
Final Report
Melaleuca Wetlands, Coochiemudlo Island,
Fauna Survey
2016
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for Coochiemudlo Island Coastcare
Supported by Redland City Council



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Photos

Photos: mostly by Ronda and Darren Green.

Photo of group on front cover by Vivienne Roberts-Thomson.

Photos of bandicoot from motion-sensing camera

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Introduction

Background

Coochiemudlo Island, although small in size and with much of the central portion residential (originally cleared for agriculture and later subdivided), retains an impressive array of habitat types, including *Melaleuca* wetlands, *Eucalyptus* woodlands, mangroves, rocky shores sandy shores, sea-grass beds and others. In contrast with many islands, the native vegetation of its entire shoreline is protected as the 'Emerald Fringe', although in some places such as near the jetty on Main Beach the understorey plants are sparse, and in others inundated to various extent by introduced weeds.

The island is also within the MacPherson-Macleay overlap of southeastern Queensland and northeastern New South Wales, where Bassian (temperate forest and woodland) and Torresian (tropical forest and woodland) biota meet, many northern species reaching their southern limits within the region and southern species reaching their northern limits (Burbidge 1960). This overlap area in general is one of the most highly biodiverse regions in Australia.

The largest reserve on Coochiemudlo Island is the Melaleuca Wetlands, a 19.5ha reserve in the northeast corner. This reserve (native vegetation with some weedy areas and one major walking track) and the much smaller Laurie Burns Sportsfield adjoining the southwest corner (mostly cleared for various uses, but with much lawn, some fringing native vegetation and a pond) lie within Moreton Bay Ramsar site, which is considered of international importance for migrating waders (Department of the Environment and Energy, 2016 and *Laurie Burns Sportsfields, Coochiemudlo Island Draft Management Plan*, Redland City Council).

The Regional Ecosystems recognised for the Melaleuca Wetlands (Fig 1), as noted by WetlandInfo (2016), are:

- 12.2.7 in the central and central-eastern areas: Palustrine *Melaleuca quinquenervia* open forest with *Eucalyptus tereticornis*, *Corymbia intermedia*, *E. robusta* and other species, on Quaternary coastal dunes and seasonally waterlogged sandplains usually fringing drainage system behind beach ridge plains or on old dunes, swales and sandy coastal creek levees. Vegetation Management Act class: least concern. Biodiversity status: of concern. Low occurrence in reserves (i.e. not much is protected in conservation areas).
- 12.5.3 surrounding this (except the central-eastern part which extends to the coastal sand dunes): *Eucalyptus racemosa* subsp. *racemosa* woodland with *Corymbia intermedia*, *E. siderophloia* and other species on remnant Tertiary surfaces +/- Cainozoic and Mesozoic sediments. Vegetation Management Act class: endangered. Biodiversity status: endangered. Low occurrence in reserves.

The Redland City Council, on 'ground-truthing' the reserve, also identified that 40% of the area designated as 12.5.3 within the Wetlands is actually 12.5.2, although this is noted only for the western portion of the island by WetlandInfo. RE 12.5.2 comprises *Corymbia intermedia* and *Eucalyptus tereticornis* open forest on remnant Tertiary surfaces, usually near coast and usually deep red soils. With only 10-30% of its original extent remaining, and with low occurrence in reserves, this is also regarded as an endangered ecosystem.

Figure 1. Melaleuca Wetlands, showing Regional Ecosystems (from WetlandInfo 2016)



The RE 12.2.7 section is periodically inundated to form a swamp dominated by broad-leafed or paperbark tea-tree (*Melaleuca quinquenervia*) with sedges and other understorey plants, which are much sparser as

would be expected) in the portions that remain for some months under water. The surrounding woodland (RE 12.2.7) has a diverse understorey of shrubs (e.g. *Exocarpus* and *Banksia* spp) and herbaceous plants, including significant species such as the swamp orchid *Phaius australis*.

Although WetlandInfo (2016) reports that over 30% of 12.2.7 remains in Queensland, *Melaleuca* wetlands have been diminishing in Southeast Queensland to the point where less than 500 ha remains of the original 12,000 ha in Brisbane (<http://www.oxleycreekcatchment.org.au>). The 19.5 ha of the Melaleuca Wetlands Reserve plus remnant and regenerating fragments elsewhere on the island could be of significance to sedentary fauna and flora species associated with such habitat and to visitors from neighbouring islands and the mainland (primarily birds and bats).

According to WetlandInfo (2010) “In southern Queensland the cyclic flowering of swamp paperbark *Melaleuca quinquenervia* can extend from mid-summer to the end of winter (January–August). These flowering events provide important food resources for nectivorous birds in summer, before honey-rich heath plants (for example, dwarf banksia *Banksia oblongifolia*) of the adjacent wallum have commenced flowering. During winter, these and many other bird species move to coastal and sub-coastal areas during their seasonal northerly or altitudinal migration. Birds of the coastal and sub-coastal tree swamps include honeyeaters, often referred to as ‘blossom nomads’, such as the noisy friar bird *Philemon corniculatus* and several species of lorikeets, which are conspicuous during flowering events ... The rich insect and arthropod fauna of coastal and sub-coastal tree swamps also attract bird life, particularly during the cooler winter months when other ecosystems might have diminished food.”

Cox and Specht (2012), in their assessment of water resources and associated ecosystems of the Moreton Bay islands, consider the wetlands of Coochiemudlo Island to have high conservation interest and also high risk (not associated with human usage of water, which they see as a lower risk here). They suggest (for all the islands) a “systematic stratified survey of all biota, not just those that appear in state, national or international conservation lists, concentrating on the variation within and between the various locations and assets” and the establishment of long-term monitoring of ecosystem status.

One of the recommendations of a submission by FOCI (1991), after noting that although no species appear to be unique to the island it may function as an important corridor for rare visitors, and that as part of a fauna and flora management plan there should be a full inventory of the Melaleuca Wetlands and the mangrove areas, and these should then be monitored regularly. It also recommends urgent planning for management of visitors to the island, as increasing numbers could otherwise place considerable stress on the ecosystems (with particular reference to the increasing popularity of Norfolk Beach, which borders the Wetlands). Planning for increased visitation in other than a very general way would ideally require an understanding of the fauna and flora that are to be thus protected. Caneris (1997) conducted a fauna survey in summer, and concluded that surveys over several seasons and several years would be required for a more detailed listing of fauna.

Ronda Green, BSc (Hons) PhD and Darren Green, who had already visited the island numerous times as ecotour-leaders, but also have long experience in conducting fauna surveys (Ronda's doctoral studies in the 1970s and much subsequent research being in field zoology) were engaged by Coochiemudlo Island Coastcare Inc., funded by a grant from Redland City Council to undertake a fauna survey of the Melaleuca Wetlands over four seasons:

- mid-summer (January 2016)
- mid- autumn (April 2016)
- mid- winter (13-16 July 2016)
- mid- spring (12-15 October 2016)

Aim of survey

The aim was to determine as far as possible the resident and migratory/nomadic fauna of the Melaleuca Wetlands throughout the year, with particular focus on native mammals, birds, reptiles and frogs but including incidental observations of all fauna species, with a view to assisting conservation management plans, including future monitoring, and nature interpretation for residents and visitors.

