

BushBlitz

SPECIES DISCOVERY PROGRAM



BUSH BLITZ SPECIES DISCOVERY PROGRAM



Wongalara Sanctuary Northern Territory

27 May–8 June 2012



Australian Government



What is Bush Blitz?

Bush Blitz is a multi-million dollar partnership between the Australian Government, BHP Billiton and Earthwatch Australia to document plants and animals in selected properties across Australia's National Reserve System.

This innovative partnership harnesses the expertise of many of Australia's top scientists from museums, herbaria, universities, and other institutions and organisations across the country.

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Summary

A two-week Bush Blitz survey was conducted in May and June 2012 on Wongalara Sanctuary on the southern border of Arnhem Land in the Northern Territory. In total, 1,053 flora and fauna species were identified, of which 878 were new records for the reserve. Of these, 27 are believed to be new to science: five true bugs, one microwhip scorpion, five pseudoscorpions, 10 spiders, three stygofauna (all crustaceans) and three snails. Combined with previous records, 1,174 species are now recorded for Wongalara Sanctuary.

While the terrestrial vertebrate fauna has been reasonably well documented, the terrestrial invertebrate fauna on Wongalara Sanctuary was poorly known. This survey was the first undertaken for invertebrates and added substantial baseline information for the reserve. It was also the first fish survey on the reserve, and the current assessment provides a solid foundation for understanding the local fish diversity.

The semi-aquatic Mertens' Water Monitor (*Varanus mertensi*) was the only threatened vertebrate species observed. It is listed as vulnerable under the *Territory Parks and Wildlife Conservation Act 2000* of the Northern Territory. Although none were caught, evidence was found of the Freshwater Sawfish (*Pristis pristis*), which is listed as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Act 1988* of the Northern Territory.

This survey was the first substantial baseline flora survey not just for Wongalara Sanctuary but also for a large area of south-eastern Arnhem Land. Some 546 vascular plants were recorded in the reserve for the first time. Many of the species records represent range extensions of 100–300 km

Abbreviations

AWC

Australian Wildlife Conservancy

DLRM

Department of Land Resource Management

EPBC Act

Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

TPWC Act

Territory Parks and Wildlife Conservation Act 2000 (Northern Territory)

NRS

National Reserve System

or significant range infillings of a similar scale. Many of the range extensions were for sandstone species, with the most obvious concentration found on the Strangman Range. Species were collected that have rarely been recorded in the Northern Territory. The reserve is also notable for the abundance of Lancewood (*Acacia shirleyi*) dominated vegetation, a species very near the northern limit of its range. Twenty-two species of conservation significance¹ were identified, although no listed threatened plants were recorded.

A significant attribute of Wongalara Sanctuary is the lack of introduced fishes. Other feral animals were common, with European Cattle (*Bos taurus*), Water Buffalo (*Bubalus bubalis*), Donkey (*Equus asinus*), Horse (*Equus caballus*) and Pig (*Sus scrofa*) seen on most parts of the reserve. A Cat (*Felis catus*) was observed on the main access road, and Cane Toads (*Rhinella marina*) were seen at many permanent water bodies.

¹ Species of conservation significance are those in the IUCN categories Data Deficient, Not Evaluated and Near Threatened.



Thirteen true bug pest species were identified in low abundances; all are Australian natives that can become pests under certain conditions. Several specimens were collected of the introduced Tailed Daddy Longlegs spider (*Crossopriza lyoni*) and the Adanson's House Jumper (*Hasarius adansoni*). Both species appear to be dependent on human modifications such as buildings and appear not to move into the surrounding bush.

Four noxious weeds gazetted under the *Weeds Management Act 2001* (NT) and 11 non-gazetted weeds were recorded. Of the gazetted species, Mint Bush (*Hyptis suaveolens*) was widespread and abundant on some of the creek flats and sandy country. Grazing by cattle and buffalo has probably increased its spread. Spinyhead Sida

(*Sida acuta*) and Flannel Weed (*S. cordifolia*) were most abundant near Wongalara homestead and were not commonly seen elsewhere. One population of Jamaica Snakeweed (*Stachytarpheta jamaicensis*) was found beside a creek, from where it has considerable potential to disperse down-stream. The site needs to be monitored regularly and plants removed before they seed.

Of the non-gazetted species, infestations of Grader Grass (*Themeda quadrivalvis*) were the most extensive seen in the Northern Territory by herbarium staff. While the Australian Wildlife Conservancy has so far been successful in limiting incursions of Grader Grass into Wongalara, it is likely to be an ongoing issue due to large infestations on the adjacent Mainoru Station.



Some of the Wongalara Bush Blitz participants © Copyright, Earthwatch Australia





Introduction

This is a report for the Bush Blitz program, which aims to survey recent additions to the National Reserve System (NRS).² Bush Blitz is an initiative of the Australian Government, through the Australian Biological Resources Study, in partnership with BHP Billiton and Earthwatch Australia. The Bush Blitz objectives are:

- + to promote, publicise and demonstrate the importance of taxonomy through species discovery;
- + to undertake a national species discovery program targeted at recently acquired properties of the National Reserve System of Australia;
- + to support the science of taxonomy in Australia through training students and early career researchers, the provision of grants for species description and resolution of taxonomically problematic, nationally important groups;
- + to promote partnerships between science, government, industry and non-government organisations; and
- + to inform the NRS, reserve managers and other stakeholders of the results.

This Bush Blitz took place on Wongalara Sanctuary, on the southern border of Arnhem Land in the Northern Territory. The survey was conducted from 27 May to 8 June 2012, during the mid-dry season for this region. The weather was characterised by cold dry nights and mild to warm sunny days, however several days were cool and overcast with some drizzle.

2 The NRS is Australia's network of protected areas, covering 17.88% of the country—over 137 million hectares, comprising Commonwealth, state and territory reserves, Indigenous lands and protected areas run by non-profit conservation organisations, through to ecosystems protected by farmers on their private working properties <<http://www.environment.gov.au/topics/land/national-reserve-system>>, accessed 6 January 2015.

The Australian Biological Resources Study provided the logistical coordination and overall leadership of the survey. Experts from the following organisations conducted the field and laboratory work: the Museum and Art Gallery of the Northern Territory, Northern Territory Herbarium, Department of Land Resource Management (DLRM) Flora and Fauna Division, Western Australian Museum, Museum Victoria, South Australian Museum, James Cook University, Australian National Herbarium, University of New South Wales, Territory Wildlife Park and the consultancy Aquagreen. BHP Billiton employees, coordinated by Earthwatch Australia, assisted scientists in the field.

Bush Blitz wishes to thank the Northern Territory Herbarium and the Museum and Art Gallery of the Northern Territory for hosting this Bush Blitz. The Australian Wildlife Conservancy (AWC) and Wongalara Sanctuary manager Chris Whatley, together with his family, facilitated access to the reserve and provided helpful advice on survey locations.



Emergent vegetation, M. Hammer © Copyright, Museum and Art Gallery of the Northern Territory

Reserve Overview³



Wongalara Sanctuary

Australian Wildlife Conservancy

Date of purchase

2007

Area

192,200 ha

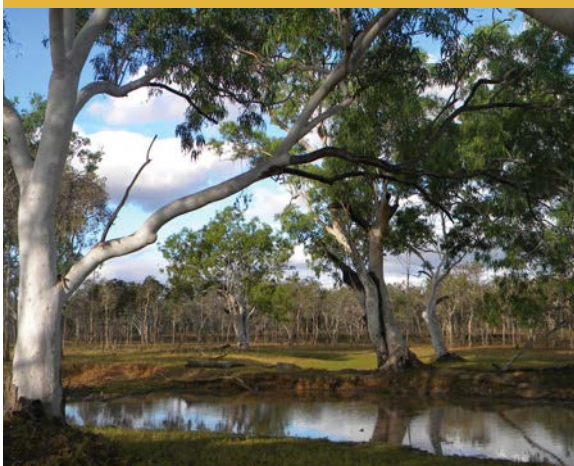
Description

Wongalara Sanctuary is located approximately 300 km east of Katherine on the southern border of Arnhem Land, in the Roper District of the Northern Territory. The reserve was acquired by the AWC through a public fundraising campaign, with assistance from the Australian Government NRS program. Previously, it had been used for low intensity pastoralism.

National Reserve System conservation values

Wongalara Sanctuary falls within the Gulf Fall and Uplands bioregion, and has a drier climate than other regions of the Northern Territory's Top End. It supports diverse habitats, largely dominated by dry spinifex-clad ranges on sandstone plateaus. A number of rivers weave through the reserve including the Wilton, Mainoru and Jalboi. Some habitats are of significant ecological value, particularly the wetlands and monsoon forests. In surrounding areas, similar habitats have largely been destroyed by cattle grazing and unsuitable fire regimes. Many of the biomes at Wongalara Sanctuary are either threatened or not protected in other reserves in the bioregion.

Soils on Wongalara Sanctuary include alluvial and coarse-textured loams, red earths/red clayey loams, and shallow and deep sands. The shallow soils host Stringybark (*Eucalyptus* spp.), Woollybutt (*Eucalyptus* spp.) and Acacia scrub over spinifex (*Triodia* spp.), annual sorghum (*Sorghum* spp.) and spear grass (*Austrostipa* spp.). The upland valley floors have a limestone, sandstone and conglomerate base that supports Silver Box (*Eucalyptus* spp.),



Wongalara Sanctuary, N. Crook © Copyright, Department of the Environment

³ Information from the NRS applications and assessments and the AWC <<http://www.australianwildlife.org/AWC-Sanctuaries/Wongalara-Sanctuary.aspx>>, accessed 28 February 2013.





Bloodwood (*Corymbia* spp.), Tea Tree (*Melaleuca* spp.), Coolibah (*Eucalyptus coolabah*) and paperbarks (*Melaleuca* spp.). Snappy Gum (*Eucalyptus* spp.) and Lancewood (*Acacia shirleyi*) grow on escarpment edges.

The reserve supports a diverse fauna, including four nationally threatened species: the Red Goshawk (*Erythrotriorchis radiatus*), Gouldian

Finch (*Erythrura gouldiae*), Northern Shrike-tit (*Falcunculus frontatus whitei*) and Digul (*Dasyurus hallucatus*). Riparian vegetation along the Wilton River provides habitat for Freshwater Crocodiles (*Crocodylus johnstoni*) and the rare Red Goshawk. Northern Territory endemic species also occur here, such as the Hooded Parrot (*Psephotus dissimilis*) and Kakadu Dunnart (*Sminthopsis bindi*).



Large Dusky-blue butterfly subspecies (*Candalides geminus* subsp. Arnhem Land), M. Braby © Copyright, Department of Land Resource Management



Methods

Collection and observation sites were selected based on land classes, supplemented by identification of suitable microhabitats during the field visit. Site selection also depended on access, suitability for trapping and time restrictions. Site locations were recorded using global positioning systems.

A number of taxonomic groups were identified as targets for study. Table 1 lists the specialists who undertook the fieldwork.



Jo Palmer pressing plant specimens, Mim Jambrecina
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Table 1: Taxonomic groups surveyed and personnel

Group	Common name	Expert	Affiliation
Reptilia and Amphibia	Reptiles and Frogs	Stephen Richards, Jared Archibald	Museum and Art Gallery of the Northern Territory
		Stephen Zozaya	Consultant
Pisces	Fishes	Michael Hammer	Museum and Art Gallery of the Northern Territory
		David Wilson	Consultant (Aquagreen)
Hymenoptera and Stygo fauna	Bees and Groundwater Fauna	Remko Leijs	South Australian Museum
Lepidoptera	Butterflies and Day-flying Moths	Michael Braby	Biodiversity Conservation, DLRM
Heteroptera	True Bugs	Marina Cheng, Gerry Cassis (identification)	University of New South Wales
Odonata	Damselflies and Dragonflies	Stephen Richards	Museum and Art Gallery of the Northern Territory
Araneae, Scorpiones, Pseudoscorpiones and Chilopoda	Spiders, Scorpions, Pseudoscorpions and Centipedes	Mark Harvey	Western Australia Museum
Gastropoda	Terrestrial Snails	Adnan Moussalli	Museum Victoria
Vascular Flora	Vascular Plants	Ian Cowie	NT Herbarium, DLRM
		Sarah Hirst	Territory Wildlife Park
		Diane Napier	Land and Vegetation, DLRM
		Kym Brennan	Biodiversity Conservation, DLRM
		Jo Palmer	Australian National Herbarium
Volunteers/ Field Assistants	-	Angela Marshall, Tracey Bauer, Renae Kaciuba, Kara Edmonds, Jacqui Roberts	BHP Billiton
		Duncan Sadler	Aitken College





Standard survey techniques were used:

- + Intensive visual and audio searches were undertaken for frogs, as well as visual surveys for reptiles. Intensive pitfall trapping and funnel trapping were conducted at three sites. Two of the three trapping sites incorporated two 10 m transects each with a 30 cm high fence, three 20 L buckets and four funnel traps. The third site had one trap line as described above, but on the second trap line buckets were replaced with funnels because the substrate was rock. Trap lines were checked and receptacles emptied every morning.
- + Freshwater turtles were sampled using two aquatic turtle traps for one day in the Turtle Lagoon.
- + Fish were surveyed primarily by backpack electrofishing, supplemented by the use of dip net, cast net, angling and spotlighting at some sites. In deeper pools and billabongs, seine nets, fyke nets, angling and some gillnetting were employed.
- + Bees were collected from flowering plants using hand nets, and were also captured in blue vane flight-interception traps at the campsite.
- + Butterflies and day-flying moths were surveyed by visual observation and collected using sweep and canopy nets. Targeted searches were also undertaken for the presence of early stages (larvae, pupae) on larval food plants. Hilltops were surveyed to exploit the well-known hill-topping mate-location behaviour exhibited by many species of butterflies.
- + True bugs were collected primarily by beating of foliage, supplemented by sweeping of grasses, light traps and searching of leaf litter.
- + Dragonflies and damselflies were captured using large insect nets during intensive searches around all accessible water bodies. Searches during the mornings, evenings and on sunny afternoons covered the different activity patterns of taxa.
- + Other arthropods (e.g. spiders, centipedes, ticks, scorpions) were collected in small pitfall traps filled with propylene glycol, and by excavating burrows, searching under logs, rocks and bark, and sifting through leaf litter. Some specimens were collected while beating and sweeping vegetation for insects. A few specimens were collected at night, using head torches or UV light.
- + Land snails were sampled by searching logs and rock crevices. Samples of leaf litter were collected and searched for microscopic snails. Both post-mortem shells and live specimens were collected.
- + Aquatic crustaceans were sampled by the Bou-Rouch method, which involves embedding a perforated steel pipe into alluvial sediments of creeks, rivers or springs followed by filtering about 100 L of water from 0.5-1 m below the surface and analysing the filtrate. Kitchen strainers with long handles were also used to take samples from springs. Sites were selected primarily based on access to groundwater via springs and alluvial sediments (for stygofauna), and access to surface water such as waterholes and streams (for surface crustaceans).
- + Vascular plants were sampled using standard methodologies for vegetation assessment and flora sampling in the Northern Territory. Emphasis was placed on collecting under-sampled flora of the region. Several pre-determined sites were selected along



transects intersecting different vegetation patterns, topography and geology types. Further collecting was done along transects between sites. A quadrat-based method was used to sample one to two sites per day for full floristic and structural information, to better document the floristic variation across Wongalara Sanctuary.

Incidental records were obtained for birds and mammals. Voucher specimens of all other groups were retained for further study and examination. Tissue for DNA analysis was obtained from representative samples of vertebrates, dragonflies and damselflies, butterflies and snails, as well as from some true bugs.

Collections were identified using available literature and the holdings of museums and herbaria. Fauna specimens were lodged with the Museum and Art Gallery of the Northern Territory, apart from true bugs, which were lodged with the University of New South Wales, and arachnids, which were lodged with the Western Australian Museum. Plant specimens were lodged with the Northern Territory Herbarium.

Final species lists were compiled by combining the results of this Bush Blitz, museum and herbarium collections, the Australian Natural Heritage Assessment Tool, Northern Territory Biodiversity Conservation Invertebrate Database and University of New South Wales Heteroptera Database.



Michael Hammer preparing fish specimens, M. Jambrecina © Copyright, Department of the Environment



Helicopter pilot Matt Wright wrangles a Bull Shark (*Carcharhinus leucas*), R. Kaciuba © Copyright, BHP Billiton





Results

The locational data of collected and observed specimens are available to reserve managers. A total of 878 species were added to those known from the reserve and 27 putative species new to science were discovered—these await assessment.

Species Lists

Appendix A provides updated species lists for the reserve. Names in **bold brown text** are putative new species. Species marked with an asterisk (*) have not been previously recorded. Those without an asterisk have been recorded previously and identified again during this survey. Species shown in **blue text** were not recorded on this survey, but are known from previous records for the reserve. Table 2 provides a summary of the number of new flora and fauna records and putative new species for the reserve.

Some specimens collected during this Bush Blitz have been identified only to family or genus level. This is because a great deal of time is required to examine and identify to species level the many collections that are generated. In the majority of cases, microscopic examination of the material is necessary. Additional limitations include the lack of experts working on particular groups, and that the taxonomic literature for some groups is not current. Further study will be conducted on these collections.

Nomenclature and taxonomic concepts used in this report are consistent with the Australian Faunal Directory, the Australian Plant Name Index and the Australian Plant Census.



Amegilla (Zonamegilla) n. sp. 'karlba', a species of blue banded bee that has been described but whose description is yet to be published, M. Braby © Copyright, Department of Land Resource Management



Helicopter pilot Matt Wright and Jared Archibald digging up spiders © Copyright, S. Zozaya



Table 2: Summary of flora and fauna records and putative new species

Group	Common name	Total number of species	Species new to reserve	Putative new species
Mammalia	Mammals	32	0	0
Aves	Birds	151	0	0
Reptilia	Reptiles	68	1	0
Amphibia	Frogs and Toads	18	0	0
Pisces	Fishes	27	25	0
Hymenoptera	Bees	39	39	0
Lepidoptera	Butterflies and Moths	59	59	0
Heteroptera	True Bugs	85	85	5
Odonata	Damselflies and Dragonflies	25	25	0
Chilopoda	Centipedes	8	8	0
Chelicerata	Mites and Ticks	5	5	0
Scorpiones	Scorpions	2	2	0
Palpigradi	Microwhip Scorpions	1	1	1
Pseudoscorpiones	Pseudoscorpions	10	10	5
Araneae	Spiders	67	67	10
Crustacea	Crustaceans	3	3	3
Gastropoda	Snails	12	12	3
Bivalvia	Mussels	1	1	0
Magnoliophyta	Flowering Plants	551	525	0
Ferns	Ferns	7	7	0
Fern Allies	Fern Allies	1	1	0
Chlorophyta	Green Algae	1	1	0
Marchantiophyta	Liverworts	1	1	0
Totals		1,174	878	27





Threatened Species

Appendix B itemises the species known from the reserve that are listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the Northern Territory's *Territory Parks and Wildlife Conservation Act 2000* (TPWC Act) or the Northern Territory's *Fisheries Act 1988*. A summary of threatened species identified during the study is provided in Table 3.

