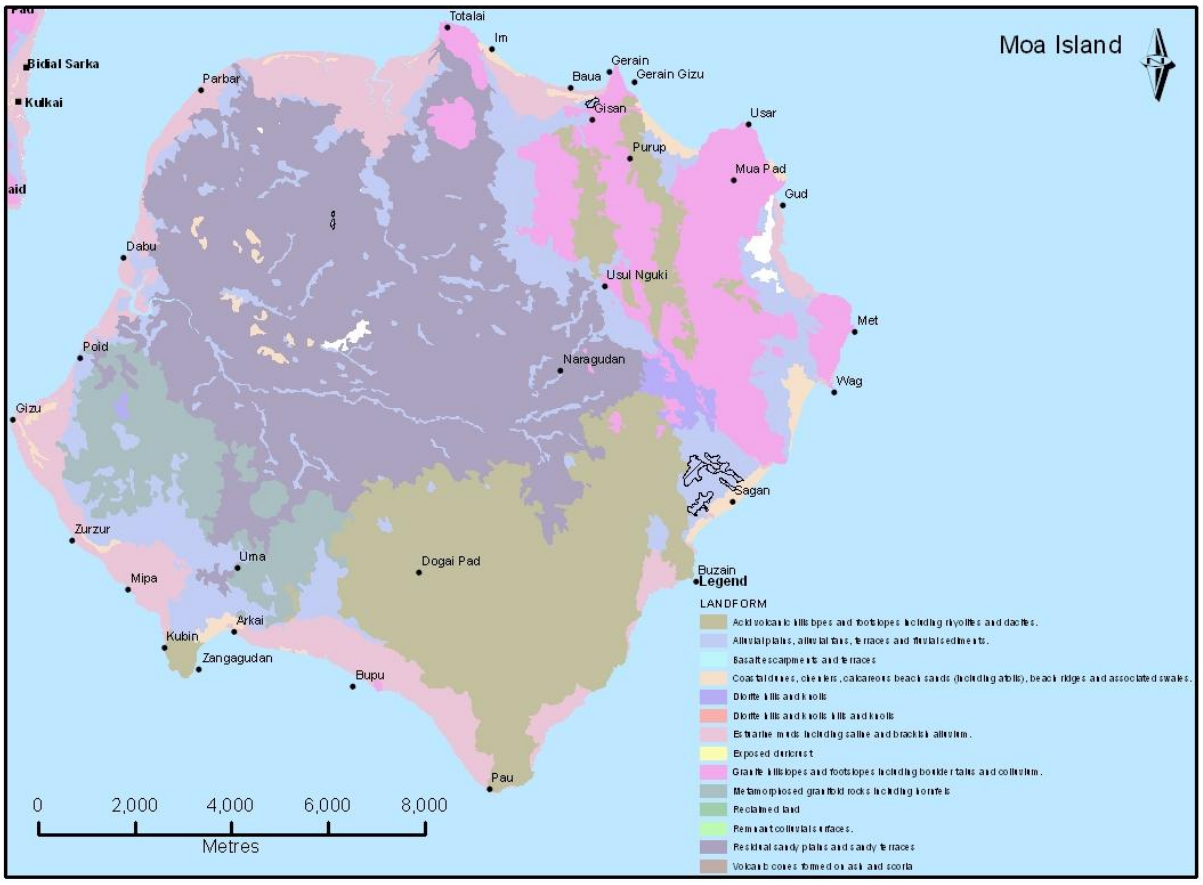


Figure 10. Distribution of *Lophostemon suaveolens* dominant habitats (place names after Lawrie, 1970).

Photograph 26. Low open forest of *Lophostemon suaveolens* and *Asteromyrtus brassii* on a sandy outwash plain.

8.7.2 Ecological / Cultural Considerations

Habitat Condition and Threats: Although limited in extent, the habitat was observed to be in excellent condition and free from exotic weeds.

Fauna: The fauna assemblage within this habitat is unknown and has not been subject to previous survey. It is expected to provide general habitat for a range of reptiles and small mammal and is unlikely to contain any specialist fauna assemblage.

Flora: No significant flora species are known from within this habitat.

Cultural Perspectives: The cultural aspects of this habitat are unknown.

8.7.3 Management Implications

This is a self maintaining habitat that requires limited active management. The most pertinent management action is to ensure the surrounding woodland habitats are subject to regular mosaic burning, which will limit impact of any severe late season fires within this habitat.

8.7.4 Summary of Recommended Management Actions

Recommendations for landscape maintenance are provided below although it should be considered that current management regimes, from evidence taken across the islands broader range of habitats, are achieving habitat maintenance objectives.

Table 15. Recommendations for management of lophostemon dominant woodland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly known.	No specific targeted survey or trapping program is required for this habitat. Ongoing collection and documentation of observed wildlife should be completed as part of the ranger's general duties.	Moderate
Plant Surveys	Flora composition of this habitat is relatively low diversity and it is unlikely that any new species records for Mua will be found within.	Flora field surveys can be undertaken on an opportunistic basis focusing on species with cultural significance.	Moderate
Traditional Ecological Knowledge	TEK within this habitat is poorly known/ documented. No formal survey of this habitat has been undertaken.	Collect and collate TEK knowledge within this habitat supported by opportunistic species collection.	Moderate
Fire Management	The habitat is not subject to regular fire incursion and fuel levels are not sufficient to carry fire except under extreme conditions.	Concentrate on mosaic burning throughout a range of seasonal conditions in adjacent woodland habitats to prevent incursion of habitat by severe late season fires	Moderate
Threatened Species Management	No threatened flora or fauna species are known to occur within or utilise this habitat other than for general habit usage.	Flora: No management actions have been identified due to lack of systematic survey. Fauna: Further baseline information is required before discrete management actions can be defined. There is no need for specific fauna survey targeting this habitat.	Moderate Moderate
Invasive Species Management	Flora: There are no existing weed issues identified in this habitat .	Flora: The habitat is not particularly prone to weed incursion due to dense canopy although informal observations of habitat condition should be made on an opportunistic basis.	Moderate

Management Category	Context/Issue	Actions	Priority
	Fauna: The extent to which feral animals utilise this habitat is unknown.	Fauna: The extent of usage by exotic fauna is unknown and will be informed by surveys associated with broader woodland habitats. No specific management actions are required.	Moderate
Monitoring	The habitat is limited in size and not critical to the survival of any particular threatened species.	Requirements for monitoring should be informed by onground surveys. Monitoring may be required if specific land management problems such as weed infestation are noted.	No action required at present.

8.8 Asteromyrtus Dominant Open Forests

8.8.1 Status of Ecological Knowledge

This habitat is unique to Mua Island, occupying a number of discontinuous, broadly linear sandy rises that are scattered across a broad erosional plain. It is considered likely that the features represent relict beach ridges, although their morphology has been degraded to a degree that confirmation of this is not possible. Vegetation on these rises is dominated by *Asteromyrtus brassii, Syzygium angophoroides, Acmena hemilampra* subsp. *hemilampra, Acacia crassicarpa* and *Melaleuca quinquenervia* with a canopy height range of 15m to 20m. The sub-canopy and shrub layers tend to merge ranging in height from 2m to 10m comprising *Leucopogon ruscifolius, Exocarpos latifolius, Lithomyrtus obtusa, Livistona muelleri,* and *Acacia crassicarpa* amongst other species. Ground cover is dominated by *Lomandra banksii.* This vegetation is more typically associated with swampy areas rather than the sandy rises with reasonable drainage capacity on which they occur. This raises questions concerning how these habitats developed.

Photograph 27 (left) . Open forest dominated by *Asteromyrtus brassii* and *Syzygium angophoroides* (VC9a) at Site MO108, and **Photograph 28.** Typical habitat of VC9a, occupying a low sandy rise on a broad residual plain.

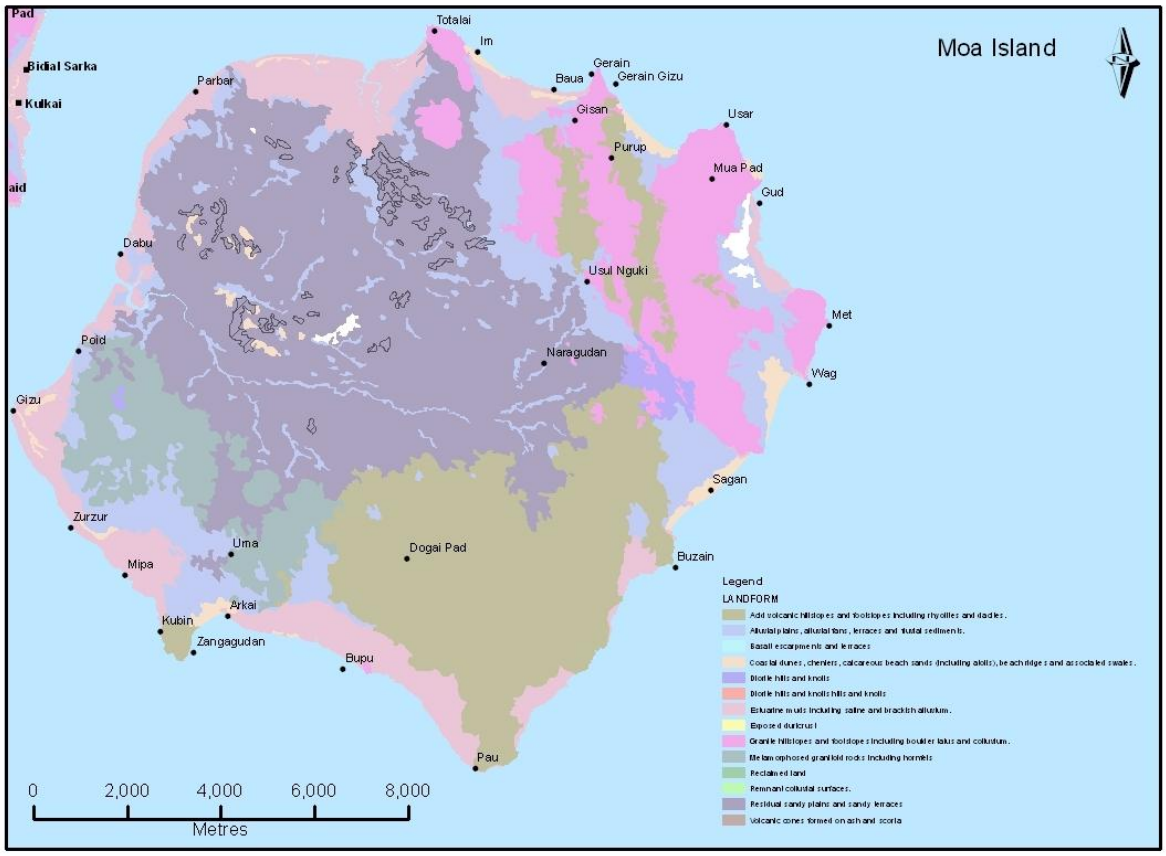


Figure 11. Distribution of asteromyrtus dominant habitats (place names after Lawrie, 1970).

8.8.2 Ecological / Cultural Considerations

Habitat Condition and Threats: These habitats are isolated from the main settlement areas and buffered by expansive areas of Melaleuca dominant shrublands on a seasonally waterlogged plain. Owing to their ecological isolation, these habitats are totally free from the impacts of exotic weeds. There is no on-ground evidence that they are being utilised by exotic fauna species to any degrading capacity. There are no known threats to this habitat.

Fauna: The fauna assemblage within this habitat is unknown and has not been subject to previous survey.

Flora: No significant flora species are known from within this habitat

Cultural Perspectives: The extent to which this habitat was utilised for cultural purposes is unknown.

8.8.3 Management Implications

The relative isolation of these habitats means there is little threat in terms of weed invasion. Additional flora and fauna survey is warranted however due to the habitats uniqueness and lack of any prior

survey efforts. They have relatively dense shrub layers which makes burning difficult in anything but the most extreme conditions. The limited fuel levels in surrounding melaleuca dominant woodlands and sedgelands offers a broad barrier to fire incursion and although these habitats are currently subject to thickening of the shrub layers, this is a highly localised effect which will have limited impact on the ecology of the broader woodland habitats.

8.8.4 Summary of Recommended Management Actions

Recommendations for landscape maintenance are provided below although it should be considered that current management regimes, from evidence taken across the islands broader range of habitats, are achieving habitat maintenance objectives.

Table 16. Recommendations for management of asteromyrtus dominant woodland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly known.	This habitat would benefit from some form of structured fauna survey including spot lighting, Elliott trapping and pit-fall traps. The inaccessible nature of the habitat however makes targeted fauna survey difficult. Collections of ground dwelling reptiles should be made on an opportunistic basis.	Moderate
Plant Surveys	Flora composition of this habitat has not been documented.	Flora field surveys need to be undertaken to identify major species constituent of both ground cover and shrub layers. Collection of specimens for formal identification would be beneficial.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. No formal survey of this habitat has been undertaken.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	Moderate
Fire Management	The habitat is subject to shrubby thickening although this is a highly localised effect that is unlikely to have any major ecological consequence.	There is no currently identified requirement to implement any structured fire management program within these habitats.	Moderate
Threatened Species Management	No threatened flora or fauna species are known to occur within or utilise these habitats for foraging.	Flora: No management actions have been identified due to lack of systematic survey. Habitat suitability for a range of potentially occurring threatened species will be informed by ongoing flora survey. Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: There are no existing weed issues identified in this habitat and the relative isolation means that these habitats are unlikely to be an introduction point for exotic weed establishment.. Fauna: The extent to which feral animal utilise this is unknown.	Flora: No active weed control or management is currently required. Fauna: Undertake on ground surveys to identify signs of habitat	No Actions Required Moderate

Management Category	Context/Issue	Actions	Priority
		disturbance by feral pigs. The extent of usage by exotic pests will be informed by results of fauna surveys. Management actions can be formulated once major threats are identified.	
Monitoring	The area is has not been surveyed floristically and current requirements for monitoring are unknown.	Undertake on ground assessment of habitat condition with any requirement for monitoring to be informed by onground surveys. It is considered unlikely that any specific requirement for monitoring will be identified.	Moderate

8.9 Pandanus Dominant Woodland and Shrubland

8.9.1 Status of Ecological Knowledge

This habitat is restricted to a broad alluvial flat in the south-western portion of the island (near the cultural place of Mipa) where it forms a mosaic with *Ischaemum australe* dominant grassland (VC17a) and *Melaleuca cajaputi* dominant open forest (VC7a). This habitat assemblage is more typical of the northern Torres Strait Islands of Boigu and Saibai with scattered occurrences of extremely limited extent on the continental islands. In this regards, the well developed nature of this occurrence on Mua is of regional significance. The location of this habitat is illustrated in **Figure 12.**

8.9.2 Ecological / Cultural Considerations

Habitat Condition and Threats: Habitat condition was observed to be excellent (November 2007). The major threats to the habitat relate to changes in current burning regimes. Cessation of regular burning practice may lead to a build-up of fuel levels over a number of seasons resulting in the advent of a severe and damaging late dry season fire event. Cessation of burning, or a large number of cool early season burns, may also lead to excessive development of the shrub layer causing long term change to the habitat structure. There is also considerable threat from the introduction of exotic grass species, particularly if habitat is disturbed, which may considerably change the ecology of these habitats. Gamba grass, which has spread rapidly across northern Cape York Peninsula presents the greatest threat. The grass is an aggressive colonist which develops a standing biomass of 5-7 times that of native species (Rossiter *et al*. 2003) resulting in extremely intense savanna fires, significantly altering savanna habitat ecology. Annual mission grass is a similarly invasive grass which is establishing within and on the margins of St Pauls community.

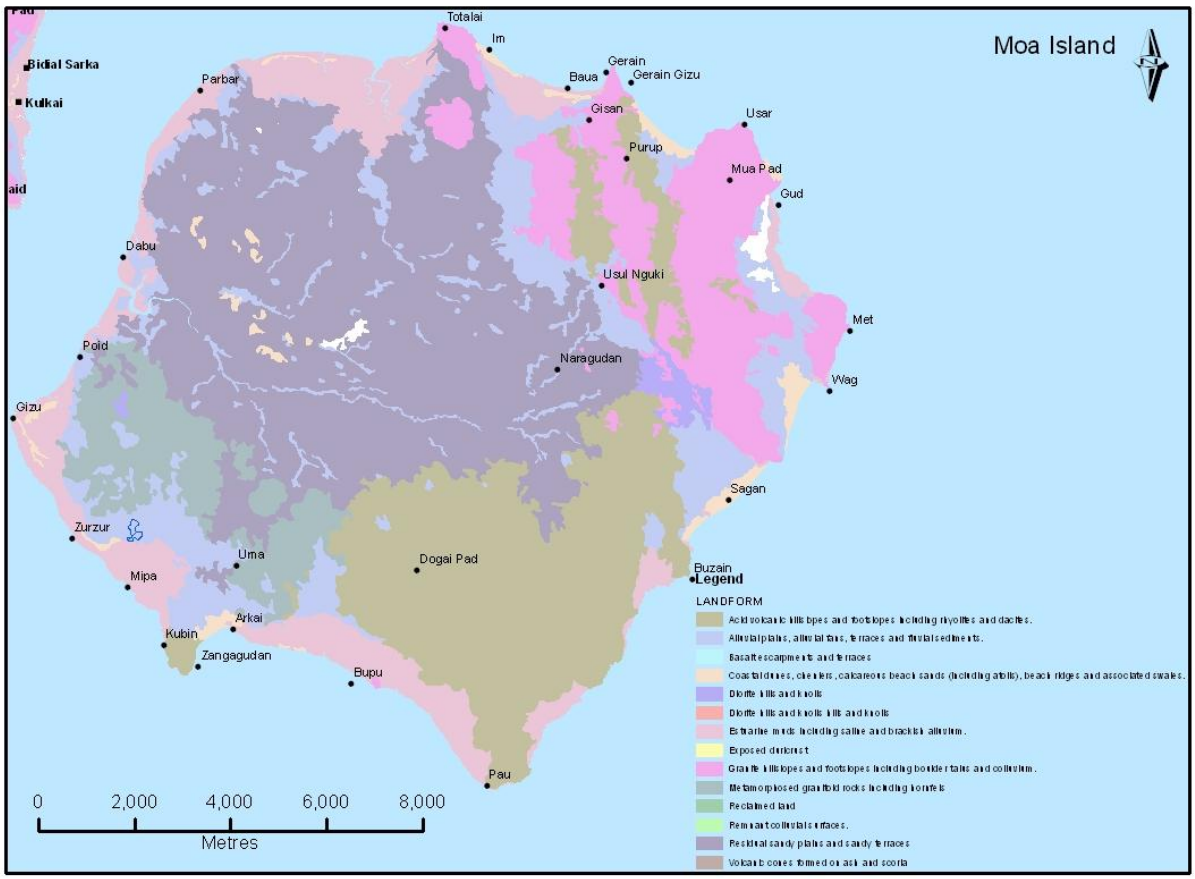


Figure 12. Distribution of pandanus dominant habitats (place names after Lawrie, 1970).

Photograph 29. Pandanus shrubland community on the south-western portion of Mua Island (Mipa), adjacent to freshly burnt grassland.

Fauna: The fauna assemblage within this habitat is unknown. The fauna assemblage is likely to be similar to grassland communities on alluvium, being significant for native rodents as well as other fauna species including bandicoots.

Flora: No significant flora are known.

Cultural Perspectives: The grassy nature of the habitat is likely to be the product of long term anthropogenic fire practice which maintained these grassy areas for ease of access and possibly gardening. It is likely that these grassy shrubland and woodland areas have been in a relatively stable state for extended periods, possibly the length of human occupancy, which on Mua exceeds 4000 years.

8.9.3 Management Implications

It is feasible that within several years without maintenance of current burning regimes that these grassy woodland areas will thicken considerably, gradually converting to a melaleuca dominant woodland. Whilst the cultural significance of this habitat is open to conjecture, irreversible changes to community structure through shrubby thickening should be considered an element of degradation until ecological and cultural significance of these habitats is more fully considered and understood. Prevention of shrubby thickening can be best achieved by a mosaic of early to late season fires with hotter late season fires targeting those areas where shrubby thickening is observed to be a problem. Burning immediately after the first storms (storm burning) will effectively promote grassy cover over shrubs and this should be considered as a management option. The frequency of late dry season fires can be reduced, once shrubby thickening is controlled, to a more consistent cycle of mid-dry season fires (August to October) completed on a 2 – 3 year cycle.

8.9.4 Summary of Recommended Management Actions

In compiling these recommendations, it is considered that any management action should aim to maintain the current landscape function which is considered important from both an ecological and cultural perspective. Recommendations for landscape maintenance are provided below although it should be considered that current management regimes, from evidence taken across the islands broader range of habitats, are achieving habitat maintenance objectives.

Table 17. Recommendations for management of pandanus dominant woodland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly known.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitat's fauna. A structured fauna survey should be undertaken in conjunction with survey of broader grassy woodland and shrub-land habitats. Focus on ethno-taxonomy should be maintained throughout the process to feed into TEK.	High
Plant Surveys	Flora composition of this habitat has not been documented.	Flora field surveys need to be undertaken to identify major species constituent of both ground cover and shrub layers. Collection of specimens for formal identification would be beneficial.	Moderate
Traditional Ecological	Composition of TEK within this habitat is poorly known. No formal	Collect and collate TEK knowledge within this habitat gained through	High

Management Category	Context/Issue	Actions	Priority
Knowledge	survey of this habitat has been undertaken.	fauna and flora survey actions on an ongoing basis. Documentation of traditional land management practices, particularly in relation to fire management practice should be undertaken through collaboration with knowledgeable members of the local community.	
Fire Management	Fire management is required to maintain current extent and condition of grassland communities and adjacent shrubland habitats.	Management should focus on maintaining current extent and occurrence of pandanus dominant woodland/ grassland habitats in the landscape although this should be guided by requirements and wishes of Mua Islanders . Concentrate on a mosaic of cool early season burns to maintain habitats that are currently in good condition. Hot fires should be a component of a broader seasonal mosaic of fire events where evidence of shrubby thickening is occurring. Timing and frequency of fires should be recorded for future reference. This will allow practice to be adjusted and refined to improve management outcomes.	High
Threatened Species Management	No threatened flora or fauna species are known to occur within or utilise these habitats for foraging.	Flora: No management actions have been identified due to lack of systematic survey. Habitat suitability for a range of potentially occurring threatened species will be informed by ongoing flora survey. Fauna: Further baseline information is required (see fauna surveys) before identification of discrete management actions.	Moderate High
Invasive Species Management	Flora: There are no existing weed issues identified in this habitat although this may reflect the lack of floristic survey. Fauna: The extent to which feral animal utilise this is unknown.	Flora: No active weed control or management is currently required. The area should be surveyed on foot to confirm habitat condition and management recommendations formulated based on this information. Fauna: Undertake on ground surveys to identify signs of habitat disturbance by feral pigs. The extent of usage by other exotic pests will be informed by results of fauna surveys. Management actions can be formulated once major threats are identified.	High High
Monitoring	The area has not been surveyed floristically and current requirements for monitoring are unknown.	Undertake on ground assessment of habitat conditions. Requirements for monitoring should be informed by onground surveys. Monitoring may be required if specific land management problems such as shrubby thickening or weed	Moderate

Management Category	Context/Issue	Actions	Priority
		infestation are noted.	

8.10 Melaleuca Dominant Shrublands and Woodlands

8.10.1 Status of Ecological Knowledge

An extensive habitat type on Mua, associated predominantly with residual sand plains in the central portion of the island, although also occurring on alluvial deposits throughout the broader island landscape. The habitat is highly variable, both structurally and floristically, reflecting minor variations in soil moisture, drainage, and fertility. The most stunted melaleuca dominant shrubland types are associated with deeply leached sand plains where *Melaleuca viridiflora* forms an association with *Asteromyrtus symphyocarpa* and *Asteromyrtus brassii* in a low open shrubland formation. Ground cover in these stunted habitats is typically sparse *Dapsilanthus spathaceus* clumps against a background of leached white sand (VC13c). With increasing soil depth and drainage capacity, shrubland stature gradually increases, occasionally reaching low woodland (canopy heights to 10m) and there is a typical increased contribution of bloodwood species (typically *Corymbia clarksoniana)* in the canopy (13f) or *Melaleuca saligna* in the case of VC13i. With increased shrubland stature, ground cover typically increases in biomass with prominence of *Themeda triandra* and *Restionaceae sp*. increasing dramatically. The habitat type also includes thickets of *Melaleuca incana* and *Melaleuca acacioides* on alluvial margins of the saline fringe (VC13e) and shrublands of *Melaleuca stenostachya* on the most infertile sites.

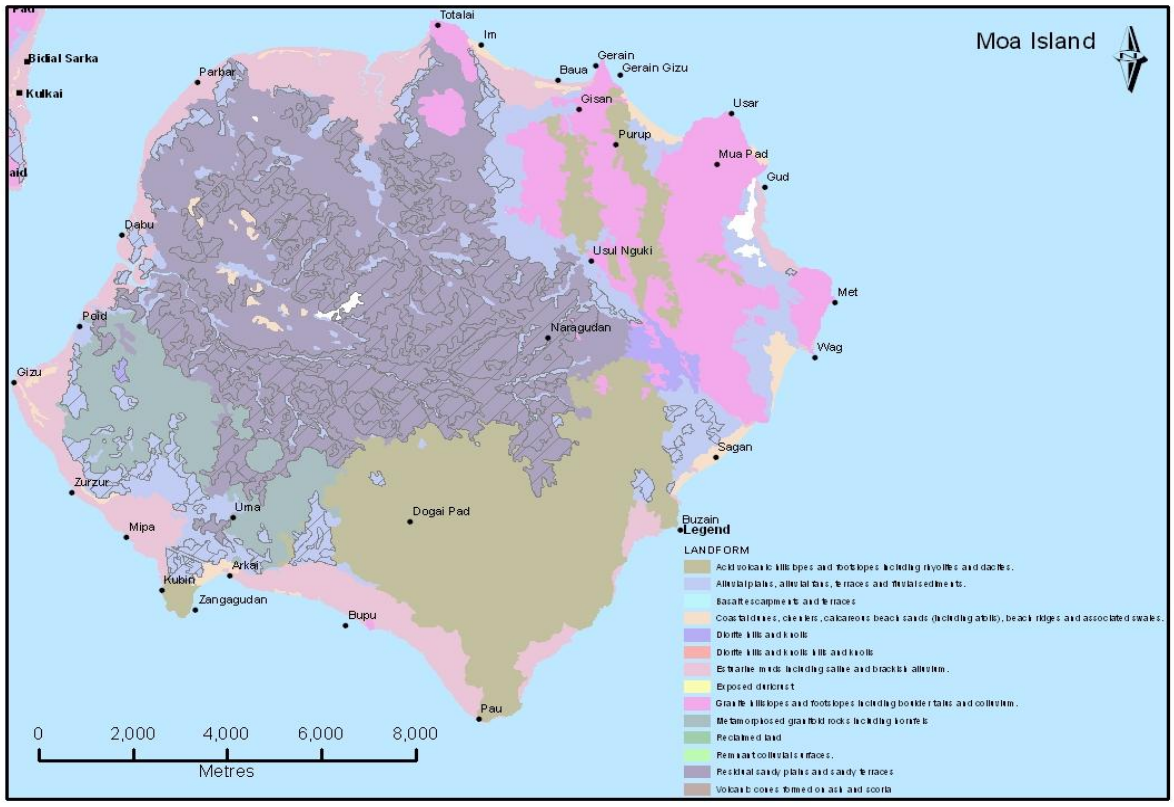


Figure 13. Distribution of melaleuca dominant habitats (place names after Lawrie, 1970).