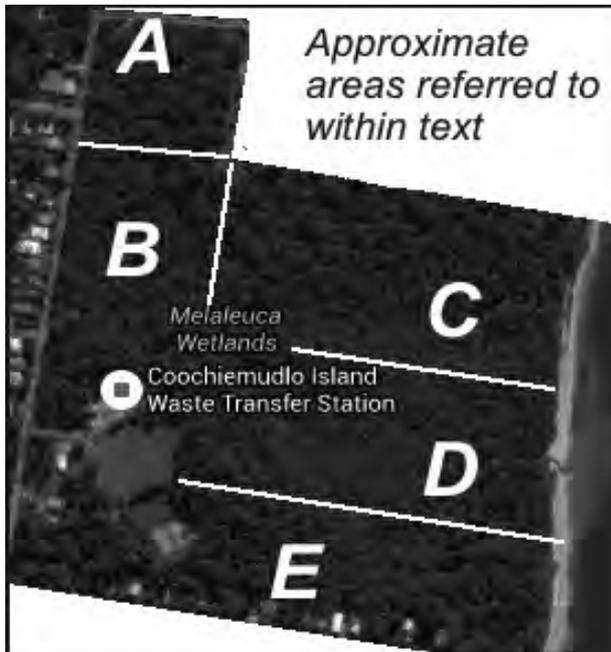
Methods

Before arrival on the island we requested three lists from Wildlife Online: (1) all fauna and flora from 1km around the midpoint of the Wetlands, (2) the same but only for confirmed records since 1980, and (3) records of rare and threatened species within 10km. We also accessed other records (e.g. Caneris 1997, Gasteen 1994) and spoke with residents about what animals had previously been seen.

Ronda and Darren Green led the survey, assisted by a small team of volunteers, mostly members of Coochiemudlo Island Coastcare, but also university students, international tourists and others (see acknowledgements) who, largely for public liability insurance purposes, joined CoastCare before the fieldwork began. All gathered on 27/1/16 for a briefing session on aims and methods of the survey. Graeme Roberts-Thomson of Coochiemudlo Island Coastcare presented a briefing on safety procedures at the start of each season, and each volunteer signed on and off for each session. The volunteers helped with carrying and (after instruction and demonstration) setting of Elliott traps, digging holes for the pitfalls and setting the drift nets, checking traps for animals and finally dismantling and washing them. This assistance was much appreciated.

We walked the entire perimeter of the Wetlands and through the wider trails on 26/1/16 for planning of traplines etc., and subdivided the wetlands area into five approximate regions to assist with communication on locations within the Wetlands (Figure 1)

Figure 2. Approximate areas within the Melaleuca Wetlands referred to within text and tables.



For the summer survey, four lines of Elliot traps were set in areas B, D and E, two with ten traps each, and two with nine. They were placed away from the main walking tracks and spaced approximately 5m apart, the precise location being selected in accordance with possible runways of animals through the vegetation or sheltering logs, ease of concealment from walkers, distance from ant nests and stability of ground. Each trap was baited with the standard mixture of rolled oats, honey (Capillano brand, as this has proved popular with native mammals) and peanut butter (Coles home-brand), with the addition on the final night of small portions of salami or sardine to attract *Dasyuridae* species (small carnivorous marsupials). Leaf litter and/or fallen *Melaleuca* bark was placed inside each trap for the animal's comfort and the same placed on and around each trap for insulation and concealment.

For the autumn survey, traps were similarly spaced but placed in a single line, mostly in area D, from eucalypt woodland through sedges and right through the middle of the tea-tree-dominated swamp, which had completely dried out apart from a couple of puddles no more than a metre or two across, and along the edge of the far side of the swamp.

For the winter survey, traps were placed along the beginning of the same line, but recent rains had filled much of the swamp, starting from a short way into the sedges, so the trapline was diverted around its edge, and shortened. A second, shorter trapline ran along a drainage line in the northern section of Area B.

For the spring survey, one line of traps was placed somewhat similarly to that of the winter survey, but penetrating into the swamp, from which the water had started receding, and another through Area C, largely in eucalypt woodland.

Three wire cage traps, similarly baited, were also set each time, in the hope of trapping larger animals such as bandicoots, and also with leaf litter and *Melaleuca* bark inside and out.

Green flagging tape was placed near each trap so as not to be conspicuous to casual walkers but to assist us in locating the traps.

Traps were set in the late afternoon each day on three consecutive days, and checked within 90 minutes after sunrise the following morning (helpers met about half an hour after dawn each morning for this purpose),

A line of pitfall traps (4 or 5 in each location) was set near each of the lines of Elliot traps, with a length of plastic drift-net to direct small animals such as frogs and lizards, and soil built up against the driftnet to make it difficult for animals to quickly pass underneath instead of traveling along the net. Six pitfalls were deep, steep-sided buckets and others were 'normal' buckets. Leaf litter, soil and *Melaleuca* bark were placed inside as well as a piece of styrofoam on which animals could climb and float if it rained heavily overnight. These traps were left open throughout, and checked morning and afternoon.

From 2 to 5 well-camouflaged motion-sensing cameras were erected each time, facing apparent bandicoot diggings or in an apparent 'runways' of a kind fairly typical of small mammals through the undergrowth. Peanut butter, rolled oats and honey mixture was scattered in front of most cameras, plus banana, sardines, salami and cooked sausage in front of some, with the hope of attracting bandicoots and dasyurids to where they would most readily be photographed.

Alexandra Beresford, a former island resident with fauna survey experience, also erected a further three cameras that had been purchased by a grant from SEQ Catchments, for the summer survey. Tim Herse took over the setting of these cameras in winter, but regrettably one of these was stolen (by a thief who came prepared with bolt-cutters to break through the protective cage. Cameras set in spring were accordingly set close to the ground with much concealing vegetation around them, and their positions photographed so we could still find them ourselves.

A 2-hour bird search was conducted throughout the Wetlands on the first morning, and from then on opportunistic sightings were made while checking traps, and further observations made from the main track each through the wetlands after traps were checked. Further opportunistic sightings were recorded throughout the day.

Nocturnal searches were conducted each night with handheld spotlights, sometimes sitting quietly without the lights and listening. We walked at least once each season the full length of the main track through the Wetlands running parallel to the beach, plus the track between Areas A and B, along the beach looking into the forest from the edge, along the edge of the oval near the Waste Transfer Station, and various short tracks through the eucalypt woodland.

A SongBird device (somewhat similar to an Anabat) was hired from Green Tape Solutions at Moggill for the final, spring survey in an attempt to identify microbats. Frog calls were recorded with a directional microphone which was to have been used also for nocturnal waterbirds in the swamp, but none were detected, the only bird calls at night being bush stone-curlew, masked lapwing, boobook owl and tawny frogmouth.

During the spring survey we also raked and sifted sand on sections of the track just prior to nightfall and examined them for tracks early the following morning.

Results

General

It is unfortunate that this was a dry year. There had not been a good wet season rainfall during the 2015/2016 summer, by autumn the swamp was almost entirely dry, and none of the twelve survey nights (spread across four seasons) produced much rain, despite some weather forecasts to the contrary. Thus it was not the ideal year for seeking frogs or waterbirds, and may have affected other fauna. Mammal life was very sparse apart from bats but there was a good abundance and diversity of arthropods and birds, the actual species composition changing somewhat with season.

Many photos were taken, and since their inclusion would make the report overly long, a Flickr account (https://www.flickr.com/photos/wildlife_australia/albums/72157675048236860) has been created, with the intention of uploading several dozen photos of fauna, habitats and survey procedures by the end of 2016 .

Mammals

Presence of bandicoots was obvious through diggings during the first two seasons, and finally a northern brown bandicoot (*Isoodon macrourus*) was captured on film by a motion-sensing camera during the winter survey. Several photos were recorded, mostly between 11.00pm and 1.30am. Other bandicoots were subsequently detected in the same way during the spring survey. None were captured in the cage traps. A couple of the photos (e.g. below, right) could have been long-nosed bandicoots (*Perameles nasuta*: ears look pointed, and nose possibly longer, but tip of snout obscured), and this species is noted as 'confirmed' for the area by Wildlife Online, but others, as in the picture to the left, had rounded ears and were more obviously northern brown. It would be surprising (although not impossible) to find both species on a small island



It is remarkable that with 480 trap-nights (number of traps x number of nights) no small mammals were captured. In several decades of trapping experience, I have never before found a total absence of small mammals even with far fewer trap-nights. One would normally expect at least a few dasyurids (carnivorous marsupials), native rodents or at the very least one or two introduced rodent species. None were detected on motion-sensing cameras either. We can safely say that if any do exist in the Wetlands they are extremely low in abundance.