Table 3: Summary of threatened species identified

Group	Total number of species	Species new to reserve
Fauna	2	1
Flora	0	0

Exotic and Pest Species

Appendix C lists the exotic and pest species known from the reserve. A summary of exotic and pest species identified during the study is provided in Table 4.

An exotic species is one that occurs outside its normal range. A pest is a species that has the potential to have a negative environmental, social or economic impact. Native species that are at times pests or are exotic to this region of Australia are included in the numbers in Table 4.

Table 4: Summary of exotic and pest species identified

Group	Total number of species	Species new to reserve
Fauna	22	15
Flora	15	15



Discussion

Putative New Species

A putative species new to science is one that has been recognised by an expert as never having been named or described in the scientific literature. It is confirmed as a new species once it is named and its description is published. In addition to species that are considered new to science, specimens collected during this Bush Blitz include taxa that are already known from museum and herbarium collections but that have not yet been formally described and named. A breakdown of the groups in which putative new species have been recorded is provided in Table 5.



Rayieria n. sp. BBWON12/HET/Msp024, one of five putative new species of true bug identified at Wongalara Sanctuary
© Copyright, University of New South Wales

Table 5: Putative new species by group

Group	Common name	Number of possible new species
Heteroptera	True Bugs	5
Palpigradi	Microwhip Scorpions	1
Pseudoscorpiones	Pseudoscorpions	5
Araneae	Spiders	10
Crustacea	Crustaceans	3
Gastropoda	Snails	3
Total		27

Invertebrate Fauna

True Bugs

Five putative new true bug species have been identified from this survey. Three are from the family Miridae, two of which are from the tribe Orthotylini. Another Orthotylini species (*Orthotylini* n. sp. BBWON12/HET/Msp029 BBFR12/HET/Msp147), first identified from the Fish River Station Bush Blitz survey, was also recorded.

Arachnids

At least 16 putative new arachnid species were collected: one microwhip scorpion, five pseudoscorpions and ten spiders. More new species may be among the specimens collected. There is insufficient expertise available and few published descriptions to allow positive identification of most specimens. In addition, many of the specimens collected were juveniles, and adults are needed to confirm the identity of the species.

Crustaceans

Three new stygofauna species (two crustaceans from the family Bathynellidae and one from the order Isopoda) were discovered in the hyporheic zone of creeks at three separate locations on Wongalara Sanctuary. These are the first records of stygofauna from the Top End. Stygofauna are usually extreme short-range endemics, and the specimens collected are without doubt undescribed species, and likely to belong to undescribed genera.





Snails

Three new snail species from the family Camaenidae were identified. Australia's leading experts, Dr Frank Koehler (Australian Museum) and Dr John Stanisc (Queensland Museum), tentatively place all three species in the genus *Torresitrachia*. The discovery of three new species within a week indicates the potential for high snail diversity in the region.

Flora

A recently discovered species of mulla mulla (*Ptilotus* n. sp. Fish River) was recorded on Wongalara Sanctuary. It is a putative new species first identified during the Bush Blitz survey at Fish River Station. Several obvious features separate it from similar, well-known species. On the basis of the known collections it occurs on both Fish River Station and Wongalara Sanctuary, where it was uncommon but not rare. This species is likely to be more widespread than current records indicate, and it has probably been collected before and confused with other taxa. Most specimens of similar taxa from the Northern Territory Herbarium are on loan interstate and have not yet been examined.



Torresitrachia n. sp. B, one of three putative new snail species identified at Wongalara Sanctuary, A. Moussalli © Copyright, Museum Victoria

Threatened Species

Australia is home to an estimated 570,000 species, most of which are yet to be described formally. Approximately 92% of Australian plants, 87% of mammals, 93% of reptiles and 45% of birds are endemic. Changes to the landscape and native habitat resulting from human activity have put many of these unique species at risk. Over the last two hundred years, many species have become extinct; many others are threatened.⁴

Vertebrate Fauna

The Mertens' Water Monitor (*Varanus mertensi*) was the only threatened terrestrial vertebrate species observed; however several others are known to occur on the reserve.⁵ The semi-aquatic Mertens' Water Monitor is listed as vulnerable under the TPWC Act. The arrival of Cane Toads (*Rhinella marina*) in the Daly Basin has caused monitor populations to decline, as the species is highly susceptible to Cane Toad toxin.⁶ Cane Toads can also deplete the prey eaten by monitors, especially foods eaten by juvenile monitors.⁷

- 4 Chapman, A. D. 2009, *Numbers of Living Species in Australia and the World*, 2nd edn. Australian Biological Resources Study, Canberra, 80 pp.
- 5 Mahney, T., Young, S., Brennan, K., Fegan, M., Ansell, S., Daly, D., Daly, J. & Long, J. 2011, 'Fish River Station Wildlife Survey 2011', Unpublished Report by Department of Natural Resources, Environment, the Arts and Sport. Northern Territory Government, Darwin.
- 6 Smith, J. G. & Phillips, B. L. 2006, 'Toxic tucker: the potential impact of cane toads on Australian reptiles', *Pacific Conservation Biology* **12**: 40–49.
- 7 Parks and Wildlife Commission of the Northern Territory, Threatened Species, Mertens Water Monitor (*Varanus mertensi*), <http://lrm.nt.gov.au/__data/assets/pdf_file/0018/10881/varanus_mertensi_vu.pdf>, accessed 11 December 2014.



A semi-aquatic Mertens' Water Monitor (*Varanus mertensi*), listed as vulnerable under the TPWC Act, basking in the sun © Copyright, S. Zozaya

Although none were caught, evidence was found of the Freshwater Sawfish (*Pristis pristis*). A series of teeth-like wounds in a straight line along the side of a Blue Catfish (*Neoarius graeffei*) was consistent with the strike mark from the rostrum of a juvenile Freshwater Sawfish. Anecdotal evidence from traditional owners upstream of Wongalara Sanctuary supports this observation.⁸ Further sampling using large mesh gill nets is needed to

⁸ Wilson, D. & Brooks, S. 2004, 'Environmental Impact Statement for the proposed Trans Territory Underground Gas Pipeline: Aquatic Fauna Study, Document Number 77606-700-024', prepared for: Alcan Engineering Pty. Ltd. EcoZ Environmental Services, Darwin.

confirm the record and assess the local population dynamics. The Freshwater Sawfish is listed as vulnerable under the Commonwealth EPBC Act and the *Fisheries Act 1988* of the Northern Territory.

Invertebrate Fauna

No invertebrate species listed under the EPBC or TPWC Acts were recorded. The IUCN has assessed the global conservation status of a number of damselfly and dragonfly species recorded at Wongalara Sanctuary, but none were rated higher than the category of 'least concern'. Some of the arachnids collected on Wongalara Sanctuary are relatively widespread, but there are many small,





new or unnamed species that are likely to have restricted ranges and these could be threatened. Two of the new snails appear to be locally restricted and/or habitat specific; further survey work is needed to determine their distribution and conservation status.

Flora

No threatened plants were recorded; however 22 species of conservation significance⁹ were identified. Table 6 lists the plants of conservation significance recorded at Wongalara Sanctuary. The wider region has been insufficiently surveyed to establish the distribution, abundance and threats to many of the rarer taxa. The region is dominated by relatively intact native vegetation, and threats have been relatively subtle (for example, grazing by introduced herbivores and changed fire regimes), but often operating at a landscape scale.

Apart from those newly discovered, the rarest species of conservation significance recorded were *Goodenia argillacea* (known from the type 1 site on nearby Mainoru before the survey); *Heliotropium geocharis*, 2 NT sites; *Spermacoce gibba*, 2 NT sites; *Stylidium tenerum*, 3 NT sites; and *Schizachyrium occultum*, 4 NT sites. A fourth NT population of *Xanthostemon umbrosus* was recorded during the survey. The species also occurs in sheltered sandstone gorges in Arnhem Land, near the Victoria River and on Goote Eylandt. While rare

and with a small area of occupancy, its habitat is secure and it is not considered threatened. Its status, however, will need to be reassessed in light of Myrtle Rust (*Puccinia psidii*), a pathogen of Myrtaceae sweeping through related species in eastern Australia.

The increased knowledge of the distribution and abundance of species collected during the survey will be used to reassess their conservation status at the next (2014–15) five yearly review of listings under the TPWC Act. For some species, it is likely that sufficient information has been gathered during this survey to result in a change of conservation category. All Northern Territory plants are assessed against IUCN criteria. This relies on having a solid taxonomic foundation. In many cases, species are Data Deficient because taxonomic research is needed to clarify species concepts or because specimen records have not been curated to species or infraspecific level. 'Not Evaluated' species have not been assessed against IUCN criteria because they have been discovered or recognised only since the last formal assessment period. In the past, some species were assigned to this category because of unresolved taxonomic problems. This Bush Blitz survey and related taxonomic research supported by Bush Blitz will contribute significant information for IUCN assessments.

⁹ Species of conservation significance are those in the IUCN categories Data Deficient, Not Evaluated and Near Threatened.



Table 6: Plant species of conservation significance recorded on Wongalara Sanctuary

Family	Species	NT IUCN category	Latitude (decimal degrees)	Longitude (decimal degrees)	Locality	No. NT localities
Araliaceae	<i>Trachymene microcephala</i> *	LC	-14.268	134.625	Strangman Range, c. 22 km south-east of Wongalara homestead	63
			-14.2571	134.6242	Wongalara	
Asteraceae	<i>Vittadinia spechtii</i> *	LC	-14.2598	134.2896	South-east of Wongalara homestead	17
Boraginaceae	<i>Heliotropium geocharis</i> *	DD	-14.1714	134.6003	South-east of Wongalara homestead	2
	<i>Heliotropium leptaleum</i> *	LC	-14.2582	134.3597	Wongalara	10
Byblidaceae	<i>Byblis aquatica</i> *	NT	-14.2531	134.3566	Wongalara	20
Casuarinaceae	<i>Casuarina cunninghamiana</i> subsp. <i>miodon</i> *	LC	-14.0239	134.2944	Mainoru River floodplain, c. 25 km north-west of Wongalara homestead	66
Cyperaceae	<i>Cyperus oxycarpus</i> *	LC	-14.0109	134.2929	Mainoru River floodplain, c. 25 km north-west of Wongalara homestead	13
	<i>Cyperus viscidulus</i> *	DD	-14.1324	134.3433	Echo Gorge	11
Droseraceae	<i>Drosera darwinensis</i> *	LC	-14.188	134.1831	Wongalara	37
Fabaceae	<i>Tephrosia humifusa</i> *	NT	-14.1338	134.249	Wongalara	8
Goodeniaceae	<i>Goodenia argillacea</i> *	DD	-14.0139	134.2937	Mainoru River floodplain, c. 25 km north-west of Wangalara homestead	1
		DD	-14.1891	134.4628	Wilton River floodplain, c. 5 km south of Wongalara homestead	
		DD	-14.2551	134.4809	Wongalara	6





Family	Species	NT IUCN category	Latitude (decimal degrees)	Longitude (decimal degrees)	Locality	No. NT localities
Malvaceae	<i>Hibiscus setulosus</i> *	DD	-14.2464	134.1415	Wongalara	13
		DD	-14.2422	134.1319	Lost City formation, south-west of Wongalara homestead near Jalboi River	
Moraceae	<i>Fatoua villosa</i> *	NT	-14.1751	134.5998	South-east of Wongalara homestead	17
Phyllanthaceae	<i>Phyllanthus arnhemicus</i> *	LC	-14.1325	134.2515	Wongalara	31
	<i>Sauropus hubbardii</i> *	NT	-14.0139	134.2937	Mainoru River floodplain, c. 25 km north-west of Wongalara homestead	28
Poaceae	<i>Cenchrus elymoides</i> *	DD	-14.2558	134.4824	Wongalara	7
	<i>Cymbopogon dependens</i> *	LC	-14.2422	134.1319	Lost City formation, south-west of Wongalara homestead near Jalboi River	42
	<i>Ectrosia confusa</i> *	LC	-14.2747	134.5061	South-south east of Wongalara homestead, near Wilton River	30
		LC	-14.1989	134.3672	NW of Wongalara homestead	
	<i>Schizachyrium occultum</i> *	DD	-14.0085	134.2917	Mainoru River floodplain, c. 25 km north-west of Wongalara homestead	4
Rubiaceae	<i>Spermacoce gibba</i> *	DD	-14.2377	134.0286	Wongalara	2
Stylidiaceae	<i>Stylidium tenerum</i> *	DD	-14.132	134.3429	Wongalara	3

* new record for this reserve

LC = Least Concern

DD= Data Deficient

NT = Near Threatened



Exotic and Pest Species

The NRS conserves and protects Australia's rare and threatened ecosystems, and provides a refuge for species at risk. Invasive species can have a major impact on already vulnerable species and ecosystems, as well as economic, environmental and social impacts. Exotic and pest species records are provided in this report to assist land managers with their pest management programs.

Vertebrate Fauna

European Cattle (*Bos taurus*), Water Buffalo (*Bubalus bubalis*), Donkey (*Equus asinus*), Horse (*Equus caballus*) and Pig (*Sus scrofa*) were seen throughout the reserve. A Cat (*Felis catus*) was observed on the main access road, and Cane Toads (*Rhinella marina*) were seen at many permanent water bodies (Table 7).

A significant attribute of Wongalara Sanctuary is the lack of introduced fishes. Potential invaders that are already problem species in tropical Queensland and southern New Guinea include Tilapia (*Oreochromis mossambica*), Spotted Tilapia (*Tilapia mariae*), Climbing Perch (*Anabas testudineus*) and Snakehead (*Channa argus*).

Invertebrate Fauna

Thirteen pest species of true bug were identified in low abundances; all are Australian natives that can become problematic under certain conditions. Brown Bean Bug (*Melanacanthus scutellaris*), Green Vegetable Bug (*Nezara viridula*) and Bean Pod-sucking Bug (*Riptortus linearis*) are known to damage agricultural crops.¹⁰ Coon Bug (*Oxycarenus arctatus*) and Seed Eating Bug



Donkeys (*Equus asinus*) were commonly seen, J. Roberts © Copyright, BHP Billiton





Table 7: Pest vertebrate species recorded during the survey

Species	Locations observed	Indication of abundance
Cane Toad	Echo Gorge and several billabongs	Very common
European Cattle	Observed occasionally at various sites in the reserve	Seen regularly
Water Buffalo	Observed throughout lower areas of the reserve	Damage evident at many sites, seen often from the helicopter
Pig	Observed throughout the reserve	Damage evident at most sites
Donkey	Several herds seen	Appear to be common
Horse	Observed around Wongalara homestead	Not common
Cat	Several seen on the main road	Seen infrequently

(*Graptostethus servus*) can form large swarms in rural areas and in Darwin. Although they do not threaten fruit trees and vegetables, they cause indirect damage and are a nuisance.¹¹

Several specimens of the introduced Tailed Daddy Longlegs spider (*Crossopriza lyoni*) and Adanson's House Jumper (*Hasarius adansonii*) were collected. Both species appear to be dependent on human modifications such as buildings and do not appear to move into the surrounding bush.¹²

10 Podsucking bugs, Qld Department of Agriculture Fisheries and Forestry, <<https://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/pod-sucking-bugs>>, accessed 9 February 2015.

11 Factsheet ENT7: Swarming bugs (family Lygaeidae), NT Department of Regional Development, Primary Industry, Fisheries and Resources, <http://www.nt.gov.au/d/Content/File/p/Garden/ENT-7_Swarming_bugs_May_2009.pdf>, accessed 9 February 2015.

12 Waldock, J. pers. comm., 18 September 2012.

Flora

Four noxious weeds that are gazetted under the *Weeds Management Act 2001* (NT) were recorded (Table 8). Eleven non-gazetted weeds were also identified (Table 9). Of the gazetted species, Mint Bush (*Hyptis suaveolens*), Spinyhead Sida (*Sida acuta*) and Flannel Weed (*S. cordifolia*) are all fairly common and widespread in the Top End. Mint Bush was widespread and abundant on some of the creek flats and sandy country at Wongalara Sanctuary. Grazing by cattle and buffalo has probably increased its spread. The two *Sida* species were most abundant near Wongalara homestead and not observed to be common elsewhere.

One population of Jamaica Snakeweed (*Stachytarpheta jamaicensis*) was found beside a creek and the plants were removed. From this location there is considerable potential for the species to be dispersed down-stream, particularly if more plants establish and reproduce. The site needs to be monitored regularly and plants removed before they seed.



While the AWC has so far been successful in limiting incursions of Grader Grass (*Themeda quadrivalvis*), it is likely to be an ongoing issue due to large infestations on the adjacent Mainoru Station, the most extensive infestations seen by

herbarium staff in the Northern Territory. There is also an issue with the reliable identification of Grader Grass as it looks very similar to the native Christmas Grass (*Themeda arguens*); the two species are often confused.