Photograph 30 (left) . Vegetation community 13c on residual sand plain, Mua Island, and **Photograph 31.** Shrubland type 13d with dominant *Melaleuca saligna, Asteromyrtus symphyocarpa* and *Melaleuca viridiflora.*

8.10.2 Ecological / Cultural Considerations

Habitat Condition and Threats: All communities observed are in undisturbed natural condition and no significant threats to habitat diversity are apparent. Structurally the habitat comprises mature shrubs and low trees with limited recruitment of shrubs in the lower structure layers (i.e. seedlings and sub-canopy shrub classes).

***Cultural Perspectives*:** The cultural usage and significance of this habitat is largely unknown.

***Flora*:** The composition of the ground flora is poorly known. The shrubland communities provide the only known record of the terrestrial orchid *Habenaria vatia* as well as potential habitat for *Dendrobium johannis* (Vulnerable NC Act). It supports a diverse array of epiphytic plants and annual herbs such as Utricularia and Stylidium. A disjunct record of *Bromheadia pulchra* has been recorded within this community.

***Fauna*:** Largely unknown although the habitat would provide a valuable seasonal nectar source for a range of birds and mammals.

8.10.3 Management Implications

The size distribution of the shrubby components suggests that the current management regime is dominated by an infrequent late season burning pattern (J. Russell-Smith, pers. comm.). The nature of the ground cover, producing only limited biomass and subsequent fuel loads, means that ignition would occur under only the most severe conditions after a number of years of burning abstinence. Whilst this late season burning pattern might not be appropriate for the majority of savannah communities on the island, the prominence of epiphytes in the canopy and general excellent condition of community suggest that it is appropriate for this particular habitat. For future reference, acknowledging the current well managed status of these habitats, records of burning events including seasonal timing, conditions (temperature, humidity and wind speed) and interval between fire events should be undertaken, largely to inform future management decisions and directions.

Formal training in the identification of orchid species would be beneficial to all rangers. Targeted surveys to determine the population size and distribution of *Habenaria vatia* are recommended and would considerably increase ecological knowledge of this threatened species and provide information relevant to future management directions.

8.10.4 Summary of Recommended Management Actions

In compiling these recommendations, it is considered that any management action should aim to maintain the current landscape function which is considered important from both an ecological and cultural perspective. Recommendations for landscape maintenance are provided below although it should be considered that current management regimes, from evidence taken across the islands broader range of habitats, are satisfying habitat maintenance objectives.

Table 18. Summary recommendations for management of melaleuca dominant shrublands and low woodlands.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly known.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitats fauna. A structured fauna survey involving nocturnal surveys (particularly during periods of melaleuca flowering) and pitfall trapping should be undertaken within this habitat. Focus on ethno-taxonomy should be maintained throughout the process to feed into TEK.	High
Plant Surveys	The floristic composition of the ground flora is poorly known and limited to surveys undertaken during drier seasonal periods. Epiphytic species and annual herbs have been poorly documented.	Botanical survey needs to focus on collection and identification of ground covers which may be particularly diverse at periods of peak productivity (March to May). Surveys of the diverse array of orchids and epiphytes should also be undertaken.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. No formal survey of this habitat has been undertaken.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis. Documentation of traditional land management practices, particularly in relation to fire management practice should be undertaken through collaboration with knowledgeable members of the local community.	High
Fire Management	Current fire regimes appear to be maintaining these habitats in excellent condition.	Continuation of current burning regimes should be maintained The timing, frequency and conditions (temperature, wind and humidity) for all fires within these habitats should be recorded for future reference and maintenance of traditional habitat management knowledge.	High

Management Category	Context/Issue	Actions	Priority
Threatened Species Management	Flora: Provided habitat for the endemic orchid *Habenaria vatia.* Provides potential habitat for the threatened orchid species *Dendrobium johannis.* Fauna: The composition of this habitat in regard to threatened fauna species is unknown	Flora: Formal training in the identification of orchid species would be beneficial to all rangers. Targeted surveys to determine the population size and distribution of *Habenaria vatia* are recommended and would considerably increase ecological knowledge of this threatened species and provide information relevant to future management directions. Educate the Mua community about the significance of relevant orchids in an effort to limit over-collecting. Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: There are no existing weed issues identified in this habitat. Fauna: The extent to which feral animals utilise this habitat is unknown.	Flora: No active weed control or management is currently required. The relative infertility of the substrate limits the degree to which exotic flora can invade the habitat. Fauna: The extent of usage by exotic pests will be informed by results of fauna surveys. Management actions can be formulated once major threats are identified.	Moderate Moderate
Monitoring	This habitat may be subject to broadscale structural change if current burning regimes are not maintained.	A number of permanently marked photographic monitoring points should be placed in representative habitats which are accessible. Photographic reference material should be captured on an annual to bi-annual basis to detect any broadscale changes to habitat structure or condition.	Moderate

8.11 Shrublands and Shrubland Complexes

8.11.1 Status of Ecological Knowledge

To adequately characterise the ecological controls on shrubland distribution, shrublands have been classified according to their broad landform association including those associated with coastal dunes (both recent and degraded), coastal headlands, residual plains and alluvial flats. These ecosystems are described briefly below. The location of shrubland habitats is provided in **Figure 14.**

Associations on Coastal Dunes

Shrublands may be associated with both degraded and recent dune formations with dramatically different floristic composition and structure. A large number of these have been incorporated into Coastal Dune Complexes which are discussed subsequently.

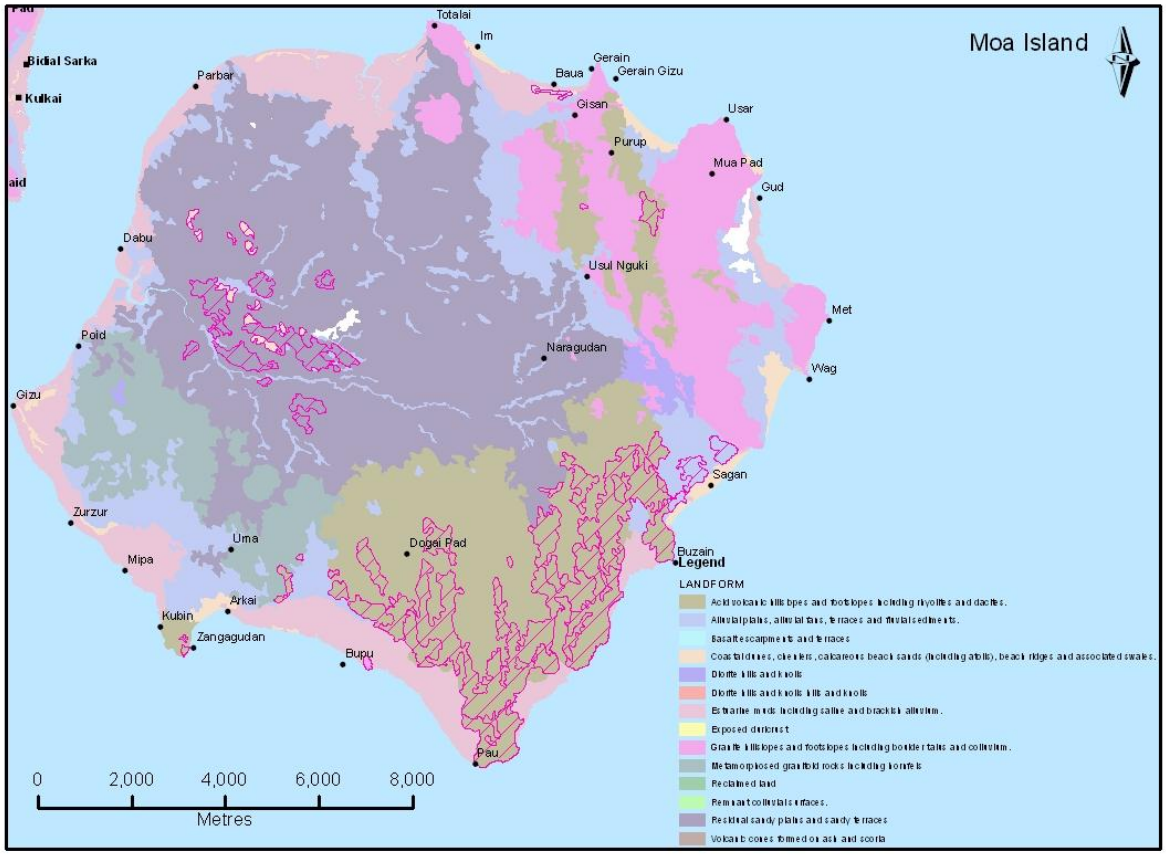


Figure 14. Distribution of shrubland habitats on Mua (place names after Lawrie, 1970).

A number of scattered, deeply leached relict dune systems occur in the residual plains on the western portion of Mua. These features host a low stunted shrubland characterised by species including *Leucopogon ruscifolius*, *Melaleuca viridiflora*, *Asteromyrtus brassii*, *Baeckea frutescens, Banksia dentata*, *Acacia crassicarpa, Alyxia spicata* and *Exocarpos latifolius.* Ground cover, dominated by *Dapsilanthus spathaceus*, *Schoenus spp.*, *Lomandra banksii* and *Dianella bambusifolia* is sparse, with areas of bare sand between the scattered shrubs.

Shrublands associated with younger prograding dune systems are typically stunted with limited canopy cover. A large number of these habitats have been mapped with coastal dune complexes, and are discussed in the following section. Unusual variations include low sparse shrubland dominated by *Cycas badensis* (VC14q) (**Photograph 37**) and low, sparse shrubland dominated by *Cochlospermum gillivraei, Canarium australianum, Eugenia reinwardtiana, Terminalia subacroptera* and *Pandanus* sp. (VC14t), which occurs as a component of VC16c (**Photograph 38**).

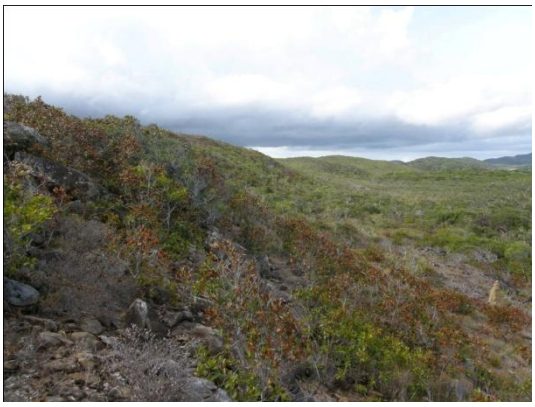
Photograph 32. Low open shrubland on a landform feature interpreted to be a relict dune, and **Photograph 33**. Low shrubland of *Cycas badensis* on a suppressed chenier amongst broader expanse of salt tolerant vegetation.

Photograph 34. Low sparse shrubland of *Pandanus sp.* and *Cochlospermum gillivraei* (VC14t) on stranded beach ridge in the Kubin area.

Shrublands on Acid Volcanic Rocks

Shrublands on acid volcanic rocks, often located on coastal headlands, form extensive complexes on the north-eastern portion of the island. The most spectacular of these complexes is VC14a, a dwarf shrubland type comprising prostrate shrubs of *Melaleuca viridiflora* and *Welchiodendron longivalve,* generally in equal proportion mixed with occasional *Asteromyrtus brassii* and *Lithomyrtus retusa.* Prominent groundcover species include *Themeda triandra* and *Cassytha filiformis.* On escarpments

to the immediate west, *Welchiodendron longivalve* forms the low scrub community 14c, blanketing extensive areas formed on infertile acid volcanic soil.



Photograph 35 (left). Prostrate dwarf shrubland in the vicinity of Saveka Point near St Pauls, and **Photograph 36.** Shrubland dominated by *Welchiodendron longivalve* on an east facing escarpment of Mua Island.

Shrublands on Alluvial and Residual Plains

Outside the extensive complexes of melaleuca dominant shrubland on alluvial and residual landforms, shrubland communities on alluvium are limited in distribution, extent and diversity. The best developed example (VC14r) occurs immediately landward from the backdune swale south of Saveka Point. In this location, a well developed mixed shrubland comprising *Acacia crassicarpa, Melaleuca viridiflora*, *Pandanus* sp., *Parinari nonda, Banksia dentata* and *Lophostemon suaveolens* occupies a silty loam plain. The ground cover in this community is relatively dense with well-developed tussock grasses dominated by *Ischaemum australe* (see **Photograph 37**).

Residual sand rises on Mua Island host an unusual shrubland expression, being a shrubland and occasionally low open forest with a general canopy height from 4m to 8m. *Asteromyrtus brassii* is the dominant species in the upper stratum, accompanied by *Melaleuca saligna, Lophostemon suaveolens,* and *Acacia crassicarpa. Lophostemon suaveolens* forms the dominant emergent species. Associated shrub species include *Leucopogon ruscifolius, Baeckea frutescens, Exocarpos latifolius, Melaleuca viridiflora, Alyxia spicata,* and *Banksia dentata.* The associated landform is severely leached humic sand which forms low rises above an erosional plain. The provenance of these low sand rises is uncertain, possibly representing old dunes or remnant fluvial deposits. There is no evidence of any significant fire incursion into the margins of this habitat (see **Photograph 38**).

8.11.2 Ecological / Cultural Considerations

Habitat Condition and Threats: All habitats examined are free from exotic weed species and generally in excellent condition. The habitats at greatest risk of degradation are those associated with alluvial landforms where the inherent fertility of the soil increases the risk of exotic weed invasion. These habitats (see **Photograph 37**) also require regular firing to manage fuel loads and prevent shrubby thickening.

Photograph 37 (left). Mixed shrubland community 14r with dense grass cover of *Ischaemum australe* **Photograph 38.** Vegetation community 14i on a residual sandy rise, Mua Island.

Fauna: No systematic survey of fauna has been undertaken in these habitats and the nature of the fauna assemblage is largely unknown. The impact to native fauna species by feral animals (cats and dogs) needs to be ascertained. Habitats associated with alluvial plains may host significant populations of rodent due to the inherent grassy nature of their ground cover whilst habitats associated with recent dune forms may provide habitat for the beach stone curlew (see Photograph 38).

Flora: Provides habitat for *Cycas badensis,* and *Psydrax reticulata.*

Cultural Perspectives: On neighbouring Badu Island, habitats associated with relictual dune systems possess large numbers of undocumented cultural sites. It is not know to what extent similar shrubland habitats on Mua host sites of cultural significance.

8.11.3 Management Implications

The majority of these habitats, particularly those on rocky pavements and those associated with relict dune systems are self maintaining and vegetation development is limited by the infertile substrate. A low ground cover fuel load means fire will not carry for any significant distance into the community margins. The major concerns relate largely to shrublands on the coastal dune system near Kubin and shrubland habitats on alluvial plains near Sagan (St Pauls), the latter requiring active fire management to prevent significant changes to habitat condition.

Whilst the *Cycas badensis* dominant shrublands on dune systems near Pabar on the islands north-west coast are of significant scientific interest, they are isolated, and from field observations, host to a robust population of *Cycas badensis* that requires little in terms of management intervention.

8.11.4 Summary of Recommended Management Actions

The majority of habitats require little in terms of active management. Prescribed burning of shrubland habitats behind the beachfront at Sagan is warranted to prevent heavy accumulation of ground cover fuel loads. Mosaic burning of this habitat in conjunction with broader prescribed burning regimes in adjacent woodland habitats will prevent extensive and damaging late season fire events.

As the fauna ecology of many of these habitats is poorly known opportunistic documentation of all animals observed (including invasive/ exotic species) should be undertaken with photographs and possible collections (preserved in freezer) where possible for future formal identification by authorities or agencies. Similarly, the collection and subsequent pressing of plant species within this habitat can be undertaken on an opportunistic basis, focusing initially on plants of particular cultural/ resource significance.

Table 19. Summary management recommendations for shrubland and shrubland complexes.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly known.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitats fauna. A structured fauna survey involving pitfall and Elliott trapping can be undertaken dependent on the soil type, site accessibility and habitat. Focus on ethno-taxonomy should be maintained throughout the process to feed into TEK.	High
Plant Surveys	The floristic composition of habitats on both recent and older dune formations is relatively well known although habitats on rockier, less accessible pavements have had limited survey.	Survey should focus on conservation significant species and those which are important cultural resource species.	Moderate
Traditional Ecological Knowledge	Cultural sites are scattered extensively throughout dune habitats, particularly shrubland areas associated with older dune systems.	Undertake further survey to confirm the location of cultural sites and record these by GPS for incorporation into a GIS database for future reference. Documentation of traditional land management practices, particularly in relation to fire management practice, should be undertaken through collaboration with knowledgeable members of the local community.	High
Fire Management	The majority of these habitats will not carry a fire although shrubland association on the alluvial plains behind Sagan (VC14r) require fuel reduction burning. The fire ecology of *Cycas badensis* requires further study.	Undertake a prescribed burning program aimed at reducing fuel loads in woodland and shrubland habitats behind Sagan. This should be started early in the year with a series of mosaic burns that are continued throughout the year to systematically reduce fuel loads. Examine *Cycas badensis* dominant shrubland (VC14q) on foot to determine prevailing fire regime and establish whether specific fire management is warranted. General fire maintenance in all woodland habitats, following a seasonal mosaic of fire patterns will adequately manage remaining shrubland habitats,	High
Threatened	Flora: The majority of threatened	Flora: Examine *Cycas badensis*	High

Management Category	Context/Issue	Actions	Priority
Species Management	flora species found within the habitat are not threatened by existing land management regimes. The *Cycas badensis* dominant dune shrubland on the islands north east coast (VC14q) appears robust.	dominant shrubland habitat (VC14q) on foot as the opportunity permits. Examine population diversity in regard to size classes as well as informal observations in respect to fire regime. Management actions can be formulated dependent on the results of the ground survey.	
	Fauna: The composition of this habitat in regard to threatened fauna species is unknown	Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined. Trapping surveys can supplement those undertaken within broader woodland habitats with techniques dependent on soil type and accessibility.	High
Invasive Species Management	Flora: There are no existing weed issues identified in these habitats.	Flora: No active weed control or management is currently required although shrubland habitats should be regularly inspected for invasive weeds where they occur in the vicinity of access tracks. Track logs indicating areas of survey should be retained for future reference.	Moderate
	Fauna: The extent to which feral animals utilise this habitat is unknown.	Fauna: The extent of usage by other exotic pests will be informed by results of fauna surveys. Management actions can be formulated once major threats are identified.	Moderate
Monitoring	There are no specific monitoring actions required in these habitats although field inspection of *Cycas badensis* dominant shrublands might identify a specific monitoring need.	Examine *Cycas badensis* dominant shrubland 14q on the ground to determine if any specific monitoring program is required.	Moderate

8.12 Coastal Dune Complexes (includes Acacia dominant open forest and woodland)

8.12.1 Status of Ecological Knowledge

This habitat is essentially a mosaic of grassland, shrubland and vine thicket copses located on coastal foredune and prograding dune landforms, that cannot be differentiated into individual components at the mapping scale. These habitats are limited in extent on Mua, and include Acacia dominant forests which similarly occupy chenier dune ridges, generally in association with mangroves. Major vegetation components are low vine thicket copses, dominated by species which including *Eugenia reinwardtiana, Manilkara kauki, Guettardia speciosa, Terminalia subacroptera., Acacia crassicarpa, Premna serratifolia, Diospyros maritima* and *Psydrax banksii.* Copses are separated by grassland and forbland communities comprising *Ipomoea pes-caprae, Spinifex sericeus, Cassytha filiformis* and *Mnesithea rottboellioides*. A range of transitional shrubland communities may also occur, typically dominated by *Cochlospermum gillivreai, Pandanus sp., Guettardia speciosa, Cordia dichotoma* and

Acacia crassicarpa. In the case of complex 16c, shrubland habitats are separated by shallow brackish swales with *Melaleuca saligna.* The communities uneven appearance is accentuated by the groved nature of the community which has scattered clumps of trees and shrubs relatively well-spaced and separated by bare sand or sparse tussock grasses and herbs. The location of grassland habitats is indicated in **Figure 15.**

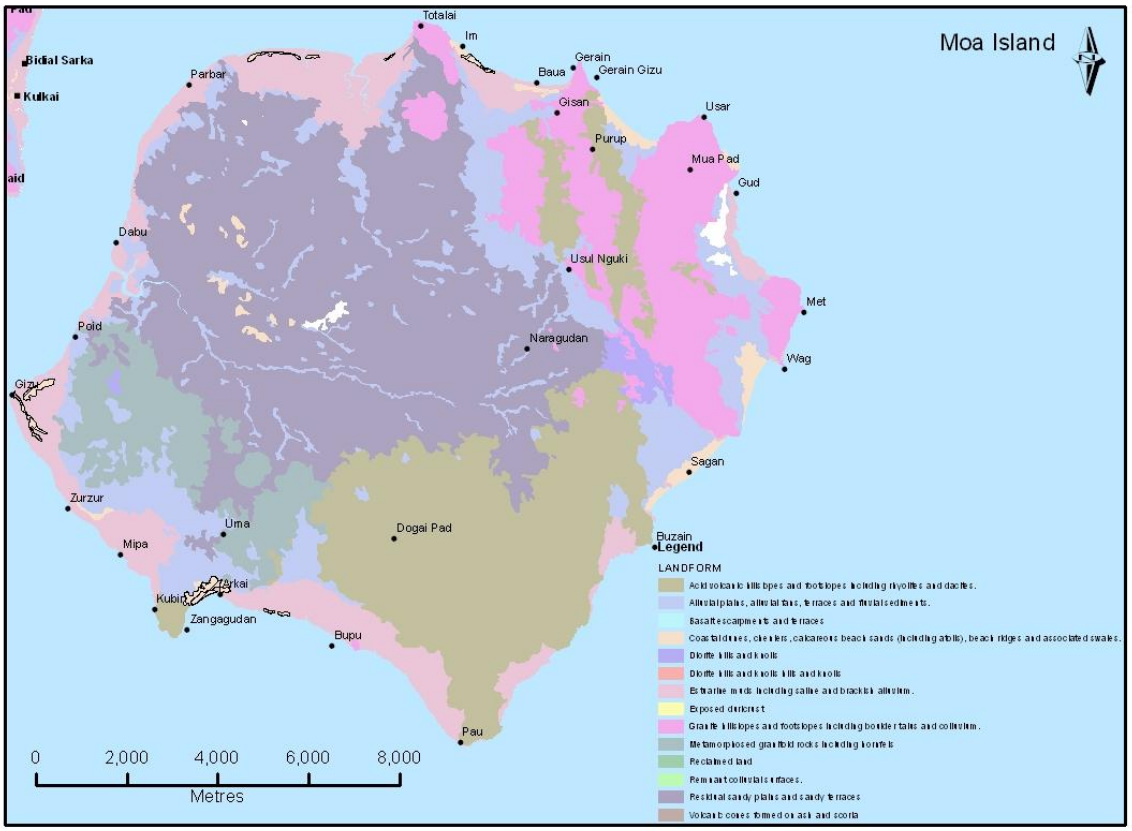


Figure 15. Distribution of coastal dune complex habitats (place names after Lawrie, 1970).

Photograph 39. A shrubland component of dune complex 16c with dominant *Cochlospermum gillivraei*.

8.12.2 Ecological / Cultural Considerations

Habitat Condition: The limited extent and general inaccessibility of these habitats means that they retain largely natural condition. Degradation, which is often indicated by a predominance of grass

(often *Mnesithea rottboelliodes* or *Imperata cylindrica*) over sprawling forbs, vines and shrubs, most likely due to inappropriate burning regimes or gross disturbance. Threatening processes include vehicle access, which has the potential to both spread exotic species and initiate dune erosion, as well as fires which can both destabilise substrates and greatly simplify the nature of the ground covers. Currently identified habitats are not threatened by these processes. This habitat will be the initial point of impact for beachside erosion related to sea level rise.

Fauna: The habitat provides an important nesting ground for marine turtles (when occurring as a foredune) and a number of bird species including beach stone curlew (*Esacus magnirostris*) which is listed as 'vulnerable' under state legislation.

Flora: No threatened flora species are known to occur within this habitat.

Cultural Perspectives: Groved thickets dispersed throughout this habitat provide an extensive repository of cultural resources, including a number of important food trees such as wongai (*Manilkara kuaki)* and cedar bay cherry (*Eugenia reinwardtiana),* and mipa *(Terminalia subacroptera).* The limited extent and accessibility of these habitats means that they would have provided a low level resource.

8.12.3 Management Implications

The inherent sensitivity of these habitats and their importance in stabilising landforms, stresses the importance of appropriate management regimes. Recommendations relate largely to ensuring access points are restricted to designated locations and continued monitoring for invasion of exotic species. The limited extent of these habitats and general inaccessibility limits the requirement for any program of active management to simplify habitat diversity.