Bats were the only mammals that were abundant. Flying foxes camped on the island in winter, not far from the Wetlands, which they made extensive use of, and they visited also in all other seasons. Microbats were frequently seen flitting past in all seasons, and in spring the Songbird device hired from Green Tape Solutions in Brisbane detected six definite species and two possible ones (Green Tape Solutions 2016).

No mammals other than bandicoots, humans and dogs were recorded by the cameras, even those that had been left for several weeks by Alexandra Beresford and Tim Herse. One of the dogs was filmed during the April survey before nightfall, not far from the oval where we had previously seen it being exercised by its owner, apparently attracted by the smell of sardine on the ground near the camera. We suspect other dogs or cats were roaming later at night on occasion, as several traps were knocked over, and dog tracks were found in the early morning leading from the Wetlands to the beach on a section of sandy track that had been smoothed over the previous evening. No human footprints were found there, indicating the dog may have been wandering alone overnight or in the early morning. A grey cat was seen to run from Area E one evening in spring and crouch on a lawn across the road, and when quietly approached quickly ran off, behaving more like a feral than a domesticated animal, but was later captured by a resident, found to be micro-chipped, and returned to its owner.

An echidna has been seen and photographed by a resident on the island since the conclusion of the survey.

Table 1. Mammals detected during survey

Species	Location	Season	Notes
Northern brown bandicoot <i>Isodon macrourus</i>	Various, especially E	Winter, Spring	Filmed on motion-sensing camera in winter. Diggings observed all seasons.
Grey-headed flying fox <i>Pteropus poliocephalus</i>	All	Summer, Autumn, Winter (maximum abundance), Spring	Feeding on <i>Corymbia</i> flowers in summer, <i>Eucalyptus tereticornis</i> and <i>Melaleuca quinquenervia</i> in winter. Some flew towards Stradbroke in summer.
Black flying fox <i>Pteropus scapulatus</i>	All	Summer, Autumn, Winter (maximum abundance), Spring	Feeding on <i>Corymbia</i> in summer and <i>Banksia</i> in winter (probably <i>Eucalyptus tereticornis</i> and <i>Melaleuca quinquenervia</i> also, but not directly observed to do so.
Microbat spp	All	Summer, Autumn, Winter, Spring	Seen flitting past in early evening during nocturnal walks, several identified in Spring (see below)
Gould's wattled bat <i>Chalinolobus gouldii</i>	B and just W of A	Spring	Identified by Green Tape Solution's analysis of recordings
Chocolate wattled bat <i>Chalinolobus morio</i>	Just W of A	Spring	Identified by Green Tape Solution's analysis of recordings
Eastern bentwinged bat <i>Miniopterus orianae oceanensis</i>	Just W of A	Spring	Identified by Green Tape Solution's analysis of recordings
Little bentwinged bat <i>Miniopterus australis</i>	Just W of A	Spring	Identified by Green Tape Solution's analysis of recordings
Ride's free-tailed bat <i>Mormopterus ridei</i>	Just W of A	Spring	Identified by Green Tape Solution's analysis of recordings
Large-footed Myotis <i>Myotis macropus</i>	B	Spring	Identified by Green Tape Solution's analysis of recordings
Broad-nosed bat <i>Scotorepens sp.?</i>	B and just W of A	Spring	Identified as 'probable' by Green Tape Solution's analysis of recordings
White-striped free-tailed bat <i>Tadarida australis</i>	Just W of A	Spring	Identified as 'probable' by Green Tape Solution's analysis of recordings, but has been recorded previously, so its status on the island is confirmed
Feral and domestic mammals		Autumn, Spring	Unaccompanied dogs captured on motion-sensing camera, unaccompanied dog tracks seen leading to beach, cat seen running from Wetlands, other unrestrained dogs and cats seen wandering nearby

Birds

A good variety of birds were sighted (over 50 species). Many appear to be resident throughout the year. Winter visitors included nectarivores (yellow-faced honeyeater, scarlet honeyeater, eastern spinebill) and species that commonly leave the mountains for lower altitudes in winter (rufous fantail, grey fantail, golden whistler). Summer migrants included dollarbird, common koel, channel-billed cuckoo and black-faced monarch. Others such as galahs and orioles that were detected only in one or two seasons may have been present in other seasons on other parts of the island. Small ground-foraging bush-birds common on the mainland however were notably absent.

Since the conclusion of the survey, a Pacific baza has been sighted and photographed in the Wetlands. They are a conspicuous and unmistakable species. According to the *Birds in Backyards* website “Little is known of their movements; they are considered sedentary in some regions and dispersive or migratory in others.”

Table 2. Birds detected during survey (those in parentheses were seen near but not in the Wetlands or not clearly identified). * indicates an introduced species.

Species	Location	Season	Notes
(White ibis) <i>Threskiornis molucca</i>	Near S border	Summer, Autumn, Winter, Spring	
Bush stone curlew <i>Burhinus grallarius</i>	Near borders and occasionally within Wetlands	Summer, Autumn, Winter, Spring	Footprints suggest entry to Wetlands from beach. Eggs and chicks in spring, close to S and N borders
(Masked lapwing) <i>Vanellus miles</i>	Near borders and occasionally within Wetlands	Summer, Autumn, Winter, Spring	Chicks in spring
(Australian Wood Duck)		Winter, Spring	Near Wetlands
(unidentified raptor)	E	Summer,	Not clearly seen. Residents have reported a sparrowhawk or brown goshawk, and Caneris (1999) noted brown goshawk as present
Brahminy kite <i>Haliastur indus</i>	D	Summer, Autumn, Winter	
Whistling kite <i>Haliastur sphenurus</i>	C	Summer, Winter	
White-bellied Sea Eagle <i>Haliaeetus leucogaster</i>		Autumn, Winter, Spring	Nest at western edge of Wetlands in Winter, fledged by Spring survey
Boobook owl <i>Ninox boobook</i>	Various	Summer, Winter, Spring	Heard, sometimes two birds answering each other
(Crested pigeon) <i>Ocyphaps lophotes</i>	Near S border	Summer, Winter	
Bar-shouldered dove <i>Geopelia humeralis</i>	Near N and S borders	Summer, Autumn, Winter, Spring	
(Indian spotted dove) * <i>Streptopelia chinensis</i>	Near S border	Summer, Spring	
Pheasant coucal <i>Centropus phasianinus</i>	E	Summer, Autumn, Spring	
Eastern Koel <i>Eudynamis orientalis</i>	B and C? (heard only)	Summer, Spring	Identification definite, exact location uncertain
Brush cuckoo <i>Cacomantis variolosus</i>	C	Summer	
(Channel-billed cuckoo)	Near E	Summer, Spring	