Table 8: NT gazetted weeds documented on Wongalara Sanctuary

Family	Species	Latitude (decimal degrees)	Longitude (decimal degrees)	Indication of abundance
Lamiaceae	<i>Hyptis suaveolens</i>	-14.14042	134.47467	Widespread, usually scattered, sometimes abundant
Malvaceae	<i>Sida acuta</i>	-14.14042	134.47467	Locally common, sometimes abundant
	<i>Sida cordifolia</i>	-14.14042	134.47467	Locally common, sometimes abundant
Verbenaceae	<i>Stachytarpheta jamaicensis</i>	-14.1454	134.22783	All six plants seen were removed

Table 9: Non-gazetted weeds documented on Wongalara Sanctuary

Family	Species	Latitude (decimal degrees)	Longitude (decimal degrees)	Indication of abundance
Asteraceae	<i>Emilia sonchifolia</i> var. <i>sonchifolia</i>	-14.14173	134.47252	Locally common
Fabaceae	<i>Alysicarpus ovalifolius</i>	-14.19103	134.61372	Locally common, sometimes abundant
	<i>Chamaecrista rotundifolia</i>	-14.17862	134.23976	Common near the homestead; apparently spreading elsewhere
	<i>Stylosanthes hamata</i>	-14.01622	134.29338	Widespread, usually scattered
	<i>Stylosanthes humilis</i>	-14.00802	134.29123	Widespread, usually scattered
	<i>Stylosanthes viscosa</i>	-14.02913	134.29514	Widespread, usually scattered
Passifloraceae	<i>Passiflora foetida</i>	-14.14042	134.47467	Widespread, usually scattered, sometimes abundant
Poaceae	<i>Bothriochloa pertusa</i>	-14.13993	134.47527	Locally common, sometimes abundant
	<i>Digitaria bicornis</i>	-14.14507	134.47638	Locally common, sometimes abundant
	<i>Echinochloa colona</i>	-14.1732	134.60054	Locally common, sometimes abundant
Verbenaceae	<i>Duranta erecta</i>	-14.14034	134.47467	Planted near the Wongalara homestead





Other Points of Interest

Vertebrate Fauna

Reptiles and Amphibians

Wongalara Sanctuary protects a diverse assemblage of amphibians and reptiles that are typical of the tropical wet-dry climate of the Top End.

Only 50 native species (12 frogs and 38 reptiles) were documented during this survey, reflecting the cool and dry conditions that prevailed. At least one species, the Phasmid Striped Gecko (*Strophurus taeniatus*), was recorded on the reserve for the first time. While the Saltwater (Estuarine) Crocodile (*Crocodylus porosus*) was not listed previously for Wongalara Sanctuary, this was presumably an accidental omission, because the species was common in larger water-bodies.

Knowledge of the herpetofauna of Wongalara Sanctuary has accumulated over a number of years through observations by staff and researchers. A series of biological studies by the AWC increased the inventory to 82 species (18 frogs and 64 reptiles).¹³ This Bush Blitz survey brings the number of amphibians and reptiles known from Wongalara Sanctuary to at least 86. Although an excellent species list has been generated, the diversity of frogs is probably underestimated due to the difficulty of accessing much of the reserve during the wet season when frog activity is greatest. Additional surveys during warmer and wetter conditions are likely to add a number of frog and possibly several reptiles to the inventory.

¹³ AWC, unpublished data.



Copland's Rock Frog (*Litoria coplandi*) is known to be a species complex containing undescribed cryptic species. DNA analysis is needed to resolve the status of this species © Copyright, S. Zozaya

A large gecko (*Gehyra* sp.) collected on exposed rock faces during the survey is currently under study at the Museum and Art Gallery of the Northern Territory. Taxonomists are investigating its relationships to the Northern Dtella (*G. australis*) and King's Dtella (*G. koira*) to determine whether it is an undescribed species. Several other species documented at Wongalara Sanctuary are known to be complexes that include undescribed cryptic species. These include the Zigzag Velvet Gecko (*Amalosia rhombifer*), Bynoe's Gecko (*Heteronotia binoei*), Marbled Velvet Gecko (*Oedura marmorata*) and Copland's Rock Frog (*Litoria coplandi*). DNA analysis is needed to resolve the status of these species. The large freshwater turtle *Elseya* sp. was extremely abundant in the lagoons and rivers. This unnamed species has been known for many years, but awaits adequate study and formal description.



The survey generated an important collection of DNA samples from a poorly collected region, which will contribute to taxonomic studies on several frog and reptile groups. There has been inadequate study of the taxonomy and relationships of many Northern Territory herpetofauna; molecular techniques are demonstrating that many well-known species in the Top End are composites of cryptic taxa. Combining molecular techniques with traditional taxonomic studies will enable researchers to describe these new species. Bush Blitz surveys provide an opportunity to obtain DNA samples needed for these studies.

Fishes

Wongalara Sanctuary has diverse fish habitats mostly in good condition. A large number of sites (28) were surveyed, recording 27 species. Interesting records include a freshwater sole (*Brachirus* sp.), the rare Gulf Grunter (*Scortum ogilbyi*), and Bull Sharks (*Carcharhinus leucas*) well inland, and larger recreationally and culturally important species such as Barramundi (*Lates calcarifer*), Sooty Grunter (*Hephaestus fuliginosus*), fork-tailed catfishes (Ariidae) and eel-tailed catfishes (Plotosidae). Although all records obtained during this survey are new for the reserve, the taxa had all been previously recorded for the Roper River system.¹⁴



Sooty Grunter (*Hephaestus fuliginosus*) is a recreationally and culturally important species, M. Hammer © Copyright, Museum and Art Gallery of the Northern Territory



The Northern Purplespotted Gudgeon (*Mogurnda mogurnda*) is a known species complex across northern Australia and showed variation in appearance across the reserve, M. Hammer © Copyright, Museum and Art Gallery of the Northern Territory

Genetic samples and voucher specimens were collected from 24 species found during the survey. These will be used for future systematic reviews of northern Australian fishes, a group that looks set for substantial changes. Fish diversity is high in the tropical north and more research is needed.¹⁵ New taxa continue to be recorded from remote regions of Australia, and recent research using genetic techniques suggests that the number of species actually present is likely to be two to three times more than currently recognised.¹⁶

14 Northern Australian Freshwater Fish Project (National Centre for Tropical Wetland Research & Australian Rivers Institute, unpublished data); Museum and Art Gallery of the Northern Territory records; Wilson, D. & Brooks, S. 2004, 'Environmental Impact Statement for the proposed Trans Territory Underground Gas Pipeline: Aquatic Fauna Study, Document Number 77606-700-024', prepared for: Alcan Engineering Pty. Ltd. EcOZ Environmental Services, Darwin.

15 Unmack, P. J. 2001, 'Biogeography of Australian freshwater fishes', *Journal of Biogeography* **28**: 1053–1089; Allen, G. R., Midgley, S. H. & Allen, M. 2002, *Field Guide to the Freshwater Fishes of Australia*, Western Australian Museum: Perth.

16 Hammer, M. P., Adams, M. & Hughes, J. H. 2013, 'Evolutionary Processes and Biodiversity', in *Ecology of Australian Freshwater Fishes*, eds Humphries, P. & Walker, K., CSIRO Press, Melbourne.





Quite a number of obligate freshwater fishes need review based on the presence of likely cryptic taxa identified using genetic techniques (for example, catfishes (Ariidae and Plotosidae), glassfishes (*Ambassis* spp.) and Mouth Almighty (*Glossamia aprion*)).

While there were no obviously new taxa observed on Wongalara Sanctuary, possible discoveries include new forms of Northern Purplespotted Gudgeon (*Mogurnda mogurnda*), glassfish (*Ambassis* sp.) and sole (*Brachirus* sp.). The Northern Purplespotted Gudgeon specimens showed variation in appearance across Wongalara Sanctuary.¹⁷ Specimens of glassfish (previously known as *Ambassis muelleri* and now a distinctive species left without a name) collected during the survey have a mix of characters from both *A. sp. 'muelleri'* and Sailfin Glassfish (*A. agrammus*). Further morphological and molecular work across northern Australia is needed to determine how the Wongalara specimens relate to these species.

The sole specimens collected could also be a variation. Only one species of sole, the Freshwater Sole (*Brachirus selheimi*), has been recorded previously for the Roper River system. Specimens obtained during the Wongalara Sanctuary survey have characters intermediate with those used to identify Saltpan Sole (*Brachirus salinarum*). The number of caudal rays and the shape of the caudal fin are more consistent with Saltpan Sole. Additional voucher and tissue samples are needed to confirm the taxonomic status of the Wongalara specimen (listed as *Brachirus* sp. for now).

17 Hammer, M. P., Adams, M. & Hughes, J. H. 2013, 'Evolutionary Processes and Biodiversity', in *Ecology of Australian Freshwater Fishes*, eds Humphries, P. & Walker, K., CSIRO Press, Melbourne.

The species list for fish now covers all major habitats and detailed spatial coverage of the reserve. Previous surveys included a handful of sites outside of the reserve, mostly upstream on adjoining properties sampled as part of the Northern Australian Freshwater Fish Project¹⁸ and a pipe-line survey.¹⁹ Replicated and increased sampling effort in the larger waterholes and billabongs, particularly during the 'build-up' season is recommended. Review of survey data for adjoining properties suggests that at least five other species may occur on Wongalara Sanctuary: Northern Saratoga (*Scleropages jardinii*), Freshwater Anchovy (*Thryssa scratchleyi*), Highfin Catfish (*Neoarius berneyi*), Boofhead Catfish (*Sciades leptaspis*) and Toothless Catfish (*Anodontiglanis dahli*).

The large Wilton River, which virtually bisects the reserve, has high conservation value. Management of water resources upstream will affect conservation of fishes within the reserve. A variety of floodplain wetlands and different types of streams, including areas isolated above waterfalls, are significant habitats and priorities for management. Localised control of vertebrate pests will improve the value of aquatic refuges. Vigilance and proactive management to keep Wongalara Sanctuary free from introduced fishes is highly recommended.

18 National Centre for Tropical Wetland Research & Australian Rivers Institute, unpublished data.

19 Wilson, D. & Brooks, S. 2004, 'Environmental Impact Statement for the proposed Trans Territory Underground Gas Pipeline: Aquatic Fauna Study, Document Number 77606-700-024', prepared for: Alcan Engineering Pty. Ltd. EcOZ Environmental Services, Darwin.



Invertebrate Fauna

The terrestrial invertebrate fauna of inland Australia is estimated to comprise at least 250,000 species.²⁰ Research on Australian invertebrates has increased significantly over the last 20 years, but it is estimated that less than 15% of species have been formally described. In general, about a third of the species collected in any area are found to be new to science, a large number of which are short range endemic (SRE) taxa. These taxa are defined²¹ as species that have naturally small distributions of less than 10,000 km² because they are poor dispersers, have relatively low reproductive rates and are conservative in their ecological requirements. These attributes make them extremely susceptible to habitat change, including fragmentation.

Bees

Thirty-nine species of native bees from four families were collected. These included species adapted to moist monsoon forest conditions, such as certain species of *Amegilla* (*Asaropoda*) and *Xylocopa* (*Koptortosoma*), and those adapted to very dry conditions. Four species of blue-banded bee (*Amegilla* spp.) were common, but particularly abundant were leafcutter and resin bees (family Megachilidae).

Eleven native bee species were identified using recent taxonomic revisions, all of which occur within their known geographical ranges. One specimen is close to *Chrysocolletes houstoni*, which is known from only two localities near Broome in Western Australia. Comparison with the type specimen is necessary to confirm its identity. *Thyreus* cf. *caeruleopunctatus* was identified provisionally using Padil-pollinators, which hosts diagnostic images of a large number of Australian native pollinators.²² Using identification keys provided with taxonomic revisions does not always result in positive identification of specimens. For unambiguous identification, comparing type specimens in museum collections is necessary.

The bees were collected from only nine species of flowering plants. Sixteen bee species were collected on *Jacksonia dilatata* and *J. odontoclada* (Fabaceae), while 13 were collected on *Waltheria indica* (Malvaceae). A significant number of native bee species was also collected from an introduced shrub (*Duranta erecta*) planted near the Wongalara homestead. This produces numerous flowers year round, and although it is a weed it is also an important resource for at least 12 species of native bees, particularly four species of blue-banded bees (*Amegilla* spp.). Several species of *Calytrix* were flowering throughout the reserve: surprisingly, only low numbers of bees were seen on these, as *Calytrix* is a popular resource for native bees at other locations.

20 Yeates, D. K., Harvey, M. S. & Austin, A. D. 2004, 'New estimates for terrestrial arthropod species-richness in Australia', *Records of the South Australian Museum*, Monograph Series 7: 231–241.

21 Harvey, M. S. 2002, 'Short-range endemism in the Australian fauna: some examples from non-marine environments', *Invertebrate Systematics* 16: 555–570.

22 Australian Pollinators <<http://www.padil.gov.au/pollinators/About#>>, accessed 11 December 2014.





Butterflies collected at Wongalara Sanctuary, M. Braby
© Copyright, Department of Land Resource Management

Butterflies and Moths

Wongalara Sanctuary has a moderate diversity of butterflies and diurnal moths, with 59 species (52 butterflies, 7 diurnal moths) recorded, 12 of which (2 species, 10 subspecies) are endemic to the Top End and/or north-western Australia. Most of the species expected to be present in the mid-dry season were recorded. A number of species normally active during the wet season may have been missed. The reserve is in a lower rainfall zone of the Top End and is expected to support a lower diversity of butterflies and diurnal moths, but its faunal composition is difficult to predict given the lack of detailed records for this region. Prior to the survey, there were no spatial records for butterflies and diurnal moths within 100 km of the reserve.

None of the butterflies or diurnal moths recorded are endemic to Wongalara Station; however five taxa (two species and three subspecies) are endemic to the Top End-western Gulf Country (Table 10). Of the three endemic subspecies, one belongs to a species that is (within Australia) restricted to the region. A further seven subspecies are endemic to north-western Australia. The remainder occur more widely across the monsoon tropics of northern Australia and/or the eastern coast of Australia.

Wongalara Sanctuary supports an interesting and unusual mix of species associated with different bioregions. The reserve supports several taxa (*Elodina padusa*, *Eurema smilax*, *Candalides delospila*) normally associated with the drier semi-arid areas of the monsoon tropics, as well as a sandstone specialist (*Candalides geminus* subsp. Arnhem Land) previously known no farther east than western Arnhem Land. There are also species (*Dysphania numana*, *Telicota augias krefftii*, *Euploea sylvester pelor*, *Hypolimnas alimena darwinensis*, *Deudorix smilis dalyensis*) restricted to moist patches of monsoon vine thicket/forest along deeply dissected gorges. This mix of species is unusual, and Wongalara is the only location known in the Northern Territory where *Candalides delospila*, *C. geminus* subsp. Arnhem Land and *C. erinus erinus* co-occur.

Several substantial range extensions were documented. Notable amongst these are two lycaenid butterflies, *Candalides geminus* and *Deudorix smilis dalyensis*, for which Wongalara effectively doubles their previously known extent of occurrence,²³ and the striking day-flying moth *Comocrus behri*, a species which appears to be

²³ Braby, M. F. 2000, *Butterflies of Australia. Their Identification, Biology and Distribution*, CSIRO Publishing: Collingwood, Melbourne.



rare and seasonal in the Northern Territory.²⁴ The hesperiid *Hesperilla crypsigramma*, although not recorded at Wongalara, was recorded nearby on the Mainoru Road, and this location represents a significant south-eastern range extension. The zygaenid *Hestiochora xanthocoma*, a small and very beautiful day-flying moth, represents a noteworthy record, previously having been recorded from only five locations in the Northern Territory. The population of *H. xanthocoma* in the Northern Territory possibly represents a species distinct from the population at the type location in south-eastern Queensland.²⁵

Fire appeared to be threatening some key breeding habitats, most notably sandstone plateaus on hilltops near the southern and western boundaries of Wongalara Sanctuary. These habitats were found to support a number of ecological specialists (*Proeidosia polysema* subsp. large spots, *Candalides geminus* subsp. Arnhem Land, *C. delospila*, *Hestiochora xanthocoma*). At these sites, fire had penetrated the sandstone plateaus of hilltops supporting low open woodland with a spinifex understorey, a habitat normally protected from fire by steep sandstone cliffs. These areas would usually be long unburnt, but appeared to be suffering from extensive and frequent burning. It is recommended that fire be excluded from these areas.

24 Braby, M. F. 2011, 'New larval food plant associations for some butterflies and diurnal moths (Lepidoptera) from the Northern Territory and eastern Kimberley, Australia', *The Beagle, Records of the Museums and Art Galleries of the Northern Territory* **27**: 85–105.

25 Tarmann, G. M. 2004, '*Zygaenid Moths of Australia. A Revision of the Australian Zygaenidae (Procrinae: Artonini)*', *Monographs of Australian Lepidoptera. Volume 9*, CSIRO Publishing: Collingwood, Melbourne.

Table 10: Butterflies and day-flying moths endemic to the Top End-western Gulf Country

Butterflies	Day-flying moths
<i>Deudorix smilis* dalyensis</i>	<i>Idalima metasticta</i>
<i>Hypolimnas alimena darwinensis</i>	
<i>Candalides geminus</i> subsp. Arnhem Land	
<i>Nesolycaena urumelia</i>	

* species restricted to the Top End-western Gulf Country region within Australian limits

Table 11: Butterflies and day-flying moths endemic to north-west Australia (Top End to the Kimberley)

Butterflies	Day-flying moths
<i>Hypocysta adiante antirius</i>	<i>Dysphania numana</i> subsp.
<i>Ocybadistes walkeri olivia</i>	
<i>Arhopala eupolis asopus</i>	
<i>Delias argenthona fragalactea</i>	
<i>Candalides margarita gilberti</i>	
<i>Euploea sylvester pelor</i>	

True Bugs

Eighty-five true bug species from 18 families were documented. Of these, 26 species have been positively identified, 53 species require further research (including species thought to be described but for which taxonomic information or keys are unavailable), and six are possibly new species. These include five putative new species and one species first encountered during the Bush Blitz held at Fish River, Northern Territory. True bugs were collected from 51 sites and approximately 31 host plant species were identified. Abundances were low, although family group diversity was high.





This was the second intensive study of true bugs in the Top End, the first being the Fish River Station Bush Blitz (Daly River Basin, approximately 300 km west of Wongalara Sanctuary). The collecting of true bugs has been more extensive across temperate, semi-arid and arid regions of Australia and to a much lesser extent in the tropical north of Queensland and the Gulf Country (near the Gulf of Carpentaria). The tropical vegetation of the Top End includes a distinctive assemblage of plant species, many found only in northern Australia and with which no true bug species have been associated.