8.12.4 Summary of Recommended Management Actions

Table 20. Summary management recommendations for coastal beach complexes.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	No previous surveys.	Undertake general fauna observation within these habitats as the opportunity permits. Focus on the presence of cultural and conservation significant species including marine turtle nesting sites and the presence of the beach stone curlew.	Moderate
Plant Surveys	Information of flora composition is incomplete and limited to rapid surveys in dry season.	Carry out additional flora field surveys as the opportunity permits across seasons, with focus on wet season herbs and grasses. Collect specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue.	Moderate
Threatened Species Management	Flora: No significant species known. Fauna: Dune complexes provide habitat for a range of significant fauna species including beach stone curlew and little tern as well as	Flora: No actions. Fauna: Further baseline data is required (see fauna surveys) before discrete management actions can be fully defined.	Moderate Moderate

Management Category	Context/Issue	Actions	Priority
	nesting grounds for marine turtles.	Opportunistic survey should also identify the extent to which exotic predators (dogs and cats) are utilising these sites for hunting purposes. The identification of nesting, and foraging sites for the beach stone curlew and recording by a GPS for incorporation within the GIS database.	
Traditional Ecological Knowledge	TEK within this habitat is poorly known/ documented. Plant and animal lists provided in the Appendices provide a good foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK knowledge through fauna and flora survey actions, and from interviews with elders on an ongoing basis.	Moderate
Fire Management	Over burning leading to the loss of species diversity and habitat structure and destruction of cultural sites.	These habitats occur in isolated locations (with the exception of the habitat in the vicinity of Kubin township). Ensuring a regular mosaic burning program is maintained in broader woodland habitats will ensure these habitats are largely protected from severe fire incursion.	Moderate
Invasive Species Management	Flora: The habitat was subject to only limited on-ground inspection although it appears to be largely free from exotic weeds. Environmental weeds including mintweed and red Natal grass, praxelis and blue top are potential threats. Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna, particularly nesting birds, by feral cats and dogs.	Flora: No specific action is required because of general inaccessibility of these habitats. Accessible habitats in the vicinity of Kubin should be inspected on an annual basis for any weed incursion. Fauna: The use of this habitat by invasive fauna needs to be derived from opportunistic fauna survey results. Assess cat activity levels by monitoring of sand pads, and nocturnal spotlighting.	Moderate Moderate
Monitoring	There are currently no issues identified which require the placement of formal monitoring sites.	General monitoring of the condition of accessible habitats should be undertaken on an annual basis.	Moderate
Cultural Heritage	Cultural heritage values occur within the habitat on other islands.	Identify any significant cultural heritage sites on an opportunistic basis. Consideration should be given to the identification and management of any significant sites.	Moderate

8.13 Grassland and Grassland Complexes

8.13.1 Status of Ecological Knowledge

Grassland communities are typically associated with areas under an intensive fire regime. They range from communities on steep granite hillslopes, communities on coastal headlands, and grassland communities on sand dunes. The latter is typically an indication of past intensive burning regimes around beachside areas of old settlement. Composition is generally dependent on fire regime with those areas exposed to frequent hot fires typically dominated by *Imperata cylindrica* and *Heteropogon*

triticeus. Other common species include *Mnesithea rottboellioides* on sand dunes and *Themeda triandra* on coastal headlands and hillslopes. A prominent anthropogenically produced grassland occurs on the broad coastal dune flat at Sagan south of St Pauls and is being maintained with fire.

Grassland communities are scattered across footslopes throughout the island and appear to be regularly maintained by burning. The most extensive grassland community occurs on granite hillslopes behind St Pauls settlement, where fire has pushed back the margins of closed forest communities to the point that they exist only as scattered remnants in sheltered pockets. This habitat has been stable since first captured in the historical aerial photographic records in 1971. It is almost certain that a frequent hot fire regime has been responsible for the creation of these anthropogenic grasslands.

The habitat also includes a relatively extensive area of grassland community 17a on an alluvial flat, a grassland habitat more typical of the northern Torres Strait Islands, and broad areas of *Dapsilanthus spathaceus* and *Schoenus* dominant sedgeland on residual sand sheets. Whilst the former habitat appears to be subject to frequent hot fire events, the latter is unlikely to carry fire under even the most favourable conditions.

Photograph 40 (left). An extensive tract of anthropogenically generated grassland on granite footslopes being the St Pauls settlement, and **Photograph 41.** A recently burnt example of *Ischaemum australe* dominant grassland on the margins of saline grassland habitats.

Photo 42 (left). An extensive sedgeland community dominated by *Dapsilanthus spathaceus* and *Schoenus sp.* on residual sand. **Photograph 43.** Extensive anthropogenically generated grassland on the coastal dune at Sagan.

8.13.2 Ecological / Cultural Considerations

Habitat Condition and Threats: Grasslands are generally free from exotic weeds although some communities, particularly on coastal dunes, are the result of frequent hot fire. All sedgeland habitats are in pristine condition (**Photograph 42**). Grassland habitats controlled by edaphic conditions are generally robust, although all are threatened by the introduction of exotic grass species including gamba grass and annual mission grass. The former is an aggressive coloniser which develops a standing biomass of 5-7 times that of native species (Rossiter *et al.* 2003) resulting in extremely intense savanna fires, significantly altering habitat ecology. Mission grass is already established in and around the St Pauls community. Praxelis is an aggressive herb which occurs in the village areas of neighbouring Badu and has potential to infest grasslands to the exclusion of native species. Other weeds noted within grassland habitats include calotropis (*Calotropis gigantea)* and prickly pear (*Opuntia stricta).* Both weeds were identified on dune grasslands at Sagan and have potential to become pest plants. These populations are earmarked for immediate eradication.

Fauna: Comprehensive fauna surveys within this habitat are lacking with fauna assemblage unknown. Grasslands are expected to host robust populations of small mammals.

Flora: Grasslands on the coastal dune at Sagan support populations of *Cycas badensis*. Species composition is otherwise poorly documented.

8.13.3 Management Implications

Management actions should aim to maintain the current landscape function which is considered important from both ecological and cultural perspectives. Recommendations for landscape maintenance are provided below although ultimately, management direction will be guided by the desires of the local community and representative rangers.

1. Selected grassland habitats should be assessed for signs of degradation on an annual basis with particular note towards evidence of invasive species or shrubby thickening. Monitoring for invasive pest species should be undertaken vigilantly on major access points and tracks. Any nucleation points should be subject to immediate eradication and plants that can not be identified in the field collected for formal identification.
2. At the discretion of the rangers, areas subject to shrubby thickening should be considered for a prescriptive late season fire regime which will destroy generating shrubs. Burning immediately after the first storms (storm burning) will effectively promote grassy cover over shrubs and this should be considered as a management option.
3. General burning regimes for grasslands should promote patchiness, with burning conducted across a range of seasonal conditions from early to late dry season. Maintaining patchiness in burnt and unburnt features is important for conservation management (Russell-Smith *et al.* 2003) and stratifying fires across a range of seasonal condition will promote patchiness. The inherent rockiness of the substrate in many of the islands grassland habitats will also promote patchiness in fire distribution.

4. Timing and frequency of fires should be recorded for future reference. This will allow practice to be adjusted and refined to improve management outcomes.
5. Monitoring for invasive pest species should be undertaken vigilantly on major access points and tracks. Any nucleation points should be subject to immediate eradication and plants that cannot be identified in the field collected for formal identification.

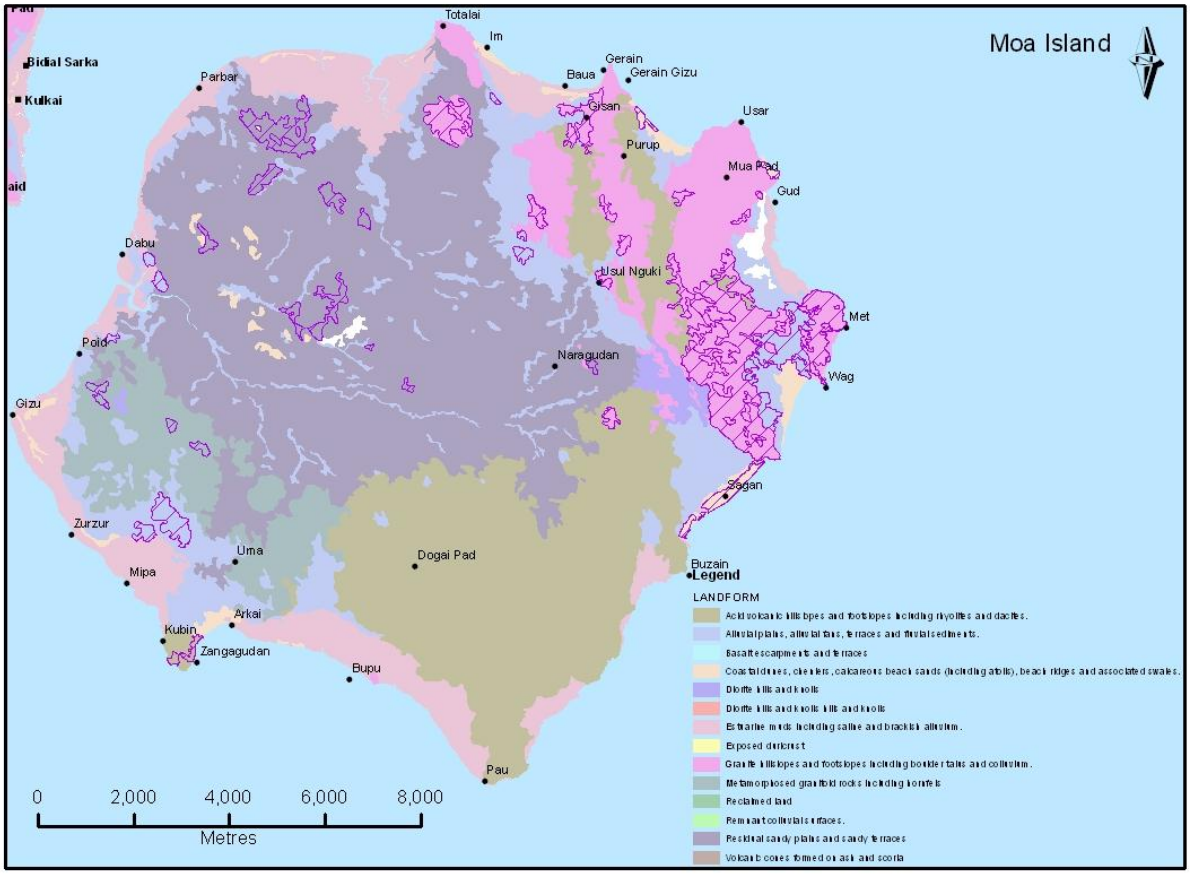


Figure 16. Location of grassland habitats on Mua (place names after Lawrie, 1970).

A critical point is the management of the large grassy flat at Sagan which is being burnt annually to maintain its recreational values. Back-burning along the edges of vine thicket copses within this habitat during cooler seasonal periods will protect these remnants from further degradation.

8.13.4 Summary of Recommended Management Actions

Table 21. Summary of Management Actions for grasslands and grassland complexes.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	These habitats have been subject to limited fauna survey and fauna assemblage has been poorly documented.	The implementation of a structured fauna survey and trapping program will provide additional detail in regard to the islands fauna assemblage. It may however be of secondary importance to survey of the more extensive open forest and woodland habitats.	Moderate

Management Category	Context/Issue	Actions	Priority
Plant Surveys	Information on flora composition is incomplete and limited to rapid surveys in dry season.	Carry out additional flora field surveys across seasons with focus on herbs and grasses. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue.	Moderate
Threatened Species Management	Flora; The habitat contains populations of *Cycas badensis* in some locations, particularly on dunefield grasslands at Sagan. It is expected that these plants have cultural significance. Fauna: The extent to which this habitat is utilised by threatened species is not known.	Flora: Conduct opportunistic flora surveys within grassland habitats and mark the locations of *Cycas badensis* populations. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate Moderate
Traditional Ecological Knowledge	TEK within this habitat is poorly known or documented. Plant and animal lists provided in the Appendices provide a good foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK through fauna and flora survey actions, and from interviews with elders on an ongoing basis. Ongoing mapping of cultural sites within this habitat should be undertaken.	High
Fire Management	The habitat requires burning to retain open structure although at present, grassland habitats are generally free from shrubland encroachment. Sedgeland habitats on swampy sand plains are largely self maintaining and do not have sufficient fuel to burn regularly.	Implement a seasonal burning regime that seeks to mosaic burn all grassland habitats starting in cooler months where fire intensity is unlikely to be severe. As a general aim burning of grassland habitats should be completed over a three-year interval. Record the timing and frequency of burning events for future reference so as to allow practice to be adjusted and refined to improve management outcomes. Incorporate the management of the Cycad population into the burning program at Sagan with consideration to times of seed and cone production. Incorporate the protection of cultural sites into burning plans.	High
Invasive Species Management	Flora: Grasslands are generally free from major invasive species however, potential weeds are known from disturbed areas within and on the vicinity of the Mua settlement. Calotropis and prickly pear near camps at Sagan have potential to become serious pest plants.	Flora: Monitoring for invasive pest species, particularly exotic herbs and grasses, should be undertaken within selected habitats every 6 months on major access points and tracks. Collect, record location using GPS, and photograph weeds that cannot be identified in the field so formal identification can be achieved. Any nucleation points should be subject to immediate eradication. Eradication of calotropis and	Immediate

Management Category	Context/Issue	Actions	Priority
		prickly pear at Sagan should be undertaken immediately.	
	Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna by feral cats and dogs.	Fauna: Composition of invasive fauna needs to be derived from fauna survey results. Assess cat and dog activity levels by nocturnal spotlighting and observation. Implement control where appropriate.	High
Monitoring	There is a requirement to observe any changes to habitat structure so that management actions can be implemented if the changes are having a negative impact on biodiversity values.	Establish permanent photographic monitoring points within any habitat subject to change or conversion (there are no known examples at present). Where problem areas are identified, carry out monitoring on a six monthly basis including observations taken late in the wet season at maximum growing season.	Moderate

8.14 Rock Pavement Communities

8.14.1 Status of Ecological Knowledge

This habitat is typically associated with steeper rocky knolls and escarpments where it forms a complex of bare rock interspersed with shrubland. Shrubland habitats typically occupy cracks and crevices where sufficient moisture and nutrient (from skeletal soil formation) is provided to allow shrub development. The shrubland component comprises deciduous vine thicket species ranging in height from 1.5 to 6m dominated by *Cochlospermum gillivraei, Canarium australianum, Terminalia subacroptera, Psydrax banksii, Psydrax reticulata, Dalbergia densa* var*. australis, Secamone elliptica, Carissa ovata, Acacia polystachya* and *Welchiodendron longivalve.* Bare pavements without any substantial cover of vegetative material are generally scattered throughout the broader shrubland mosaic. These habitats are of much more limited extent than on neighbouring Badu Island.

Photograph 44. Typical rock pavement habitat on granite slopes behind St Paul's settlement.

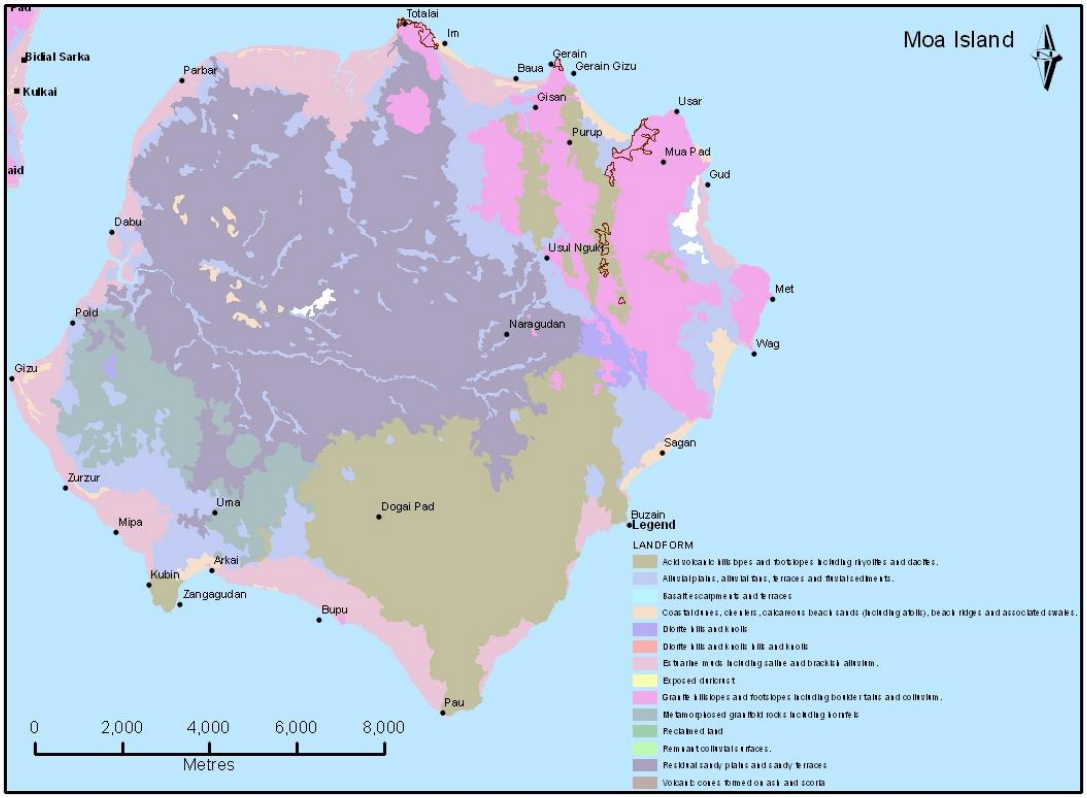


Figure 17. The location of rock pavement habitats on Mua (place names after Lawrie, 1970).

8.14.2 Ecological / Cultural Considerations

Habitat Condition and Threats: Rock pavements, due to their inherent infertility and exposure, have been unaffected by ecological changes that occur due to human influence. The major threats to the habitat include the spread and establishment of exotic weed species including grass species such as red Natal grass (*Melinis repens),* molasses grass *(Melinis minutiflora)* as well as invasive shrubs such as lantana and praxelis *(Praxelis clematidea)* (the latter occurs as a garden plant in the Badu Township area). Exotic species will most likely establish in habitats close to the vicinity of settlement areas, as well as pavement areas that are regularly burnt, although such accessible areas are lacking on Mua.

Fauna: There has been no fauna survey undertaken within this habitat on Mua Island. The rocky nature of the habitat may be particularly suitable for a range of skink and gecko species including the slender chained gecko (*Lepidodactylus pumilis*).

Flora: No flora survey has been undertaken within this habitat on Mua Island. It is expected to host healthy populations of *Psydrax reticulata (*Vulnerable*)* and a range of orchid species.

Cultural Perspectives: The cultural significance of these habitats on Mua is unknown.

8.14.3 Management Implications

The relatively stable nature of this habitat type means that little management intervention is required. The majority of habitats are buffered from fire incursion by surrounding pyrophobic vegetation as well

as their rocky nature which acts as a natural buffer to fire incursion. No active management is required although opportunistic survey of flora and fauna composition is recommended.

8.14.4 Summary of Recommended Management Actions

Table 22. Summary of management actions for rock pavement habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	No fauna surveys have been undertaken in this habitat.	Design and implement a structured fauna survey and trapping program supported by specialists. Maintain focus on culturally significant species and ethno-taxonomy to feed into TEK.	Moderate
Plant Surveys	No floristic survey has been undertaken in this habitat.	Carry out flora field surveys across seasons with focus on herbs and grasses. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue.	Moderate
Threatened Species Management	Flora: *Psydrax reticulata* is predicted to occur within this habitat although the species is expected to be widespread and relatively common. Fauna: Composition of significant fauna within this habitat is not known.	Flora: Carry out field surveys to identify any plants of conservation or cultural significance within this habitat. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the Appendices provide a good foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK through fauna and flora survey actions, and from interviews with elders on an ongoing basis.	High
Fire Management	The habitat by its physical nature excludes fire.	No management actions required	No Action Required
Invasive Species Management	Flora: Weeds with potential to invade this habitat are known from disturbed areas in the vicinity of the St Pauls township. Fauna: The composition of invasive fauna within this habitat is not known.	Flora: Carry out field surveys to identify any exotic plants occurring within this habitat. Fauna: The general inaccessibility of this habitat limits the potential for thorough assessment of invasive species utilisation. Informal documentation of exotic species usage should be undertaken in conjunction with habitat field inspection.	Moderate Moderate
Monitoring	These are stable habitats controlled by infertile substrates and limited soil development. The major cause of habitat change is likely to be invasive plant species.	No monitoring actions required at present. Revise monitoring requirements based on field inspection.	No Action Required

8.15 Samphire Grasslands

8.15.1 Status of Ecological Knowledge

Broad mosaics of samphire grassland (*Sporobolus virginicus),* samphire forblands, and mangrove forest/ shrubland complexes occur in sheltered embayments around the island, particularly in the islands south west where the maximum development of mangrove vegetation occurs. This is a dynamic vegetation mosaic which has the capacity to rapidly respond to changes in salinity and tidal regime, whether these be long term or short. Frequent tidal inundation in the absence of sufficient rainfall to flush accumulating salt will favor the gradual replacement of grass with chenopod forbs.

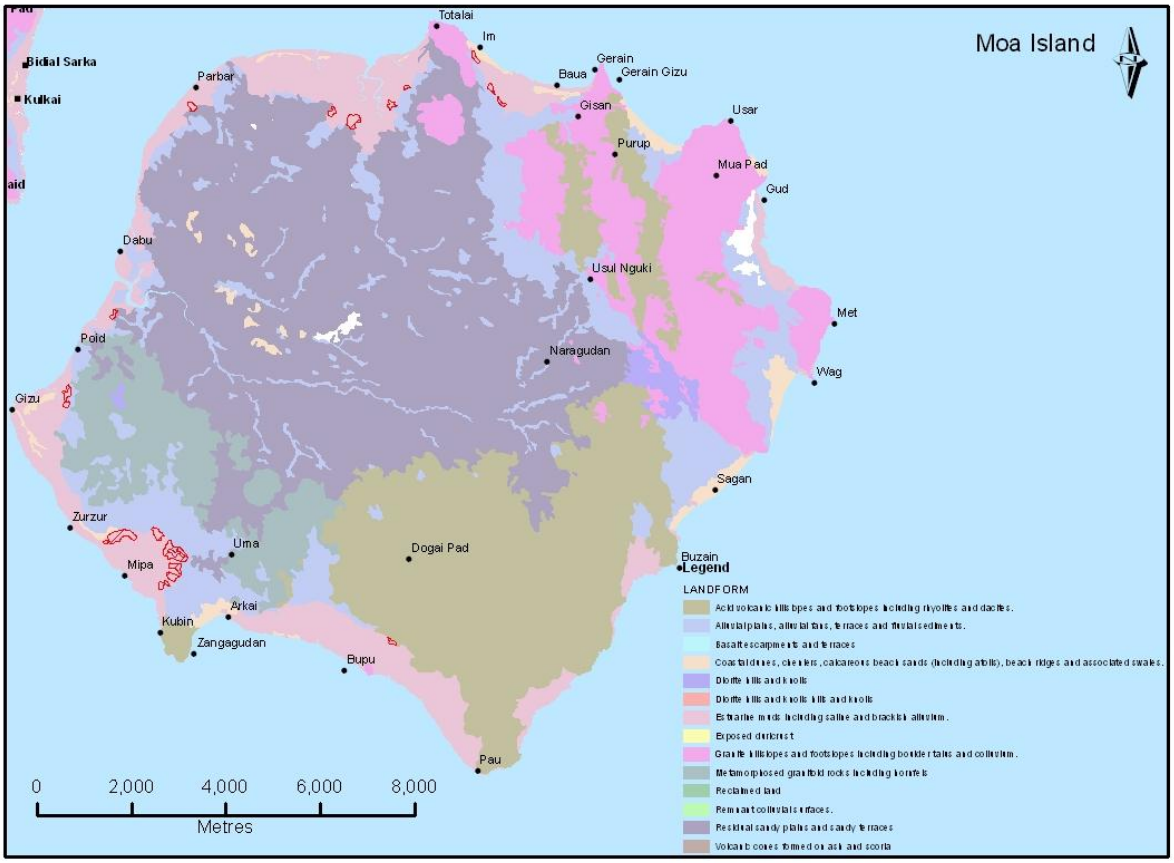


Figure 18. Location of samphire grassland habitats on Mua Island (place names after Lawrie, 1970).

Photograph 45. A complex of mangrove closed forest and brackish sedgeland on the west coast of Mua Island.

8.15.2 Ecological / Cultural Considerations

Habitat Condition: The habitat is universally free from exotic species, with species composition regulated by soil salinity.

Fauna: Samphire grassland provides valuable habitat for a range of significant fauna species including black-necked stork (*Ephippiorhynchus asiaticus),* radjah shelduck (*Tadorna radjah*) and water mouse (*Xeromys myoides)*.

Flora: No significant flora species are currently known to be associated with this habitat.

Cultural Perspectives: The cultural usage of sporobolus grasslands is unknown.

8.15.3 Management Implications

This is a self-regulating habitat that requires minimal input in terms of active management. The long-term distribution of saline grassland will be determined largely by tidal regime, trends in sea level and climatic factors such as rainfall. Documentation of all animals observed (including invasive/ exotic species) should be undertaken with photographs and possible collections (preserved in freezer) where possible for future formal identification by authorities or agencies. Consideration should be given to assessing the presence of the water mouse although there is currently no record of the species on the island. Documentation of the traditional usage of this habitat should be an ongoing component of the ranger program.

8.15.4 Summary of Recommended Management Actions

A summary of recommended management actions is provided in **Table 23**.

Table 23. Summary of recommended management actions for saline grassland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly documented although the assemblage is likely to be relatively simple.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitats fauna assemblage and utilisation. Targeted survey for water mouse should be considered a priority action. This can be completed using Elliott Traps (A or B) baited with sardines placed on the interface between mangroves and grasslands. Focus on ethno-taxonomy should be maintained throughout the process to feed into TEK.	High
Plant Surveys	Flora composition is well documented and comprises a simple suite of species.	No action required.	No action Required.
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the appendices provide a good	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	Moderate

Management Category	Context/Issue	Actions	Priority
	foundation for increasing TEK and ethno-taxonomy.	Documentation of traditional land management practices, particularly in relation to fire management practice should be undertaken through collaboration with knowledgeable members of the local community.	
Fire Management	No fire management is required within this habitat as it is regulated by salinity and occasional tidal inundation.	This habitat generally does not require fire for maintenance and hence no structured fire management planning is required.	No action required
Threatened Species Management	No threatened flora species are known to occur within this habitat. The grassland however provides habitat and foraging ground for a range of threatened fauna species.	Flora: No management actions required. Carry out ongoing surveys as identified in flora and actions above. Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined. Particular attention should be paid to recording site locations of threatened species including Black-necked stork and Radjah shelduck. Targeted survey for water mouse should be considered priority and inform management requirements.	Moderate Moderate
Invasive Species Management	FloraThis habitat is not susceptible to weed invasion due to the salinity of the soils. Fauna: The degree to which feral species are utilizing this habitat requires further investigation.	Flora: No active weed control or management is currently required. Fauna: Survey of habitat usage by exotic species including cats, feral dogs and pigs should be an ongoing component of the ranger program utilising sand pads and tracking. Indications of population expansions, particularly feral cats and dogs will require a structured eradication program.	Moderate High
Monitoring	No monitoring is currently required within this habitat.	No action required.	No action required.