<i>Scythrops novaehollandiae</i>			
Scaly-breasted Lorikeet <i>Trichoglossus chlorolepidotus</i>	E	Summer, Spring	
Rainbow Lorikeet <i>Trichoglossus haematodus</i>	Various	Summer, Autumn, Winter, Spring	Feeding on bloodwood nectar and <i>Euodia</i> nectar in summer,
Galah <i>Eolophus roseicapillus</i>	B	Summer	
Little corella <i>Cacatua sanguinea</i>	Near B	Spring	Between house and Wetlands
Sulphur-crested cockatoo <i>Cacatua galeria</i>	Near B	Autumn, Winter, Spring	Between house and Wetlands
Tawny frogmouth <i>Podargus strigoides</i>	A, B	Autumn, Spring	Seen at night
Sacred kingfisher <i>Todiramphus sanctus</i>	D	Summer, Spring	
Forest kingfisher <i>Todiramphus macleayii</i>	A	Summer, Spring	
Laughing kookaburra <i>Dacelo novaeguineae</i>	Various, including centre of swamp	Summer, Autumn, Winter, Spring	
Dollarbird <i>Eurystomus orientalis</i>	E	Summer	
Silvereye <i>Zosterops lateralis</i>	D	Summer, Winter	<i>Eucalyptus tereticornis</i> flowers, large flock in <i>Alphitonia</i> (eating fruit?)
(Noisy miner) <i>Manorina melanocephala</i>	near S border	Summer, Autumn, Winter	
Blue-faced honeyeater <i>Entomyzon cyanotis</i>	B,E near S border	Summer, Autumn, Spring	Feeding on <i>Euodia</i> and <i>Grevillea</i> flowers in summer,
Noisy friarbird <i>Philemon corniculatus</i>	C B	Summer, Autumn, Winter, Spring	
Yellow-faced honeyeater <i>Lichenostomus chrysops</i>		Winter	
Scarlet honeyeater <i>Myzomela sanguinolenta</i>		Winter	
Eastern Spinebill <i>Acanthorhynchus tenuirostris</i>		Winter	
White-throated treecreeper <i>Cormobates leucophaea</i>	B	Summer	
Spangled drongo <i>Dicrurus bracteatus</i>	E	Summer, Autumn, Winter	Seen feeding at <i>Banksia</i> flower
Grey Fantail <i>Rhipidura albiscapa</i>		Winter	
Rufous Fantail <i>Rhipidura rufifrons</i>		Winter	
Willy Wagtail <i>Rhipidura leucophrys</i>		Winter	
Rufous Whistler <i>Pachycephala rufiventris</i>		Winter	
Golden Whistler <i>Pachycephala pectoralis</i>		Winter	

Grey Shrike-thrush <i>Colluricincla harmonica</i>		Spring	
Figbird <i>Sphecotheres vieilloti</i>		Spring	
Olive-backed oriole <i>Oriolus sagittatus</i>		Spring	
Striated pardalote <i>Pardalotus striatus</i>	C,D	Summer, Autumn, Winter, Spring	
White-throated gerygone <i>Gerygone albogularis</i>		Autumn	
Black-faced cuckooshrike <i>Coracina novaehollandiae</i>		Winter, Spring	
Torresian crow <i>Corvus orru</i>	B	Summer, Autumn, Spring	
Grey butcherbird <i>Cracticus torquatus</i>	Near N border	Summer, Autumn, Winter, Spring	
Pied butcherbird <i>Cracticus nigrogularis</i>	Near N border	Winter, Spring	
Australian magpie <i>Cracticus tibicen</i>	Near N an W borders	Summer, Autumn, Winter, Spring	
Black-faced monarch <i>Monarcha melanopsis</i>	E	Summer	
Leaden flycatcher <i>Myiagra rubecula</i>	E	Summer, Spring	

Reptiles

We saw at least 4 species of native lizard (some small skins too fast to catch could have been additional species), one exotic lizard, and 4 snake species (see Table 3).

The blind snake was probably (syn *Rhamphotyphlops*) *nigrescens*. Dr. Patrick Couper of the Queensland Museum informed us that *R. nigrescens* had been recorded previously from the island, that the colour of our specimen is consistent with it belonging to this species, and that it was very doubtful there would be more than one species of *Rhamphotyphlops* on the island.

A death adder had previously been confirmed for the island, and a recent sighting in the Wetlands has been reported by a resident (a short thick-bodied snake in the grass, definitely not a lizard). Diane Gilham photographed a keelback snake in early 2016 (our only sighting was a long-dead specimen). Several residents (e.g. Noel Christensen, Emma Proctor and Gary Sheely) have photographed carpet pythons in and near the Wetlands, the latest being one photographed on the main track in early November, 2016, and they have frequently been observed by Coastcare members during monthly Dunecare activities. Yellow-faced whipsnakes have also been reported.



Table 3. Reptiles detected during survey

Species	Location	Season	Notes
Small-eyed snake <i>Rhinoplacephalus nigrescens</i>	A	Summer	Nocturnal search
Blackish blind snake <i>Amilios</i> (syn <i>Rhamphotyphlops</i>) <i>nigrescens</i>	D	Autumn	Pitfall, in swamp
Green tree snake <i>Dendrelaphis punctulata</i>	C	Spring	Saw snake resting on reeds, then found shed skin nearby next day
Keelback snake <i>Tropidomorphus punctulatus</i>	D	(Winter: dead)	Old carcass found near oval
Garden skink <i>Lampropholis guichenotti</i>	E	Summer	Several in pitfalls
Grass skink <i>Lampropholis delicata</i>	D, E	Summer, Autumn, Winter, Spring	Pitfalls and incidental sightings in swamp and woodland
(Wall skink <i>Cryptoblepharus virgatus</i>)	Seen near western and southern edges	Autumn, Spring	Incidental sightings
Bearded dragon <i>Pogona barbata</i>	B, C, D, E	Summer, Autumn,	Motion-sensing camera and incidental sightings
(*Asian House Gecko <i>Hemidactylus frenatus</i>)	Near C	Summer	Incidental sighting



Green treesnake



Blackish blind snake

Amphibians

Two species of frog (eastern sedge frog and striped marsh frog) were detected during the surveys plus occasional cane toads.

One frog photographed but not captured had the general appearance of an eastern sedge frog (*Litoria fallax*) but an unusual pattern of dark brown spots on a pale brown back. We sent a copy to Steve Wilson of the Queensland Museum, who confirmed there was not much else it could be but a strangely patterned *L. fallax*. Since then we have seen a couple of others with similar pattern and heard from local residents that they have also seen them. Residents also reported green tree frogs (*L. caerulea*) on and near their properties.



Table 4. Amphibians detected during survey

Species	Location	Season	Notes
Striped marshfrog <i>Limnodynastes peronii</i>	D, E	Summer, Autumn, Winter (fewer), Spring	Many in pitfalls, others seen and heard
Eastern sedge frog <i>Litoria fallax</i>	D, E	Summer, Autumn, Spring	Many heard on nocturnal searches in summer and some in spring, started calling after 6.30pm on dry days, earlier after rain, sometimes also heard by day
Cane toad * <i>Rhinella</i> (syn <i>Bufo</i>) marina	C	Summer	A few on the main track



Striped marshfrog



Eastern sedgefrog

Fish

Several very small juvenile eels (*Anguilla?*) were seen in summer at night in the small stream emptying to the beach on the eastern edge of the Wetlands. The eels were unexpected, and were probably very young long-finned eels that had swum from breeding grounds in the Southwest Pacific to enter rivers on the mainland. It seems likely they would soon re-enter the sea and continue on to mainland rivers.

Invertebrates

We noted a good diversity of spiders, butterflies and other invertebrates, though not all of those seen were recorded or identified, as the main focus of the survey was on vertebrate fauna.

Since the survey ended there has been an influx of caper white butterflies, probably blown off their normal migration route by inclement weather.