Orthotylini n. sp. Stripey BBWON12/HET/Msp031, one of five putative new species of true bug identified at Wongalara Sanctuary
© Copyright, University of New South Wales

Species richness of true bugs was half that compared to the collection from Fish River Station, probably owing to the drier climate of Wongalara Sanctuary. The species composition of collections from Wongalara Sanctuary is quite different from collections from southern Australia. The species richness is spread more evenly across true bug families as a whole in contrast to Bush Blitz collections from other parts of Australia, where species richness is dominated by species belonging to the plant bug family Miridae.

Damselflies and Dragonflies

Wongalara Sanctuary supports a moderate diversity of damselflies and dragonflies (Odonata). A total of 25 species, including seven damselflies and 18 dragonflies, were documented. The fauna was dominated by widespread skimmer (Libellulidae) dragonflies. The relatively low diversity documented reflects the cool, dry conditions that prevailed, which meant that few species were active. The survey also generated an important collection of DNA samples that will contribute to taxonomic studies on several groups. It was a unique opportunity to sample a region that was under-documented but potentially harbouring new and poorly known species. Several records were obtained for poorly known species. The list of odonates for the reserve is preliminary, and additional surveys, particularly in spring and summer, can be expected to increase the inventory substantially.

Populations of the Spotted Grasshawk dragonfly (*Neurothemis oligoneura*) were documented. This species has a mostly New Guinean distribution and has also been recorded from several locations on the northern Cape York Peninsula in Queensland. In the Northern Territory, it was known only from



a single specimen collected in 1976 at Maningrida. Wongalara thus appears to support the second population of this poorly known species in the Northern Territory. The Spotted Grasshawk was encountered infrequently and had a patchy distribution. It was most commonly seen in moist gullies with patches of monsoon vine forest, where at two sites it occurred at moderately high densities (at least 1 individual every 2-3 m). Several individuals were also observed in the vicinity of the Wongalara homestead indicating that the species may occur more widely in savannah habitats; however these individuals may have merely strayed slightly from the nearby Wilton River. The Spotted Grasshawk was not encountered away from streams or moister gullies.

Records of the Bicoloured Skimmer (*Notolibellula bicolor*) and Black-winged Threadtail (*Nososticta baroalba*) are also noteworthy. The former is known from very few locations in northern Australia, but was found at several sites in Wongalara Sanctuary. This attractive blue and red species has an extremely patchy distribution on clear permanent streams in the monsoonal tropics between the Kimberley in Western Australia and northern Queensland. The Wongalara population fills a large gap in its known distribution. It was found in relatively cool, moist forested gullies that drain the escarpments. The Black-winged Threadtail is a tiny and slender black damselfly with smoky patches in the wings. Endemic to the Top End, it is restricted to clear and permanent streams found approximately between Litchfield National Park and Fish River Station in the west and Kakadu National Park in the east. The Wongalara Sanctuary population represents an easterly range extension of approximately 150 km.

Spiders, Pseudoscorpions and Centipedes

Spiders from 27 families were collected, but few specimens of the two target groups, wolf spiders (Lycosidae) and trapdoor spiders (Mygalomorphae) were identified. Very few trapdoor spider burrows were located, which is consistent with a reduced diversity in the monsoonal regions of Australia.²⁶ The orb-weaving spiders (Araneidae) were the most diverse group collected. Most of the specimens remain to be identified beyond family level because there are few specialists available to examine the large number of specimens collected.

For some species only juveniles were caught, but adults are needed for identification. Specimens of Symphytognathidae spiders represent only the second record of this family from the Northern Territory. Similarly, the first specimen from the Northern Territory of a palpigrade scorpion (Order Palpigradi) was collected at Wongalara. A number of centipede (chilopod) species were also documented.



Marbled Scorpion (*Lychas variatus*), M. Harvey
© Copyright, Western Australian Museum

26 Raven, R. J. 1985, 'The spider Infraorder Mygalomorphae (Araneae). Cladistics and Systematics', *Bulletin of the American Museum of Natural History* **182**: 1–180.





Land and Freshwater Molluscs

Ten terrestrial and three freshwater molluscs were documented, all of which are new records for the reserve. Species diversity and abundance was low, probably owing to the lack of topographic relief and a high frequency of fire. The exception was a single site surveyed in the northern region of the reserve that exhibited relatively low fire impact and yielded nine species. It would be beneficial for future research to address the impact of alternative fire regimes on the terrestrial invertebrate fauna, particularly those with low dispersal ability.



Torresitrachia n. sp. C, one of three putative new snail species identified at Wongalara Sanctuary, A. Moussalli © Copyright, Museum Victoria

Very few mollusc surveys have been conducted within southern Arnhem Land. An assessment of museum databases found records for only 22 indigenous species. Accordingly, this survey represents an important contribution to the understanding of terrestrial molluscs within this region.

Groundwater Fauna and Surface Crustaceans

This was the first survey of groundwater fauna (stygo fauna) in the Top End. Expectations of finding specimens were high because of the large number of springs and alluvial sediments along the creeks. In Australia, these habitats normally yield new species, however finding the most productive spots for stygo fauna usually requires more time than was available. Although sampling was attempted at numerous springs and gravel banks along creeks, stygo fauna were found only at three locations. A single specimen of an isopod (suborder Asellota) was also found in a little pool near a spring.

One of the tributaries of the Jalboi River in the western part of the reserve revealed a single specimen of a Bathynellidae and low numbers of other groundwater crustaceans, such as Ostracoda and Copepoda. Two additional visits and pumping of hundreds of litres of water from different depths and positions along the waterhole did not recover additional specimens. Work at another creek bed site, however, exposed a large number of Bathynellid specimens with minimal effort. Bathynellidae are an ancient group of crustaceans that are found only in underground water and occur all over the world. The evolution and biogeography of the group is still not well understood, and the Wongalara findings may help clarify this. The rocks of the area were mainly formed in the Proterozoic eon, some 2.5 billion to 542 million years ago. Some believe that the stygo fauna inhabiting such ancient geologies are relicts; alternatively, they could have migrated from elsewhere. In either case, the groundwater fauna is likely to have been stranded in the subsurface for millions of years.



Flora

This survey represents the first substantial baseline flora survey not just for Wongalara but a substantial area of south-eastern Arnhem Land. Previously, the Northern Territory Rainforest Survey recorded 28 taxa at one site, but specimens were not vouchered. While records on the NT Herbarium database (Holtze) initially showed over 20 accessions from Wongalara, more than half of these were found to be incorrectly geocoded. After correction, six apparently genuine records from Wongalara remained. Opportunistic collecting has occurred along the Central Arnhem Highway over many decades and this has built up a reasonable picture of species occurring along that corridor. Some survey work was undertaken on several adjacent properties to the south of Wongalara in the 2003 wet season and extended the ranges of many species. Extensive surveys of Limmen National Park (70 to 250 km to the south) and of the Arafura Swamp catchment (100 km and more to the north) were undertaken over 2008–2010 and 1998–2000, respectively.²⁷ However, these areas are sufficiently far away not to be useful in predicting the flora of Wongalara. Areas to the north-west of Wongalara Sanctuary, and adjacent in an arc from north-east to south-east, are inaccessible and very under-surveyed.

Approximately 535 plant taxa were collected for the first time at Wongalara Sanctuary during this survey, bringing the number of plant taxa known for the reserve to 561.

The collections made during this survey included at least five taxa thought to be undescribed; all are relatively widespread, common and well known in the Northern Territory. Further study by specialist taxonomists is necessary to confirm and describe how they differ from related taxa. In some cases (e.g. *Tephrosia* sp. Pentecost River) they form part of a widespread species complex extending across the Northern Territory, and establishing species limits is a substantial task requiring examination of large numbers of specimens and populations in the field. In addition to the undescribed taxa, five taxa were unplaced at the time of writing and require further study by specialists in those groups. Some of these may represent undescribed taxa. They have not been given formal phrase names at this stage as some are in groups for which the variation is poorly understood, and the available broad species concepts may include several taxa. Specimens in some groups (e.g. *Wedelia*) are on loan interstate and under investigation by specialists. Until a working taxon concept can be established, it is premature to use phrase names for these taxa.

A substantial number of the species records from this survey represent range extensions of 100–300 km or significant range infillings of a similar scale. Many of the range extensions were for sandstone species, with the most obvious concentration found on the Strangman Range. These species had previously been known only from the Western Arnhem Land Plateau and its outliers, including Kakadu National Park and

²⁷ Brennan, K., Woinarski, J., Hempel, C., Cowie, I. & Dunlop, C. 2003, 'Biological inventory of the Arafura Swamp and catchment', Report to Natural Heritage Trust. Parks and Wildlife Commission of the Northern Territory, Darwin; Cowie, I. D., Lewis, D. L. & Stuckey, B. M. 2012, 'Flora and Vegetation Survey of Limmen National Park (proposed), Northern Territory', Northern Territory Herbarium, Department of Natural Resources, Environment, The Arts and Sport, Northern Territory Government, Technical Report Number 20/2011D, Palmerston.





Nitmiluk National Park to the north and west of Wongalara, or from the Gulf region to the south. Significant range extensions or infillings of this scale included *Acacia sericiflora*, *A. yirrkallensis*, *Calycopeplus collinus*, *Comesperma aphyllum*, *Comesperma secundum*, *Cryptandra gemmata*, *Dapsilanthus spathaceus*, *Eleocharis sundaica*, *Eriachne pallescens* var. *pallescens*, *Actinoschoenus* sp. sandstone, *Hibiscus setulosus*, *Ischaemum tropicum*, *Jacksonia effusa*, *J. arnhemica*, *Leptosema uniflorum*, *Leptosema villosum*, *Lindernia pubescens*, *Pentalepis ecliptoides*, *Pupalia micrantha*, *Thecanthes filifolia*, *Tephrosia reticulata*, *Tephrosia humifusa*, *Trianthera rhynchocalyptum* and *Zornia areolata*. These species are not generally of particular conservation significance.

The most notable records for rare species included: the rediscovery of the yellow-flowered herb *Goodenia argillacea*, otherwise known only from the type that was collected near Mainoru in 1974; the third record of Swamp Trigger Plant (*Stylidium tenerum*); a fourth record for the tree *Xanthostemon umbrosus*, otherwise known from Groote Eylandt, sandstone gorges of the Victoria River area and western Arnhem Land; and a fifth record for the aquatic Swamp Lily (*Ottelia ovalifolia*). The reserve is also notable for the abundance of Lancewood (*Acacia shirleyi*) dominated vegetation, a species very near the northern limit of its range.

Surveys at different times of the year are likely to record more species on Wongalara Sanctuary, especially during the early wet season. Seasonal conditions may have influenced the collection and recording of some taxa. For example, although identifiable at the time of survey, species such as Red Flowered Kurrajong (*Brachychiton paradoxus*) and *Cochlospermum* spp. were sterile and therefore



The collection of *Hibiscus setulosus* at Wongalara Sanctuary adds to the knowledge of this data deficient species, I. Cowie © Copyright, Northern Territory Herbarium

unsuitable for collecting. Some species, such as ground orchids and small lilies, are difficult to find at most times, but are most easily detected during the early wet season. Others such as *Sedopsis* spp. and some bladderworts (*Utricularia* spp.) die back rapidly during the dry season and can only be detected in the wet season.



Notes



Lost city formation, S. Zozaya © Copyright, James Cook University





Appendix A: Species Lists

Nomenclature and taxonomy used in this appendix are consistent with that from the Australian Faunal Directory (AFD), the Australian Plant Name Index (APNI) and the Australian Plant Census (APC).

Current at June 2014



Fauna



The Dingo (*Canis dingo*) has recently had its full species status restored, D. Wilson © Copyright, Aquagreen

Vertebrates

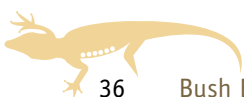
Mammals		
Family	Species	Common name
Bovidae	<i>Bos taurus</i> ^	European Cattle
	<i>Bubalus bubalis</i> ^	Swamp Buffalo, Water Buffalo
Canidae	<i>Canis dingo</i>	Dingo
Dasyuridae	<i>Dasyurus hallucatus</i> # ~	Digul, Northern Quoll
	<i>Planigale ingrami</i>	Long-tailed Planigale
	<i>Planigale maculata</i>	Common Planigale
	<i>Sminthopsis bindi</i>	Kakadu Dunnart
	<i>Sminthopsis bindi undescr.</i>	Kakadu/Wongalara Dunnart
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat
	<i>Taphozous georgianus</i>	Common Sheathtail-bat
Equidae	<i>Equus asinus</i> ^	Donkey
	<i>Equus caballus</i> ^	Horse, Brumby
Felidae	<i>Felis catus</i> ^	Cat
Hipposideridae	<i>Rhinonictis aurantia</i>	Orange Leaf-nosed Bat
Macropodidae	<i>Lagorchestes conspicillatus</i>	Spectacled Hare-wallaby
	<i>Macropus agilis</i>	Agile Wallaby
	<i>Macropus antilopinus</i>	Antilopine Wallaroo
	<i>Macropus robustus</i>	Common Wallaroo
	<i>Onychogalea unguifera</i>	Northern Nailtail Wallaby
Muridae	<i>Hydromys chrysogaster</i>	Water-rat
	<i>Melomys burtoni</i>	Grassland Melomys
	<i>Pseudomys delicatulus</i>	Delicate Mouse
	<i>Pseudomys johnsoni</i>	Central Pebble-mound Mouse
	<i>Pseudomys nanus</i>	Western Chestnut Mouse
	<i>Zyzomys argurus</i>	Common Rock-rat
Peramelidae	<i>Isodon macrourus</i>	Northern Brown Bandicoot

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Mammals		
Family	Species	Common name
Petauridae	<i>Petaurus breviceps</i>	Sugar Glider
Pseudocheiridae	<i>Petropseudes dahli</i>	Rock Ringtail Possum
Pteropodidae	<i>Pteropus alecto</i>	Black Flying-fox
	<i>Pteropus scapulatus</i>	Little Red Flying-fox
Suidae	<i>Sus scrofa</i> ^	Pig
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna

Birds		
Family	Species	Common name
Acanthizidae	<i>Gerygone olivacea</i>	White-throated Gerygone
	<i>Smicromnis brevirostris</i>	Weebill
Accipitridae	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk
	<i>Accipiter fasciatus</i>	Brown Goshawk
	<i>Aquila audax</i>	Wedge-tailed Eagle
	<i>Aviceda subcristata</i>	Pacific Baza
	<i>Circus assimilis</i>	Spotted Harrier
	<i>Erythrotriorchis radiatus</i> # ~	Red Goshawk
	<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle
<i>Haliastur sphenurus</i>	Whistling Kite	



Birds nest with eggs, R. Kaciuba © Copyright, BHP Billiton



Birds		
Family	Species	Common name
Accipitridae	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard
	<i>Hieraaetus morphnoides</i>	Little Eagle
	<i>Milvus migrans</i>	Black Kite
	<i>Pandion cristatus</i>	Eastern Osprey
Alcedinidae	<i>Ceyx azureus</i>	Azure Kingfisher
	<i>Dacelo leachii</i>	Blue-winged Kookaburra
	<i>Todiramphus macleayii</i>	Forest Kingfisher
	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher
	<i>Todiramphus sanctus</i>	Sacred Kingfisher
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck
	<i>Dendrocygna arcuata</i>	Wandering Whistling-Duck
	<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck
	<i>Nettapus pulchellus</i>	Green Pygmy-goose
	<i>Tadorna radjah</i>	Rajah Shelduck
Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian Darter
Anseranatidae	<i>Anseranas semipalmata</i>	Magpie Goose
	<i>Ardea intermedia</i>	Intermediate Egret
	<i>Ardea modesta</i>	Eastern Great Egret
	<i>Ardea pacifica</i>	White-necked Heron
	<i>Ardea sumatrana</i>	Great-billed Heron
	<i>Egretta novaehollandiae</i>	White-faced Heron
	<i>Egretta picata</i>	Pied Heron
	<i>Ixobrychus flavicollis</i>	Black Bittern
Artamidae	<i>Artamus cinereus</i>	Black-faced Woodswallow
	<i>Artamus leucorhynchus</i>	White-breasted Woodswallow
	<i>Artamus minor</i>	Little Woodswallow
	<i>Cracticus nigrogularis</i>	Pied Butcherbird
	<i>Cracticus tibicen</i>	Australian Magpie
	<i>Cracticus torquatus</i>	Grey Butcherbird
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
	<i>Cacatua sanguinea</i>	Little Corella
	<i>Calyptorhynchus banksii</i>	Red-tailed Black Cockatoo
	<i>Eolophus roseicapillus</i>	Galah
	<i>Nymphicus hollandicus</i>	Cockatiel

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Birds		
Family	Species	Common name
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike
	<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike
	<i>Lalage leucomela</i>	Varied Triller
	<i>Lalage sueurii</i>	White-winged Triller
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu
Centropodidae	<i>Centropus phasianinus</i>	Pheasant Coucal
Charadriidae	<i>Euseyornis melanops</i>	Black-fronted Dotterel
	<i>Vanellus miles</i>	Masked Lapwing
Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork
Cisticolidae	<i>Cisticola exilis</i>	Golden-headed Cisticola
Climacteridae	<i>Climacteris melanura</i>	Black-tailed Treecreeper
Columbidae	<i>Geopelia cuneata</i>	Diamond Dove
	<i>Geopelia humeralis</i>	Bar-shouldered Dove
	<i>Geopelia striata</i>	Peaceful Dove
	<i>Geophaps smithii smithii</i> # ~	Partridge Pigeon
	<i>Ocyphaps lophotes</i>	Crested Pigeon
	<i>Petrophassa rufipennis</i>	Chestnut-quilled Rock-Pigeon
	<i>Phaps chalcoptera</i>	Common Bronzewing
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird
Corvidae	<i>Corvus bennetti</i>	Little Crow
	<i>Corvus orru</i>	Torresian Crow
Cuculidae	<i>Cacomantis pallidus</i>	Pallid Cuckoo
	<i>Cacomantis variolosus</i>	Brush Cuckoo
	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo
Estrildidae	<i>Erythrura gouldiae</i> # ~	Gouldian Finch
	<i>Neochmia phaeton phaeton</i>	Crimson Finch
	<i>Poephila acuticauda</i>	Long-tailed Finch
	<i>Poephila personata</i>	Masked Finch
	<i>Taeniopygia bichenovii</i>	Double-barred Finch
	<i>Taeniopygia guttata</i>	Zebra Finch
Falconidae	<i>Falco berigora</i>	Brown Falcon
	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Falco longipennis</i>	Australian Hobby
	<i>Falco peregrinus</i>	Peregrine Falcon
Gruidae	<i>Grus antigone</i>	Sarus Crane
	<i>Grus rubicunda</i>	Brolga
Hirundinidae	<i>Petrochelidon ariel</i>	Fairy Martin
Jacaniidae	<i>Irediparra gallinacea</i>	Comb-crested Jacana
Maluridae	<i>Malurus lamberti</i>	Variegated Fairy-wren
	<i>Malurus melanocephalus</i>	Red-backed Fairy-wren