8.16 Samphire Herblands and Shrublands and Salt pans

8.16.1 Status of Ecological Knowledge

The habitat is a response to hyper-saline conditions, a result of repetitive tidal wetting and subsequent surface water evaporation. The major occurrences are found on the landward fringes on mangrove forests on the islands north-west coast. No systematic floristic survey of this habitat has been undertaken.

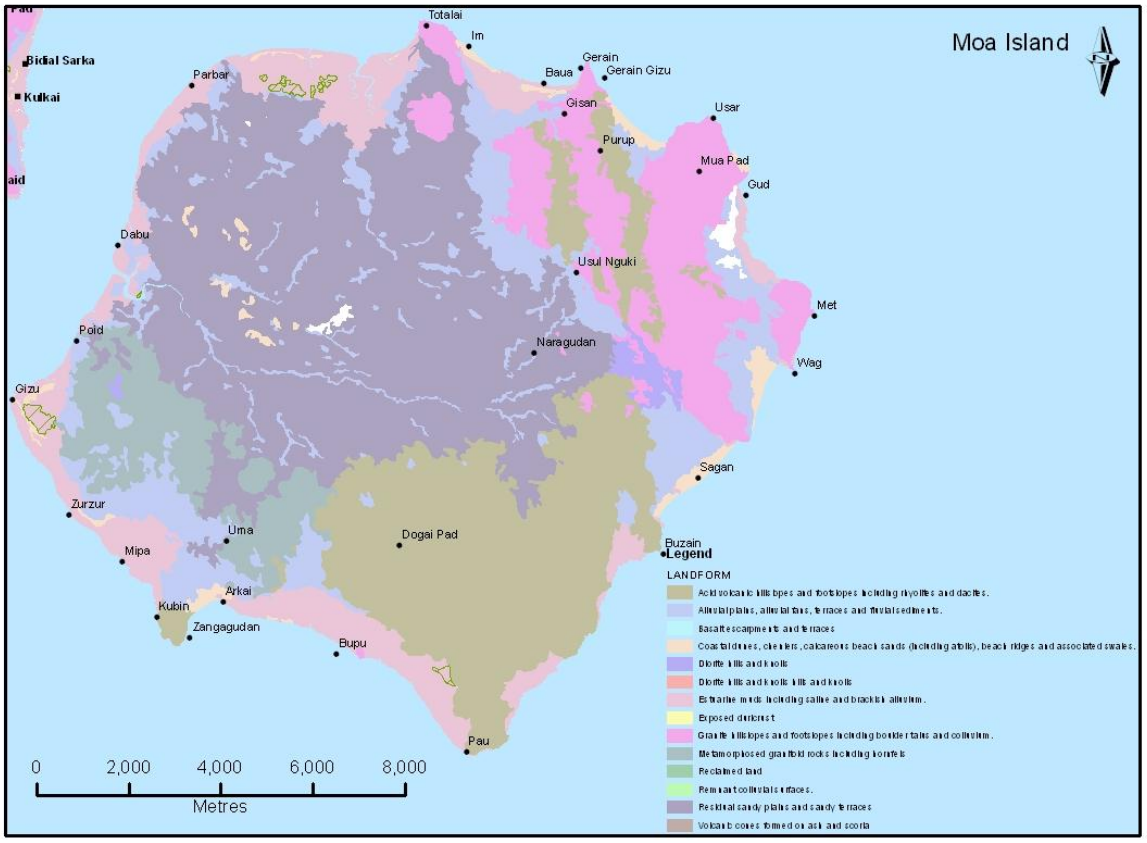


Figure 19. Distribution of samphire herblands and shrublands (place names after Lawrie, 1970).

8.16.2 Ecological / Cultural Considerations

Habitat Condition and Threats: The habitat is universally free from exotic species. This is a dynamic community, the composition of which will undoubtedly respond to cyclical variations in climate and tidal incursion.

Fauna: Samphire grassland provides habitat for a range of significant fauna species including black-necked stork (*Ephippiorhynchus asiaticus*), radjah shelduck (*Tadorna radjah*) and possibly water mouse (*Xeromys myoides*).

Flora: No significant flora species are known to be associated with this habitat.

Cultural Perspectives: Traditional usage is unknown.

8.16.3 Management Implications

This is a self-regulating habitat that requires minimal input in terms of active management. The long term distribution and floristic composition of this habitat will be determined largely by tidal regime, trends in sea level and climatic factors such as rainfall.

8.16.4 Summary of Recommended Management Actions

The habitat has limited extent on Mua Island and no active management is required. Actions identified in **Table 24** should be considered during the course of the rangers duties.

Table 24. Summary of recommended management actions for samphire herblands and shrublands.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition and utilisation within this habitat is poorly documented.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitat's fauna assemblage and utilisation. Targeted survey for water mouse should be considered a priority action. This can be completed using Elliott Traps (A or B) baited with sardines placed on the interface between wetland areas and other habitats (mangroves, samphire grasslands etc). Focus on ethno-taxonomy should be maintained throughout the process to feed into TEK.	Moderate
Plant Surveys	Flora composition is relatively well documented and simple both in composition and structure.	Flora field surveys should focus on the collection and identification of important cultural resource species.	Moderate
Traditional Ecological Knowledge	The extent of TEK within this habitat is not known or documented. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethno-taxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey on an ongoing basis. Documentation of any traditional habitat utilisation is a fundamental information requirement.	Moderate
Fire Management	This habitat will not generally carry fire and there is no requirement for active fire management or monitoring.	No action required.	No Action
Threatened Species Management	No threatened flora species are known to occur within this habitat. The wetland habitats however provide habitat and foraging ground for a range of threatened fauna species.	Flora: No management actions required. Carry out ongoing surveys as identified in flora and actions above. Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined. Particular attention should be paid to recording site locations of threatened species including black -necked stork, radjah shelduck and estuarine crocodile. Targeted survey for water mouse should be undertaken in conjunction with broader surveys within suitable habitats.	No Action Moderate
Invasive Species Management	Flora: There are no existing weed issues identified within this habitat and weed incursions are likely to be regulated by saline incursion which	Fauna: A survey of habitat usage by exotic species should be an	Moderate

Management Category	Context/Issue	Actions	Priority
	limits the potential for aggressive weed invasion. Fauna: The extent to which exotic fauna species utilise this habitat is unknown.	ongoing component of the ranger program with informal sitings of feral species recorded for future reference.	Moderate
Monitoring	No monitoring is required in this habitat.	No monitoring is required in this habitat.	No Action

8.17 Mangrove Forest, Woodland and Shrubland Complexes

8.17.1 Status of Ecological Knowledge

Extensive areas of mangrove closed forest and shrubland are found on broad embayments in the islands south-west and western coastline, with scattered occurrences associated with tidal inlets and watercourses along the islands entire coastline. The habitat has been largely unsurveyed floristically.

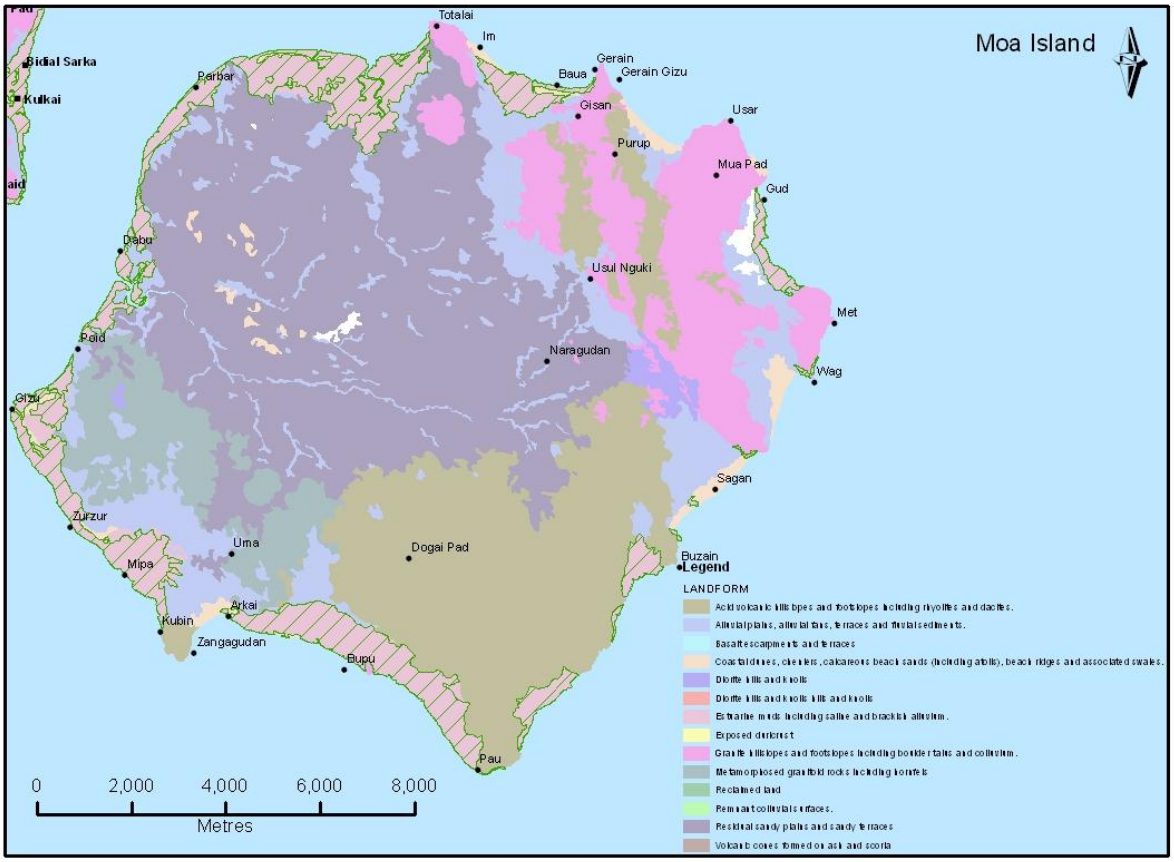


Figure 20. Distribution of mangrove habitats on Mua Island (place names after Lawrie, 1970).

8.17.2 Ecological / Cultural Considerations

Habitat Condition and threats: The habitat exhibits high integrity. Sea level rise will ultimately lead to expansion of mangrove habitats and changes to both structure and floristic composition of existing mangrove stands.

Flora: No significant species are known from mangrove habitat although the Near-Threatened *Dolichandrone spathacea* is likely to occur.

Fauna: No comprehensive survey of the fauna assemblage has been undertaken although it is known to be important habitat for estuarine crocodile and possible habitat/ foraging ground for the water mouse.

Cultural Perspectives: Provides a cultural resource for traditional fishing and hunting. The degree and nature of resource utilisation for timber is unknown although as on other Torres Strait Islands, it is likely to provide an essential natural resource.

8.17.3 Management Implications

This is a self-regulating habitat that requires minimal input in terms of active management. Extensive recommendations for management and monitoring of mangrove ecosystems are identified by Burrows (2010). Mangroves have not been subject to any floristic detailed survey.

8.17.4 Summary of Recommended Management Actions

Actions identified in **Table 25** should be considered during the course of the rangers duties.

Table 25. Summary of recommended management actions for mangrove habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition and utilisation within this habitat is poorly documented.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitats fauna assemblage and utilisation. Targeted survey for water mouse should be considered a priority action. This can be completed using Elliott Traps (A or B) baited with sardines placed on the interface between mangrove areas and other habitats (estuarine wetlands, samphire grasslands etc). Focus on ethno-taxonomy should be maintained throughout the process to feed into TEK.	High
Plant Surveys	Floristic composition has not been comprehensively assessed	Floristic survey should focus on the collection and identification of important cultural resource species and traditional nomenclature.	Moderate
Traditional Ecological	Composition of TEK within this habitat is poorly known. Plant and	Collect and collate TEK knowledge within this habitat gained through	Moderate

Management Category	Context/Issue	Actions	Priority
Knowledge	animal lists provided in the appendices provide a good foundation for increasing TEK and ethno-taxonomy.	fauna and flora survey actions on an ongoing basis. Documentation of traditional habitat utilisation is a fundamental information requirement.	
Fire Management	This habitat will not generally carry fire and there is no requirement for active fire management or monitoring.	No action required.	No action required
Threatened Species Management	The habitat has potential to host the 'Near-Threatened' species *Dolichandrone spathacea* on the habitat margins.	Flora: No management actions required. Carry out ongoing surveys as identified in flora and actions above. Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined. Particular attention should be paid to recording site locations of threatened species including black -necked stork, emerald monitor and estuarine crocodile. Targeted survey for water mouse should be considered priority and inform management requirements.	Moderate High
Invasive Species Management	Flora: There are no existing weed issues identified within this habitat and weed incursions are likely to be regulated by saline incursion which limits the potential for aggressive weed invasion. Fauna: The extent to which invasive species utilize this habitat is unknown	Flora: No active weed control or management required at present. Fauna: Incidental observations relating to usage of this habitat by exotic species should be an ongoing component of the ranger field program.	Moderate Moderate
Monitoring	Changes to mangrove condition and structure may occur due to the effects of ongoing sea level rise.	Extensive recommendations for management and monitoring of mangrove ecosystems within the Mangrove Watch program are identified by Duke (2010).	Moderate

8.18 Cleared Areas and Regrowth

8.18.1 Status of Ecological Knowledge

Cleared areas refer to areas of anthropogenic (human) disturbance, generally relating to development of community areas and associated infrastructure. Management of these areas is under control of the local Council although the spread of exotic species from these areas poses a particular threat to the integrity of natural habitats across the island.

Areas utilised for habitation and infrastructure purposes are sites for a number of processes with significant potential to degrade natural ecosystems. Of these processes, the proliferation of exotic

weed species presents by far the most serious threat to the integrity of natural habitats across the island. Observations from around the St Paul and Kubin townships indicate a number of potentially invasive weeds which include hyptis (*Hyptis suaveolens)*, leucaena (*Leucaena leucocephala*), snakeweed (*Stachytarpheta jamaicensis*), Brazilian joyweed (*Alternanthera brasiliana)*, para-grass (*Brachiaria mutica)*, annual mission grass, *Themeda intermedia*, rubber vine (*Cryptostegia grandiflorus*), and ringworm shrub (*Senna alata*). Lantana *(Lantana camara* – Class 2 under the LPA and WONS*)* and porcupine flower (*Barleria prionitis*), considering their presence on other Torres Strait Islands, are also considered potential threats to the island's habitats although they are not presently known to occur on Mua.

Whilst detailed weed management strategies are beyond the scope of this exercise, priority should be given to ensure weeds are contained within the township area and do not spread to natural habitats. A focused effort to eliminate these weeds from settlement areas should however be a preferred management option. Dispersal mechanisms into natural habitats will include natural means such as water, wind, and birds, as well as by human vectors, including vehicles and machinery. The spread of other weeds onto the islands can be minimised by washdown of all vehicle and machinery arriving on the island. It is also very important for any plant and equipment working on Mua to be thoroughly cleaned before moving to other Torres Strait Islands.

8.18.2 Summary of Recommended Management Actions

The following actions should be considered during the course of the rangers duties. It should be noted that comprehensive weed and feral pest control in the council area is likely to be outside the scope of general ranger duties.

Table 26. Summary of recommended management actions for disturbed areas.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition and utilisation within cleared habitats has not been documented although these areas have concentrated populations of domestic dogs and to a lesser extent cats.	Maintain communications with council animal control and DAFF officers in regard to the spread of domesticated animals into broader environs.	Moderate
Plant Surveys	The introduction of problematic pest species is most likely to occur in the vicinity of the island settlement.	No formal surveys required other than recording occurrences of problematic pest species.	High
Traditional Ecological Knowledge	No issues identified.	No Action Required	No Action
Fire Management	Fire exclusion area.	Implement hazard reduction burning around communities to protect life and property.	Immediate
Threatened Species Management	The extent to which threatened fauna species utilise disturbed land is unknown. Disturbed areas are generally unviable habitats for threatened flora species.	Fauna: Documentation of native fauna species utilizing cleared habitats may provide information on the degree to which disturbed areas are utilised by threatened species.	Moderate

Management Category	Context/Issue	Actions	Priority
Invasive Species Management	Cleared and disturbed areas are likely to be the focal point for introduction of exotic flora and fauna species.	Monitor disturbed areas for any suspected new arrivals of exotic plant and animal species and liaise with DAFF in regard to potential introductions. Liaise with council in regard to priorities for weed control and clean up.	High
Monitoring	No issues are identified other than those identified in regard to exotic species invasion.	Restricted largely to informal monitoring of exotic species infestation.	High.

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10.0 Glossary

Alluvium/ Alluvial: Sediments deposited by the action of flowing water, generally derived from the action of rivers or from wash of hillslopes.

Bioregion: The bioregion is forms the primary level of classification for terrestrial biodiversity values on a state and nationwide basis. Thirteen bioregions are classified in Queensland with the Torres Strait Islands being a sub-province of the broader Cape York Peninsula bioregion.

Broad Vegetation Group: The highest level of classification used to describe plant assemblages in the Torres Strait Islands, typically referring to plant habit and structure.

Deciduous: A tree species that undergoes a seasonal shedding of leaves, typically being leafless in the drier seasonal periods (e.g. Bombax ceiba).

Edaphic: Pertaining to characteristics of the soil including moisture, drainage and fertility.

Evergreen: A tree or vegetation community that retains foliage on an annual basis i.e. always has leaves.

Holocene: The period of time less than 11 thousand years to present. Less than 5 thousand years old is considered to be 'Late Holocene'.

Igneous Rock: A rock formed by cooling and solidification of molten magma or lava.

Notophyll: A category of leaf size with a leaf blade for 7.5 to 12.5 cm long.

Obligate Seeder: A plant that can only regenerate after fire from a seed or stored seed bank.

Palustrine: Vegetated when referring to a wetland i.e. vegetated swamp.

Pleistocene: The period of time between 11 thousand and 1.8 million years old.

Pyrophytic: In relation to vegetation, refers to a habitat which benefits or regenerates following a fire event.

Pyrophobic: In relation to vegetation, a vegetation type which is fire intolerant, or is killed or damaged by a fire event.

Quaternary: The period of time between present and 1.8 million years old, which is sub-divided into Pleistocene and Holocene ages.

Regional Ecosystem: The primary unit against which Queensland's Vegetation Management Act (1999) is regulated and as such, the classification specific legislative significance. The classification of regional ecosystems is based on a hierarchical system with a three part code defining bioregion, followed by land zone, and then vegetation.

Savanna: A habitat typified by grasses where trees do not form a closed canopy.

Semi-evergreen: A tree or forest type whose pattern of leaf loss can be related to specific periods of environmental stress. In semi-evergreen vine forest, only portions of the canopy will be subject to leaf loss at a particular time.

Semi-deciduous: A rainforest or vine thicket type in which a component of the forest canopy trees and canopy emergents are seasonally (obligate) deciduous.

Vine Thicket: A vegetation community that is formed by predominantly soft leaf (rainforest) trees and shrubs, typically with dense layers of wiry lianes (vines) growing from ground level and reaching canopy height. Thicket is in reference to canopy height with the predominant canopy forming at < 9m.

Vine Forest: A vegetation community commonly referred to as rainforest, that is formed by predominantly soft leaf (rainforest) trees and shrubs. Dense cover of lianes (vines) and epiphytes are common at all structural levels. Vine forest is differentiated from vine thicket by height, with predominant vine forest canopy being > 9m.

Appendices

Appendix A. Expert Panel Attendees

Expert	Organisation	Expertise	Inputs
David Stanton	3D Environmental	Vegetation and landscape mapping and assessment.	• Specialist knowledge of Torres Strait vegetation community distribution, condition and landscape (geology, geomorphology).
David Fell	3D Environmental	Flora survey, species identification, species distribution, and significant flora.	• Specialist knowledge of Torres Strait and Cape York flora and habitats.
David Gooding	3D Environmental	GIS analyst	• Development and management of Torres Strait GIS.
Peter Stanton	Consultant	Landscape scale ecological and fire management.	• Specialist regional knowledge of Cape York ecology • Practical implementation of ecological management practices i.e. fire, weeds, vegetation change
Dr Jeremy Russell-Smith	Consultant - North Australian Indigenous Land & Sea Management Alliance (NAILSMA)	Sustainable ecological and cultural resource management.	• PNG and regional northern Australian context • Advice on integrated fire and cultural resource management • Emissions abatement in tropical savanna fire regimes.
Dr Garrick Hitchcock	Arafura Consulting	Environmental anthropology and cultural resource use and management Torres Strait and PNG	• Cultural landscape context • integration of cultural resource values • Cultural use of fauna, flora and habitats.
Terry Reis	Biodiversity Assessment and Management	Fauna ecology	• Identification and review of fauna values • Fauna survey methods • Management of habitat for fauna values.
Dr Paul Forster	DERM - Qld Herbarium	Taxonomy and distribution of Qld flora	• Threatened flora distribution • Conservation and listing context.
Keith Macdonald	DERM Threatened Species Unit	Fauna and flora ecology and distribution	• Back on Track methodology. • Threatened fauna and flora distribution • Conservation and listing context.
Tony O'Keeffe Michael Bradby	TSRA LMSU	Land and Sea Program and Ranger Project	• Project background, management and liaison. • Protocols and process.

Appendix B. Queensland Govt. Vegetation Structural Classification

Structural formation classes qualified by height for Non-Rainforest Vegetation: Neldner *et al.* 2005) modified from Specht (1970).

Projective Foliage Cover	**70-100%**	**30-70%**	**10-30%**	**<10%**
Approximate Crown Cover %	**80 - 100%**	**50 - 80%**	**20 - 50%**	**< 20%**
Crown separation	**closed or dense**	**mid-dense**	**sparse**	**very sparse**
Growth Form[7]	**Structural Formation Classes (qualified by height)**			
Trees > 30m	tall closed-forest (TCF)	tall open-forest (TCF)	tall woodland (TW)	tall open-woodland (TOW)
Trees 10 – 30m	closed-forest (CF)	open-forest (OF)	woodland (W)	open-woodland (OW)
Trees < 10m	low closed-forest (LCF)	low open-forest (LOF)	low woodland (LW)	low open-woodland (LOW)
Shrubs 2 - 8m	closed-scrub (CSC)	open-scrub (OSC)	tall shrubland (TS)	tall open-shrubland (TOS)
Shrubs 1 - 2m	closed-heath (CHT)	open-heath (OHT)	shrubland (S)	open-shrubland (OS)
Shrubs <1m	-	dwarf open-heath (DOHT)	dwarf shrubland (DS)	dwarf open-shrubland (DOS)
Succulent shrub	-	-	succulent shrubland (SS)	dwarf succulent shrubland (DSS)
Hummock grasses	-	-	hummock grassland (HG)	open hummock grassland (OHG)
Tussock grasses	closed-tussock grassland (CTG)	tussock grassland (TG)	open tussock grassland (OTG)	sparse-tussock grassland (STG)
Herbs	closed-herbland (CH)	Herbland (H)	open-herbland (OH)	sparse-herbland (SH)
Forbs	closed-forbland (CFB)	Forbland (FB)	open-forbland (OFB)	sparse-forbland (SFB)
Sedges	closed-sedgeland (CV)	Sedgeland (V)	open-sedgeland (OV I)	-

[7] Growth form of the predominant layer (the ecologically dominant layer).

Appendix C. Preliminary List of Useful Wild Plants for Mua Island

- denotes introduced species
- language names derived from Mabuiag.

Language Name Kala Lagau Ya	Common Name	Scientific Name	Life Form	Broad Use	Part Used	Broad Habitat
bussamargh	Cycad	*Cycas badensis*	Shrub	Food	Seeds or pith once used for food after processing.	Grasslands, Vine thickets, Welchiodendron forests, eucalypt open forests and woodlands, & shrublands.
mumu	Finger Cherry	*Rhodomyrtus macrocarpa*	Shrub	Food	Edible fruit	Vine forest & thickets
abau	Noni Plum Rotten Cheesefruit	*Morinda citrifolia*	Shrub	Medicinal	Edible fruit	Vine forest & thickets, Paperbark open forests, community areas.
meke	Sea Almond	*Terminalia catappa*	Tree	Food	Outer skin of fruit eaten when ripe. Inner nut eaten when dry.	Community areas.
mipa	No Common Name	*Terminalia subacroptera*	Shrub or small tree	Food	Fleshy skin of small purplish-black fruit eaten when ripe.	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands.
bomer	Corkscrew Palm	*Pandanus spiralis*	Palm	Food Material	Kernel of individual fruit segments hammered out when dry and eaten. Leaves used for baskets etc.	Pandanus grasslands.
yarakakur	Peanut Tree	*Sterculia quadrifida*	Tall shrub to tree	Food	Nut flavoured seeds within a woody follicle are eaten	Vine forests & thickets.
weiba	Nonda Plum	*Parinari nonda*	Tree	Food	Outer flesh of fruit is eaten when fully ripe.	Open forests & woodlands.
kuper	White Apple	*Syzygium forte* subsp. *forte*	Tree	Food	Fleshy white fruit are eaten when ripe.	Vine forests.
kaway	Red Bush Apple or Lady Apple	*Syzygium suborbiculare*	Tree	Food	Fleshy red fruit eaten when ripe. A good shade tree.	Open forests & woodlands.
ubar	Wongai	*Manilkara kauki*	Tree	Food Material	Fruit are eaten. Strong timber favoured for carving. Seeds used for necklaces.	Vine forests & thickets.
duduam	Water Lilly	*Nymphaea* sp.	Aquatic	Food	Ovaries of flower eaten.	Wetlands
mergey	Black Currant Bush	*Antidesma parviflora*	Shrub	Food	Small purplish-black fruit eaten (stains hands and mouth)	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands.
uzu	Lockerbie Satin Ash	*Syzygium branderhorstii*	Shrub/Tree	Food	Fruit eaten. This plant grows in the wild on Mua, Erub, Dauan however is planted in domestic gardens.	Town
biiu	Mangrove	*Rhizophora apiculata or stylosa*	Tree	Food	Pod was eaten after processing (no longer consumed).	Mangroves
urgi	Yellow Plum	*Ximenia americana*	Shrub	Food	Fruit with yellowish flesh is eaten.	Edge of Mangroves
kuman	Native Grape	*Ampelocissus acetosa*	Vine	Food	Small black grape like fruits are eaten when ripe.	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands.