Table 6. Invertebrates detected during survey

Species	Location	Season	Notes
Small blue butterfly Lycaenidae spp	various	Summer, Spring	
Orchard swallowtail butterfly <i>Papilio aegens</i>	various	Summer,	E
Orange ringlet butterfly <i>Hypocysta agianta</i>	all	Summer, Autumn, Spring	Numerous throughout Wetlands
Meadow argus butterfly <i>Junonia villida</i>	various	Spring	Numerous
Evening brown butterfly <i>Melanitis ledia</i>	all	Summer, Autumn, Winter, Spring	Seen in both summer/wet season colours and winter/dry season colours
Common crow butterfly <i>Euploea core</i>	various	Summer, Autumn, Spring	Many
Blue tiger butterfly <i>Tirumala hamata</i>		Summer,	
Swamp Tiger Butterfly <i>Danaus affinis</i>		Winter	
Lemon migrant butterfly <i>Catopsilia pomona</i>		Summer, Autumn,	
Common grass yellow butterfly <i>Eurema hecabe</i>		Summer, Autumn,	
Orange Dart butterfly <i>Suniana sunias</i>		Summer	On exotic yellow daisy flowers
Unidentified skipper butterfly, brown, possibly Common Swift <i>Pelopidas agna</i>		Summer	
Other butterflies, mostly Lycaenidae and Hesperiidae		Summer, Autumn, Spring	Unidentified, fleeting glimpses, small
Moth <i>Lymantria antennata?</i>		Summer,	
Saunders' Case Moth <i>Metura elongatus</i>		Summer, Autumn, Winter, Spring	Pupa cases seen all seasons, uncertain whether active
Black Thorax Wasp Moth - <i>Amata trigonophora?</i>		Summer	
Noctuid Moth <i>Grammodes sp</i>		Summer	
Scribbly gum moth <i>Ogmograptis scribula</i>		Summer, Autumn, Winter, Spring	Scribbles on trunks, uncertain when active
Tiger Moth, Family Arctiidae, subfamily Ctenuchinae	swamp	Spring	Seen resting on vegetation
Other moths, unidentified		All	

Dung Beetle? Possibly <i>Onitis</i> or <i>Onthophagus</i> sp.		Spring	In pitfall
Orange Antlion - <i>Callistoleon erythrocephalus</i>		Summer	Adults on reeds in swamp, presumably at least one of the species responsible for the many antlion its on the island
Paperbark sawfly <i>Pergagraptia polita</i>	C	Spring	Custer of larvae
Paper wasp, Family Vespidae, Subfamily Polistinae	C	Spring	
Spiny Bark Mantid <i>Gyromantis kraussi</i>		Spring	On eucalypt tree trunk, well-camouflaged
Paperbark cicada <i>Cicadetta hackeri</i>	swamp	Summer	
Other cicadas, heard, not identified. Superfamily Cicadoidea		Summer,	Many calling
Giant water bug <i>Lethocerus insulanus</i>	swamp	Autumn	Dead specimen found
Gumtree Shield bug <i>Theseus modestus</i>		Summer	Nymphs in summer on <i>Melaleuca</i>
Flatheaded leaf-hopper. Family Cicadellidae, Subfamily Ledrinae	Main track through Wetlands	Summer	On <i>Eucalyptus tereticornis</i> bark
Lerp insects on <i>Dodonaea</i>		Spring	Masses of white lerp-like scales on stems of <i>Dodonaea</i>
Mole cricket <i>Gryllotalpa pluvialis</i>	swamp	Winter	
Small black crickets, unidentified. Family Gryllidae	swamp	Autumn, Winter, Spring	Very numerous
Grasshoppers, unidentified. Suborder Caelifera		Autumn	
Phasmid: Goliath stick insect? <i>Eurycnema goliath</i>	swamp	Spring	Resembles young instar of goliath stick insect (see photo)
Dragonfly red abdomen, possibly Red Arrow <i>Rhodothermis lieftincki</i>	swamp	Summer	
Damselfly, green head. <i>Austrolestes</i> sp. female?	swamp	Summer	
Common Bluetail Damselfly <i>Ischnura heterosticta</i> female?	swamp	Spring	
Black Woodland Cockroach –		Spring	

<i>Platyzozeria melanaria</i>			
Other native cockroaches		Autumn	
Many other insects			
Leaf-curl spider <i>Phonognatha sp.</i>		Summer, Autumn, Winter, Spring	
Andrew's Cross Spider <i>Argiope keyserlingi</i>		Summer, Autumn, Winter, Spring	
Golden orb-weaver <i>Nephilia sp.</i>		Summer,	
Other orb-weaver <i>Eriophorba sp.?</i>		Summer, Autumn, Winter, Spring	At night
Silver Orb Spider <i>Leucauge granulata</i>		Summer	
Net-casting spider <i>Deinopsis sp.</i>	Main track through Wetlands	Summer, Autumn, Winter, Spring	Seen holding nets at night
Common Lynx Spider <i>Oxyopes quadrifasciatus</i>		Summer	
Swift Spider <i>Corinnid sp.</i>		Spring	
Tent spider <i>Cyrtophora sp.</i>	C	Spring	
Wolf spider, , unidentified <i>Lycosa sp.</i>		Summer, Autumn	
Brown Huntsman Spider <i>Heteropoda</i> sp.		Summer	
Grey Huntsman spider <i>Holconia immanis</i>	Main track through Wetlands	Summer, Autumn, Winter	
Jumping spider, unidentified. Family Salticidae		Summer, Spring	
Whip Spider. Family Theridiidae		Winter, Spring	
Other spiders			Unidentified
Spirobolid millipede. Diplopoda, Order Spirobolida		Spring	Black with red bands, red legs (see photo)
Giant Centipede. Chilopoda, Order Scolopendromorpha		Spring	In pitfall



Instar of Goliath Phasmid?



Mantid (*Gyromantis?*)



Dung beetle



Sawfly larvae



Millipede (Spirabolida order)



Net-casting spider

Resources for fauna

Termite nests and hollows in trees provided nests for kingfishers, the hollows providing same for parrots and presumably boobook owls. Terrestrial termites are also, along with ant larvae and pupae, the primary diet of the blind snake. Seasonal flowering and fruiting provided food directly or (through insects) indirectly for birds and bats. Butterfly host plants were also present (e.g. *Cynachum carnosum*, essential for the swamp tiger, also *Corymbia intermedia*, *Imperata ingens*, *Lophostemon suaveolens* and others used by other butterfly larvae.)

There would appear to be ample logs, shrubs, long grass, sedges and other shelter for rodents, dasyurids, echidnas, fairy-wrens and other small ground-foraging animals

Water was abundant in some seasons, but must have imposed severe constraints for animals such as water rat, myotis, waterbirds and frogs in this and other dry years.

Table 7. A sample of the potential food plants flowering or fruiting within wetlands during survey.

Species	Common name	Flowering?	Fruiting?	Notes
<i>Austromyrtus dulcis</i>	Paperbark TeaTree	Mostly Winter		attracting nectarivorous birds and bats
<i>Corymbia intermedia</i>	Pink bloodwood	Summer		Profuse, attracting birds and fruitbats
<i>Dianella caerulea</i>	Blue fax lily		Summer (few)	Possibly attracting frugivorous birds
<i>Elaeocarpus reticulatus</i>	Blueberry Ash		Autumn (ripe), Spring (green)	Could attract frugivorous birds and bats when ripe
<i>Eucalyptus robusta</i>	Swamp mahogany	Spring		Attracting nectarivorous birds and butterflies
<i>Eucalyptus tereticornis</i>	Forest red gum or Queensland blue gum	Winter		Attracting nectarivorous birds and bats
<i>Eucalyptus racemosa</i>	Scribbly gum	Spring		Attracting nectarivorous birds
<i>Banksia integrifolia</i>	Coast banksia	Autumn, Winter (mostly), Spring		Attracting birds and at least occasional fruitbats
<i>Eustrephus latifolius</i>	Wombat berry		Summer (few)	Possibly attracting frugivorous birds
<i>Geitonoplesium cymosum</i>	Scrambling lily		Summer (few), Autumn	Possibly attracting frugivorous birds
<i>Smilax glyciphylla</i>	Sweet sarsparella		Summer (Mostly green, few ripe), Autumn	Possibly attracting frugivorous birds
<i>Austromyrtus dulcis</i>	Midjinberry		Autumn	Possibly attracting frugivorous birds

Discussion

General

2016 was a very dry year, even during the wet season. Records at Owl Cottage (top end of Tageruba Street, Coochiemudlo Island) showed 232mm for the first quarter of the year, compared to 826.5mm for the same period in 2015, 227.5mm in 2014 (another dry 'wet' season), 741.5mm in 2013, 772.5mm in 2012, 653.5mm in 2011. Total rainfall for the second quarter was 192mm, the driest since 2010, with most of the rain falling unseasonably in June (only 43.5mm in April and 17mm in May). Further surveys in a wetter year might possibly detect more frog species (some of which become active only in warm, wet weather) and waterbirds. Caneris 1999 noted white-faced heron, little egret, intermediate egret, royal spoonbill, magpie goose, dusky moorhen, Australasian (formerly purple) swamphen and buff-banded rail, all of which are strong flyers and may possibly return in wetter years.