Birds		
Family	Species	Common name
Meliphagidae	<i>Certhionyx pectoralis</i>	Banded Honeyeater
	<i>Conopophila rufogularis</i>	Rufous-throated Honeyeater
	<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater
	<i>Gavicalis virescens</i>	Singing Honeyeater
	<i>Lichmera indistincta</i>	Brown Honeyeater
	<i>Manorina flavigula</i>	Yellow-throated Miner
	<i>Melithreptus albobularis</i>	White-throated Honeyeater
	<i>Melithreptus gularis</i>	Black-chinned Honeyeater
	<i>Myzomela obscura</i>	Dusky Honeyeater
	<i>Philemon argenticeps</i>	Silver-crowned Friarbird
	<i>Philemon buceroides</i>	Helmeted Friarbird
	<i>Philemon citreogularis</i>	Little Friarbird
	<i>Ptilotula flavescens</i>	Yellow-tinted Honeyeater
	<i>Ptilotula plumulus</i>	Grey-fronted Honeyeater
	<i>Ramsayornis fasciatus</i>	Bar-breasted Honeyeater
<i>Stomiopera unicolor</i>	White-gaped Honeyeater	
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark
	<i>Myiagra alecto</i>	Shining Flycatcher
	<i>Myiagra inquieta</i>	Restless Flycatcher
	<i>Myiagra rubecula</i>	Leaden Flycatcher
Nectariniidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole
Otididae	<i>Ardeotis australis</i>	Australian Bustard
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush
	<i>Colluricincla woodwardi</i>	Sandstone Shrike-thrush
	<i>Falcunculus frontatus whitei</i> # ~	Northern Shrike-tit
	<i>Pachycephala rufiventris</i>	Rufous Whistler
Pardalotidae	<i>Pardalotus rubricatus</i>	Red-browed Pardalote
	<i>Pardalotus striatus</i>	Striated Pardalote
Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian Pelican
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter
	<i>Microeca flavigaster</i>	Lemon-bellied Flycatcher
	<i>Poecilodryas cerviniventris</i>	Buff-sided Robin

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Birds		
Family	Species	Common name
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant
	<i>Phalacrocorax carbo</i>	Great Cormorant
	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant
	<i>Phalacrocorax varius</i>	Pied Cormorant
Phasianidae	<i>Coturnix ypsilophora</i>	Brown Quail
Podargidae	<i>Podargus papuensis</i>	Papuan Frogmouth
	<i>Podargus strigoides</i>	Tawny Frogmouth
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe
Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler
Psittacidae	<i>Aprosmictus erythropterus</i>	Red-winged Parrot
	<i>Platycercus venustus</i>	Northern Rosella
	<i>Psephotus dissimilis</i>	Hooded Parrot
	<i>Psitteuteles versicolor</i>	Varied Lorikeet
	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet
Ptilonorhynchidae	<i>Ptilonorhynchus nuchalis</i>	Great Bowerbird
Rhipiduridae	<i>Rhipidura dryas</i>	Arafura Fantail
	<i>Rhipidura fuliginosa</i>	New Zealand Fantail
	<i>Rhipidura leucophrys</i>	Willie Wagtail
	<i>Rhipidura rufiventris</i>	Northern Fantail
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper
Strigidae	<i>Ninox connivens</i>	Barking Owl
	<i>Ninox novaeseelandiae</i>	Southern Boobook
	<i>Ninox rufa</i>	Rufous Owl
Threskiornithidae	<i>Platalea flavipes</i>	Yellow-billed Spoonbill
	<i>Platalea regia</i>	Royal Spoonbill
	<i>Threskiornis molucca</i>	Australian White Ibis
	<i>Threskiornis spinicollis</i>	Straw-necked Ibis
Turnicidae	<i>Turnix sp.</i>	—

Reptiles		
Family	Species	Common name
Agamidae	<i>Diporiphora arnhemica</i>	Arnhemland Two-lined Dragon
	<i>Diporiphora bennettii</i>	Robust Two-line Dragon
	<i>Diporiphora bilineata</i>	Two-lined Dragon
	<i>Diporiphora magna</i>	Yellow-sided Two-line Dragon
	<i>Lophognathus gilberti</i>	Gilbert's Dragon, Ta-ta Lizard
Boidae	<i>Antaresia childreni</i>	Children's Python
	<i>Aspidites melanocephalus</i>	Black-headed Python
	<i>Liasis olivaceus olivaceus</i>	Olive Python
Carphodactylidae	<i>Nephrurus sheai</i>	Northern Knob-tailed Gecko



Reptiles		
Family	Species	Common name
Chelidae	<i>Chelodina oblonga</i>	Northern Snake-necked Turtle
	<i>Elseya</i> sp.	—
	<i>Emydura subglobosa worrelli</i>	Diamond-head Turtle
Colubridae	<i>Boiga irregularis</i>	Brown Tree Snake, Night Tiger
	<i>Dendrelaphis punctulatus</i>	Common Tree Snake, Green Tree Snake
	<i>Stegonotus cucullatus</i>	Slaty-grey Snake
	<i>Tropidonophis mairii</i>	Keelback
Crocodylidae	<i>Crocodylus johnstoni</i>	Freshwater Crocodile
	<i>Crocodylus porosus</i>	Saltwater Crocodile
Diplodactylidae	<i>Amalosia rhombifer</i>	Zigzag Velvet Gecko
	<i>Lucasium stenodactylum</i>	Crowned Gecko, Sand-plain Gecko
	<i>Oedura marmorata</i>	Marbled Velvet Gecko
	<i>Rhynchoedura ornata</i>	Western Beaked Gecko
	<i>Strophurus ciliaris</i>	Northern Spiny-tailed Gecko
	<i>Strophurus taeniatus</i> *	Phasmid Striped Gecko
Elapidae	<i>Brachyuropis roperi</i>	Northern Shovel-nosed Snake
	<i>Cryptophis pallidiceps</i>	Northern Small-eyed Snake
	<i>Demansia olivacea</i>	Olive Whipsnake
	<i>Demansia papuensis</i>	Greater Black Whipsnake
	<i>Demansia quaesitor</i>	Sombre Whipsnake
	<i>Demansia vestigiata</i>	Black Whipsnake, Lesser Black Whipsnake
	<i>Furina ornata</i>	Moon Snake, Orange-naped Snake
	<i>Pseudechis australis</i>	King Brown Snake
	<i>Pseudechis weigeli</i>	Weigel's Black Snake
	<i>Pseudonaja nuchalis</i>	Northern Brown Snake
	<i>Suta punctata</i>	Little Spotted Snake
<i>Vermicella intermedia</i>	Intermediate Bandy-bandy	
Gekkonidae	<i>Gehyra australis</i>	Northern Dtella
	<i>Gehyra nana</i>	Northern Spotted Rock Dtella
	<i>Gehyra</i> sp.	—
	<i>Heteronotia binoei</i>	Bynoe's Gecko
Pygopodidae	<i>Delma borea</i>	Rusty-topped Delma
	<i>Lialis burtonis</i>	Burton's Snake-lizard
	<i>Pygopus steelescotti</i>	Northern Hooded Scaly-foot
Scincidae	<i>Carlia amax</i>	Bauxite Rainbow-skink, Two-spined Rainbow Skink
	<i>Carlia munda</i>	Shaded-litter Rainbow-skink
	<i>Carlia triacantha</i>	Desert Rainbow-skink
	<i>Cryptoblepharus mertensi</i>	Merten's Snake-eyed Skink

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Reptiles		
Family	Species	Common name
Scincidae	<i>Cryptoblepharus metallicus</i>	Metallic Snake-eyed Skink
	<i>Ctenotus essingtoni</i>	Port Essington Ctenotus
	<i>Ctenotus inornatus</i>	Bar-shouldered Ctenotus, Plain Ctenotus
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus
	<i>Ctenotus quirinus</i>	Spear-like Ctenotus
	<i>Ctenotus robustus</i>	Robust Ctenotus
	<i>Ctenotus spaldingi</i>	Spalding's Ctenotus, Straight-browed Ctenotus
	<i>Ctenotus vertebralis</i>	Scant-striped Ctenotus
	<i>Eremiascincus isolepis</i>	Northern Bar-lipped Skink
	<i>Lerista orientalis</i>	North-eastern Orange-tailed Slider
	<i>Menetia greyii</i>	Common Dwarf Skink
	<i>Menetia maini</i>	Northern Dwarf Skink
	<i>Morethia ruficauda ruficauda</i>	Lined Firetail Skink
	<i>Morethia storri</i>	Storr's Snake-eyed Skink, Top End Firetail Skink
	<i>Notoscincus ornatus wotjulum</i>	Ornate Soil-crevice Skink
<i>Proablepharus tenuis</i>	Northern Soil-crevice Skink	
Typhlopidae	<i>Ramphotyphlops diversus</i>	Northern Blind Snake
Varanidae	<i>Varanus glebopalma</i>	Black-palmed Monitor
	<i>Varanus mertensi</i> ~	Mertens' Water Monitor
	<i>Varanus scalaris</i>	Spotted Tree Monitor
	<i>Varanus tristis</i>	Black-headed Monitor



Brown Tree Snake (*Boiga irregularis*) © Copyright, S. Zozaya



Frogs and Toads

Family	Species	Common name
Bufonidae	<i>Rhinella marina</i> ^	Cane Toad
Hylidae	<i>Litoria bicolor</i>	Northern Dwarf Tree Frog
	<i>Litoria caerulea</i>	Green Tree Frog
	<i>Litoria coplandi</i>	Copland's Rock Frog
	<i>Litoria inermis</i>	Peters' Frog
	<i>Litoria meiriana</i>	Rockhole Frog
	<i>Litoria nasuta</i>	Rocket Frog
	<i>Litoria pallida</i>	Pale Frog
	<i>Litoria rothii</i>	Roth's Tree Frog
	<i>Litoria rubella</i>	Desert Tree Frog, Red Tree Frog
	<i>Litoria tornieri</i>	Tornier's Frog
Myobatrachidae	<i>Litoria watjulumensis</i>	Wotjulum Frog
	<i>Crinia remota</i>	Remote Froglet
	<i>Limnodynastes convexiusculus</i>	Marbled Frog
	<i>Notaden melanoscaphus</i>	Northern Spadefoot Toad
	<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog
	<i>Uperoleia inundata</i>	Floodplain Toadlet
	<i>Uperoleia lithomoda</i>	Stonemason Toadlet

Fishes

Family	Species	Common name
Ambassidae	<i>Ambassis macleayi</i> *	Macleay's Glassfish
	<i>Ambassis</i> sp. *	Glassfish
Apogonidae	<i>Glossamia aprion</i> *	Mouth Almighty
Ariidae	<i>Neoarius graeffei</i> *	Blue Catfish
	<i>Sciades paucus</i> *	Shovelnose Catfish
Atherinidae	<i>Craterocephalus stercusmuscarum</i> *	Flyspecked Hardyhead
Belonidae	<i>Strongylura krefftii</i> *	Freshwater Longtom
Carcharhinidae	<i>Carcharhinus leucas</i>	Bull Shark
Clupeidae	<i>Nematalosa erebi</i> *	Bony Bream
Eleotridae	<i>Mogurnda mogurnda</i> *	Northern Purple-spotted Gudgeon
	<i>Oxyeleotris lineolata</i> *	Sleepy Cod
	<i>Oxyeleotris selheimi</i> *	Blackbanded Gudgeon

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Fishes		
Family	Species	Common name
Gobiidae	<i>Glossogobius aureus</i> *	Golden Flathead Goby
	<i>Glossogobius munroi</i> *	Munro's Goby
Latidae	<i>Lates calcarifer</i>	Barramundi
Megalopidae	<i>Megalops cyprinoides</i> *	Oxeye Herring
Melanotaeniidae	<i>Melanotaenia splendida inornata</i> *	Chequered Rainbowfish
Plotosidae	<i>Neosilurus ater</i> *	Black Catfish
	<i>Neosilurus hyrtlii</i> *	Hyrtl's Catfish
	<i>Porochilus rendahli</i> *	Rendahli's Catfish
Pristidae	<i>Pristis pristis</i> # + *	Freshwater Sawfish
Soleidae	<i>Brachirus</i> sp. *	Sole
Terapontidae	<i>Amniataba percoides</i> *	Barred Grunter
	<i>Hephaestus fuliginosus</i> *	Sooty Grunter
	<i>Leiopotherapon unicolor</i> *	Spangled Perch
	<i>Scortum ogilbyi</i> *	Gulf Grunter
Toxotidae	<i>Toxotes chatareus</i> *	Sevenspot Archerfish



Freshwater Longtom (*Strongylura krefftii*), D. Wilson © Copyright, Aquagreen



Invertebrates

Bees	
Family	Species
Apidae	<i>Amegilla (Asaropoda)</i> n. sp. 01 *
	<i>Amegilla (Zonamegilla)</i> n. sp. 'karlba' *
	<i>Amegilla adelaidae</i> *
	<i>Amegilla aeruginosa</i> *
	<i>Amegilla walkeri</i> *
	<i>Braunsapis clarissima</i> *
	<i>Braunsapis diminuta</i> *
	<i>Braunsapis nitida</i> *
	<i>Braunsapis simillima</i> *
	<i>Braunsapis unicolor</i> *
	<i>Tetragonula mellipes</i> *
	<i>Thyreus cf. caeruleopunctatus</i> *
	<i>Xylocopa parvula</i> *
Colletidae	<i>Chrysocolletes nr houstoni</i> *
	Euryglossinae sp. 01 *
	<i>Hylaeus</i> sp. 01 *
	<i>Hylaeus</i> sp. 02 *
	<i>Leioproctus</i> sp. 01 *
Halictidae	<i>Homalictus woodsi</i> *
	<i>Lipotriches</i> sp. 01 *
	<i>Lipotriches</i> sp. 02 *
	<i>Lipotriches</i> sp. 03 *
	<i>Lipotriches</i> sp. 04 *
	<i>Lipotriches</i> sp. 05 *

Bees	
Family	Species
Megachilidae	<i>Megachile</i> sp. 01 *
	<i>Megachile</i> sp. 02 (<i>Hackeriapis</i>) *
	<i>Megachile</i> sp. 03 *
	<i>Megachile</i> sp. 04 *
	<i>Megachile</i> sp. 05 *
	<i>Megachile</i> sp. 06 *
	<i>Megachile</i> sp. 07 *
	<i>Megachile</i> sp. 08 *
	<i>Megachile</i> sp. 09 *
	<i>Megachile</i> sp. 10 *
	<i>Megachile</i> sp. 11 *
	<i>Megachile</i> sp. 12 *
	<i>Megachile</i> sp. 13 *
	<i>Megachile</i> sp. 14 *
	<i>Megachile</i> sp. 15 *



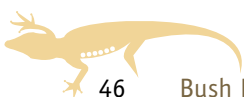
Some of the many bee specimens collected, J. Roberts © Copyright, BHP Billiton

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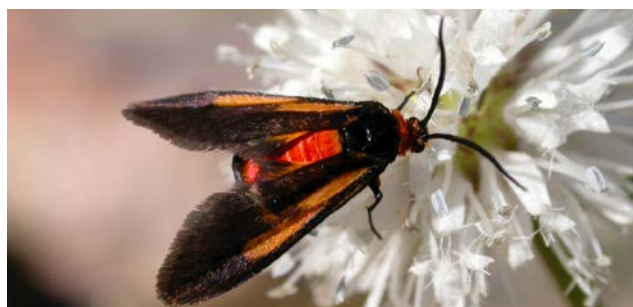


Butterflies and Moths

Family	Species
Arctiidae	<i>Amata</i> sp. 01 *
	<i>Amata</i> sp. 02 *
Geometridae	<i>Dysphania numana</i> subsp. *
Hesperiidae	<i>Cephrenes trichopepla</i> *
	<i>Ocybadistes walkeri olivia</i> *
	<i>Pelopidas lyelli lyelli</i> *
	<i>Proeidosia polysema</i> subsp. large spots *
	<i>Telicota augias krefftii</i> *
Immidae	<i>Birhana cleis</i> *
Lycaenidae	<i>Arhopala eupolis asopus</i> *
	<i>Candalides delospila</i> *
	<i>Candalides erinus erinus</i> *
	<i>Candalides geminus</i> subsp. Arnhem Land *
	<i>Candalides margarita gilberti</i> *
	<i>Catochrysops panormus platissa</i> *
	<i>Catopyrops florinda estrella</i> *
	<i>Deudorix smilis dalyensis</i> *
	<i>Euchrysops cnejus cnidus</i> *
	<i>Famegana alsulus alsulus</i> *
	<i>Freyeria putli putli</i> *
	<i>Jamides phaseli</i> *
	<i>Nacaduba biocellata biocellata</i> *
	<i>Nesolycaena urumelia</i> *
	<i>Ogyris amaryllis meridionalis</i> *
	<i>Ogyris zosine zosine</i> *
	<i>Prosotas dubiosa dubiosa</i> *
<i>Theclinesthes miskini miskini</i> *	
<i>Zizina otis labradus</i> *	
Noctuidae	<i>Comocrus behri</i> *
	<i>Idalima metasticta</i> *
Nymphalidae	<i>Acraea andromacha andromacha</i> *
	<i>Charaxes sempronius sempronius</i> *
	<i>Danaus affinis affinis</i> *
	<i>Danaus petilia</i> *
	<i>Euploea corinna</i> *
	<i>Euploea sylvester pelor</i> *
	<i>Hypocysta adiante antirius</i> *
	<i>Hypolimnas alimena darwinensis</i> *