Language Name Kala Lagau Ya	Common Name	Scientific Name	Life Form	Broad Use	Part Used	Broad Habitat
dua	Tar Tree or Marking Nut Tree	*Semecarpus australiensis*	Tree	Food	Part of fruit is eaten. Part of fruit together with leaves and sap are highly toxic causing inflammation.	Vine forest & disturbed areas.
woeywi	Mango	*Mangifera indica**	Tree	Food	Fruit eaten.	Disturbed areas.
thuul	Hickory Wattle	*Acacia polystachya*	Tree	Material	Timber favoured for the making of dugong spears (whaps), building timber and firewood.	Welchiodendron forests, woodlands & shrublands.
TBD	Sandpaper Fig	*Ficus opposita*	Shrub	Food Material	Small fruit ripen black and are edible. Leaves rough and sandpapery.	Welchiodendron forests, woodlands & shrublands.
TBD	Ground Lily	*Crinum uniflorum*	Tuber	Food	The tuber is dug and is scraped tin preparation of a paste. Used like gasi.	
TBD	Dodder Laurel Devils twine	*Cassytha filiformis*	Vine	Food	Small fruit eaten as a snack when ripe.	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands.
TBD	Wild Passionfruit	*Passiflora foetida**	Vine	Food	Small fruit eaten as a snack when ripe.	Welchiodendron forests, woodlands & shrublands, grasslands, Paperbark open forests, vine thickets, shrublands.
TBD	White Currant	*Flueggia virosa* subsp. *melanthesoides*	Shrub	Food	Small white fruit eaten as a snack when ripe.	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands, grasslands.
TBD	Cedar Bay Cherry	*Eugenia reinwardtiana*	Shrub	Food	Small black fruit eaten as a snack when ripe.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Gidee Gidee	*Abrus precatorius*	Vine	Material	Black and red seeds used for decorative purposes i.e. necklaces and bracelets.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Little Gooseberry Tree	*Buchanania arborescens*	Tree	Food	Small black fruits eaten as a snack when ripe.	Vine forests & thickets.
TBD	Coral Tree	*Erythrina variegata*	Tree	Material	Glossy red seeds used for decorative purposes i.e. necklaces and bracelets.	Vine forests and thickets.
TBD	Coral Tree	*Erythrina insularis*	Tree	Material	Glossy red seeds used for decorative purposes i.e. necklaces and bracelets.	Vine forests and thickets.
TBD	Matchbox Bean	*Entada phaseoloides*	Vine	Material	Large flat glossy brown seeds used for dancing decorations and instruments in music.	Vine forests & thickets, mangroves edges.
TBD	Cottonwood Hibiscus	*Hibiscus tiliaceus*	Tree	Material	Fibrous bark used for fibre in tying and making of bags etc.	Coastal grasslands & mangrove edges.
TBD	Whip Vine	*Flagellaria indica*	Vine	Material	Cane like stems used for tying, binding and carrying fish.	Welchiodendron forests, woodlands & shrublands, vine forests & thickets, paperbark open forests.
TBD	Sisal hemp	*Agave vivipara* var. *vivipara**	Succulent shrub	Material	Leaves dried and processed for fibre used for decorative skirts.	Disturbed areas.

Language Name Kala Lagau Ya	Common Name	Scientific Name	Life Form	Broad Use	Part Used	Broad Habitat
TBD	No common name	*Sesuvium portulacastrum*	Succulent herb	Feed (fattening pigs)	Fleshy leaves used for feeding pigs and for kup mauri.	Coastal grasslands.
TBD	Cashew	*Anacardium occidentale**	Shrub	Food	Fruit eaten.	Disturbed areas.
TBD	No common name	*Tabernaemontana orientalis*	Shrub	Material (making shanghais)	Forks of small branches favoured for shanghai (slingshot) construction.	Vine forests & thickets.
TBD	Sea Trumpet	*Cordia subcordata*	Shrub/Tree	Material	Timber	Vine thickets (dunes), Coastal grasslands, edge of mangroves.
TBD	Ringworm shrub	*Senna alata**	Shrub	Medicinal	Decoction from leaves used for treatment of ringworms.	Disturbed areas.
TBD	Yam	*Dioscorea esculenta*	Vine	Food	Tuber used for food.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Yam	*Dioscorea transversa*	Vine	Food	Tuber used for food.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Cassava	*Manilhot esculenta**	Shrub	Food	Tuber used for food.	Disturbed areas.
TBD	Sea Cabbage	*Scaevola taccada*	Shrub	Spiritual	Leaves broken off plant causes wind to blow strongly.	Coastal grasslands (seashore).
TBD	Broad leaved Ballart	*Exocarpos latifolius*	Shrub	Food	Small fruit sometimes eaten when ripe.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Pemphis	*Pemphis acidula*	Shrub	Material	Timber used for firewood.	Mangrove margins.
TBD	Bamboo	*Bambusa vulgaris**	Bamboo	Material	Stems used for construction and various purposes.	
TBD	Tridax	*Tridax procumbens**	Annual herb	Medicinal	Decoction of leaves used for treating cuts and sores.	Disturbed areas.
TBD	Pacific Rosewood	*Thespesia populneoides*	Shrub/Tree	Material	Round fruit used for toys.	Mangrove margins.
TBD	Pacific Rosewood	*Thespesia populnea*	Shrub/Tree	Material	Round fruit used for toys.	Mangrove margins.
TBD	Macarnaga	*Macaranga tanarius*	Shrub/Tree	Material	Leaves used for kup mauri. Sticky exudate from broken stems/branches used for glue (info from Iama).	Welchiodendron forests, woodlands & shrublands, vine thickets.

Appendix D. Preliminary Flora Species List – Mua Island, Torres Strait, Queensland.

D.G. Fell & D.J. Stanton 3D Environmental_27 April 2011 Version 3

Nomenclature follows Bostock & Holland (2010) 'Census of the Queensland Flora'.
* Denotes naturalised or doubtfully naturalised taxa according to Bostock & Holland (2010).
Unnamed taxa are followed by a collection number (i.e. DGF10153) pending formal identification at Qld Herbarium.

SUMMARY

676 species (19 ferns, 2 conifers, 1 cycad, 652 angiosperms)
607 native (90%)
67 naturalised (10%)
127 families

Family	Species	Regionally Significant	Herbarium Records	3D
Acanthaceae	*Asystasia australasica*		1	1
Acanthaceae	*Asystasia gangetica subsp. gangetica**		1	
Acanthaceae	*Hygrophila angustifolia*		1	
Acanthaceae	*Pseuderanthemum variable*			1
Acanthaceae	*Ruellia simplex**		1	
Adiantaceae	*Cheilanthes nudiuscula*		1	1
Agavaceae	*Agave sp.**			1
Aizoaceae	*Sesuvium portulacastrum*			1
Amaranthaceae	*Alternanthera brasiliana**		1	1
Amaranthaceae	*Celosia argentea**		1	1
Amaryllidaceae	*Crinum pedunculatum*			1
Anacardiaceae	*Anacardium occidentale**		1	1
Anacardiaceae	*Buchanania arborescens*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Anacardiaceae	*Euroschinus falcata*			1
Anacardiaceae	*Mangifera indica**		1	1
Anacardiaceae	*Mangifera sp. (DGF10805+)*			1
Anacardiaceae	*Semecarpus australiensis*			1
Annonaceae	*Annonaceae vine (DGF10748+)*			1
Annonaceae	*Desmos wardianus*	1	1	1
Annonaceae	*Haplostichanthus fruticosus*	1	1	1
Annonaceae	*Meiogyne cylindrocarpa subsp. trichocarpa*	1	1	1
Annonaceae	*Meiogyne sp. (Mua Island DGF + DJS)*	1	1	1
Annonaceae	*Melodorum scabridulum*	1	1	
Annonaceae	*Melodorum sp. (DGF8987+)*			1
Annonaceae	*Miliusa traceyi*	1	1	1
Annonaceae	*Polyalthia australis*	1		1
Annonaceae	*Polyalthia nitidissima*			1
Annonaceae	*Uvaria rufa*	1	1	1
Apocynaceae	*Alstonia actinophylla*		1	1
Apocynaceae	*Alstonia scholaris*	1		1
Apocynaceae	*Alstonia spectabilis subsp. spectabilis*			1
Apocynaceae	*Alyxia spicata*		1	1
Apocynaceae	*Brachystelma glabriflorum*		1	
Apocynaceae	*Calotropis gigantea**		1	1
Apocynaceae	*Cascabella thevetia* (Declared Class 3)*			1
Apocynaceae	*Ceropegia cumingiana*		1	1
Apocynaceae	*Cryptostegia grandiflora* (Declared Class 2) Kubin Village*			1
Apocynaceae	*Cynanchum brachystelmoides*		1	
Apocynaceae	*Dischidia littoralis (Vulnerable)*		1	1
Apocynaceae	*Dischidia major*		1	1
Apocynaceae	*Dischidia nummularia*			1
Apocynaceae	*Dischidia ovata*		1	1
Apocynaceae	*Hoya anulata (Near-Threatened)*		1	1
Apocynaceae	*Hoya australis subsp. sanae*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Apocynaceae	*Hoya revoluta (near threatened)*		1	1
Apocynaceae	*Ichnocarpus frutescens*		1	1
Apocynaceae	*Marsdenia connivens*		1	
Apocynaceae	*Marsdenia tricholepis*		1	1
Apocynaceae	*Parsonsia velutina*		1	1
Apocynaceae	*Sarcolobus hullsii*	1	1	
Apocynaceae	*Sarcostemma viminale subsp. brunonianus*			1
Apocynaceae	*Secamone auriculata (Vulnerable)*		1	1
Apocynaceae	*Secamone elliptica*		1	1
Apocynaceae	*Secamone sp. (DGF10783+)*			1
Apocynaceae	*Tabernaemontana orientalis*		1	1
Apocynaceae	*Tabernaemontana pandacaqui*		1	1
Apocynaceae	*Tylophora benthamii*		1	
Apocynaceae	*Voacanga grandifolia*	1	1	1
Apocynaceae	*Wrightia pubescens subsp. penicillata*		1	1
Araceae	*Amorphophallus galbra*		1	1
Araceae	*Epipremnum pinnatum*	1	1	1
Araceae	*Scindapsis altissima*	1		1
Araceae	*Typhonium brownii*		1	
Araliaceae	*Polyscias australiana*	1	1	1
Araliaceae	*Polyscias elegans*		1	1
Araliaceae	*Polyscias macgillivraei*			1
Araliaceae	*Schefflera actinophylla*			1
Arecaceae	*Arenga australasica (Vulnerable)*			1
Arecaceae	*Cocos nucifera**			1
Arecaceae	*Elaeis guineensis**			1
Arecaceae	*Licuala ramsayi var. tuckeri*	1	1	1
Arecaceae	*Livistona muelleri*		1	1
Arecaceae	*Normanbya normanbyi (planted)*		1	1
Arecaceae	*Ptychosperma elegans*		1	1
Arecaceae	*Ptychosperma macarthurii*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Aristolochiaceae	*Aristolochia acuminata*	1	1	
Aristolochiaceae	*Pararistolochia linearifolia*	1	1	1
Asparagaceae	*Asparagus racemosus*		1	1
Asparagaceae	*Pleomele angustifolia*		1	1
Aspleniaceae	*Asplenium laserpitiifolium*		1	
Aspleniaceae	*Asplenium nidus*		1	1
Asteraceae	*Acanthospermum hispidum**		1	1
Asteraceae	*Allopterigeron filifolius*		1	
Asteraceae	*Blainvillea dubia*		1	
Asteraceae	*Eleutheranthera ruderalis**		1	1
Asteraceae	*Phacellothrix cladochaeta*		1	
Asteraceae	*Pluchea indica*		1	1
Asteraceae	*Praxelis clematidea**		1	
Asteraceae	*Pterocaulon sp. (DGF10757+)*			1
Asteraceae	*Sphagneticola trilobata* (Declared Class 3)*		1	1
Asteraceae	*Tridax procumbens**			1
Asteraceae	*Wedelia longipes*		1	
Avicenniaceae	*Avicennia marina subsp. eucalyptifolia*		1	1
Bignoniaceae	*Deplanchea tetraphylla*		1	1
Bignoniaceae	*Pandorea pandorana*		1	1
Bignoniaceae	*Pandorea sp.*		1	
Bignoniaceae	*Tecoma stans var. stans**			1
Bixaceae	*Cochlospermum gillivraei*		1	1
Blechnaceae	*Blechnum indicum*			1
Bombacaceae	*Bombax ceiba var. leiocarpum*		1	1
Bombacaceae	*Camptostemon schultzii*		1	1
Boraginaceae	*Cordia subcordata*			1
Boraginaceae	*Heliotropium foertherianum*		1	1
Brownlowiaceae	*Berrya javanica*	1	1	1
Burmanniaceae	*Burmannia juncea*		1	

Family	Species	Regionally Significant	Herbarium Records	3D
Burseraceae	*Canarium australianum var. australianum*		1	1
Burseraceae	*Canarium vitiense*	1		1
Byblidaceae	*Byblis liniflora*		1	1
Byttneriaceae	*Commersonia sp. (DGF8919a)*	1		1
Byttneriaceae	*Melochia corchorifolia*		1	
Byttneriaceae	*Sterculia quadrifida*		1	1
Byttneriaceae	*Sterculia shillinglawii (Near-Threatened)*			1
Byttneriaceae	*Sterculia sp. (DGF8951+)*			1
Byttneriaceae	*Waltheria indica*		1	1
Cactaceae	*Opuntia stricta* (Class 2 Declared)*			1
Caesalpiniaceae	*Caesalpinea sp. (DGF8982+)*	1		1
Caesalpiniaceae	*Chamaecrista absus*		1	
Caesalpiniaceae	*Chamaecrista nomame var. nomame*		1	
Caesalpiniaceae	*Senna alata**		1	1
Caesalpiniaceae	*Senna occidentalis**		1	1
Caesalpiniaceae	*Senna sp.* (DGF10815+)*			1
Campanulaceae	*Isotoma gulliveri*		1	
Campanulaceae	*Lobelia dioica*		1	
Campanulaceae	*Lobelia stenophylla*		1	
Campanulaceae	*Wahlenbergia caryophylloides*		1	1
Capparaceae	*Capparis canescens*		1	
Capparaceae	*Capparis quiniflora*		1	1
Capparaceae	*Capparis sepiaria*			1
Casuarinaceae	*Casuarina equisetifolia subsp. equisetifolia*		1	1
Celastraceae	*Cassine melanocarpum*			1
Celastraceae	*Celastraceae*		1	
Celastraceae	*Euonymus australiana*	1	1	1
Celastraceae	*Gymnosporia inermis*		1	1
Celastraceae	*Pleurostylia opposita*		1	1
Celastraceae	*Salacia chinensis*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Chrysobalanaceae	*Parinari nonda*		1	1
Chrysobalancaceae	*Maranthes corymbosa*			1
Cleomaceae	*Cleome viscosa*		1	1
Clusiaceae	*Calophyllum australianum*	1	1	1
Clusiaceae	*Calophyllum sil*		1	1
Clusiaceae	*Garcinia dulcis*	1	1	1
Clusiaceae	*Garcinia warrenii*		1	1
Combretaceae	*Lumnitzera racemosa*		1	1
Combretaceae	*Quisqualis indica**		1	
Combretaceae	*Terminalia complanata*	1		1
Combretaceae	*Terminalia muelleri*		1	1
Combretaceae	*Terminalia sericocarpa*	1		1
Combretaceae	*Terminalia subacroptera*		1	1
Commelinaceae	*Cartonema baileyi*		1	
Commelinaceae	*Cartonema parviflorum*		1	
Commelinaceae	*Commelina diffusa*		1	1
Commelinaceae	*Commelina ensifolia*		1	1
Commelinaceae	*Commelina sp.*		1	
Commelinaceae	*Cyanotis axillaris*		1	
Commelinaceae	*Murdannia gigantea*		1	1
Commelinaceae	*Murdannia vaginata**		1	
Convolvulaceae	*Evolvulus alsinoides*		1	1
Convolvulaceae	*Ipomoea aquatica*		1	
Convolvulaceae	*Ipomoea hederifolia**		1	1
Convolvulaceae	*Ipomoea mauritiana*		1	1
Convolvulaceae	*Ipomoea nil**			1
Convolvulaceae	*Ipomoea pes-capre subsp. brasiliensis*			1
Convolvulaceae	*Ipomoea plebeia*		1	
Convolvulaceae	*Merremia quinata*		1	
Convolvulaceae	*Xenostegia tridentata*		1	1
Costaceae	*Costus potierae (Endangered)*		1	1
Cucurbitaceae	*Muellerargia timorensis*		1	

Family	Species	Regionally Significant	Herbarium Records	3D
Cycadaceae	*Cycas badensis (Vulnerable)*		1	1
Cyperaceae	*Bulbostylis barbata*		1	1
Cyperaceae	*Cyperus aquatilis*		1	1
Cyperaceae	*Cyperus castaneus*		1	
Cyperaceae	*Cyperus compressus* *		1	
Cyperaceae	*Cyperus cuspidatus*		1	
Cyperaceae	*Cyperus decompositus*		1	
Cyperaceae	*Cyperus eboracensis*		1	
Cyperaceae	*Cyperus iria*		1	
Cyperaceae	*Cyperus metzii**		1	
Cyperaceae	*Cyperus polystachyos*		1	
Cyperaceae	*Cyperus scaber*		1	
Cyperaceae	*Cyperus sp. (Mission Beach N.Byrnes MB14)*		1	
Cyperaceae	*Cyperus squarrosus*		1	
Cyperaceae	*Fimbristylis acicularis*		1	
Cyperaceae	*Fimbristylis aestivalis var. aestivalis*		1	
Cyperaceae	*Fimbristylis bisumbellata*		1	
Cyperaceae	*Fimbristylis cymosa*		1	
Cyperaceae	*Fimbristylis furva*		1	
Cyperaceae	*Fimbristylis insignis*		1	
Cyperaceae	*Fimbristylis littoralis*		1	1
Cyperaceae	*Fimbristylis modesta*		1	
Cyperaceae	*Fimbristylis recta*		1	
Cyperaceae	*Hypolytrum compactum*		1	1
Cyperaceae	*Rhynchospora exserta*		1	
Cyperaceae	*Rhynchospora leae*		1	
Cyperaceae	*Rhynchospora pterochaeta*		1	
Cyperaceae	*Schoenus calostachyus*		1	1
Cyperaceae	*Schoenus falcatus*		1	
Cyperaceae	*Schoenus punctatus*		1	
Cyperaceae	*Scleria brownii*		1	

Family	Species	Regionally Significant	Herbarium Records	3D
Cyperaceae	*Scleria caricina*		1	
Cyperaceae	*Scleria laxa*		1	
Cyperaceae	*Scleria levis*		1	
Cyperaceae	*Scleria mackaviensis*		1	1
Cyperaceae	*Scleria polycarpa*		1	1
Cyperaceae	*Scleria pygmaea*		1	
Cyperaceae	*Scleria rugosa*		1	
Cyperaceae	*Scleria tricuspidata*		1	
Cyperaceae	*Tricostularia undulata*		1	
Davalliaceae	*Davallia denticulata var. denticulata*		1	1
Davalliaceae	*Humata pectinata*		1	
Dilleniaceae	*Dillenia alata*		1	1
Dilleniaceae	*Tetracera nordtiana*		1	1
Dioscoreaceae	*Dioscorea bulbifera*		1	1
Dioscoreaceae	*Dioscorea esculenta**			1
Dioscoreaceae	*Dioscorea pentaphylla var. papuana*		1	
Dioscoreaceae	*Dioscorea sp. (DGF9007+)*			1
Droseraceae	*Drosera indica*		1	1
Droseraceae	*Drosera lanata*		1	
Ebenaceae	*Diospyros calycantha*		1	1
Ebenaceae	*Diospyros cupulosa*		1	
Ebenaceae	*Diospyros hebecarpa*		1	1
Ebenaceae	*Diospyros maritima*		1	1
Ebenaceae	*Diospyros sp. (Kuranda L.J.Webb+ 7265A)*	1	1	1
Ebenaceae	*Diospyros sp. (Mt White P.I.Forster PIF14415)*		1	1
Elaeocarpaceae	*Elaeocarpus arnhemicus*	1	1	1
Ericaceae	*Leucopogon ruscifolius*			1
Ericaceae	*Leucopogon yorkensis*		1	1
Eriocaulaceae	*Eriocaulon clarksonii*		1	
Erythroxylaceae	*Erythroxylum sp. (Mosquito Ck)*	1		1