The invertebrate, bat and bird fauna showed good diversity, other faunal groups less so, probably due to isolation from similar habitats for initial colonisation or for recolonisation by non-volant animals after local extinction caused by habitat change or loss, human activity or feral predators.

Definite inhabitants include:

- Mammals: marsupials (Orders Peramelemorpha and Diprotodonta) and bats (Order Chiroptera, Sub-Orders Megachiroptera and Microchiroptera)
- Birds (Orders Anseriformes, Columbiformes, Cuculiformes, Caprimulgiformes, Charadriiformes, Accipitriformes, Strigiformes, Coraciiformes, Falconiformes, Psittaciformes and Passeriformes, many families within these)
- Reptiles (Order Squamata only, but, with confirmed records of pythons by residents, we can say that all of the four Australian snake families and two of the four or five (taxonomists not yet in agreement) lizard families are represented)
- Frogs (two families represented)
- Butterflies (all five major Australian families)
- Spiders (at least seven families represented)
- Many unidentified invertebrates

The MacPherson-Macleay overlap effect was apparent to some degree, though with more northern species than southern ones. Primarily northern species included northern brown bandicoot, black flying-fox, little bent-winged bat, Torresian crow, brown honeyeater, forest kingfisher, pheasant coucal, pale-headed rosella, brahminy kite, bar-shouldered dove, keelback snake, evening brown butterfly, orange ringlet butterfly, common grass yellow butterfly and lemon migrant butterfly. Primarily southern species included grey-headed flying-fox, chocolate wattled bat, and blackish blind snake

Seasonal differences were more obvious, such as the influx of small birds in winter and northern migrants in the summer, and the greater activity of reptiles and butterflies in warmer seasons. The bat *Tadarida* may also be a migrant, as southern individuals often migrate north for winter (Minnick 2006). Chocolate wattled bats and common bent-wing bats are known to hibernate in winter in southern regions, and may do so here.

Mammals

Marsupials (bandicoots, wallabies) and bats are present. One monotreme (echidna) has been seen and photographed on the island by a resident in 2016 but there was no evidence of them in the Wetlands during the survey, nor of rodents (although native water rat was also noted by Caneris 1999, and introduced rodents are apparently present in neighbouring houses). Water rats would find it difficult to persist in the Wetlands during droughts that dry out the entire swamp, as happened this year. It is at least fortunate that the introduced rodents have not colonised the Wetlands. Echidnas are wide-ranging, solitary animals with rather unpredictable movements, and not attracted into traps or by the baits left near the cameras, so it is not surprising if a few exist on the island, even in the Wetlands, but remained undetected. It would however be

surprising not to detect rodents if present with the amount of trapping conducted

Negative evidence is never conclusive, but after 480 trap-nights we can say that if native rodents or small terrestrial marsupials do exist on the island they must be very sparsely populated, at least in the Wetlands.

Marsupials

We found no direct evidence of wallabies, despite nocturnal and pre-dawn searches, but residents reported finding tracks leading from the Wetlands to the beach, and since the end of the survey two were seen by residents at dawn grazing on the oval in the Laurie Burns reserve, just west of (and adjacent to) the Wetlands. One resident reported having seen a swamp wallaby (*Wallabia bicolor*) swimming from the mainland a couple of years ago (reason for this unknown: possibly chased onto the water by a dog or disturbed by traffic or other human activity?). Others reported sightings in the Wetlands, one of the earliest being in February 2012. Motion-sensing cameras have also detected swamp wallabies in the Wetlands in 2014. A dead one was found on the beach nearby in late 2015: we are told there was not much visible injury, but one area of damaged skin could be consistent with dog bite. The swamp wallaby depends on low dense vegetation, which would explain why it is mostly seen in or very near the Wetlands, and its preference for such vegetation may have saved it so far from further pursuit by dogs. Severe stress, such as can be induced by a prolonged chase, can lead to death through myopathy even when the animal is not actually caught (Garlick and Austin 2014, Rose 2005), so free-ranging dogs remain a threat in regard to direct and indirect mortality as well as possibly disturbing foraging behaviour.

Koalas used to be on the island several decades ago (Gasteen 1994). According to the Hunter Koala Preservation Society Inc., *Melaleuca quinquenervia* is a favourite food tree on Tilligerry Peninsula (also six *Eucalyptus* species). Friends of the Koala Inc. (2016) regard it as a secondary browse species in the Northern Rivers district of northeaster NSW. Other food trees on the island include *Eucalyptus tereticornis* (a well-known favourite), *Eucalyptus siderophloia*, *Eucalyptus racemosa* and *Corymbia intermedia*. Although these are available on the island, research by koala experts would be needed to ascertain whether there would still be sufficient trees to maintain a population of koalas, given the extensive clearing of the centre of the island, or whether reintroduction might lead to problems experienced in Kangaroo Island and other regions they have been introduced to.

Bats

Both megabats (flying foxes and kin, a group found only from Africa to the southwest Pacific) and microbats (found in all non-polar regions) were both present. Black flying foxes and grey-headed flying foxes obviously make good use of the island, sometimes camping on the island in winter when eucalypts, tea-trees and banksias are flowering and sometimes apparently flying across from camps on the mainland or Stradbroke Island. It is likely that the winter flowering is important to the bats, especially as so much tea-tree wetland has been cleared on the mainland of southeast Queensland. The grey-headed flying fox is regarded as 'of least concern' in Queensland but as 'vulnerable' nationally (Environment Protection and Biodiversity Conservation Act 1999) and is ranked as a 'critical priority' under the Department of Environment and Heritage Protection because of declining population numbers in many areas. The Office of Environment and Heritage, NSW (2014), citing various sources, states that it shows "a regular pattern of seasonal movement. Much of the population concentrates in May and June in northern NSW and Queensland where animals exploit winter-flowering trees such as Swamp Mahogany *Eucalyptus robusta*, Forest Red Gum *E. tereticornis* and Paperbark *Melaleuca quinquenervia*", and that "[c]ounts of flying foxes over the past decade suggest that the national population may have declined by up to 30%", the main threat being clearing or modification of native vegetation. They make the observation (again citing several sources) that "urbanisation of the coastal plains of south-eastern Queensland and northern NSW has seen the removal of annually-reliable winter feeding sites, and this threatening process continues ... In N.S.W less than 15% of potentially suitable forest for the Grey-headed Flying-fox occurs in conservation reserves; only 5% of roost sites are similarly reserved."

Microbats were not identified until the final, spring season, and we were then hampered by very windy weather and some rain. However, five species were positively identified, with divergent foraging habits, so they will be taking a variety of insects, and in one case small fish. Ride's free-tailed bats tend to forage in the canopies of forests and woodlands, Gould's wattled bats and little bentwing bats below the canopy, and common bent-winged bats and white-striped free-tailed bats above the canopy.