Spotted Dusky-blue (*Candalides delospila*), M. Braby © Copyright, Department of Land Resource Management



Adults of the *Hestiochora xanthocoma* moth are rather wasp-like in appearance, M. Braby © Copyright, Department of Land Resource Management

Butterflies and Moths

Family	Species
Nymphalidae	<i>Hypolimnas bolina nerina</i> *
	<i>Junonia hedonia zelima</i> *
	<i>Junonia orithya albicincta</i> *
	<i>Junonia villida villida</i> *
	<i>Melanitis leda bankia</i> *
	<i>Mycalesis perseus perseus</i> *
	<i>Mycalesis sirius sirius</i> *
	<i>Ypthima arctous</i> *
	Papilionidae
<i>Papilio demoleus sthenelus</i> *	
Pieridae	<i>Belenois java teutonia</i> *
	<i>Catopsilia pomona</i> *
	<i>Cepora perimale</i> Northern Australia form *
	<i>Delias argenthona fragalactea</i> *
	<i>Elodina padusa</i> *
	<i>Eurema alitha novaguineensis</i> *
	<i>Eurema hecabe</i> *
	<i>Eurema herla</i> *
<i>Eurema laeta sana</i> *	
<i>Eurema smilax</i> *	
Zygaenidae	<i>Hestiochora xanthocoma</i> *



True Bugs	
Family	Species
Alydidae	<i>Leptocorisa</i> sp. BBWON12/HET/Msp004 BBFR12/HET/Msp157 *
	<i>Melanacanthus scutellaris</i> ^ *
	<i>Noliphus erythrocephalus</i> *
	<i>Riptortus linearis</i> ^ *
	<i>Riptortus serripes</i> ^ *
Blissidae	<i>Heinsius</i> sp. BBWON12/HET/Msp006 *
Coreidae	<i>Amorbus</i> sp. 01 BBWON12/HET/Msp007 *
	<i>Amorbus</i> sp. 02 BBWON12/HET/Msp008 *
	<i>Aulacosternum nigrorubrum</i> ^ *
	<i>Cletomorpha</i> sp. BBWON12/HET/Msp011 *
	<i>Gralliclava australiensis</i> *
	<i>Mictis profana</i> ^ *
Cydnidae	Cydnidae sp. 01 BBWON12/HET/Msp013 *
	Cydnidae sp. 02 BBWON12/HET/Msp014 *
	Cydnidae sp. 03 BBWON12/HET/Msp015 *
	Cydnidae sp. 04 BBWON12/HET/Msp016 BBFR12/HET/Msp060 *
	Cydnidae sp. 05 BBWON12/HET/Msp017 *
Geocoridae	<i>Germalus</i> sp. 01 BBWON12/HET/Msp018 BBFR12/HET/Msp063 *
Gerridae	<i>Limnogonus</i> sp. 01 BBWON12/HET/Msp019 BBFR12/HET/Msp095 *
	<i>Limnogonus</i> sp. 02 BBWON12/HET/Msp020 *
	<i>Rhagadotarsus anomalus</i> *
Lygaeidae	<i>Graptostethus servus</i> ^ *
Miridae	<i>Austrocapsus</i> sp. BBWON12/HET/Msp025 BBFR12/HET/Msp136 *
	<i>Campylomma</i> sp. BBWON12/HET/Msp032 BBFR12/HET/Msp124 *
	<i>Mirini</i> sp. BBWON12/HET/Msp026 *
	<i>Nesidiocoris tenuis</i> ^ *

True Bugs	
Family	Species
Miridae	Orthotylini n. sp. BBWON12/HET/Msp029 BBFR12/HET/Msp147 *
	Orthotylini n. sp. Spotty BBWON12/HET/Msp030 *
	Orthotylini n. sp. Stripey BBWON12/HET/Msp031 *
	Orthotylini sp. BBWON12/HET/Msp028 BBFR12/HET/Msp144 *
	Phylini sp. 01 BBWON12/HET/Msp033 *
	Phylini sp. 01A BBWON12/HET/Msp035 BBFR12/HET/Msp132 *
	Phylini sp. 03 BBWON12/HET/Msp036 *
	Phylini sp. 04 BBWON12/HET/Msp037 *
	Phylini sp. 13A BBWON12/HET/Msp034 *
	Phylini sp. A BBWON12/HET/Msp038 *
	Phylini sp. B BBWON12/HET/Msp039 *
	Phylini sp. C BBWON12/HET/Msp040 *
	Phylini sp. D BBWON12/HET/Msp041 *
	Rayieria n. sp. BBWON12/HET/Msp024 *
nr <i>Stenotus</i> sp. BBWON12/HET/Msp027 *	
Nepidae	<i>Goondnomdanepa</i> sp. BBWON12/HET/Msp042 *
	<i>Ranatra</i> sp. BBWON12/HET/Msp043 *
Notonectidae	<i>Paranisops</i> sp. 01 BBWON12/HET/Msp044 *
	<i>Paranisops</i> sp. 02 BBWON12/HET/Msp045 *
Oxycarenidae	<i>Oxycarenum arctatus</i> ^ *
Pachygronthidae	<i>Pachygrontha austrina</i> *
	<i>Stenophyella macreta</i> *
Pentatomidae	<i>Antestiopsis</i> sp. BBWON12/HET/Msp050 *
	nr <i>Antestiopsis</i> sp. BBWON12/HET/Msp051 *
	<i>Aspideurus</i> sp. BBWON12/HET/Msp063 *

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True Bugs	
Family	Species
Pentatomidae	<i>Bromocoris souefi</i> BBWON12/HET/Msp060 *
	<i>Cephaloplatus n. sp. BBWON12/HET/Msp072</i> *
	<i>Cephaloplatus pertyi</i> *
	<i>Cuspicona</i> sp. 01 BBWON12/HET/Msp066 *
	<i>Cuspicona</i> sp. 02 BBWON12/HET/Msp067 *
	<i>Cuspicona</i> sp. 03 BBWON12/HET/Msp068 *
	<i>Eysarcoris lereddii</i> *
	<i>Eysarcoris</i> sp. BBWON12/HET/Msp057 *
	<i>Eysarcoris trimaculatus</i> ^ *
	<i>Lathraedoeus</i> sp. BBWON12/HET/Msp064 *
	<i>Nezara viridula</i> ^ *
	<i>Ocirrhoe</i> nr <i>lutescens</i> BBWON12/HET/Msp070 *
	<i>Ocirrhoe</i> sp. BBWON12/HET/Msp069 *
	<i>Oechalia schellenbergii</i> ^ *
	<i>Oncocoris</i> sp. 01 BBWON12/HET/Msp054 BBFR12/HET/Msp005 *
	<i>Oncocoris</i> sp. 02 BBWON12/HET/Msp055 *
	<i>Parocirrhoe</i> sp. BBWON12/HET/Msp071 *
	<i>Plautia affinis</i> ^ *
	<i>Poecilometis nigriventris</i> *
	nr <i>Poecilotoma</i> sp. BBWON12/HET/Msp061 *
nr <i>Pseudapines</i> sp. BBWON12/HET/Msp053 *	
<i>Spermatodes australis</i> *	
Reduviidae	<i>Dactylopodocoris</i> sp. BBWON12/HET/Msp077 *
	<i>Ploiaria</i> sp. BBWON12/HET/Msp074 *
	<i>Pristhesancus</i> sp. 01 BBWON12/HET/Msp075 *
	<i>Pristhesancus</i> sp. 02 BBWON12/HET/Msp076 *
Rhopalidae	<i>Liorhyssus hyalinus</i> *
Rhyparochromidae	<i>Paraecocosmetus</i> sp. BBWON12/HET/Msp079 BBFR12/HET/Msp054 *

True Bugs	
Family	Species
Scutelleridae	<i>Choerocoris paganus</i> ^ *
	<i>Lampromicra senator</i> *
Tingidae	nr <i>Lasiacantha</i> sp. BBWON12/HET/Msp083 BBFR12/HET/Msp077 *
	<i>Nethersia n. sp. BBWON12/HET/Msp082</i> *
	<i>Tingis</i> sp. 01 BBWON12/HET/Msp084 *
	<i>Urentius sarinae</i> *

Damselflies and Dragonflies	
Family	Species
Aeshnidae	<i>Anax papuensis</i> *
Coenagrionidae	<i>Argiocnemis pygmaea</i> *
	<i>Argiocnemis rubescens</i> *
	<i>Austroagrion watsoni</i> *
	<i>Ceriagrion aeruginosum</i> *
	<i>Ischnura heterosticta</i> *
Libellulidae	<i>Diplacodes bipunctata</i> *
	<i>Diplacodes haematodes</i> *
	<i>Lathrecista asiatica</i> *
	<i>Macrodiplax cora</i> *
	<i>Nannodiplax rubra</i> *
	<i>Neurothemis oligoneura</i> *
	<i>Neurothemis stigmatizans</i> *
	<i>Notolibellula bicolor</i> *
	<i>Orthetrum caledonicum</i> *
	<i>Orthetrum migratum</i> *
	<i>Orthetrum sabina</i> *
	<i>Pantala flavescens</i> *
	<i>Rhyothemis graphiptera</i> *
	<i>Tholymis tillarga</i> *
	<i>Tramea loewii</i> *
<i>Zyxomma elgneri</i> *	
Lindeniidae	<i>Ictinogomphus australis</i> *
Platycnemididae	<i>Nososticta baroalba</i> *
	<i>Nososticta fraterna</i> *



Centipedes	
Family	Species
[Class Symphyla]	Symphyla spp. *
Mecistocephalidae	Mecistocephalidae spp. *
Scolopendridae	<i>Cormocephalus lissadellensis</i> *
	<i>Ethmostigmus muiri</i> *
	<i>Rhysida polyacantha</i> *
	<i>Scolopendra laeta</i> *
	<i>Scolopendra morsitans</i> *
Scutigerae	Scutigerae sp. *

Mites and Ticks	
Family	Species
Argasidae	<i>Ornithodoros gurneyi</i> *
Caeculidae	Caeculidae sp. *
Erythraeidae	Erythraeidae sp. *
Ixodidae	<i>Amblyomma triguttatum ornatissimum</i> *
	<i>Rhipicephalus australis</i> *

Scorpions	
Family	Species
Buthidae	<i>Lychas variatus</i> *
	<i>Lychas marmoreus</i> *

Microwhip Scorpions	
Family	Species
[Order Palpigradi]	Palpigradi n. sp. *

Pseudoscorpions	
Family	Species
Atemnidae	<i>Paratemnoides</i> sp. *
	<i>Stenatemnus</i> n. sp. *
Cheiridiidae	Cheiridiidae PSE AAB n. sp. 'Wongalara' *
Garypidae	<i>Synsphyronus heptatrichus</i> *
	<i>Synsphyronus</i> n. sp. 'Wongalara' *
Geogarypidae	<i>Geogarypus</i> n. sp. 'Wongalara' *
Olpiidae	<i>Austrohorus</i> sp. *
	<i>Beierolpium</i> spp. *
	<i>Euryolpium</i> spp. *
Sternophoridae	<i>Afrosterophorus</i> n. sp. *



Stenatemnus n. sp., a putative new pseudoscorpion species, M. Harvey © Copyright, Western Australian Museum

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A new species of goblin spider, *Opopaea gilliesi* n. sp., named for Chris Gillies of Earthwatch Australia, recognising his field assistance during the survey, M. Harvey © Copyright, Western Australian Museum

Spiders	
Family	Species
Araneidae	<i>Argiope dietrichae</i> *
	<i>Argiope katherina</i> *
	<i>Argiope protensa</i> *
	<i>Argiope radon</i> *
	<i>Austracantha minax</i> *
	<i>Cyrtobill darwini</i> *
	<i>Cyrtophora</i> sp. *
	<i>Paraplectanoides</i> sp. *
<i>Poltys</i> sp. *	
Corinnidae	Corinnidae sp. *
	<i>Supunna</i> sp. *
Deinopidae	Deinopidae sp. *
Desidae	Desidae sp. *
Filistatidae	Filistatidae spp. *
Gnaphosidae	Gnaphosidae spp. *
Lamponidae	<i>Asadipus</i> cf. <i>areyonga</i> *
	<i>Lampona ampeinna</i> *
	<i>Lamponina</i> sp. *
	<i>Notsodipus marun</i> *
Linyphiidae	<i>Dunedinia</i> sp. *
	Linyphiidae spp. *
Liocranidae	<i>Orthobula</i> sp. *
Lycosidae	Lycosidae sp. 01 *
	Lycosidae sp. 02 *
	Lycosidae sp. 03 *

Spiders	
Family	Species
Nemesiidae	<i>Aname</i> n. sp. MYG261 *
	<i>Aname</i> spp. *
Nephilidae	<i>Nephila edulis</i> *
Oonopidae	<i>Cavisternum gillespieae</i> n. sp. *
	<i>Cavisternum leichhardti</i> n. sp. *
	<i>Opopaea gilliesi</i> n. sp. *
	<i>Opopaea wongalara</i> n. sp. *
	<i>Pelicanus</i> n. sp. 01 *
	<i>Pelicanus</i> n. sp. 02 *
Oxyopidae	Oxyopidae sp. 01 *
	Oxyopidae sp. 02 *
	Oxyopidae sp. 03 *
Pholcidae	<i>Crossopriza lyoni</i> ^ *
	<i>Trichocyclus arabana</i> *
Prodidomidae	Prodidomidae spp. *
Salticidae	<i>Cyrba PBS</i> sp. 01 *
	<i>Cytaea</i> n. sp. *
	<i>Cytaea</i> spp. *
	<i>Grayenulla</i> sp. *
	<i>Hasarius adansonii</i> ^ *
	<i>Mopsus mormon</i> *
	<i>Portia fimbriata</i> *
	<i>Portia</i> sp. *
	Salticidae gen. 05 sp. 01 *
	<i>Simaetha</i> sp. *
<i>Zenodorus metallescens</i> *	



Spiders	
Family	Species
Selenopidae	<i>Selenopidae</i> sp. *
Sparassidae	<i>Neosparassus</i> sp. *
Symphytognathidae	<i>Symphytognatha</i> n. sp. *
	<i>Symphytognathidae</i> sp. *
Tetrablemmidae	<i>Tetrablemmidae</i> spp. *
Tetragnathidae	<i>Leucauge</i> spp. *
	<i>Tetragnatha</i> spp. *
Theraphosidae	<i>Selenotholus</i> n. sp. *
Theridiidae	<i>Euryopsis</i> spp. *
	<i>Latrodectus geometricus</i> *
	<i>Latrodectus hasseltii</i> *
	<i>Steatoda</i> spp. *
Thomisidae	<i>Amyciaea</i> sp. *
	<i>Thomisus</i> spp. *
Uloboridae	<i>Uloboridae</i> spp. *
Zodariidae	<i>Zodariidae</i> spp. *

Crustaceans	
Family	Species
[Order Isopoda]	<i>Asellota</i> n. sp. *
Bathynellidae	<i>Bathynellidae</i> n. sp. 01 *
	<i>Bathynellidae</i> n. sp. 02 *



The orb-weaver *Argiope katherina*, M. Harvey
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Snails	
Family	Species
Camaenidae	<i>Torresitrachia</i> n. sp. A (MV/BB/20120526/PUL/CAEM001) *
	<i>Torresitrachia</i> n. sp. B (MV/BB/20120526/PUL/CAEM002) *
	<i>Torresitrachia</i> n. sp. C (MV/BB/20120526/PUL/CAEM003) *
	<i>Xanthomelon durvillii</i> *
Charopidae	<i>Pilsbrycharopa tumida</i> *
Helicarionidae	<i>Westracystis lissus</i> *
Helicodiscidae	<i>Stenopylis coarctata</i> *
Lymnaeidae	<i>Austropeplea lessoni</i> *
Pupillidae	<i>Gastrocopta</i> sp. aff. <i>mussoni</i> *
Subulinidae	<i>Allopeas gracile</i> *
Succineidae	<i>Succinea strigillata</i> *
Viviparidae	<i>Notopala essingtonensis</i> *

Mussels	
Family	Species
Hyriidae	<i>Velesunio angasi</i> *

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Flora

Flowering Plants	
Family	Species
Acanthaceae	<i>Dicliptera armata</i> *
	<i>Hypoestes floribunda</i> var. <i>varia</i> *
	<i>Nelsonia campestris</i> *
	<i>Rostellularia adscendens</i> var. <i>clementii</i> *
	<i>Staurogyne leptocaulis</i> subsp. <i>decumbens</i> *
Aizoaceae	<i>Trianthema rhynchocalyptum</i> *
Alismataceae	<i>Caldesia oligococca</i> var. <i>oligococca</i> *



Copper Plant (*Polycarpha spirostylis*), N. Crook © Copyright, Department of the Environment

Flowering Plants	
Family	Species
Amaranthaceae	<i>Achyranthes aspera</i> *
	<i>Alternanthera angustifolia</i> *
	<i>Gomphrena canescens</i> *
	<i>Gomphrena flaccida</i> *
	<i>Gomphrena floribunda</i> *
	<i>Ptilotus distans</i> *
	<i>Ptilotus fusiformis</i> *
	<i>Ptilotus</i> n. sp. Fish River (D.L.Lewis 2249) *
	<i>Pupalia micrantha</i> *
	Apocynaceae
Araliaceae	<i>Trachymene microcephala</i> *
Arecaceae	<i>Livistona inermis</i> *
Asparagaceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i> *
	<i>Thysanotus chinensis</i> *
Asteraceae	<i>Allopterigeron filifolius</i> *
	<i>Blumea saxatilis</i> *
	<i>Blumea tenella</i> *
	<i>Centipeda borealis</i> *
	<i>Cyanthillium cinereum</i> *
	<i>Eclipta</i> sp. Humpty Doo (H.S.McKee 8360) *
	<i>Emilia sonchifolia</i> var. <i>sonchifolia</i> ^ *
	<i>Iotasperma australiense</i> *
	<i>Pentalepis ecliptoides</i> *
	<i>Pterocaulon serrulatum</i> var. <i>velutinum</i> *
	<i>Sphaeromorphaea australis</i> *
	<i>Vittadinia spechtii</i> *
	<i>Wedelia</i> sp. *
	Wedelia urticifolia
	Bignoniaceae