Family	Species	Regionally Significant	Herbarium Records	3D
Euphorbiaceae	*Chamaesyce bifida*		1	
Euphorbiaceae	*Claoxylon hillii*		1	1
Euphorbiaceae	*Cleistanthus peninsularis*		1	1
Euphorbiaceae	*Codiaeum variegatum var. moluccanum*		1	1
Euphorbiaceae	*Croton arnhemicus*		1	1
Euphorbiaceae	*Euphorbia cyathophora**		1	1
Euphorbiaceae	*Euphorbia tannensis*		1	
Euphorbiaceae	*Excoecaria agallocha*		1	1
Euphorbiaceae	*Macaranga involucrata var. mallotoides*	1	1	1
Euphorbiaceae	*Macaranga tanarius*		1	1
Euphorbiaceae	*Mallotus mollissimus*	1	1	
Euphorbiaceae	*Mallotus philippensis*		1	1
Euphorbiaceae	*Mallotus resinosus*	1	1	
Euphorbiaceae	*Pimeleodendron amboinicum*	1		1
Fabaceae	*Abrus precatorius subsp. precatorius*		1	1
Fabaceae	*Acacia crassicarpa*		1	1
Fabaceae	*Acacia polystachya*		1	1
Fabaceae	*Alysicarpus ovalifolius**		1	1
Fabaceae	*Aphyllodium schindleri*		1	
Fabaceae	*Cajanus sp. (DGF10846+)*			1
Fabaceae	*Canavalia sp.*			1
Fabaceae	*Cathormion umbellatum subsp. moniliforme*		1	1
Fabaceae	*Clitoria ternatea**		1	1
Fabaceae	*Crotalaria brevis*		1	
Fabaceae	*Crotalaria calycina*		1	1
Fabaceae	*Crotalaria goreensis**		1	1
Fabaceae	*Crotalaria medicaginea var. neglecta*		1	
Fabaceae	*Crotalaria retusa var. retusa**		1	
Fabaceae	*Crotalaria sessiliflora var. anthylloides*		1	
Fabaceae	*Cullen badocanum*		1	1
Fabaceae	*Dalbergia densa var. australis*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Fabaceae	*Derris sp. (DGF9178+)*			1
Fabaceae	*Derris trifoliata*		1	1
Fabaceae	*Desmodium heterocarpon var. strigosum*		1	
Fabaceae	*Desmodium trichostachyum*		1	
Fabaceae	*Entada phaseoloides*		1	1
Fabaceae	*Entada rheedii*		1	1
Fabaceae	*Erythrina vespertilio*		1	1
Fabaceae	*Galactia sp.*		1	
Fabaceae	*Gompholobium nitidum*		1	1
Fabaceae	*Intsia bijuga (IUCN Endangered)*	1		1
Fabaceae	*Macroptilium atropurpureum**			1
Fabaceae	*Macroptilium lathryoides**			1
Fabaceae	*Millettia pinnata*		1	1
Fabaceae	*Mucuna gigantea*		1	1
Fabaceae	*Mucuna pruriens var. utilis**		1	
Fabaceae	*Pueraria montana var. lobata**		1	1
Fabaceae	*Pycnospora lutescens*		1	1
Fabaceae	*Sesbania sp.*		1	
Fabaceae	*Smithia conferta*		1	
Fabaceae	*Tephrosia sp. (DGF8963+)*			1
Fabaceae	*Vandasina retusa*		1	1
Fabaceae	*Vigna vexillata var. youngiana*		1	1
Fabaceae	*Zornia muelleriana subsp. muelleriana*		1	
Fabaceae	*Zornia muriculata subsp. muriculata*		1	1
Flacourtiaceae	*Flacourtia sp. Shiptons Flat (L.W.Jessup + GJ.D3200)*	1	1	1
Flagellariaceae	*Flagellaria indica*		1	1
Gnetaceae	*Gnetum gnemon (DGF10776+)*	1		1
Goodeniaceae	*Goodenia debilis*		1	
Goodeniaceae	*Goodenia pilosa*		1	
Goodeniaceae	*Lechenaultia filiformis*		1	
Goodeniaceae	*Scaevola taccada*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Goodeniaceae	*Velleia sp.*		1	
Haemodoraceae	*Haemodorum brevicaule*			1
Haloragaceae	*Gonocarpus acanthocarpus*		1	
Haloragaceae	*Myriophyllum sp. (DGF10810+)*			1
Hemerocallidaceae	*Dianella caerulea*		1	
Hemerocallidaceae	*Dianella caerulea var. vannata*		1	1
Hemerocallidaceae	*Dianella pavopennacea var. major*		1	
Johnsoniaceae	*Caesia parviflora var. parviflora*		1	
Johnsoniaceae	*Caesia setifera*		1	
Johnsoniaceae	*Tricoryne anceps subsp. pterocaulon*		1	1
Juncaginaceae	*Triglochin dubium*		1	
Lamiaceae	*Anisomeles malabarica*			1
Lamiaceae	*Clerodendrum inerme*		1	1
Lamiaceae	*Clerodendrum longiflorum var. glabrum*		1	1
Lamiaceae	*Clerodendrum sp. (DGF10816+)**			1
Lamiaceae	*Faradaya splendida*		1	1
Lamiaceae	*Glossocarya hemiderma*		1	1
Lamiaceae	*Gmelina dalrympleana*		1	1
Lamiaceae	*Hyptis suaveolens**			1
Lamiaceae	*Orthosiphon aristatus*		1	
Lamiaceae	*Plectranthus scutellarioides*		1	1
Lamiaceae	*Premna dallachyana*		1	1
Lamiaceae	*Premna serratifolia*		1	1
Lamiaceae	*Vitex sp. (DGF8949+)*			1
Lauraceae	*Beilschmiedia obtusifolia*		1	1
Lauraceae	*Cassytha filiformis*			1
Lauraceae	*Cryptocarya bamagana (DGF8989+)*	1		1
Lauraceae	*Cryptocarya brassii*	1	1	1
Lauraceae	*Cryptocarya cunninghamii*	1		1
Lauraceae	*Cryptocarya exfoliata*		1	1
Lauraceae	*Cryptocarya hypospodia*	1	1	1
Lauraceae	*Cryptocarya triplinervis*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Lauraceae	*Endiandra glauca*		1	1
Lauraceae	*Endiandra sp. (DGF9739+)*	1		1
Lauraceae	*Litsea breviumbellata*		1	1
Lauraceae	*Litsea glutinosa*		1	1
Lauraceae	*Neolitsea brassii*	1		1
Laxmanniaceae	*Cordyline fruticosa*		1	1
Laxmanniaceae	*Eustrephus latifolius*		1	1
Laxmanniaceae	*Lomandra banksii*		1	1
Laxmanniaceae	*Thysanotus banksii*		1	1
Lecythidaceae	*Barringtonia acutangula subsp. acutangula*		1	1
Lecythidaceae	*Barringtonia calyptrata*		1	1
Lecythidaceae	*Planchonia careya*		1	1
Lentibulariaceae	*Utricularia chrysantha*		1	
Lindsaeaceae	*Lindsaea brachypoda*		1	
Lindsaeaceae	*Lindsaea ensifolia subsp. ensifolia*		1	1
Lindsaeaceae	*Lindsaea media*		1	1
Loganiaceae	*Mitrasacme sp. (DGF9009+)*			1
Loganiaceae	*Strychnos sp. (DGF8997+)(DGF9165+)*	1		1
Loranthaceae	*Amyema villiflora subsp. tomentilla*		1	
Loranthaceae	*Amylotheca dictyophleba*		1	
Lythraceae	*Pemphis acidula*		1	1
Malvaceae	*Gossypium barbadense**		1	
Malvaceae	*Hibiscus meraukensis*		1	1
Malvaceae	*Hibiscus sabdariffa**		1	
Malvaceae	*Hibiscus tiliaceus*		1	1
Malvaceae	*Sida acuta**		1	1
Malvaceae	*Sida cordifolia**		1	1
Malvaceae	*Thespesia populneoides*		1	1
Malvaceae	*Urena lobata**			1
Melastomataceae	*Melastoma malabathricum subsp. malabathricum*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Melastomataceae	*Osbeckia chinensis*		1	1
Melastomataceae	*Pternandra coerulescens*		1	1
Meliaceae	*Aglaia brownii*	1	1	1
Meliaceae	*Aglaia eleagnoidea*			1
Meliaceae	*Aglaia euryanthera*	1	1	1
Meliaceae	*Aglaia sapindina*	1	1	1
Meliaceae	*Aglaia sp. (not identifed to species)*		1	
Meliaceae	*Aglaia tomentosa*	1	1	1
Meliaceae	*Anthocarapa nitidula*	1		1
Meliaceae	*Dysoxylum acutangulum subsp. foveolatum*		1	1
Meliaceae	*Dysoxylum latifolium (DGF8979+)*	1		1
Meliaceae	*Dysoxylum oppositifolium*		1	1
Meliaceae	*Turraea pubescens*		1	1
Menispermaceae	*Hypserpa decumbens*		1	1
Menispermaceae	*Hyserpa laurina*			1
Menispermaceae	*Menispermaceae vine (DGF8977+)*			1
Menispermaceae	*Pachygone ovata*		1	1
Menispermaceae	*Stephania japonica var. timorense*			1
Menispermaceae	*Tiliacora australiensis*			1
Menyanthaceae	*Nymphoides*		1	
Menyanthaceae	*Nymphoides exiliflora*		1	
Menyanthaceae	*Nymphoides triangularis*		1	
Menyanthaceae	*Ornduffia sp. (Laura C.Dalliston CC18)*		1	
Mimosaceae	*Acacia auriculiformis*			1
Mimosaceae	*Acacia leptocarpa*		1	1
Mimosaceae	*Acacia simsii*		1	1
Mimosaceae	*Archidendron grandiflorum*		1	1
Mimosaceae	*Archidendron hirsutum(Near-Threatened)*		1	1
Mimosaceae	*Leucaena leucocephala subsp. glabrata**		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Mimosaceae	*Maniltoa lenticellata var. lenticellata*		1	1
Mimosaceae	*Mimosa pudica**			1
Mimosaceae	*Paraserianthes toona*			1
Molluginaceae	*Glinus oppositifolius*		1	
Monimiaceae	*Wilkiea rigidifolia*		1	1
Moraceae	*Antiaris toxicaria subsp. macrophylla*		1	1
Moraceae	*Ficus congesta*		1	1
Moraceae	*Ficus cumingii var. androbrota*		1	1
Moraceae	*Ficus drupacea (DGF8950+)*			1
Moraceae	*Ficus microcarpa*		1	1
Moraceae	*Ficus opposita*		1	1
Moraceae	*Ficus sp. (DGF10792+)*			1
Moraceae	*Ficus virens var. virens*		1	1
Moraceae	*Streblus brunonianus*		1	1
Moraceae	*Trophis scandens subsp. scandens*			1
Myristicaceae	*Horsfieldia australiensis*	1		1
Myristicaceae	*Myristica insipida var. cimicifera*		1	1
Myristicaceae	*Myristica insipida var. insipida*		1	1
Myrsinaceae	*Myrsine urceolata*		1	1
Myrtaceae	*Acmena hemilampra subsp. hemilampra*	1		1
Myrtaceae	*Acmenosperma claviflorum*	1	1	1
Myrtaceae	*Asteromyrtus brassii*		1	1
Myrtaceae	*Asteromyrtus symphyocarpa*		1	1
Myrtaceae	*Beackea frutescens*			1
Myrtaceae	*Corymbia clarksoniana*			1
Myrtaceae	*Corymbia nesophila*			1
Myrtaceae	*Corymbia novoguinensis*		1	1
Myrtaceae	*Corymbia stockeri subsp. peninsularis*			1
Myrtaceae	*Corymbia tessellaris*	1	1	1
Myrtaceae	*Eugenia reinwardtiana*		1	1
Myrtaceae	*Gossia floribunda*		1	1
Myrtaceae	*Lithomyrtus obtusa*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Myrtaceae	*Lithomyrtus retusa*		1	1
Myrtaceae	*Lophostemon suaveolens*		1	1
Myrtaceae	*Melaleuca acacioides*		1	1
Myrtaceae	*Melaleuca argentea*			1
Myrtaceae	*Melaleuca cajuputi (DGF8927+)*			1
Myrtaceae	*Melaleuca cajuputi subsp. platyphylla*			1
Myrtaceae	*Melaleuca dealbata*			1
Myrtaceae	*Melaleuca leucadendra*		1	1
Myrtaceae	*Melaleuca quinquenervia*		1	1
Myrtaceae	*Melaleuca saligna*		1	1
Myrtaceae	*Melaleuca viridiflora*		1	1
Myrtaceae	*Melaleuca viridiflora var. viridiflora*		1	1
Myrtaceae	*Rhodamnia australis*	1	1	1
Myrtaceae	*Rhodomyrtus macrocarpa*		1	1
Myrtaceae	*Syzygium angophoroides*			1
Myrtaceae	*Syzygium bamagense*	1	1	1
Myrtaceae	*Syzygium branderhorstii*	1		1
Myrtaceae	*Syzygium buettnerianum (Near-Threatened)*		1	1
Myrtaceae	*Syzygium bungadinnia*	1		1
Myrtaceae	*Syzygium fibrosum*	1		1
Myrtaceae	*Syzygium forte subsp. forte*			1
Myrtaceae	*Syzygium forte subsp. potamophilum*	1	1	1
Myrtaceae	*Syzygium puberulum*	1		1
Myrtaceae	*Syzygium suborbicualre*			1
Myrtaceae	*Welchiodendron longivalve*		1	1
Nephrolepidaceae	*Nephrolepis*		1	
Nephrolepidaceae	*Nephrolepis biserrata*		1	1
Nyctaginaceae	*Boerhavia mutabilis*		1	1
Oleaceae	*Chionanthus ramiflorus*		1	1
Oleaceae	*Jasminum didymum subsp. didymum (DGF8999a)*			1

Family	Species	Regionally Significant	Herbarium Records	3D
Oleaceae	*Jasminum elongatum*		1	1
Ophioglossaceae	*Ophioglossum sp.*		1	
Opiliaceae	*Cansjera leptostachya*		1	1
Opiliaceae	*Opilia amentacea*		1	1
Orchidaceae	*Bromheadia venusta (DGF9149+)*	1		1
Orchidaceae	*Bulbophyllum baileyi*		1	1
Orchidaceae	*Cadetia clausa*		1	
Orchidaceae	*Cadetia funiformis*		1	
Orchidaceae	*Cadetia wariana (Near-Threatened)*		1	
Orchidaceae	*Chiloschista phyllorhiza*	1		1
Orchidaceae	*Crepidium marsupichilum*	1	1	
Orchidaceae	*Dendrobium discolor*			1
Orchidaceae	*Dendrobium trilamellatum*			1
Orchidaceae	*Diplocaulobium glabrum*	1	1	
Orchidaceae	*Empusa habenarina*	1	1	
Orchidaceae	*Grastidium luteocilium*	1	1	
Orchidaceae	*Habenaria elongata*		1	
Orchidaceae	*Habenaria propinquior*		1	
Orchidaceae	*Habenaria vatia (Vulnerable nomination)*		1	
Orchidaceae	*Liparis habenarina*		1	
Orchidaceae	*Luisia atacta*	1	1	
Orchidaceae	*Nervilia holochila*	1	1	
Orchidaceae	*Nervilia peltata*	1	1	
Orchidaceae	*Pholidota imbricata*	1	1	
Orchidaceae	*Vrydagzynea sp.*		1	
Oxalidaceae	*Biophytum petersianum*		1	
Pandanaceae	*Pandanus tectorius*		1	1
Pandanaceae	*Pandanus zea (Near-Threatened)*			1
Passifloraceae	*Passiflora foetida**		1	1
Passifloraceae	*Turnera subulata*		1	
Pentaphylacaceae	*Ternstroemia cherryi*	1	1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Phyllanthaceae	*Actephila venusta*	1		1
Phyllanthaceae	*Antidesma bunius*		1	1
Phyllanthaceae	*Antidesma ghaesembilla*		1	1
Phyllanthaceae	*Antidesma parvifolium*		1	1
Phyllanthaceae	*Breynia cernua*		1	1
Phyllanthaceae	*Breynia oblongifolia*		1	1
Phyllanthaceae	*Breynia sp.*		1	
Phyllanthaceae	*Breynia sp. Black Mountain (B.Hyland 25658RFK)*	1	1	
Phyllanthaceae	*Bridelia finalis*	1	1	
Phyllanthaceae	*Bridelia tomentosa*		1	1
Phyllanthaceae	*Cleistanthus apodus*	1	1	1
Phyllanthaceae	*Flueggea virosa subsp. melanthesoides*		1	1
Phyllanthaceae	*Glochidion apodogynum*			1
Phyllanthaceae	*Glochidion disparipes*		1	1
Phyllanthaceae	*Glochidion lobocarpum*			1
Phyllanthaceae	*Phyllanthus novae-hollandiae*		1	1
Phyllanthaceae	*Phyllanthus reticulatus*		1	
Picrodendraceae	*Petalostigma pubescens*			1
Piperaceae	*Piper caninum*		1	1
Pittosporaceae	*Pittosporum ferrugineum*		1	1
Plumbaginaceae	*Aegialitis annulata*		1	1
Poaceae	*Alloteropsis cimicina*		1	
Poaceae	*Ancistrachne uncinulata*			1
Poaceae	*Aristida dominii*		1	
Poaceae	*Aristida holathera var. holathera*		1	
Poaceae	*Bambusa sp. (DGF8999+)*			1
Poaceae	*Bambusa sp.**		1	1
Poaceae	*Cenchrus brevisetosus*		1	
Poaceae	*Cenchrus echinatus**			1
Poaceae	*Cenchrus pedicellatum subsp. unispiculum**			1

Family	Species	Regionally Significant	Herbarium Records	3D
Poaceae	*Eremochloa ciliaris (Near-Threatened)*		1	
Poaceae	*Eriachne pallescens*		1	
Poaceae	*Eriachne squarrosa*		1	
Poaceae	*Eulalia mackinlayi*		1	
Poaceae	*Germainia capitata (Vulnerable)*		1	
Poaceae	*Heteropogon contortus*		1	1
Poaceae	*Heteropogon triticeus*		1	1
Poaceae	*Ischaemum australe var. villosum*		1	1
Poaceae	*Ischaemum fragile*		1	
Poaceae	*Ischaemum polystachyum*		1	
Poaceae	*Ischaemum tropicum*		1	
Poaceae	*Leptaspis banksii*		1	1
Poaceae	*Lepturus repens*		1	
Poaceae	*Melinis minutiflora**		1	1
Poaceae	*Melinis repens**			1
Poaceae	*Mnesithea formosa*		1	1
Poaceae	*Mnesithea rottboelliodes*			1
Poaceae	*Neololeba atra (Near-Threatened)*			1
Poaceae	*Oplismenus compositus*		1	1
Poaceae	*Perotis rara*		1	1
Poaceae	*Phragmites karka*		1	1
Poaceae	*Poaceae (DGF8966+)*			1
Poaceae	*Pseudopogonatherum contortum*		1	
Poaceae	*Rottboellia cochinchinensis**		1	
Poaceae	*Sarga plumosum*		1	1
Poaceae	*Setaria australiensis*		1	
Poaceae	*Setaria surgens*		1	1
Poaceae	*Sorghum nitidum forma aristatum*		1	
Poaceae	*Sorghum nitidum forma nitidum*		1	1
Poaceae	*Sporobolus virginicus*			1
Poaceae	*Themeda arguens*		1	1
Poaceae	*Themeda intermedia**		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Poaceae	*Urochloa holosericea subsp. holosericea*		1	
Poaceae	*Urochloa mutica**		1	1
Podocarpaceae	*Podocarpus grayae*	1	1	1
Polygalaceae	*Salomonia ciliata*		1	
Polygonaceae	*Antigonon leptopus**		1	1
Polygonaceae	*Fagopyrum esculentum*		1	
Polypodiaceae	*Acrostichum aureum*			1
Polypodiaceae	*Drynaria quercifolia*			1
Polypodiaceae	*Lecanopteris sinuosa*	1	1	
Polypodiaceae	*Pyrrosia lanceolata*		1	1
Polypodiaceae	*Pyrrosia longifolia*		1	1
Portulacaceae	*Portulaca lutea*		1	
Primulaceae	*Aegiceras corniculatum*		1	1
Proteaceae	*Banksia dentata*		1	1
Proteaceae	*Helicia australasica*	1	1	1
Putranjivaceae	*Drypetes deplanchei*		1	1
Restionaceae	*Dapsilanthus spathaceus*		1	1
Restionaceae	*Leptocarpus schultzii*		1	
Rhamnaceae	*Alphitonia excelsa*		1	1
Rhamnaceae	*Colubrina asiatica*		1	1
Rhizophoraceae	*Bruguiera cylindrica*		1	
Rhizophoraceae	*Bruguiera exaristata*		1	1
Rhizophoraceae	*Carallia brachiata*		1	1
Rubiaceae	*Aidia racemosa*		1	1
Rubiaceae	*Antirhea ovatifolia*		1	1
Rubiaceae	*Atractocarpus sessilis*		1	1
Rubiaceae	*Cyclophyllum brevipes*		1	1
Rubiaceae	*Cyclophyllum maritimum*		1	1
Rubiaceae	*Everistia vacciniifolia*	1	1	1
Rubiaceae	*Gardenia sp. (DGF10787+)*	1		1
Rubiaceae	*Gardenia sp. (DGF8923+)*			1

Family	Species	Regionally Significant	Herbarium Records	3D
Rubiaceae	*Hydnophytum moseleyanum var. moseleyanum*		1	1
Rubiaceae	*Ixora timorensis*		1	1
Rubiaceae	*Morinda citrifolia*		1	1
Rubiaceae	*Morinda reticulata*		1	1
Rubiaceae	*Myrmecodia platytyrea subsp. antoinii*		1	1
Rubiaceae	*Oldenlandia corymbosa var. corymbosa**		1	
Rubiaceae	*Pavetta australiensis var. australiensis*		1	1
Rubiaceae	*Pavetta brownii var. brownii*		1	1
Rubiaceae	*Pogonolobus reticulatus*		1	1
Rubiaceae	*Psychotria loniceroides*		1	1
Rubiaceae	*Psychotria nesophila*		1	1
Rubiaceae	*Psychotria poliostemma*		1	1
Rubiaceae	*Psychotria sp.*		1	
Rubiaceae	*Psydrax banksii*			1
Rubiaceae	*Psydrax graciliflora*	1	1	1
Rubiaceae	*Psydrax lamprophylla forma latissima*	1	1	1
Rubiaceae	*Psydrax reticulata (Vulnerable)*		1	1
Rubiaceae	*Psydrax sp. (DGF8955+)*			1
Rubiaceae	*Rubiaceae (DGF9713+)*			1
Rubiaceae	*Scyphiphora hydrophyllacea*		1	1
Rubiaceae	*Spermacoce papuana*		1	
Rubiaceae	*Spermacoce sp. (Lorim Point A.Morton AM1237)*		1	
Rubiaceae	*Tarenna dallachiana subsp. dallachiana*		1	
Rubiaceae	*Triflorensia australis*	1	1	1
Rutaceae	*Acronychia imperforata*	1		1
Rutaceae	*Acronychia sp. Batavia Downs (J.R.Clarkson 8511)*	1	1	
Rutaceae	*Clausena brevistyla (DGF8987a)*	1		1
Rutaceae	*Glycosmis trifoliata*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Rutaceae	*Halfordia kendack*		1	1
Rutaceae	*Melicope peninsularis*			1
Rutaceae	*Micromelum minutum*		1	1
Rutaceae	*Murraya paniculata*		1	1
Rutaceae	*Zanthoxylum rhetsa*		1	1
Santalaceae	*Exocarpos latifolius*		1	1
Sapindaceae	*Arytera bifoliolata*		1	1
Sapindaceae	*Arytera divaricata (check A. pseudofoveolata)*	1		1
Sapindaceae	*Atalaya australiana*	1	1	1
Sapindaceae	*Cupaniopsis anacardioides*		1	1
Sapindaceae	*Dictyoneura obtusa*	1	1	1
Sapindaceae	*Dodonaea polyandra*		1	1
Sapindaceae	*Elattostachys microcarpa*	1	1	1
Sapindaceae	*Elattostachys rubrofructus*	1	1	
Sapindaceae	*Elattostachys sp. (DGF8978+)*			1
Sapindaceae	*Ganophyllum falcatum*			1
Sapindaceae	*Mischocarpus lachnocarpus*		1	1
Sapindaceae	*Mischocarpus stipitatus*	1	1	1
Sapjndaceae	*Allophyllus cobbe*			1
Sapotaceae	*Chrysophyllum roxburghii (Near threatened)*		1	1
Sapotaceae	*Manilkara kauki (DGF 9168 + DS)*	1		1
Sapotaceae	*Manilkara kauki*		1	1
Sapotaceae	*Mimusops elengi*		1	1
Sapotaceae	*Palaquium galactoxylon (DGF9181+)*	1		1
Sapotaceae	*Pouteria myrsinodendron*		1	
Sapotaceae	*Pouteria chartacea*	1		1
Sapotaceae	*Pouteria obovata*			1
Sapotaceae	*Manilkara kanosiensis (DGF9168+)*	1	1	
Sapotaceae	*Sersalisia sericea*		1	1
Schizaeaceae	*Lygodium flexuosum*		1	1

Family	Species	Regionally Significant	Herbarium Records	3D
Scrophulariaceae	*Angelonia salicariifolia**		1	
Scrophulariaceae	*Buchnera gracilis*		1	
Scrophulariaceae	*Buchnera linearis*		1	
Scrophulariaceae	*Buchnera tetragona*		1	
Scrophulariaceae	*Limnophila fragrans*		1	
Scrophulariaceae	*Lindernia ciliata*		1	
Scrophulariaceae	*Lindernia crustacea*		1	
Scrophulariaceae	*Lindernia scapigera*		1	
Scrophulariaceae	*Lindernia sp.*		1	
Scrophulariaceae	*Lindernia tenuifolia*		1	
Scrophulariaceae	*Scoparia dulcis**		1	1
Simaroubiaceae	*Brucea javanica*			1
Smilacaceae	*Smilax australis*		1	1
Smilacaceae	*Smilax blumei*	1	1	1
Smilacaceae	*Smilax calophylla*		1	1
Solanaceae	*Physalis angulata**		1	1
Solanaceae	*Physalis minima**		1	
Solanaceae	*Solanum nodiflorum**		1	
Solanaceae	*Solanum viridifolium*		1	1
Sparrmanniaceae	*Grewia australis*		1	
Sparrmanniaceae	*Grewia breviflora*		1	1
Sparrmanniaceae	*Grewia papuana*		1	
Sparrmanniaceae	*Grewia retusifolia*		1	1
Stemonuraceae	*Gomphandra australiana (DGF8952+)*	1		1
Sterculiaceae	*Argyrodendron polyandrum*	1	1	1
Sterculiaceae	*Heritiera littoralis*		1	1
Stylidiaceae	*Stylidium schizanthum*		1	
Surianaceae	*Suriana maritima*		1	
Taccaceae	*Tacca leontopetaloides*			1
Thymelaeaceae	*Phaleria octandra*		1	1
Ulmaceae	*Celtis australiensis*	1	1	
Ulmaceae	*Celtis philippensis*			1

Family	Species	Regionally Significant	Herbarium Records	3D
Ulmaceae	*Trema aspera var. viridis*		1	1
Unknown	Aquatic macrophyte (DGF10818+)			1
Unknown	Unknown aquatic herb (DGF10736+)			1
Unknown	Unknown shrub (DGF10799+)			1
Unknown	Unknown vine (DGF10789+)			1
Unknown	Unknown vine (DGF8984+)			1
Verbenaceae	*Stachytarpheta jamaicensis**		1	1
Violaceae	*Hybanthus enneaspermus*		1	1
Vitaceae	*Ampelocissus acetosa*		1	1
Vitaceae	*Cayratia trifolia*		1	1
Vitaceae	*Cissus repens*		1	
Vitaceae	*Tetrastigma sp. (DGF10786+)*	1		1
Vittariaceae	*Vittaria ensiformis*		1	1
Xyridaceae	*Xyris complanata*		1	1
Zingiberaceae	*Curcuma australasica*		1	1
Zingiberaceae	*Globba marantina (Vulnerable)*		1	1
Zingiberaceae	*Zingiber zerumbet**			1
Zingiberaceae	*Zingiberaceae (DGF8958+)*			1
Zygophyllaceae	*Tribulus cistoides*		1	1

Appendix E. Terrestrial Fauna Species List For Mua Island and Surrounding Islets[8]

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
AMPHIBIANS						
Myobatrachidae	*Limnodynastes ornatus*	Ornate Burrowing Frog		LC		Australian Museum, published & unpublished records.
Myobatrachidae	*Uperoleia lithomoda*	Stonemason Toadlet		LC		
Myobatrachidae	*Uperoleia mimula*	Mimic Toadlet		LC		Australian Museum & unpublished records.
Hylidae	*Litoria bicolor*	Northern Dwarf Tree Frog		LC		Australian Museum record.
Hylidae	*Litoria caerulea*	Green Tree Frog		LC		Australian Museum, WildNet, published & unpublished records.
Hylidae	*Litoria gracilenta*	Dainty Green Tree Frog		LC		Unpublished record.
Hylidae	*Litoria infrafrenata*	White-lipped Tree Frog		LC		
Hylidae	*Litoria nasuta*	Rocket Frog		LC		Australian Museum, Queensland Museum, WildNet, published & unpublished records.
Hylidae	*Litoria nigrofrenata*	Bridle Frog		LC		Australian Museum, Queensland Museum, published & unpublished records.
Hylidae	*Litoria rubella*	Red Tree Frog		LC		
Microhylidae	*Austrochaperina gracilipes*	Slender Frog		LC		
Microhylidae	*Cophixalus* sp.					
Ranidae	*Rana daemeli*	Wood Frog		LC		Unpublished record.
Bufonidae	*Rhinella marina*	Cane Toad		I		
REPTILES						
Crocodylidae	*Crocodylus porosus*	Salt-water Crocodile	M	V		Unpublished record (Terry Reis survey record 2011).
Chelidae	*Emydura subglobosa*	Jardine River Turtle		NT		

[8] Compiled by Terry Reis, Natural Reource Assessments, Cairns.