The large-footed myotis (*Myotis macropus*, syn. *Myotis adversus*) is unusual amongst Australian bats in that it catches and eats fish, which they skim (along with aquatic insects) from the surface of water with their large feet, and are never found far from water (Strahan and Van Dyck 2008). The young stay with their mothers longer than most species, and it is thought this may be because it takes a fair bit of practice to master the technique. It was formerly divided into two species, but now they are included as one species, it is the only bat in Australia known to include fish in its diet. It may have been the bat observed by one local resident (Martin Newton) to skim closely over the surface of the sea near the small watercourse that empties to the

beach from the eastern edge of the Wetlands: the sea was very calm that night, and although they may have been taking only the moths and other insects seen flying above the surface of the water, it is possible from Mr Newton's observations that they also took small fish. I have been unable to find any record of myotis catching fish at sea, but they do take them from large coastal lagoons, and have recently been seen fishing in the salt water of Sydney Harbour, so it is possible that those on the island fish in the swamp but resort to the sea (or visit the mainland) when this is dry. A study by Clarke-Wood (2016) near Sydney showed them to avoid lagoons contaminated with heavy metals, so if the Wetlands remain free of these it could be a useful feeding area in seasons when it is indeed wet. It is not yet considered a threatened species, as it has a wide distribution, but is considered vulnerable to pollution, vegetation clearing near water, human visits to the caves and other shelters (e.g. under bridges) where it roosts, usually in numbers of around 15. Although referred to as 'endangered' by a newspaper article, they are listed as 'of least concern' by IUCN's Red List, as it has a wide distribution in Australia and "its numbers do not appear to be declining fast enough to qualify for listing in a threatened category" and is also regarded as 'of least concern' in Queensland. It does however appear to be extinct or endangered in South Australia, and listed as 'near threatened' in Victoria and 'vulnerable' in New South Wales (Atlas of Living Australia), suggesting the southeast Queensland populations could become vulnerable in the future.

Koalas used to be on the island (Gasteen 1994). According to the Hunter Koala Preservation Society Inc. *Melaleuca quinquenervia* is a favourite food tree on Tilligerry Peninsula (also six *Eucalyptus* species). Friends of the Koala Inc. (2016) regard it as a secondary browse species in the Northern Rivers district of northeastern NSW. Other food trees on the island include *Eucalyptus tereticornis* (a well-known favourite), *Eucalyptus siderophloia*, *Eucalyptus racemosa* and *Corymbia intermedia*. Gasteen also noted that residents had heard possum in the past, but their presence has not been confirmed.

Birds

There was quite a good bird diversity, although not as much as one might expect in similar habitat on the mainland, and there were some notable absences. We did not detect any pipits, finches, cisticolas, robins, fairywrens, thornbills or scrubwrens in any season. All (except so thornbill species) are common in similar habitats (including neighbouring grassy areas in the case of the pipit) on the mainland, and sufficiently conspicuous to be seen by us on most visits to sites where they occur. They are all small birds that forage on or near the ground and so are especially vulnerable to predation by cats. They are also weak flyers, so not as able as some to re-colonise. There are two unconfirmed reports of red-backed fairywrens (*Malurus melanocephalus*) by Wildlife Online and Caneris (1999) reported superb fairywren (*Malurus cyaneus*), Australasian (formerly Richard's) pipit (*Anthus novaeseelandiae*) and golden-headed cisticola (*Cisticola exilis*) almost two decades ago.. It has been reported by residents that crimson rosellas (larger-bodied but also often feeding on the ground, and thus also vulnerable to cats and dogs) were once common on the island but no longer so. Peaceful doves (a small, ground-foraging species) were also reported by Caneris (1999) but not seen in our survey either in the Wetlands or elsewhere on the island. It is disturbing that these birds appear to have vanished from the island. Some may persist at sites other than the Wetlands, but it would seem to provide the ideal habitat for most, and be readily recolonised from other parts of the island.

Reptiles and amphibians

All four Australian snake families are represented on the island: pythons (carpet python), front-fanged snakes (small-eyed, plus yellow-faced whipsnake and death adders reported by others), rear-fanged (keel-back and green treesnake) and blind snakes.

Two families of lizard – skinks and dragons – were detected, though not as many species as we would have expected. Land monitors or goannas (*Varanus varius*) were once present on the island, but were not detected in the survey and there have been no recent sightings by local residents. The only geckos seen were the introduced Asian house gecko in nearby houses, despite much searching of tree trunks in the Wetlands at night, and n flap-footed (or legless) lizards were found. As for small mammals and ground-foraging birds, it is possible they have been diminished by predation by cats and dogs

Only two frog species were detected (the introduced cane toad was also observed). Three species of frog previously reported on the island (*Litoria rubella*, *Litoria gracilentia* and *Litoria caerulea*) by Rob Friend & Associates Pty Ltd. (2004) were not detected in our survey, although several residents reported the presence of the green tree frog (*Litoria caerulea*) on their properties and elsewhere. We had hoped to find frogs associated with wallum habitats, such as wallum froglet (*Crinia tinnula*), wallum rocketfrog (*Litoria freycineti*) and wallum sedgefrog (*Litoria olongburensis*), all regarded as vulnerable. There is an unconfirmed report of a small group wallum sedge frogs being found by council workers, which could repay further investigation. The Wetlands (when actually wet) would seem an ideal area for conserving these frogs.

The lack of frogs may be due to the very dry conditions. Some species, such as Striped Burrowing Frog (*Litoria alboguttata*) and the green-thighed frog (*Litoria brevipalmata*) can remain concealed for months or even years, only appearing after heavy rain, usually in warm weather. It would be very useful if residents or visiting volunteers could record frog calls and take photos of any frogs seen on warm, wet evenings, to ascertain whether these or other, hitherto undetected, species exist in the Wetlands. Council could also consider the possibility of providing additional ponds in the Laurie Burns reserve to facilitate the survival of frogs and other wildlife during droughts.

Invertebrates

Although neglected by many fauna surveys, invertebrates make up about 90% of all animal species, and as such comprise the bulk of any region's biodiversity and perform many essential ecological roles (e.g. pollination, seed dispersal (chiefly certain ant species), breakdown of waste, aeration of soil, and essential food for many birds, small mammals and reptiles, and all frogs).

Time did not permit a thorough survey of invertebrates, but we did take opportunistic records, especially of butterflies and spiders. All five major butterfly families (Pieridae, Nymphalidae, Lyceinidae, Papilionidae and Hesperidae) in Australia are represented, and these are well-appreciated by tourists visiting the island (personal observation when leading tours through Araucaria Ecotours, mostly with international guests).

We found spiders representing at least 7 families: Araneidae (orb weavers other than golden, and kin), Corrinidae (swift spiders), Deinopidae (net-casting spiders), Lycosidae (wolf spiders), Nephilidae (golden orb spiders), Salticidae (jumping spiders), Theridiidae (whip spiders and kin) and there are very likely to be others. Spiders feed on a variety of other invertebrates using a variety of methods (large nets by golden orb-weavers, small nets by others, web-throwing by net-casting spiders, running after or ambushing prey by huntsman and wolf spiders, etc.) in different microhabitats and at different levels above the ground. They are thus sometimes recommended as indicator species of the integrity of ecosystems (e.g. Hore and Uniya 2008, Neet 1996).

Importance of tea-tree wetlands to the wildlife of southeast Queensland, and the role of Coochiemudlo's Melaleuca Wetlands.

Coochiemudlo is a small island, and the Melaleuca Wetlands a small reserve. However:

- it is close enough (less than one km) to the mainland for very easy passage by many nomadic nectarivorous birds and fruitbats
- there has been much clearing of this ecosystem in southeast Queensland over the decades, especially in the Greater Brisbane area, and
- there was an influx of honeyeaters and fruitbats in winter, when *Eucalyptus tereticornis*, *Melaleuca quinquenervia* and *Banksia* were flowering.