Polymeria sp., I. Cowie © Copyright, Northern Territory Herbarium

Flowering Plants	
Family	Species
Boraginaceae	<i>Heliotropium alcyonium</i> *
	<i>Heliotropium foliatum</i> *
	<i>Heliotropium geocharis</i> *
	<i>Heliotropium glabellum</i> *
	<i>Heliotropium leptaleum</i> *
	<i>Heliotropium ovalifolium</i> *
	<i>Heliotropium ventricosum</i> *
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i> *
Burmanniaceae	<i>Burmannia juncea</i> *
Burseraceae	<i>Canarium australianum</i>
Byblidaceae	<i>Byblis aquatica</i> *
	<i>Byblis liniflora</i> *
Campanulaceae	<i>Lobelia douglasiana</i> *
	<i>Wahlenbergia caryophylloides</i> *
Cannabaceae	<i>Celtis australiensis</i> *
Capparaceae	<i>Capparis lasiantha</i> *
Caryophyllaceae	<i>Polycarpaea corymbosa</i> *
	<i>Polycarpaea spirostylis</i> *

Flowering Plants	
Family	Species
Casuarinaceae	<i>Casuarina cunninghamiana</i> subsp. <i>miodon</i> *
Celastraceae	<i>Denhamia cunninghamii</i> *
	<i>Stackhousia intermedia</i> *
Centrolepidaceae	<i>Centrolepis exserta</i> *
Cleomaceae	<i>Cleome viscosa</i> *
Combretaceae	<i>Terminalia canescens</i>
	<i>Terminalia carpentariae</i> *
	<i>Terminalia erythrocarpa</i> *
	<i>Terminalia ferdinandiana</i> *
	<i>Terminalia platyptera</i> *
	<i>Terminalia pterocarya</i> *
Commelinaceae	<i>Terminalia volucris</i> *
	<i>Cartonema parviflorum</i> *
	<i>Commelina agrostophylla</i> *
	<i>Commelina ensifolia</i> *

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Flowering Plants	
Family	Species
Convolvulaceae	<i>Bonamia pannosa</i> *
	<i>Evolvulus alsinoides</i> *
	<i>Ipomoea coptica</i> *
	<i>Ipomoea eriocarpa</i> *
	<i>Ipomoea gracilis</i> *
	<i>Ipomoea graminea</i> *
	<i>Ipomoea polymorpha</i> *
	<i>Jacquemontia browniana</i>
	<i>Jacquemontia paniculata</i> *
	<i>Merremia gemella</i>
	<i>Merremia incisa</i> *
	<i>Polymeria ambigua</i> *
	<i>Polymeria</i> sp. *
	<i>Xenostegia tridentata</i> *
Cucurbitaceae	<i>Cucumis melo</i> subsp. <i>agrestis</i> *
Cupressaceae	<i>Callitris intratropica</i> *
Cyperaceae	<i>Actinoschoenus</i> sp. sandstone (P.K.Latz 7686) *
	<i>Bulbostylis barbata</i> *
	<i>Cyperus aquatilis</i> *
	<i>Cyperus breviculmis</i> *
	<i>Cyperus conicus</i>
	<i>Cyperus haspan</i> subsp. <i>juncoides</i> *
	<i>Cyperus microcephalus</i> subsp. <i>saxicola</i> *
	<i>Cyperus oxycarpus</i> *
	<i>Cyperus serotinus</i> *
	<i>Cyperus tenuispica</i> *
	<i>Cyperus viscidulus</i> *
	<i>Eleocharis geniculata</i> *
	<i>Eleocharis rivalis</i> *
	<i>Eleocharis setifolia</i> *
	<i>Eleocharis sundaica</i> *
	<i>Fimbristylis acuminata</i> *
	<i>Fimbristylis cardiocarpa</i> *
	<i>Fimbristylis ferruginea</i> *
	<i>Fimbristylis furva</i> *
	<i>Fimbristylis littoralis</i> *
<i>Fimbristylis nutans</i> *	
<i>Fimbristylis pachyptera</i> *	
<i>Fimbristylis pallida</i> *	
<i>Fimbristylis pauciflora</i> *	

Flowering Plants	
Family	Species
Cyperaceae	<i>Fimbristylis pterigosperma</i> *
	<i>Fimbristylis punctata</i> *
	<i>Fimbristylis schultzei</i> *
	<i>Fimbristylis sieberiana</i> *
	<i>Fimbristylis simplex</i> *
	<i>Fimbristylis squarrolosa</i> *
	<i>Fimbristylis tetragona</i> *
	<i>Fuirena ciliaris</i> *
	<i>Isolepis humillima</i> *
	<i>Lipocarpa microcephala</i> *
	<i>Rhynchospora leae</i> *
	<i>Rhynchospora longisetis</i> *
	<i>Rhynchospora pterochaeta</i> *
	<i>Schoenus punctatus</i> *
	<i>Schoenus sparteus</i> *
	<i>Scleria annularis</i> *
	<i>Scleria lithosperma</i> var. <i>lithosperma</i> *
	<i>Scleria pygmaea</i> *
	<i>Scleria rugosa</i> *
<i>Tricostularia undulata</i> *	
Dilleniaceae	<i>Hibbertia haplostemona</i> *
	<i>Hibbertia juncea</i> *
	<i>Hibbertia lepidota</i> *
	<i>Hibbertia tomentosa</i> *
Dioscoreaceae	<i>Dioscorea transversa</i>
Droseraceae	<i>Drosera burmanni</i> *
	<i>Drosera darwinensis</i> *
	<i>Drosera indica</i> *
	<i>Drosera lanata</i> *
Ebenaceae	<i>Diospyros humilis</i> *
	<i>Diospyros rugosula</i> *
Elatinaceae	<i>Bergia pedicellaris</i> *
Eriocaulaceae	<i>Eriocaulon cinereum</i> *
	<i>Eriocaulon depressum</i> *
	<i>Eriocaulon fistulosum</i> *
	<i>Eriocaulon setaceum</i> *
	<i>Eriocaulon spectabile</i> *
Euphorbiaceae	<i>Calycopeplus collinus</i> *
	<i>Euphorbia schultzei</i> *
	<i>Microstachys chamaelea</i> *
	<i>Notoleptopus decaisnei</i> *
	<i>Petalostigma quadriloculare</i> *



Flowering Plants	
Family	Species
Fabaceae	<i>Abrus precatorius</i>
	<i>Abrus precatorius</i> subsp. <i>precatorius</i> *
	<i>Acacia acradenia</i> *
	<i>Acacia alleniana</i> *
	<i>Acacia conspersa</i> *
	<i>Acacia difficilis</i> *
	<i>Acacia dimidiata</i> *
	<i>Acacia galioides</i> *
	<i>Acacia gonocarpa</i> *
	<i>Acacia gonoclada</i> *
	<i>Acacia hammondii</i>
	<i>Acacia holosericea</i> *
	<i>Acacia humifusa</i> *
	<i>Acacia lamprocarpa</i> *
	<i>Acacia latescens</i> *
	<i>Acacia limbata</i> *
	<i>Acacia monticola</i> *
	<i>Acacia multisiliqua</i> *
	<i>Acacia oncinophylla</i> *
	<i>Acacia sericoflora</i> *
	<i>Acacia shirleyi</i> *
	<i>Acacia subternata</i> *
	<i>Acacia torulosa</i> *
	<i>Acacia tropica</i> *
	<i>Acacia umbellata</i> *
	<i>Acacia yirrkallensis</i> *
	<i>Alysicarpus ovalifolius</i> ^ *
	<i>Bossiaea bossiaeooides</i> *
	<i>Cajanus acutifolius</i> *
	<i>Cathormion umbellatum</i>
	<i>Cathormion umbellatum</i> subsp. <i>moniliforme</i> *
	<i>Chamaecrista grisea</i> *
	<i>Chamaecrista mimosoides</i> *
	<i>Chamaecrista rotundifolia</i> ^ *
<i>Crotalaria calycina</i> *	
<i>Crotalaria montana</i> var. <i>angustifolia</i> *	
<i>Daviesia reclinata</i> *	

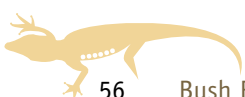
Flowering Plants	
Family	Species
Fabaceae	<i>Desmodium brownii</i> *
	<i>Desmodium filiforme</i> *
	<i>Desmodium flagellare</i> *
	<i>Desmodium glareosum</i> *
	<i>Desmodium muelleri</i> *
	<i>Desmodium trichostachyum</i> *
	<i>Dichrostachys spicata</i> *
	<i>Erythrophleum chlorostachys</i> *
	<i>Flemingia pauciflora</i> *
	<i>Galactia tenuiflora</i> *
	<i>Glycine tomentella</i> *
	<i>Gompholobium subulatum</i> *
	<i>Indigofera haplophylla</i> *
	<i>Indigofera hirsuta</i> *
	<i>Indigofera linifolia</i> *
	<i>Indigofera pratensis</i> *
	<i>Jacksonia arnhemica</i> *
	<i>Jacksonia dilatata</i> *
	<i>Jacksonia effusa</i> *
	<i>Jacksonia odontoclada</i> *
	<i>Leptosema uniflorum</i> *
	<i>Leptosema villosum</i> *
	<i>Mirbelia viminalis</i> *
	<i>Rhynchosia minima</i> *
	<i>Senna cladophylla</i> *
	<i>Senna oligoclada</i> *
	<i>Sesbania cannabina</i> var. <i>cannabina</i> *
	<i>Stylosanthes hamata</i> ^ *
	<i>Stylosanthes humilis</i> ^ *
	<i>Stylosanthes viscosa</i> ^ *
	<i>Tephrosia filipes</i> var. <i>filipes</i> *
	<i>Tephrosia humifusa</i> *
	<i>Tephrosia leptoclada</i> *
	<i>Tephrosia polyzyga</i> *
<i>Tephrosia reticulata</i> *	
<i>Tephrosia</i> sp. Pentecost River (I.D.Cowie 4168) *	
<i>Tephrosia spechtii</i> *	

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Flowering Plants	
Family	Species
Fabaceae	<i>Vachellia ditricha</i> *
	<i>Vachellia pachyphloia</i>
	<i>Vigna lanceolata</i> var. <i>lanceolata</i> *
	<i>Vigna lanceolata</i> var. <i>filiformis</i> *
	<i>Zornia areolata</i> *
	<i>Zornia muriculata</i> subsp. <i>angustata</i> *
	<i>Zornia prostrata</i> var. <i>prostrata</i> *
Gentianaceae	<i>Canscora diffusa</i> *
Gleicheniaceae	<i>Dicranopteris linearis</i> var. <i>linearis</i> *
Goodeniaceae	<i>Goodenia argillacea</i> *
	<i>Goodenia armstrongiana</i> *
	<i>Goodenia hispida</i> *
	<i>Goodenia holtzeana</i> *
	<i>Goodenia janamba</i> *
	<i>Goodenia leiosperma</i> *
	<i>Goodenia malvina</i> *
	<i>Goodenia pilosa</i> *

Flowering Plants	
Family	Species
Goodeniaceae	<i>Goodenia pumilio</i> *
	<i>Goodenia purpurascens</i> *
	<i>Goodenia redacta</i> *
	<i>Goodenia</i> sp. Melville Island (N.B.Byrnes 666) *
	<i>Lechenaultia filiformis</i> *
	<i>Scaevola revoluta</i> subsp. <i>revoluta</i> *
Haemodoraceae	<i>Haemodorum coccineum</i> *
Haloragaceae	<i>Gonocarpus chinensis</i> *
	<i>Gonocarpus leptothecus</i> *
	<i>Myriophyllum filiforme</i> *
Hydrocharitaceae	<i>Najas graminea</i> var. <i>graminea</i> *
	<i>Najas malesiana</i> *
	<i>Najas tenuifolia</i> *
	<i>Ottelia ovalifolia</i> *
	<i>Vallisneria nana</i> *



Batchelors Buttons (*Gomphrena canescens*), N. Crook © Copyright, Department of the Environment



Flowering Plants	
Family	Species
Lamiaceae	<i>Basilicum polystachyon</i> *
	<i>Callicarpa candicans</i> *
	<i>Hyptis suaveolens</i> ^ *
	<i>Muniria angustisepala</i> *
Lauraceae	<i>Cassytha capillaris</i> *
	<i>Cassytha filiformis</i> *
Lecythidaceae	<i>Barringtonia acutangula</i> *
Lentibulariaceae	<i>Utricularia caerulea</i> *
	<i>Utricularia chrysantha</i> *
	<i>Utricularia gibba</i> *
	<i>Utricularia limosa</i> *
	<i>Utricularia muelleri</i> *
	<i>Utricularia quinquedentata</i> *
Linderniaceae	<i>Lindernia aplectra</i> *
	<i>Lindernia clausa</i> *
	<i>Lindernia pubescens</i> *
Lindsaeaceae	<i>Lindsaea ensifolia</i> *
Loganiaceae	<i>Mitrasacme aggregata</i> *
	<i>Mitrasacme ambigua</i> *
	<i>Mitrasacme connata</i> *
	<i>Mitrasacme exserta</i> *
	<i>Mitrasacme multicaulis</i> *
	<i>Mitrasacme nudicaulis</i> var. <i>nudicaulis</i> *
	<i>Strychnos lucida</i> *
Loranthaceae	<i>Amyema bifurcata</i>
	<i>Amyema conspicua</i> subsp. <i>obscurinervis</i>
	<i>Amyema herbertiana</i>
	<i>Amyema sanguinea</i>
	<i>Decaisnina angustata</i> *
	<i>Dendrophthoe glabrescens</i> *
	<i>Dendrophthoe odontocalyx</i> *
	<i>Lysiana spathulata</i> subsp. <i>spathulata</i> *
	<i>Lysiana subfalcata</i> *
Lythraceae	<i>Ammannia baccifera</i> *
	<i>Ammannia multiflora</i> *
	<i>Rotala diandra</i> *
	<i>Rotala mexicana</i> *

Flowering Plants	
Family	Species
Malvaceae	<i>Abutilon hannii</i> subsp. <i>erect</i> *
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i> *
	<i>Corchorus fascicularis</i> *
	<i>Corchorus pumilio</i> *
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i> *
	<i>Gossypium australe</i> *
	<i>Helicteres cana</i> subsp. <i>cana</i> *
	<i>Helicteres integrifolia</i> subsp. <i>St Vidgeons</i> (K.Manning 425) *
	<i>Helicteres isora</i> *
	<i>Hibiscus leptocladus</i> *
	<i>Hibiscus meraukensis</i> *
	<i>Hibiscus setulosus</i> *
	<i>Melochia pyramidata</i> *
	<i>Sida acuta</i> ^ *
	<i>Sida cordifolia</i> ^ *
	<i>Sida laevis</i> *
	<i>Sida</i> sp. *
<i>Sida</i> sp. *	
<i>Sida spinosa</i> *	
<i>Triumfetta glaucescens</i> *	
<i>Triumfetta parviflora</i> *	
<i>Triumfetta plumigera</i> *	
<i>Waltheria indica</i> *	
Melastomataceae	<i>Melastoma malabathricum</i> subsp. <i>malabathricum</i> *
	<i>Memecylon pauciflorum</i> *
Meliaceae	<i>Owenia vernicosa</i> *
Menyanthaceae	<i>Nymphoides crenata</i> *
	<i>Nymphoides indica</i> *
Moraceae	<i>Fatoua villosa</i> *
	<i>Ficus aculeata</i> var. <i>indecora</i> *
	<i>Ficus brachypoda</i> *
	<i>Ficus subpuberula</i> *
Myrtaceae	<i>Asteromyrtus magnifica</i> *
	<i>Asteromyrtus symphyocarpa</i> *
	<i>Calytrix achaeta</i> *

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Blue Waterlily (*Nymphaea violacea*), M. Hammer © Copyright, Museum and Art Gallery of the Northern Territory

Flowering Plants	
Family	Species
Myrtaceae	<i>Calytrix brownii</i> *
	<i>Calytrix extipulata</i> *
	<i>Corymbia bleeseri</i>
	<i>Corymbia dichromophloia</i> *
	<i>Corymbia ferruginea</i> subsp. <i>ferruginea</i> *
	<i>Corymbia foelscheana</i> *
	<i>Corymbia jacobiana</i> *
	<i>Corymbia kombolgiensis</i> *
	<i>Corymbia latifolia</i>
	<i>Corymbia polycarpa</i> *
	<i>Corymbia terminalis</i> *
	<i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> *
	<i>Eucalyptus distans</i> *
	<i>Eucalyptus leucophloia</i> subsp. <i>euroa</i> *
	<i>Eucalyptus microtheca</i> *
	<i>Eucalyptus patellaris</i> *
	<i>Eucalyptus phoenicea</i>
	<i>Eucalyptus pruinosa</i> subsp. <i>tenuata</i> *
	<i>Eucalyptus tetradonta</i> *
	<i>Eucalyptus umbrawarrensii</i> *
<i>Homalocalyx ericaeus</i> *	

Flowering Plants		
Family	Species	
Myrtaceae	<i>Lophostemon grandiflorus</i> subsp. <i>riparius</i> *	
	<i>Lophostemon lactifluus</i> *	
	<i>Melaleuca acacioides</i> *	
	<i>Melaleuca citrolens</i>	
	<i>Melaleuca dealbata</i> *	
	<i>Melaleuca leucadendra</i> *	
	<i>Melaleuca nervosa</i> *	
	<i>Melaleuca viridiflora</i> *	
	<i>Syzygium angophoroides</i>	
	<i>Verticordia verticillata</i> *	
	<i>Xanthostemon umbrosus</i> *	
	Nymphaeaceae	<i>Nymphaea violacea</i> *
	Onagraceae	<i>Ludwigia hyssopifolia</i> *
<i>Ludwigia octovalvis</i> *		
Orchidaceae	<i>Dendrobium dicuphum</i> *	
Orobanchaceae	<i>Buchnera gracilis</i> *	
	<i>Buchnera linearis</i> *	
	<i>Centranthera cochinchinensis</i> *	
Passifloraceae	<i>Passiflora foetida</i> ^ *	
Philydraceae	<i>Philydrum lanuginosum</i> *	