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
Chelidae	*Macrochelodina rugosa*	Northern Long-necked Turtle		LC		
Gekkonidae	*Cyrtodactylus louisiadensis*	Ring-tailed Gecko		LC		
Gekkonidae	*Gehyra baliola*	Short-tailed Dtella		LC		Australian Museum, Queensland Museum & published records.
Gekkonidae	*Gehyra dubia*	Dubious Dtella		LC		Unpublished record.
Gekkonidae	*Gehyra variegata*	Tree Dtella		LC		
Gekkonidae	*Hemidactylus frenatus*	House Gecko		I		Australian Museum, published & unpublished records.
Gekkonidae	*Heteronotia binoei*	Bynoe's Gecko		LC		
Gekkonidae	*Lepidodactylus lugubris*	Mourning Gecko		LC		Australian Museum record.
Gekkonidae	*Lepidodactylus pumilis*	Slender Chained Gecko		NT		Queensland Museum & published records.
Gekkonidae	*Nactus eboracensis*	no common name		LC		
Gekkonidae	*Nactus 'pelagicus'*	Pelagic Gecko		LC		Australian Museum, Queensland Museum & published records.
Gekkonidae	*Oedura rhombifer*	Zigzag Velvet Gecko		LC		Australian Museum record.
Gekkonidae	*Pseudothecadactylus australis*	Giant Tree Gecko		LC		
Pygopodidae	*Lialis burtonis*	Burton's Snake-lizard		LC		Australian Museum & published records.
Scincidae	*Bellatorias frerei*	Major Skink		LC		WildNet & published records.
Scincidae	*Carlia coensis*	Coen Rainbow-skink		LC		
Scincidae	*Carlia longipes*	Closed-litter Rainbow-skink		LC		Australian Museum, Queensland Museum, published & unpublished records.
Scincidae	*Carlia quinquecarinata*	no common name		LC		
Scincidae	*Carlia sexdentata*	no common name		LC		
Scincidae	*Carlia storri*	Brown Bicarinate Rainbow-skink		LC		Australian Museum record.
Scincidae	*Cryptoblepharus litoralis litoralis*	Supralittoral Shinning-skink		LC		Queensland Museum, published & unpublished records.
Scincidae	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink		LC		Australian Museum record.
Scincidae	*Ctenotus inornatus*	Bar-shouldered Ctenotus		LC		
Scincidae	*Ctenotus robustus*	Robust Ctenotus		LC		Unpublished record (Terry Reis survey record 2011).
Scincidae	*Ctenotus spaldingi*	Straight-browed Ctenotus		LC		Australian Museum, WildNet & unpublished records.

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
Scincidae	*Emoia atrocostata*	Littoral Whiptail-skink		NT		WildNet record (reported in Ingram (2008).
Scincidae	*Emoia longicauda*	Shrub Whiptail-skink		LC		Australian Museum record.
Scincidae	*Eremiascincus pardalis*	Lowlands Bar-lipped Skink		LC		
Scincidae	*Eugongylus rufescens*	Bar-lipped Sheen-skink		LC		Unpublished record.
Scincidae	*Glaphyromorphus crassicaudus*	Cape York Mulch-skink		LC		Australian Museum & published records.
Scincidae	*Glaphyromorphus nigricaudis*	Black-tailed Bar-lipped Skink		LC		Queensland Museum & published records.
Scincidae	*Glaphyromorphus pumilis*	Dwarf Mulch-skink		LC		Unpublished record.
Scincidae	*Lygisaurus foliorum*	Tree-base Litter-skink		LC		
Scincidae	*Lygisaurus macfarlani*	Translucent Litter-skink		LC		Australian Museum, Queensland Museum, published & unpublished records.
Agamidae	*Chlamydosaurus kingii*	Frilled Lizard		LC		Published & unpublished records.
Agamidae	*Diporiphora bilineata*	Two-lined Dragon		LC		Australian Museum & published records.
Agamidae	*Lophognathus temporalis*	Swamplands Lashtail		LC		
Varanidae	*Varanus gouldii*	Gould's Goanna		LC		
Varanidae	*Varanus indicus*	Mangrove Monitor		LC		Australian Museum & published records.
Varanidae	*Varanus mertensi*	Mertens' Water Monitor		LC		
Varanidae	*Varanus panoptes*	Yellow-spotted Monitor		LC		Australian Museum & unpublished records.
Varanidae	*Varanus prasinus*	Emerald Monitor		NT		Queensland Museum, WildNet & unpublished records.
Varanidae	*Varanus scalaris*	Spotted Tree Monitor		LC		Australian Museum, published & unpublished records.
Varanidae	*Varanus tristis*	Black-tailed Monitor		LC		
Typhlopidae	*Ramphotyphlops braminus*	Flowerpot Blind Snake		I		
Typhlopidae	*Ramphotyphlops leucoproctus*	Cape York Blind Snake		LC		Australian Museum record.
Typhlopidae	*Ramphotyphlops polygrammicus*	North-eastern Blind Snake		LC		
Boidae	*Antaresia cf childreni*	Children's Python		LC		Unpublished record. Children's Python is not known from the Torres Strait or northern Cape York Peninsula.
Boidae	*Antaresia maculosa*	Spotted Python		LC		Australian Museum record.
Boidae	*Liasis fuscus*	Water Python		LC		
Boidae	*Morelia amethistina*	Amethyst Python		LC		
Boidae	*Morelia kinghorni*	Scrub Python		LC		Australian Museum record.

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
Colubridae	*Boiga irregularis*	Brown Tree Snake		LC		Unpublished record.
Colubridae	*Cerberus australis*	Bockadam		LC		
Colubridae	*Dendrelaphis calligastra*	Northern Tree Snake		LC		Australian Museum & Queensland Museum records.
Colubridae	*Dendrelaphis punctulatus*	Common Tree Snake		LC		Australian Museum & unpublished records.
Colubridae	*Stegonotus cucullatus*	Slaty-grey Snake		LC		Published record.
Colubridae	*Stegonotus parvus*	Slate-brown Snake		LC		
Colubridae	*Tropidonophis mairii*	Freshwater Snake		LC		
Elapidae	*Acanthophis praelongus*	Northern Death Adder		LC		WildNet record (reported in Ingram (2008).
Elapidae	*Demansia papuensis*	Papuan Whipsnake		LC		WildNet record (reported in Ingram (2008).
Elapidae	*Demansia vestigiata*	Black Whipsnake		LC		
Elapidae	*Furina tristis*	Brown-headed Snake		LC		WildNet (reported in Ingram (2008) & unpublished records.
Elapidae	*Oxyuranus scutellatus*	Taipan		LC		
Elapidae	*Pseudechis papuanus*	Papuan Black Snake		LC		
BIRDS						
Megapodiidae	*Alectura lathami*	Australian Brush-turkey		LC		
Megapodiidae	*Megapodius reinwardt*	Orange-Footed Scrubfowl		LC		WildNet, published & unpublished records.
Phasianidae	*Coturnix ypsilophora*	Brown Quail		LC		Published record.
Anseranatidae	*Anseranas semipalmata*	Magpie Goose		LC		
Anatidae	*Dendrocygna guttata*	Spotted Whistling-Duck		LC		
Anatidae	*Dendrocygna eytoni*	Plumed Whistling-Duck		LC		WildNet record (reported in Ingram (2008).
Anatidae	*Dendrocygna arcuata*	Wandering Whistling-Duck		LC		Published record.
Anatidae	*Tadorna radjah*	Radjah Shelduck		NT		WildNet & published records.
Anatidae	*Chenonetta jubata*	Australian Wood Duck		LC		
Anatidae	*Nettapus pulchellus*	Green Pygmy-goose		LC		Unpublished record.
Anatidae	*Anas gracilis*	Grey Teal		LC		WildNet & unpublished records.
Anatidae	*Anas superciliosa*	Pacific Black Duck		LC		Published record.
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe		LC		
Columbidae	*Columba livia*	Rock Dove		I		
Columbidae	*Geopelia striata papua*	Emerald Dove		LC		Published record.
Columbidae	*Geopelia striata*	Peaceful Dove		LC		Published & unpublished records.

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
Columbidae	*Geopelia humeralis*	Bar-shouldered Dove		LC		Australian Museum, WildNet, published & unpublished records.
Columbidae	*Ptilinopus magnificus*	Wompoo Fruit-Dove		LC		Australian Museum, published & unpublished records.
Columbidae	*Ptilinopus superbus*	Superb Fruit-Dove		LC		WildNet & published records.
Columbidae	*Ptilinopus regina*	Rose-crowned Fruit-Dove		LC		Australian Museum, published & unpublished records.
Columbidae	*Ptilinopus iozonus*	Orange-Bellied Fruit-Dove		LC		
Columbidae	*Ducula mullerii*	Collared Imperial-Pigeon		LC		
Columbidae	*Ducula bicolor*	Pied Imperial-Pigeon		LC		WildNet & published records.
Columbidae	*Lopholaimus antarcticus*	Topknot Pigeon		LC		
Podargidae	*Podargus strigoides*	Tawny Frogmouth		LC		
Podargidae	*Podargus papuensis*	Papuan Frogmouth		LC		
Eurostopodidae	*Eurostopodus mystacalis*	White-throated Nightjar		LC		
Eurostopodidae	*Eurostopodus argus*	Spotted Nightjar		LC		
Caprimulgidae	*Caprimulgus macrurus*	Large-tailed Nightjar		LC		WildNet & published records.
Apodidae	*Collocalia esculenta*	Glossy Swiftlet		LC		
Apodidae	*Aerodramus terraereginae*	Australian Swiftlet		NT		
Apodidae	*Aerodramus vanikorensis*	Uniform Swiftlet		LC		
Apodidae	*Hirundapus caudacutus*[5]	White-throated Needletail	M	LC		Unpublished record (Terry Reis survey record 2011).
Apodidae	*Mearnsia novaeguineae*	Papuan Spine-tailed Swift		LC		
Apodidae	*Apus pacificus*	Fork-tailed Swift	M	LC		Published record.
Apodidae	*Apus affinis*	House Swift		LC		
Anhingidae	*Anhinga novaehollandiae*	Australasian Darter		LC		WildNet & published records.
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant		LC		Published record.
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant		LC		
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant		LC		Published record.
Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant		LC		Published record.
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican		LC		WildNet & published records.
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork		NT		WildNet record (reported in Ingram (2008).
Ardeidae	*Ixobrychus dubius*	Australian Little Bittern		LC		WildNet record (reported in Ingram (2008).

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
Ardeidae	*Ixobrychus flavicollis*	Black Bittern		LC		Published record.
Ardeidae	*Ardea pacifica*	White-necked Heron		LC		Published & unpublished records.
Ardeidae	*Ardea modesta*[6]	Eastern Great Egret	M	LC		WildNet & published records.
Ardeidae	*Ardea intermedia*	Intermediate Egret		LC		Published & unpublished records.
Ardeidae	*Ardea sumatrana*	Great-billed Heron		LC		
Ardeidae	*Ardea ibis*[7]	Cattle Egret	M	LC		
Ardeidae	*Butorides striata*	Striated Heron		LC		Published record.
Ardeidae	*Egretta picata*	Pied Heron		LC		Published & unpublished records.
Ardeidae	*Egretta novaehollandiae*	White-faced Heron		LC		Published & unpublished records.
Ardeidae	*Egretta garzetta*	Little Egret		LC		Published & unpublished records.
Ardeidae	*Egretta sacra*	Eastern Reef Egret	M	LC		WildNet, published & unpublished records.
Ardeidae	*Nycticorax caledonicus*	Nankeen Night-Heron		LC		Published record.
Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis	M	LC		WildNet record.
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis		LC		WildNet & published records.
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis		LC		Published record.
Threskiornithidae	*Platalea regia*	Royal Spoonbill		LC		Published record.
Accipitridae	*Pandion cristatus*[8]	Eastern Osprey	M	LC		WildNet, published & unpublished records.
Accipitridae	*Elanus axillaris*	Black-shouldered Kite		LC		Published record.
Accipitridae	*Hamirostra melanosternon*	Black-breasted Buzzard		LC		
Accipitridae	*Aviceda subcristata*	Pacific Baza		LC		
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	M	LC		WildNet & published records.
Accipitridae	*Haliastur sphenurus*	Whistling Kite		LC		Published record.
Accipitridae	*Haliastur indus*	Brahminy Kite		LC		WildNet record.
Accipitridae	*Milvus migrans*	Black Kite		LC		
Accipitridae	*Accipiter fasciatus*	Brown Goshawk		LC		Published & unpublished records.
Accipitridae	*Accipiter cirrhocephalus*	Collared Sparrowhawk		LC		
Accipitridae	*Accipiter novaehollandiae*	Grey Goshawk		NT		Published & unpublished records.
Accipitridae	*Circus assimilis*	Spotted Harrier		LC		WildNet record.
Accipitridae	*Circus approximans*	Swamp Harrier		LC		
Accipitridae	*Erythrotriorchis radiatus*	Red Goshawk	V	E	high	WildNet & published records. Draffan *et al*. (1983) refers to an uncertain 1919 record. DERM staff advise that the WildNet record is the same 1919 record

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
						entered as a historical record.
Accipitridae	*Aquila gurneyi*	Gurney's Eagle		LC		
Falconidae	*Falco cenchroides*	Nankeen Kestrel		LC		Unpublished record.
Falconidae	*Falco berigora*	Brown Falcon		LC		WildNet & published records.
Falconidae	*Falco longipennis*	Australian Hobby		LC		Unpublished record.
Falconidae	*Falco peregrinus*	Peregrine Falcon		LC		
Gruidae	*Grus rubicunda*	Brolga		LC		
Rallidae	*Porphyrio porphyrio*	Purple Swamphen		LC		WildNet, published & unpublished records.
Rallidae	*Eulabeornis castaneoventris*	Chestnut Rail		LC		
Rallidae	*Rallina tricolor*	Red-necked Crake		LC		Published record.
Rallidae	*Gallirallus philippensis*	Buff-banded Rail		LC		WildNet & published records.
Rallidae	*Porzana pusilla*	Baillon's Crake		LC		
Rallidae	*Porzana fluminea*	Australian Spotted Crake		LC		
Rallidae	*Porzana tabuensis*	Spotless Crake		LC		WildNet record (reported in Ingram (2008).
Rallidae	*Amaurornis cinerea*	White-browed Crake		LC		WildNet record (reported in Ingram (2008).
Rallidae	*Amaurornis moluccana*	Pale-vented Bush-hen		LC		Published record.
Otididae	*Ardeotis australis*	Australian Bustard		LC		
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew		LC		Published & unpublished records.
Burhinidae	*Esacus magnirostris*	Beach Stone-curlew		V	high	WildNet & published records.
Haematopodidae	*Haematopus longirostris*	Australian Pied Oystercatcher		LC		WildNet & published records.
Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher		NT		
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt		LC		WildNet & published records.
Charadriidae	*Pluvialis fulva*	Pacific Golden Plover	M	LC		WildNet, published & unpublished records.
Charadriidae	*Pluvialis squatarola*	Grey Plover	M	LC		WildNet & published records.
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover		LC		WildNet record.
Charadriidae	*Charadrius bicinctus*	Double-banded Plover	M	LC		
Charadriidae	*Charadrius mongolus*	Lesser Sand Plover	M	LC		WildNet & published records.
Charadriidae	*Charadrius leschenaultii*	Greater Sand Plover	M	LC		WildNet, published & unpublished records.
Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel		LC		
Charadriidae	*Vanellus miles*	Masked Lapwing		LC		WildNet, published & unpublished records.

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe	M	LC		Predicted by the EPBC Protected Matters Search Tool
Scolopacidae	*Gallinago megala*	Swinhoe's Snipe	M	LC		
Scolopacidae	*Limosa limosa*	Black-tailed Godwit	M	LC		WildNet record.
Scolopacidae	*Limosa lapponica*	Bar-tailed Godwit	M	LC		WildNet & published records.
Scolopacidae	*Numenius minutus*	Little Curlew	M	LC		Published record.
Scolopacidae	*Numenius phaeopus*	Whimbrel	M	LC		WildNet, published & unpublished records.
Scolopacidae	*Numenius madagascariensis*	Eastern Curlew	M	NT		WildNet & published records.
Scolopacidae	*Xenus cinereus*	Terek Sandpiper	M	LC		WildNet & published records.
Scolopacidae	*Actitis hypoleucos*[9]	Common Sandpiper	M	LC		WildNet & published records.
Scolopacidae	*Tringa brevipes*[10]	Grey-tailed Tattler	M	LC		WildNet, published & unpublished records.
Scolopacidae	*Tringa incana*[11]	Wandering Tattler	M	LC		Published record.
Scolopacidae	*Tringa nebularia*	Common Greenshank	M	LC		WildNet & published records.
Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper	M	LC		Unpublished record (Terry Reis survey record 2011).
Scolopacidae	*Tringa glareola*	Wood Sandpiper	M	LC		
Scolopacidae	*Arenaria interpres*	Ruddy Turnstone	M	LC		WildNet record.
Scolopacidae	*Calidris tenuirostris*	Great Knot	M	LC		WildNet record.
Scolopacidae	*Calidris canutus*	Red Knot	M	LC		WildNet record.
Scolopacidae	*Calidris alba*[12]	Sanderling	M	LC		
Scolopacidae	*Calidris ruficollis*	Red-necked Stint	M	LC		Published record.
Scolopacidae	*Calidris melanotos*	Pectoral Sandpiper	M	LC		
Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper	M	LC		WildNet & published records.
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	M	LC		WildNet record.
Turnicidae	*Turnix maculosus*	Red-backed Button-quail		LC		WildNet, published & unpublished records.
Turnicidae	*Turnix pyrrhothorax*	Red-chested Button-quail		LC		
Glareolidae	*Glareola maldivarum*	Oriental Pratincole	M	LC		Published record.
Glareolidae	*Stiltia isabella*	Australian Pratincole		LC		Published record.
Laridae	*Anous stolidus*	Common Noddy	M	LC		
Laridae	*Anous minutus*	Black Noddy		LC		
Laridae	*Onychoprion anaethetus*[13]	Bridled Tern	M	LC		Published record.
Laridae	*Onychoprion fuscata*	Sooty Tern		LC		WildNet record.
Laridae	*Sternula albifrons*[14]	Little Tern	M	E	high	Published & unpublished records.

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
Laridae	*Gelochelidon nilotica*	Gull-billed Tern		LC		WildNet & published records.
Laridae	*Hydroprogne caspia*	Caspian Tern	M	LC		WildNet, published & unpublished records.
Laridae	*Chlidonias hybrida*	Whiskered Tern		LC		WildNet record (reported in Ingram (2008).
Laridae	*Chlidonias leucopterus*	White-winged Black Tern	M	LC		WildNet record.
Laridae	*Sterna dougallii*	Roseate Tern	M	LC		
	Sterna striata	White-fronted Tern		LC		
Laridae	*Sterna sumatrana*	Black-naped Tern	M	LC		Published & unpublished records.
Laridae	*Sterna hirundo*	Common Tern	M	LC		
Laridae	*Thalasseus bengalensis*[15]	Lesser Crested Tern	M	LC		Published & unpublished records.
Laridae	*Thalasseus bergii*	Crested Tern		LC		WildNet & published records.
Laridae	*Chroicocephalus novaehollandiae*	Silver Gull		LC		WildNet, published & unpublished records.
Cacatuidae	*Probosciger aterrimus*	Palm Cockatoo		NT		
Cacatuidae	*Eolophus roseicapilla*	Galah		LC		
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo		LC		WildNet, published & unpublished records.
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet		LC		WildNet, published & unpublished records.
Psittacidae	*Cyclopsitta* species	fig-parrot species				
Psittacidae	*Eclectus roratus polychloros*	Eclectus Parrot		LC		
Psittacidae	*Geoffroyus geoffroyi*	Red-cheeked Parrot		LC		
Cuculidae	*Centropus phasianinus*	Pheasant Coucal		LC		Australian Museum, WildNet, published & unpublished records.
Cuculidae	*Eudynamys orientalis*	Eastern Koel		LC		Published & unpublished records.
Cuculidae	*Urodynamys taitensis*	Long-tailed Cuckoo				
Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo		LC		Published record.
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-Cuckoo		LC		Published record.
Cuculidae	*Chalcites osculans*	Black-eared Cuckoo		LC		
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo		LC		Published record.
Cuculidae	*Chalcites minutillus*	Little Bronze-Cuckoo		LC		WildNet & published records.
Cuculidae	*Cacomantis pallidus*	Pallid Cuckoo		LC		
Cuculidae	*Cacomantis castaneiventris*	Chestnut-breasted Cuckoo		LC		
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo		LC		

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
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Cuculidae	*Cacomantis variolosus*	Brush Cuckoo		LC		WildNet & published records.
Cuculidae	*Cuculus optatus*[16]	Oriental Cuckoo	M	LC		WildNet & published records.
Strigidae	*Ninox connivens*	Barking Owl		LC		Published record.
Strigidae	*Ninox novaeseelandiae*	Southern Boobook		LC		
Tytonidae	*Tyto longimembris*	Eastern Grass Owl		LC		WildNet & published records.
Alcedinidae	*Ceyx azureus*	Azure Kingfisher		LC		Published record.
Alcedinidae	*Ceyx pusilla*	Little Kingfisher		LC		Published record.
Halcyonidae	*Tanysiptera sylvia*	Buff-breasted Paradise-Kingfisher		LC		WildNet & published records.
Halcyonidae	*Tanysiptera galatea*	Common Paradise-Kingfisher		LC		
Halcyonidae	*Tanysiptera hydrocharis*	Little Paradise-Kingfisher				
Halcyonidae	*Dacelo leachii*	Blue-winged Kookaburra		LC		
Halcyonidae	*Syma torotoro*	Yellow-billed Kingfisher		LC		
Halcyonidae	*Todiramphus macleayii*	Forest Kingfisher		LC		WildNet, published & unpublished records.
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher		LC		Published & unpublished records.
Halcyonidae	*Todiramphus chloris*	Collared Kingfisher		LC		
Meropidae	*Merops ornatus*	Rainbow Bee-eater	M	LC		WildNet & published records.
Coraciidae	*Eurystomus orientalis*	Dollarbird		LC		Published & unpublished records.
Pittidae	*Pitta erythrogaster*	Red-bellied Pitta		LC		
Pittidae	*Pitta versicolor*	Noisy Pitta		LC		WildNet & published records.
Ptilonorhynchidae	*Ptilonorhynchus nuchalis*	Great Bowerbird		LC		
Acanthizidae	*Sericornis beccarii*	Tropical Scrubwren		LC		WildNet record (reported in Ingram (2008).
Acanthizidae	*Gerygone levigaster*	Mangrove Gerygone		LC		
Acanthizidae	*Gerygone magnirostris*	Large-billed Gerygone		LC		WildNet & published records.
Acanthizidae	*Gerygone palpebrosa*	Fairy Gerygone		LC		
Meliphagidae	*Meliphaga notata*	Yellow-spotted Honeyeater		LC		WildNet, published & unpublished records.
Meliphagidae	*Meliphaga gracilis*	Graceful Honeyeater		LC		
Meliphagidae	*Lichenostomus versicolor*	Varied Honeyeater		LC		WildNet & published records.
Meliphagidae	*Manorina melanocephala*	Noisy Miner		LC		
Meliphagidae	*Ramsayornis modestus*	Brown-backed Honeyeater		LC		WildNet, published & unpublished records.
Meliphagidae	*Conopophila albogularis*	Rufous-banded		LC		WildNet & published records.

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
		Honeyeater				
Meliphagidae	*Myzomela obscura*	Dusky Honeyeater		LC		WildNet, published & unpublished records.
Meliphagidae	*Myzomela erythrocephala*	Red-headed Honeyeater		LC		WildNet & published records.
Meliphagidae	*Cissomela pectoralis*	Banded Honeyeater		LC		
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater		LC		Unpublished record.
Meliphagidae	*Philemon buceroides*	Helmeted Friarbird		LC		WildNet, published & unpublished records.
Meliphagidae	*Philemon argenticeps*	Silver-crowned Friarbird		LC		
Meliphagidae	*Philemon corniculatus*	Noisy Friarbird		LC		
Meliphagidae	*Philemon citreogularis*	Little Friarbird		LC		
Meliphagidae	*Xanthotis flaviventer*	Tawny-breasted Honeyeater		LC		
Pomatostomidae	*Pomatostomus temporalis*	Grey-crowned Babbler		LC		
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		LC		Published & unpublished records.
Campephagidae	*Coracina papuensis*	White-bellied Cuckoo-shrike		LC		WildNet & published records.
Campephagidae	*Coracina lineata*	Barred Cuckoo-shrike		LC		
Campephagidae	*Coracina tenuirostris melvillensis*	(Melville) Cicadabird	M	LC		WildNet & published records.
Campephagidae	*Lalage tricolor*	White-winged Triller		LC		
Campephagidae	*Lalage leucomela*	Varied Triller		LC		WildNet, published & unpublished records.
Pachycephalidae	*Pachycephala melanura*	Mangrove Golden Whistler		LC		WildNet & published records.
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler		LC		
Pachycephalidae	*Colluricincla megarhyncha*	Little Shrike-thrush		LC		WildNet, published & unpublished records.
Oriolidae	*Sphecotheres vieilloti*	Australasian Figbird		LC		WildNet & published records.
Oriolidae	*Oriolus flavocinctus*	Yellow Oriole		LC		
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole		LC		Published record.
Artamidae	*Artamus leucorynchus*	White-breasted Woodswallow		LC		WildNet, published & unpublished records.
Artamidae	*Artamus cinereus*	Black-faced Woodswallow		LC		
Artamidae	*Artamus minor*	Little Woodswallow		LC		
Artamidae	*Cracticus quoyi alecto*	Black Butcherbird		LC		
Dicruridae	*Dicrurus bracteatus*	Spangled Drongo		LC		WildNet, published & unpublished records.
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail	M	LC		WildNet & published records.

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
Rhipiduridae	*Rhipidura phasiana*	Mangrove Grey Fantail		LC		
Rhipiduridae	*Rhipidura rufiventris*	Northern Fantail		LC		
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail		LC		
Corvidae	*Corvus orru orru*	Torresian Crow		LC		
Monarchidae	*Myiagra ruficollis*	Broad-billed Flycatcher		LC		WildNet & published records.
Monarchidae	*Myiagra rubecula*	Leaden Flycatcher		LC		Australian Museum, WildNet, published & unpublished records.
Monarchidae	*Myiagra cyanoleuca*	Satin Flycatcher	M	LC		Predicted by the EPBC Protected Matters Search Tool
Monarchidae	*Myiagra alecto*	Shining Flycatcher		LC		Australian Museum, WildNet, published & unpublished records.
Monarchidae	*Myiagra inquieta*	Restless Flycatcher		LC		
Monarchidae	*Monarcha melanopsis*	Black-faced Monarch	M	LC		
Monarchidae	*Monarcha frater*	Black-winged Monarch	M	LC		Predicted by the EPBC Protected Matters Search Tool
Monarchidae	*Symposiarchus trivirgatus*[17]	Spectacled Monarch	M	LC		WildNet, published & unpublished records.
Monarchidae	*Grallina cyanoleuca*	Magpie-lark		LC		Published record.
Monarchidae	*Arses telescopthalmus*	Frilled Monarch		LC		
Paradisaeidae	*Phonygammus keraudrenii*	Trumpet Manucode		LC		
Paradisaeidae	*Ptiloris magnificus*	Magnificent Riflebird		LC		
Petroicidae	*Microeca flavigaster*	Lemon-bellied Flycatcher		LC		
Petroicidae	*Peneoenanthe pulverulenta*	Mangrove Robin		LC		
Petroicidae	*Drymodes superciliaris*	Northern Scrub-robin		LC		
Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola		LC		WildNet, published & unpublished records.
Acrocephalidae	*Acrocephalus australis*[18]	Australian Reed-Warbler	M	LC		
Megaluridae	*Megalurus timoriensis*	Tawny Grassbird		LC		Published record.
Megaluridae	*Megalurus gramineus*	Little Grassbird		LC		WildNet record (reported in Ingram (2008).
Timaliidae	*Zosterops citrinella*	Pale White-eye		LC		
Timaliidae	*Zosterops lateralis*	Silvereye		LC		
Hirundinidae	*Hirundo rustica*	Barn Swallow	M	LC		Published record. Draffan *et al*. (1983) refers to an uncertain 1919 record.
Hirundinidae	*Hirundo neoxena*	Welcome Swallow		LC		Published record.
Hirundinidae	*Petrochelidon ariel*	Fairy Martin		LC		Published & unpublished records.
Hirundinidae	*Petrochelidon nigricans*	Tree Martin		LC		WildNet & published records.