Flowering Plants	
Family	Species
Phyllanthaceae	<i>Breynia cernua</i> *
	<i>Bridelia tomentosa</i> *
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i> *
	<i>Margaritaria dubium-traceyi</i> *
	<i>Phyllanthus arnhemicus</i> *
	<i>Phyllanthus carpentariae</i> *
	<i>Phyllanthus exilis</i> *
	<i>Phyllanthus indigoferoides</i> *
	<i>Phyllanthus maderaspatensis</i> *
	<i>Phyllanthus minutiflorus</i> *
	<i>Phyllanthus rhytidospemus</i> *
	<i>Phyllanthus sulcatus</i> *
	<i>Phyllanthus virgatus</i> *
	<i>Sauropus hubbardii</i> *
<i>Sauropus stenocladus</i> subsp. <i>stenocladus</i> *	
Plantaginaceae	<i>Bacopa floribunda</i> *
	<i>Limnophila fragrans</i> *
	<i>Stemodia lathraia</i> *
	<i>Stemodia lythrifolia</i>
Plumbaginaceae	<i>Plumbago zeylanica</i> *
Poaceae	<i>Alloteropsis semialata</i> *
	<i>Aristida exserta</i> *
	<i>Aristida holathera</i> var. <i>holathera</i> *
	<i>Aristida hygrometrica</i> *
	<i>Aristida inaequiglumis</i> *
	<i>Aristida latifolia</i> *
	<i>Aristida schultzei</i> *
	<i>Aristida utilis</i> var. <i>utilis</i> *
	<i>Arundinella nepalensis</i> *
	<i>Bothriochloa pertusa</i> ^ *
	<i>Cenchrus elymoides</i> *
	<i>Chionachne cyathopoda</i> *
	<i>Chloris lobata</i> *
	<i>Chrysopogon elongatus</i> *
	<i>Chrysopogon fallax</i> *
	<i>Cymbopogon bombycinus</i> *

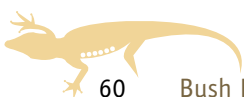
Flowering Plants	
Family	Species
Poaceae	<i>Cymbopogon dependens</i> *
	<i>Dichanthium fecundum</i> *
	<i>Dichanthium sericeum</i> subsp. <i>polystachyum</i> *
	<i>Digitaria bicornis</i> ^ *
	<i>Digitaria breviglumis</i> *
	<i>Digitaria brownii</i> *
	<i>Digitaria nematostachya</i> *
	<i>Digitaria papposa</i> *
	<i>Dimeria acinaciformis</i> *
	<i>Dimeria ornithopoda</i> *
	<i>Echinochloa colona</i> ^ *
	<i>Ectrosia confusa</i> *
	<i>Ectrosia leporina</i> *
	<i>Ectrosia scabrada</i> *
	<i>Ectrosia schultzei</i> var. <i>annua</i> *
	<i>Elytrophorus spicatus</i> *
	<i>Eragrostis cumingii</i> *
	<i>Eragrostis pubescens</i> *
	<i>Eragrostis schultzei</i> *
	<i>Eragrostis spartinoides</i> *
	<i>Eragrostis</i> spp. *
	<i>Eragrostis stagnalis</i> *
	<i>Eragrostis tenellula</i> *
	<i>Eriachne agrostidea</i> *
	<i>Eriachne armittii</i> *
	<i>Eriachne avenacea</i> *
	<i>Eriachne burkittii</i> *
	<i>Eriachne filiformis</i> *
	<i>Eriachne melicacea</i> *
	<i>Eriachne obtusa</i> *
	<i>Eriachne pallescens</i> var. <i>pallescens</i> *
	<i>Eriachne trisetata</i> *
	<i>Eulalia annua</i> *
	<i>Eulalia aurea</i> *
<i>Heterachne abortiva</i> *	
<i>Heterachne gulliveri</i> var. <i>gulliveri</i> *	
<i>Heteropogon contortus</i> *	

Key

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Colour coding for entries:

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- Brown** = Putative new species
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Flowering Plants	
Family	Species
Poaceae	<i>Heteropogon triticeus</i> *
	<i>Ischaemum decumbens</i> *
	<i>Ischaemumropicum</i> *
	<i>Iseilema fragile</i> *
	<i>Iseilema macratherum</i> *
	<i>Iseilema vaginiflorum</i> *
	<i>Mnesithea formosa</i> *
	<i>Mnesithea rottboellioides</i> *
	<i>Ophiuros exaltatus</i> *
	<i>Panicum seminudum</i> var. <i>cairnsianum</i> *
	<i>Panicum trichoides</i> *
	<i>Paspalidium distans</i> *
	<i>Paspalidium rarum</i> *
	<i>Paspalum scrobiculatum</i> *
	<i>Perotis rara</i> *
	<i>Pheidochloa gracilis</i> *
	<i>Pseudopogonatherum contortum</i> *
	<i>Pseudoraphis spinescens</i> *
	<i>Sacciolepis myosuroides</i> *
	<i>Schizachyrium crinizonatum</i> *
<i>Schizachyrium fragile</i> *	
<i>Schizachyrium occultum</i> *	

Flowering Plants	
Family	Species
Poaceae	<i>Schizachyrium pachyarthron</i> *
	<i>Schizachyrium pseudeulalia</i> *
	<i>Sehima nervosum</i> *
	<i>Setaria apiculata</i> *
	<i>Sorghum plumosum</i> var. <i>plumosum</i> *
	<i>Sorghum stipoideum</i> *
	<i>Thaumastochloa brassii</i> *
	<i>Thaumastochloa major</i> *
	<i>Thaumastochloa rubra</i> *
	<i>Thaumastochloa striata</i> *
	<i>Themeda arguens</i> *
	<i>Themeda triandra</i> *
	<i>Triodia bitextura</i> *
	<i>Triodia inutilis</i> *
	<i>Triodia microstachya</i> *
	<i>Triodia pungens</i> *
	<i>Tripogon loliiiformis</i> *
	<i>Urochloa holosericea</i> *
	<i>Whiteochloa airoides</i> *
	<i>Whiteochloa multiciliata</i> *
<i>Yakirra majuscula</i> *	
<i>Yakirra nulla</i> *	



A sundew (*Drosera* sp.), J. Roberts © Copyright, BHP Billiton



Flowering Plants	
Family	Species
Polygalaceae	<i>Comesperma aphyllum</i> *
	<i>Comesperma secundum</i> *
	<i>Polygala coralliformis</i> *
	<i>Polygala crassitesta</i> *
	<i>Polygala exsuarrosa</i> *
	<i>Polygala longifolia</i> *
	<i>Polygala petrophila</i> var. <i>angustifolia</i> *
Portulacaceae	<i>Calandrinia gracilis</i> *
	<i>Calandrinia spergularina</i> *
	<i>Calandrinia uniflora</i> *
	<i>Portulaca bicolor</i> *
Proteaceae	<i>Banksia dentata</i> *
	<i>Grevillea decurrens</i>
	<i>Grevillea dryandri</i> subsp. <i>dasycarpa</i> *
	<i>Grevillea heliosperma</i>
	<i>Grevillea parallela</i>
	<i>Grevillea pteridifolia</i> *
	<i>Grevillea pungens</i> *
	<i>Grevillea refracta</i> subsp. <i>refracta</i> *
	<i>Hakea lorea</i> subsp. <i>borealis</i> *
	<i>Stenocarpus acacioides</i> *
Restionaceae	<i>Dapsilanthus spathaceus</i> *
Rhamnaceae	<i>Alphitonia excelsa/pomaderroides</i> *
	<i>Cryptandra gemmata</i> *
	<i>Ziziphus oenopolia</i> *
	<i>Ziziphus quadrilocularis</i> *
Rhizophoraceae	<i>Carallia brachiata</i> *
Rubiaceae	<i>Gardenia ewartii</i> subsp. <i>ewartii</i> *
	<i>Gardenia fucata</i> *
	<i>Gardenia megasperma</i> *
	<i>Oldenlandia argillacea</i> *
	<i>Oldenlandia galioides</i> *

Flowering Plants	
Family	Species
Rubiaceae	<i>Oldenlandia mitrasacmoides</i> subsp. <i>mitrasacmoides</i> *
	<i>Pavetta brownii</i> var. <i>brownii</i> *
	<i>Spermacoce brevicilia</i> *
	<i>Spermacoce dolichosperma</i> *
	<i>Spermacoce fabiformis</i> *
	<i>Spermacoce gibba</i> *
	<i>Spermacoce stenophylla</i> *
Rutaceae	<i>Boronia lanceolata</i> *
	<i>Boronia lanuginosa</i> *
	<i>Glycosmis trifoliata</i>
	<i>Micromelum minutum</i>
Santalaceae	<i>Exocarpos latifolius</i> *
Sapindaceae	<i>Dodonaea hispidula</i> var. <i>hispidula</i> *
	<i>Dodonaea oxyptera</i> *
	<i>Dodonaea platyptera</i> *
Sapotaceae	<i>Pouteria arnhemica</i> *
Stemonaceae	<i>Stemona australiana</i> *
Stylidiaceae	<i>Stylidium dunlopianum</i> *
	<i>Stylidium floodii</i> *
	<i>Stylidium multiscapum</i> *
	<i>Stylidium tenerum</i> *
Thymelaeaceae	<i>Arnhemia cryptantha</i> *
	<i>Thecanthes filifolia</i> *
	<i>Thecanthes punicea</i> *
	<i>Thecanthes sanguinea</i> *
	<i>Thecanthes</i> sp. Donydji (C.R.Dunlop 8498) *
Verbenaceae	<i>Duranta erecta</i> ^ *
	<i>Stachytarpheta jamaicensis</i> ^ *
Violaceae	<i>Hybanthus enneaspermus</i> *
Xyridaceae	<i>Xyris complanata</i> *
	<i>Xyris indica</i> *
Zygophyllaceae	<i>Tribulopsis pentandra</i> *

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Ferns	
Family	Species
Blechnaceae	<i>Blechnum orientale</i> *
Lygodiaceae	<i>Lygodium flexuosum</i> *
Pteridaceae	<i>Cheilanthes brownii</i> *
	<i>Cheilanthes caudata</i> *
	<i>Cheilanthes contigua</i> *
	<i>Cheilanthes nitida</i> *
	<i>Cheilanthes praetermissa</i> *

Green Algae	
Family	Species
Characeae	<i>Nitella</i> sp. *

Liverworts	
Family	Species
Ricciaceae	<i>Riccia</i> sp. *

Fern Allies	
Family	Species
Selaginellaceae	<i>Selaginella ciliaris</i> *



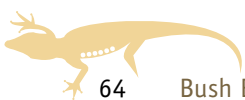
One of Wongalara's many water habitats, M. Hammer © Copyright, Museum and Art Gallery of the Northern Territory



Notes



Chequered Rainbowfish (*Melanotaenia splendida inornata*), Dave Wilson © Copyright, Aquagreen





Appendix B: Threatened Species

Nomenclature and taxonomy used in this appendix are consistent with that from the Australian Faunal Directory (AFD), the Australian Plant Name Index (APNI) and the Australian Plant Census (APC).

Current at June 2014



Fauna

Vertebrates

Mammals			
Family	Species	Common name	Status
Dasyuridae	<i>Dasyurus hallucatus</i>	Digul, Northern Quoll	EPBC—Endangered; TPWCA—Critically Endangered

Birds			
Family	Species	Common name	Status
Acciptridae	<i>Erythrotriorchis radiatus</i>	Red Goshawk	EPBC—Vulnerable; TPWCA—Vulnerable
Columbidae	<i>Geophaps smithii smithii</i>	Partridge Pigeon	EPBC—Vulnerable; TPWCA—Vulnerable
Estrildidae	<i>Erythrura gouldiae</i>	Gouldian Finch	EPBC—Endangered; TPWCA—Vulnerable
Pachycephalidae	<i>Falcunculus frontatus whitei</i>	Northern Shrike-tit	EPBC—Vulnerable; TPWCA—Near Threatened

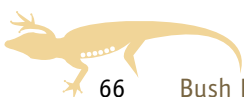
EPBC = refers to the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)

TPWCA = refers to the *Territory Parks and Wildlife Conservation Act 2000* (Northern Territory)

FA = refers to the *Fisheries Act 1988* (Northern Territory)

* = New record for this reserve

Blue = Previously recorded on the reserve but not found on this survey





Reptiles			
Family	Species	Common name	Status
Varanidae	<i>Varanus mertensi</i>	Mertens' Water Monitor	TPWCA—Vulnerable

Fishes			
Family	Species	Common name	Status
Pristidae	<i>Pristis pristis</i> *	Freshwater Sawfish	EPBC—Vulnerable; FA—Vulnerable



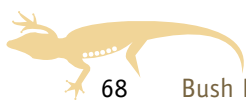
Mertens' Water Monitor (*Varanus mertensi*), listed as vulnerable under the TPWC Act, N. Crook © Copyright, Department of the Environment



Notes



A lagoon on Mainoru River, I. Cowie © Copyright, Northern Territory Herbarium





Appendix C: Exotic and Pest Species

Nomenclature and taxonomy used in this appendix are consistent with that from the Australian Faunal Directory (AFD), the Australian Plant Name Index (APNI) and the Australian Plant Census (APC).

Current at June 2014



Fauna

Vertebrates

Mammals		
Family	Species	Common Name
Bovidae	<i>Bos taurus</i>	European Cattle
	<i>Bubalus bubalis</i>	Swamp Buffalo, Water Buffalo
Equidae	<i>Equus asinus</i>	Donkey
	<i>Equus caballus</i>	Horse, Brumby
Felidae	<i>Felis catus</i>	Cat
Suidae	<i>Sus scrofa</i>	Pig

Frogs and Toads		
Family	Species	Common Name
Bufoidea	<i>Rhinella marina</i>	Cane Toad



Termite mounds, J. Roberts © Copyright, BHP Billiton





Invertebrates

True Bugs		
Family	Species	Common Name
Alydidae	<i>Melanacanthus scutellaris</i> *	Brown Bean Bug, Podsucking Bug
	<i>Riptortus linearis</i> *	Bean Podsucking Bug
	<i>Riptortus serripes</i> *	Brown Bean Bug, Podsucking Bug
Coreidae	<i>Aulacosternum nigrorubrum</i> *	Cotton Plant Bug, False Stainer
	<i>Mictis profana</i> *	Crusader Bug
Lygaeidae	<i>Graptostethus servus</i> *	Seed Eating Bug
Miridae	<i>Nesidiocoris tenuis</i> *	Tomato Mirid
Oxycarenidae	<i>Oxycarenus arctatus</i> *	Coon Bug
Pentatomidae	<i>Eysarcoris trimaculatus</i> *	Rice Stink Bug, Ricespotting Bug
	<i>Nezara viridula</i> *	Green Vegetable Bug
	<i>Oechalia schellenbergii</i> *	Predatory Shield Bug
	<i>Plautia affinis</i> *	Green Stink Bug
Scutelleridae	<i>Choerocoris paganus</i> *	Ground Shield Bug

Spiders		
Family	Species	Common Name
Pholcidae	<i>Crossopriza lyoni</i> *	Tailed Daddy Longlegs
Salticidae	<i>Hasarius adansonii</i> *	Adanson's House Jumper

* = New record for this reserve



Flora

Flowering Plants		
Family	Species	Common name
Asteraceae	<i>Emilia sonchifolia</i> var. <i>sonchifolia</i> *	Emilia, Red Tassel-flower
Fabaceae	<i>Alysicarpus ovalifolius</i> *	Oval-leaved Alysicarpus
	<i>Chamaecrista rotundifolia</i> *	Round-leaf Cassia, Round-leaved Cassia
	<i>Stylosanthes hamata</i> *	Caribbean Stylo
	<i>Stylosanthes humilis</i> *	Townsville Stylo
	<i>Stylosanthes viscosa</i> *	Sticky Stylo
Lamiaceae	<i>Hyptis suaveolens</i> *	Mint Bush, Mint Weed
Malvaceae	<i>Sida acuta</i> *	Spinyhead Sida
	<i>Sida cordifolia</i> *	Flannel Weed
Passifloraceae	<i>Passiflora foetida</i> *	Stinking Passion Flower
Poaceae	<i>Bothriochloa pertusa</i> *	Indian Bluegrass
	<i>Digitaria bicornis</i> *	Hairy Finger Grass
	<i>Echinochloa colona</i> *	Awnless Barnyard Grass
Verbenaceae	<i>Duranta erecta</i> *	Golden Dewdrop
	<i>Stachytarpheta jamaicensis</i> *	Jamaica Snakeweed

* = New record for this reserve



A Wongalara waterway, M. Hammer © Copyright, Museum and Art Gallery of the Northern Territory".





Glossary



B

Biome

A major ecological community, extending over a large area and usually characterized by a dominant vegetation type.

C

Cryptic species (cryptospecies)

Species that are physically similar but reproductively isolated from each other.

D

Diurnal

Diurnal: Active during the day.

E

Emergent vegetation

Vegetation that grows in water but pierces the surface so that it is partially in air.

H

Hill-topping

The congregation of butterflies and other insects at the top of hills and ridges to facilitate mate location.

I

Infraspecific

At a taxonomic level below that of species, e.g. subspecies, variety, form.

P

Phrase name

An informal name given to a plant taxon that has not yet been described and has therefore not yet been given a formal scientific name.

Proterozoic

A geological eon representing the time just before the proliferation of complex life on Earth. It began 2.5 billion years ago and ended 542 million years ago.

Putative new species

A species that has been recognised by an expert as never having been named or described in the scientific literature. Note that specimens may already be in museum or herbarium collections.

R

Range extension

Increase in the known distribution or area of occurrence of a species.

Rostrum

A projecting snout or beak.

S

Stygofauna

Animals that live in underground water, including crustaceans, worms, snails, insects, other invertebrate groups, and in Australia a blind fish and a newt.

T

Taxon (plural taxa)

A member of any particular taxonomic group, e.g. a species, genus, family.

Taxonomy

The categorisation and naming of species. The science of identifying and naming species, as well as grouping them based on their relatedness.

Type location

The location where the holotype (type specimen) was originally found.

Type specimen

The specimen, or each of a set of specimens, on which the description and name of a new species is based.

U

Undescribed taxon

A taxon (usually a species) that has not yet been formally described or named.



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FRONT COVER Kimberley Heath (*Calytrix exstipulata*), newly recorded at Wongalara Sanctuary, R. Kaciuba © Copyright, BHP Billiton



Bush Blitz survey report

Wongalara Sanctuary Northern Territory + 27 May–8 June 2012



Australian Government