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
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Hirundinidae	*Cecropis daurica*[19]	Red-rumped Swallow	M	LC		
Turdidae	*Zoothera* sp.	thrush species		LC		
Sturnidae	*Aplonis cantoroides*	Singing Starling		LC		
Sturnidae	*Aplonis metallica*	Metallic Starling		LC		WildNet & published records.
Sturnidae	*Sturnus tristis*	Common Myna		I		
Nectariniidae	*Dicaeum geelvinkianum*	Red-capped Flowerpecker		LC		
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird		LC		WildNet, published & unpublished records.
Nectariniidae	*Nectarinia jugularis*	Olive-backed Sunbird		LC		Australian Museum, WildNet, published & unpublished records.
Estrildidae	*Poephila personata*	Masked Finch		LC		
Estrildidae	*Lonchura punctulata*	Nutmeg Mannikin		I		
Estrildidae	*Lonchura castaneothorax*	Chestnut-breasted Mannikin		LC		WildNet, published & unpublished records.
Passeridae	*Passer domesticus*	House Sparrow		I		WildNet, published & unpublished records.
Motacillidae	*Motacilla* sp.	Yellow Wagtail species	M	LC		
MAMMALS						
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna		LC		Published record.
Peramelidae	*Isoodon macrourus*	Northern Brown Bandicoot		LC		Unpublished record.
Peramelidae	*Isoodon obesulus*	Southern Brown Bandicoot		LC		Unpublished record.
Macropodidae	*Macropus agilis*	Agile Wallaby		LC		Published & unpublished records.
Pteropodidae	*Dobsonia magna*	Bare-backed Fruit-bat		NT		WildNet record (reported in Ingram (2008) & published record.
Pteropodidae	*Macroglossus minimus*	Northern Blossom-bat		LC		Australian Museum &WildNet records.
Pteropodidae	*Syconycteris australis*	Common Blossom-bat		LC		
Pteropodidae	*Nyctimene cephalotes*	Torresian Tube-nosed Bat		NT		WildNet record.
Pteropodidae	*Nyctimene robinsoni*	Eastern Tube-nosed Bat		LC		Australian Museum &WildNet records.
Pteropodidae	*Pteropus alecto*	Black Flying-fox		LC		Australian Museum, WildNet & unpublished records.
Pteropodidae	*Pteropus conspicillatus*	Spectacled Flying-fox	V	LC	high	Predicted by the EPBC Protected Matters Search Tool
Pteropodidae	*Pteropus macrotis*	Large-eared Flying-fox		LC		
Pteropodidae	*Pteropus scapulatus*	Little Red Flying-fox		LC		
Rhinolophidae	*Rhinolophus philippinensis* (large form)	Greater Large-eared Horseshoe Bat	E	E	high	

Family	Scientific Name[3]	Common Name	Status[4]			Mua Island
			EPBC Act	NC Act	BoT	
Hipposideridae	*Hipposideros ater aruensis*	(eastern) Dusky Leaf-nosed Bat		LC		Queensland Museum record.
Hipposideridae	*Hipposideros cervinus*	Fawn Leaf-nosed Bat		V	high	Queensland Museum, WildNet & unpublished records.
Hipposideridae	*Hipposideros diadema*	Diadem Leaf-nosed Bat		LC		
Emballonuridae	*Saccolaimus saccolaimus nudicluniatus*	Bare-rumped Sheathtail-bat	CE	E	high	Predicted by the EPBC Protected Matters Search Tool
Emballonuridae	*Taphozous australis*	Coastal Sheathtail Bat		V	high	Queensland Museum & WildNet records.
Molossidae	*Chaerephon jobensis*	Northern Freetail-bat		LC		
Molossidae	*Mormopterus beccarii*	Beccari's Freetail-bat		LC		
Vespertilionidae	*Chalinolobus nigrogriseus*	Hoary Wattled Bat		LC		
Vespertilionidae	*Miniopterus australis*	Little Bent-wing Bat		LC		WildNet record (reported in Ingram (2008).
Vespertilionidae	*Miniopterus schreibersii*	Eastern Bent-wing Bat		LC		
Vespertilionidae	*Myotis macropus*	Large-footed Myotis		LC		Unpublished record.
Vespertilionidae	*Nyctophilus bifax*	Eastern Long-eared Bat		LC		Queensland Museum & WildNet records.
Vespertilionidae	*Pipistrellus* sp.	Pipistrelle species		LC		
Muridae	*Conilurus penicillatus*	Brush-tailed Tree-rat	V	LC		
Muridae	*Hydromys chrysogaster*	Water-rat		LC		Australian Museum & published records.
Muridae	*Melomys burtoni*	Grassland Melomys		LC		Published & unpublished records.
Muridae	*Melomys capensis*	Cape York Melomys		LC		
Muridae	*Melomys rubicola*	Bramble Cay Melomys	E	E	high	
Muridae	*Mus musculus*	House Mouse		I		
Muridae	*Pseudomys delicatulus*	Delicate Mouse		LC		Published record.
Muridae	*Rattus exulans*	Pacific Rat		I		
Muridae	*Rattus norvegicus*	Brown Rat		I		Unpublished record.
Muridae	*Rattus rattus*	Black Rat		I		
Muridae	*Xeromys myoides*	Water Mouse	V	V	high	Predicted by the EPBC Protected Matters Search Tool
Canidae	*Canis lupus*	Dingo, Domestic Dog		I		Published & unpublished records.
Felidae	*Felis catus*	Cat		I		Unpublished record (Terry Reis survey record 2011).
Equidae	*Equus caballus*	Horse, Brumby		I		Unpublished record.
Suidae	*Sus scrofa*	Pig		I		Published & unpublished records.
Bovidae	*Capra hircus*	Goat		I		
Cervidae	*Cervus timorensis*	Rusa Deer		I		

1. Known from Museum records, published literature (*eg* Tyler 1972; Storr 1973; Draffan *et al*. 1983; Whittier & Moeller 1993; Clarke 2004a, b; 2005, 2006; Wilson 2005; Ingram 2008), WildNet database and/or reports and other grey literature (*eg* Smith & Smith 2006; Borsboom 2007; Conics 2008a, b, c; 2009a, b; Schaffer 2010). These sources are not necessarily mutually exclusive and many records are un-confirmed. Some appear unreliable. WildNet database searches were conducted for Boigu, Saibai, Dauan, Bramble Cay, Erub , Mer, Mabuiag, Iama, Mua, Badu, Possession, Thursday, Wednesday, Friday, Horn, Hammond and Prince of Wales Islands.
2. Predicted by the EPBC Protected Matters Search Tool maintained by the Department of Sustainability, Environment, Water, Population and Communities, Canberra (DSEWPC) http://www.environment.gov.au/erin/ert/epbc/index.html. Only noted if not recorded from another source.
3. Nomenclature follows the Australian Faunal Directory maintained by DSEWPC. http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/index.html
4. Status: CE = Critically Endangered, E = Endangered, V = Vulnerable, NT = Near-Threatened, M = Migratory, LC = Least Concern (Common), I = Introduced (Exotic) under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and/or *Nature Conservation Act* 1992 (NC Act). BoT = species listed as critical or high priority under the Back on Track species prioritisation framework. Department of Environment and Resource Management, Brisbane. http://www.derm.qld.gov.au/wildlife-ecosystems/wildlife/back_on_track_species_prioritisation_framework/index.html.
5. Also listed under the EPBC Act (ROKAMBA) as *Chaetura caudacuta*.
6. Listed under the EPBC Act (CAMBA, JAMBA) as Great Egret *Ardea alba*. Australian birds elevated to full species level as *A. modesta* (Kushlan & Hancock 2005; Christidis & Boles 2008).
7. Listed under CAMBA as *Ardeola ibis*, listed under JAMBA as *Bubulcus ibis*.
8. Listed under the Bonn Convention as Osprey *Pandion haliaetus*. Australian birds have been elevated to species level as *P. cristatus* (Wink *et al*. 2004; Christidis & Boles 2008).
9. Also listed under CAMBA and ROKAMBA as *Tringa hypoleucos*.
10. Also listed under the Bonn Convention and JAMBA as *Heteroscelus brevipes*.
11. Also listed under the Bonn Convention and JAMBA as *Heteroscelus incanus*.
12. Also listed under ROKAMBA as *Crocethia alba*.
13. Listed under the EPBC Act (CAMBA, JAMBA) as *Sterna anaethetus*.
14. Listed under the EPBC Act (Bonn Convention, CAMBA, JAMBA, ROKAMBA) as *Sterna albifrons*.
15. Listed under the EPBC Act (CAMBA) as *Sterna bengalensis*.
16. Listed under the EPBC Act (CAMBA, JAMBA, ROKAMBA) as *Cuculus saturatus*. Australian birds elevated to full species level as *A. optatus* (Christidis & Boles 2008).
17. Listed under the EPBC Act (Bonn Convention) as *Monarcha trivirgatus*.
18. Listed under the EPBC Act (Bonn Convention) as Clamorous Reed-warbler *Acrocephalus stentoreus*. Australian birds elevated to full species level as *A. australis* (Higgins *et al*. 2006b).
19. Listed under the EPBC Act (ROKAMBA) as *Hirundo daurica*.

Appendix E1. Mua: Preliminary List Of Terrestrial Vertebrate Fauna Language Names

Compiled by G. Hitchcock (March 2011)

Scientific Name/s	Common Name/s	Language Name
Isoodon sp.	Bandicoot	*makas* (also general name for rats and mice)
Morelia sp.	Python	*tabu* (also general name for snakes)
Chlamydosaurus kingii	Frill-necked Lizard	*walek*
Varanus scalaris	Spotted Tree Monitor	*thamay*
Varanus panoptes	Monitor	*karum*
Varanus prasinus	Emerald Monitor	*wynes*
Ctenotus spp.	Ctenotus	*ziziruk*
Egernia frerei	Major Skink	*kadu*
Lialis burtonis	Burton's Legless Lizard	*gilbu*
Geckoes	Geckoes	*sis*
Carlia spp.	Skinks	*moegay*
Tachyglossus aculeatus	Short-beaked Echidna	*kuik*
Pteropus alecto	Black Flying-fox	*sapur*
Small bats, inc. *Taphozous australis* and *Hipposideros* spp.	Coastal Sheath-tail Bat; Leaf-nosed Bats	*ap*
Canis familiaris; *Canis lupus dingo*	Domestic Dog; Dingo	*umai*
Chelodina sp. (?)	Long-necked Freshwater Turtle	*kobi*
Sus scrofa	Pig	*burum*

Appendix F. Information on Migratory Fauna Species Potentially occurring on Mua Island and Surrounding Islets

Waders

Life history: Waders listed as Migratory under the EPBC Act that have been recorded in the Torres Strait include plovers, sandpipers and oriental pratincole. Sandpipers are known by a number of common names including snipe, godwit, curlew, tattler, knot and stint. The majority of the waders recorded occur in coastal areas, particularly in the intertidal zone, on mudflats, sandflats, beaches, saltmarsh, coastal lagoons and mangroves. Some also forage and/or roost on rocky shores. Many of these species are also found on freshwater and artificial waterbodies such as rivers, streams, swamps, dams and sewage ponds. Two species are unlikely to be found in the intertidal zone, oriental pratincole and wood sandpiper. Oriental pratincole is largely restricted to grasslands and other open areas and wood sandpiper occurs on freshwater waterbodies (Pringle 1987). None of these wader species breed in Australia but individuals of some species, especially large sandpipers such as eastern curlew and bar-tailed godwit, may be present year-round.

Flat tidal shores with extensive muddy intertidal areas support the most species and individuals, though some waders feed in mangroves forests at low tide (Lane 1987). The coastal species have a life cycle driven largely by the tidal cycle, roosting in mixed species flocks above the high water mark at high tide and moving to feeding areas as the tide recedes. Most of these species are gregarious, wary and fly strongly and swiftly (Pringle 1987; Geering *et al*. 2007). Smaller species, such as red-necked stint and curlew sandpiper, feed for longer each tide cycle than do larger species and may continue to feed in non-tidal areas during high tide (Lane 1987).

Other than double-banded plover, which breeds in New Zealand, all the Migratory waders breed in the northern hemisphere during the Australian winter. Migration to Australia after breeding starts in mid-July and finishes by December. Birds begin returning to breeding grounds as early as mid-February, though most birds leave in mid-March (Lane 1987).

Threats: Although none of the species breed in Australia they are susceptible to loss of foraging and roosting habitat and to disturbance when foraging or roosting by human activities and feral and domestic animals. Such disturbance may limit their ability to undertake long migration flights through depletion of their energy reserves. Pollution may also affect the intertidal invertebrate species on which so many Migratory waders depend (Lane 1987).

Terns

Life history*:* Terns, with gulls, belong to the family Laridae. The terns include the noddies, a group of largely tropical pelagic species. Four Migratory tern and one noddy species have been recorded from Mua Island, though other species are also expected to occur.

Many tern species are cosmopolitan, with very large distributions. Most species are coastal, found in a variety of habitats, including open beaches, lagoons, estuaries, river mouths, lakes, bays, harbours

and inlets. Some species do also occur on inland freshwater habitats and others are largely restricted to pelagic waters. Fish is the major food item but crustaceans and insects are also taken by some and those species that feed in freshwater may also eat reptiles, frogs and small mammals. Most terns are gregarious when feeding and are colonial nesters, with most of the species that breed in Australia simply laying their eggs in shallow depressions, though noddies will nest in trees (Pringle 1987; Higgins & Davies 1996).

Threats: Ground-nesting makes many species susceptible to loss of eggs and chicks through native and feral predators and adverse weather conditions. Colonies can be threatened by human disturbance and birds are affected by degradation of feeding areas, pesticide residues in fish, and oil-fouling, both of birds and beaches. Birds occasionally are tangled in fishing nets (Blakers et al. 1984; Higgins & Davies 1996; Garnett & Crowley 2000). There is likely to be little, if any, breeding by terns on Mua. Threats appear to be minimal.

Herons and Egrets

Life history: The family Ardeidae includes herons, egrets and bitterns and all species are characterised by long necks and legs and long sharp bills. Although there is variation, most species forage in shallow water and eat fish, crustaceans, frogs, insects and other small animals (McKilligan 2005). Three species listed as Migratory occur in the Torres Strait; eastern great egret, cattle egret and eastern reef egret.

Eastern great egrets are generally associated with shallow water, both freshwater and saline, but also occur in dry habitats. The species occurs on coastal and inland habitats, including rivers, estuaries, tidal mudflats, swamps, man-made dams and ponds, sewage farms and wet pasture. Eastern great egrets eat mainly fish but also small vertebrates such as frogs and aquatic insects (Pringle 1985; Marchant & Higgins 1990; McKilligan 2005). The cattle egret inhabits grasslands, wetlands and wooded lands, often foraging away from water in grassland, pasture and crops. The species is strongly associated with grazing animals in Australia, but also forages at garbage tips, follows machinery, and feeds independently. Cattle egrets feed on invertebrates, especially grasshoppers, and small vertebrates such as frogs, reptiles and mammals (Pringle 1985; Marchant & Higgins 1990). Eastern reef egret is found on coastlines, foraging on rocky and muddy shores. The species eats mostly fish, but also crustaceans, molluscs, bird chicks and turtle hatchlings (McKilligan 2005).

Eastern great egret is common and widespread in Australia even in some arid areas. The cattle egret occurs in all Australian states and mainland territories. Eastern reef egret occurs along most of the Australian coastline. All three species extend through the Torres Strait into south-east Asia. The cattle egret has a limited distribution in the Torres Strait but has been undergoing a global expansion of range (Pringle 1985; Marchant &Higgins 1990; McKilligan 2005). It may become more widespread and common in the Torres Strait if there are changes to land use which favour the species.

Threats: The eastern great egret is threatened by destruction and modification of freshwater habitats by drainage and groundwater extraction, clearing, livestock, burning, increased salinity and weed invasions (Marchant & Higgins 1990). The most important issue is the allocation of water from

regulated rivers in sufficient quantity and with appropriate timing to maintain suitable wetland conditions (Maddock 2000). The cattle egret is also threatened by loss of breeding habitat through drainage of wetlands and river regulation and water harvesting that prevent or limit flooding of temporary wetlands. Nestlings may be susceptible to predation by Cats (DSEWPC 2011b). Eastern reef egrets can be disturbed by human activity near nest sites and are threatened by reclamation of tidal areas and deepening of channels. However, the species often tolerates human presence and roosts, and sometimes breeds, on artificial structures (Marchant & Higgins 1990).

Neither eastern great nor cattle egret is likely to breed on Mua Island and threats appear minimal. Eastern reef egret may breed and would be susceptible to disturbance at its nest. The level of threat is likely to be minor.

Swifts

Life history: In Australia the white-throated needletail and fork-tailed swift are almost completely aerial species, possibly even sleeping on the wing. These species are sometimes found roosting in trees and may on rare occasions rest in trees and on the ground during the day. They are found over a wide variety of habitat, including forest, open areas, modified land and the ocean. Foraging for aerial invertebrates occurs at heights from less than one metre up to more than 1000 metres (Higgins 1999).

Both species breed in Asia and arrive in Australia in September/October and leave by April. Some birds may over-winter. White-throated needletail is widespread in eastern and south-eastern Australia and fork-tailed swift is widespread throughout Australia (Higgins 1999). The total population of white-throated needletail is unknown but it is described as abundant in some regions of Australia (Chantler 1999). A comparison of Birds Australia atlas data between 1977–81 and 1998–2002 indicates that the species has undergone a decline in both its area of occupancy and extent of occurrence in Australia (Blakers et al. 1984; Barrett et al. 2003). Worldwide the fork-tailed swift is thought to have a stable population with no evidence for any declines or substantial threats (BirdLife International 2011).

Threats: Both species are occasionally killed by collision with man-made structures, and fork-tailed swifts are occasionally killed by cats (Higgins 1999), but there is no apparent major threat to either species overall, either in Australia or elsewhere (DSEWPC 2011a, f). A potential threat is a reduction in prey due to loss of habitat (Low 1995; DSEWPC 2011a). Neither species would be subject to any significant level of threat on Mua Island.

Raptors

Life history: The family Accipitridae includes a very large number of species with an enormous variety of body sizes, prey species and habitat use. The two Migratory raptors, eastern osprey and white-bellied sea-eagle, are, however, very similar in much of their life history. Both species occur along the entire Australian coastline and extend far inland, typically along major rivers or on large lakes and reservoirs. Eastern osprey feeds on fish but the white-bellied sea-eagle also eats mammals, birds, reptiles and carrion. Both species will nest on cliffs and in large trees but eastern

osprey also nest on artificial structures such as power poles and towers (Debus 1998; NSW NPWS 2002). Established breeding pairs are mostly sedentary although there is evidence that territorial adults move long distances. Inland territorial birds are probably more dispersive than those on the coast and may move as waters disappear (Debus 1998).

Threats: The eastern osprey population in Australia has decreased since European settlement but has been recovering in recent years (Olsen 1998). They are threatened by loss of existing and suitable replacement breeding trees, disturbance at the nest site, reduction in quality and quantity of fish stocks, collision with or electrocution by power lines, and the use of pesticides (NSW NPWS 2002). The white-bellied sea-eagle is threatened by clearing of forests and the consequent loss of optimal breeding sites (Marchant & Higgins 1993) and disturbance at nest sites (Debus 1998). There is no record of eastern osprey for Mua Island but it is expected to occur. Neither species is likely to be threatened by current land use practices on Mua Island.

Glossy Ibis (*Plegadis falcinellus*)

The glossy ibis is usually seen as single individuals or small groups. It feeds on aquatic invertebrates and occurs in terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora (Pringle 1985; Marchant & Higgins 1990). The species is widespread, occurring in Europe, Africa, Asia and North America. It occurs in much of Australia but is more widespread in the wetter northern and eastern areas. Glossy Ibis breeds in dense colonies, often with other species of ibis and waterbirds (Marchant & Higgins 1990).

Threats: The species is generally uncommon and erratic in occurrence (Pringle 1985) and is threatened by destruction or modification of wetlands, invasion of wetlands by weeds and predation of breeding birds (Marchant & Higgins 1990). Occurrence on Mua Island is unlikely and threats would be minimal should it occur.

Oriental Cuckoo (*Cuculus optatus*)

The Oriental Cuckoo breeds in northern Asia with birds spending the non-breeding season in south-east Asia, New Guinea, the Solomons and Australia. The species mostly occurs on the northern and eastern coasts of Australia, between September and April. Most birds do not arrive in Australia until December. Oriental Cuckoos occur in rainforest, vine thicket and open forest and woodland. The species is sometimes found in mangroves and is often recorded in gardens and plantations. It feeds on invertebrates, particularly caterpillars (Blakers et al. 1984; Higgins 1999).

Threats: The species is sometimes killed by cats and by collisions with windows and lighthouses (Higgins 1999). Oriental cuckoo is likely to be a sporadic, possibly annual, visitor to Mua Island, in almost any habitat other than grasslands, but threats would be minimal.

Rainbow Bee-eater (*Merops ornatus*)

The rainbow bee-eater occurs in almost any habitat. The species eats insects, preferring bees and wasps, which are mostly caught in the air, and will also take food from the ground or vegetation and

occasionally water. It is widespread in Australia, New Guinea, Indonesia and Micronesia. In northern Australia populations are present in coastal or sub-coastal areas where they breed in the riparian areas and move into more open habitat after the breeding season. Breeding may take place individually or in colonies, nesting in burrows in soft sand or soil (Higgins 1999; Boland 2004a).

Threats: The species appears little threatened, although Cane Toads Rhinella marina have been found to prey on the eggs and nestlings (Boland 2004b). Rainbow bee-eater could occur in, or over, all habitats on Mua Island. Cane toads are not reported for the island and threats to rainbow bee-eater would be minimal.

Passerines

Ten species of Migratory passerine are known from the Torres Strait. These species may be split into two broad groups, species that occur mostly in wooded habitats and those that occur mostly in open habitats. Members of these pairings may not be particularly closely related.

Wooded habitat species

Life history: Six of the Migratory passerine species that occur in Torres Strait occur mostly in wooded habitats. All of these birds, (Melville) cicadabird (subspecies melvillensis), rufous fantail, satin flycatcher, black-faced, black-winged and spectacled monarchs, occur in rainforest, melaleuca woodlands, mangroves and occasionally open forests, except for satin flycatcher, which typically avoids closed forest. All the species are insectivorous, though the cicadabird may also eat some fruit and seeds. All breed in Australia and, except for black-winged Monarch; all are at least partly resident in Australia. Some individuals of black-winged monarch may also be present year-round (Higgins et al. 2006a).

Threats: Threats include the loss and fragmentation of habitat, especially along the migratory routes, and predation of eggs and young by the black rat *Rattus rattus* (Higgins et al. 2006a). All six species do or could occur on Mua Island and would use a majority of the habitats present. Breeding by any species would be limited, if any breeding occurs, and black rat has not been reported. Threats would appear to be limited to habitat loss should land use practices change.

Open habitat species

Life history: Four of the Migratory passerine species that occur in Torres Strait occur mostly in open habitats. Reed-warblers in Australia were previously thought to be a subspecies of the migratory clamorous reed-warbler (*Acrocephalus stentoreus)*. They are now considered a full species, Australian reed-warbler (*A. australis*), and all movements are thought to occur within Australia. Australian reed-warblers typically occur in reeds and other dense vegetation in and adjacent to a variety of wetland types. They feed on insects and spiders. The species is not known to breed in the Torres Strait (Higgins *et al.* 2006b).

Barn and red-rumped swallows are both widespread species, particularly in the northern hemisphere, and neither breeds in Australia. Barn swallow is an annual visitor to northern Australia in small

numbers but red-rumped swallow may not be present every year. Both species feed in open areas, particularly over wetlands, cane fields and sporting fields and often perch on overheard wires.

Yellow Wagtail is listed under the EPBC Act as (*Motacilla flava* s. lat.). The birds that occur in Australia are now treated as full species, Eastern Yellow Wagtail (*M. tschutschensis*) and Green-headed Yellow Wagtail (*M. taivana)* (Christidis & Boles 2008). They were previously regarded as subspecies of *M. flava*, which is no longer considered to occur in Australia. The occurrence of Yellow Wagtails in the Torres Strait appears unconfirmed but Yellow Wagtails have been reported for Boigu, Thursday and Horn Islands (Baxter 2010) and are likely to occur as irregular visitors on many of the Torres Strait Islands.

Yellow wagtails occur in open areas with low vegetation, especially in cultivation and on lawns, sporting fields and air fields. They are often recorded near water. Yellow wagtails are probably regular wet season non-breeding visitors to north Queensland. Diet consists mainly of invertebrates, taken mostly from the ground and occasionally from the air (Higgins *et al.* 2006b).

Threats: The major threat to Australian reed-warbler is loss of habitat due to coastal development in natural habitat areas (Higgins *et al*. 2006b). Barn and red-rumped swallows appear to be increasing in numbers in Australia, though this may be due to an increase in observers. Neither species appears subject to any particular threat in Australia. Threats to yellow wagtail in Australia are unknown. None of these species is known from Mua Island and should they occur threats would be minimal. Other than Australian reed-warbler, increased clearing of wooded areas would actually benefit the species.