The Queensland Government (2015) stated “The wetland habitat showing the greatest decline in the coastal zone (approximately 245 ha/year) is the productive freshwater palustrine wetlands (for example Melaleuca wetlands). This loss is a reflection of development pressures along the coastal strip of the east coast of Queensland and represents a loss in connectivity between estuarine and critical freshwater habitats.” Catterall and Kingston (1994) estimated that over the past 15 years 50% of the Melaleuca forests of southeast Queensland have been lost as a consequence of residential development and rural activities.

The swamp tiger, a large and attractive butterfly, is found only in swampy areas where its larval host plant *Cynachum carnosum* grows. This plant is indeed recorded on the island, and we regularly see this butterfly on the island but more seldom on the mainland.

No waterbirds were observed in the swamp, but the Wetlands are included as part of the Ramsar-declared site Moreton Bay and has in the past harboured a variety of waterbirds in non-drought years (see above).

Catterall *et al* 1998 speak of substantially higher total densities in winter than in summer in lowland eucalypt forest remnants of southeast Queensland, due mainly to bushland-dependent winter immigrants, and note that these are at risk of further declines with ongoing habitat loss. Although referring to eucalypt forests, the same presumably applies to tea-tree forests, and where lowland and tea-tree and eucalypt forests adjoin each other, as on Coochiemudlo, the nectar afforded by winter-flowering plants, and the insects these flowers attract, are probably an important resource for both birds and bats.

Control of feral animals and plants and problems with domestic pets

It is encouraging that there were no introduced rodents or birds detected in the Wetlands. There were however occasional cane toads in summer and evidence of wandering cats and dogs. It is well-known that domestic and feral cats can cause severe declines, even local and global extinctions, of small mammals and birds (Dickman 2009, 1996, Paton, 1991, 1993). Dickman (1996) states “Rough extrapolations from the capture rate data suggest that the impact of domestic cats on native fauna is substantial. Given densities of cats in suburban Adelaide of 2/ha, densities of birds of 10-30/ha and an off-take by cats of 10-20 birds per year, predation by cats will remove at least 50% of the standing bird populations or destroy all the young being hatched.”

Birds, bats and butterflies can recolonize from mainland, rodents, echidnas and most marsupials can't. Williams (2016) has recently suggested making Stradbroke Island dog and cat-free, a move strongly supported by the Quandamooka people. Tourists also love to see Stradbroke's wildlife but there are several recent reports of kangaroos and koalas killed by dogs. Kangaroo Island, South Australia, is phasing out cat ownership as well as attempting to eradicate feral cats and dogs. The threatened species commissioner Gregory Andrews has identified feral cats as a major driver of wildlife extinction in Australia. Saying “[o]f the 29 mammals that we've lost to extinction, feral cats are implicated in 28 out of those 29 extinctions, and over 120 Australian animals are at risk of extinction from feral cats” (Lauder 2015), and there is now a national plan for threat abatement (Commonwealth of Australia, 2015). They estimate costs for eradication of feral cats from islands could range from \$4 per hectare for a smaller uninhabited island such as Faure Island to \$50-\$100 per hectare for larger, inhabited such as Kangaroo Island.

It would obviously be better for the wildlife if there were no dogs or cats on the island. However, pet owners typically form strong emotional bonds with their animals, and there is considerable evidence to show real health benefits to pet ownership (McColgan and Schofield 2007, Casciotti, and Zuckerman 2016 and references therein). Rather than introducing a blanket ban on dog and cat ownership, which would almost certainly meet with much resistance, Council could consider legislation demanding dog-proof and cat-proof (more expensive but possible) fencing for all suburban homes with such pets, and tighter restrictions on straying animals and off-lead dog-walking (for both residents and visitors) outside of a few off-lead designated areas.

Dickman ((2009) advises “By-laws vary greatly from council to council, but most include provisions for registration of pet cats, incentives for sterilization, nighttime curfews, and stipulations for a maximum number of cats per property; some also allow for removal of unowned cats from parks and other areas of sensitive habitat,” and that such measures should not only reduce the depletion of native wildlife but also improve cat welfare by reducing the numbers of dumped cats, and reuniting lost pets with their owners.

The normally-wet areas of the Wetlands seem essentially weed-free, with just occasional extraneous plants amongst the native, but there are other regions, especially near the oval and other 'edge' areas, where natives of the understorey have been overwhelmed by weedy species. According to the Environmental Protection Agency (2001), dumping of weeds and unwanted garden plants into native habitats “is most pronounced in areas of *Melaleuca quinquenervia* adjacent to urbanisation, especially in areas where there is a road between the houses and the *Melaleuca quinquenervia* community”

Recommendations:

- eliminate feral cats humanely
- ensure that residents and visitors restrict nocturnal activities of domestic pets both resident and visiting, not allowing new pets to be acquired unless appropriate dog-proof or cat-proof fencing is installed, and encouraging existing pet-owners to install these
- display very clear signage as to where off-lead dogs are and are not allowed
- fence the oval currently used for dog recreation, and consider other fencing, especially along the western western edge of the Wetlands, to help protect native fauna from dogs, cats and vehicles.
- survey similar habitats on the mainland and Stradbroke Island to find what fauna is there but missing from the island
- consider introducing small mammals such as dunnarts, antechinus, swamp rats, water rats, squirrel gliders, wallum frogs and small ground-frequenting bushbirds if present on nearby land-masses and if domestic and feral animals are first adequately controlled.

- continue careful environmentally-friendly weeding (as conducted by Coochiemudlo Island Coastcare) to protect diversity of native plants and thus also of the fauna, including the removal of all cocos palms, which sometimes entangle flying foxes in leaf-sheaths and choke young ones that try to swallow them
- develop a rapid-method on-going monitoring plan to be carried out in at least two seasons (summer and winter) each year over the next couple of decades or longer, with methodology that will be easy for residents and other volunteers to carry out in a standardised way. I would suggest that at least birds and spiders (or subgroups of each) should be monitored, as both are easy to observe, spiders are sensitive to various environmental factors and there is a variety of spider in different microhabitats within the Wetlands, birds include a range of foraging and habitat needs, and it would be of considerable interest to see if ground-frequenting bush-birds make a comeback in future years. Birds are frequently used as indicator (e.g. see <http://www.birdsinbackyards.net/birds/Birds-Indicators-Sustainability>) and are more easily observed and identified than many other animal groups. Such monitoring over the years would also assist with understanding effects of wet and dry years and the onset of climate change. Much useful advice can be gleaned from Lindenmeyer and Gibbons (2012).
- Hold special 'frogging' nights on warm wet evenings, especially after periods of drought, in the hope of adding to hither-to undetected species. As weather conditions are notoriously unpredictable, it may not be possible to involve specialist herpetologists in this, but if volunteers could obtain clear photos (preferably from more than one angle) and sound recordings these could be subsequently identified by experts
- consider fauna-training workshops for locals of all ages (basic natural history, detection, recording) and possibly a bioblitz (see <http://csna.gaiaresources.com.au/wordpress/australian-guide-to-running-a-bioblitz/>)
- promote natural history aspects of the island to residents and visitors (as is already being done through signage and brochures, but it could be extended with posters or fliers in public places such as jetties, shops, cafes and accommodation)
- since the Laurie Burns reserve is adjacent to the Wetlands and considered part of the Ramsar area, consider (without removal of existing native vegetation) establishing a couple of additional, permanent ponds, surrounded by thick shrubbery and sedges to deter cane toads, to enable frogs and possibly waterbirds, water rat and aquatic invertebrates, to persist through drought periods.
- promote low-impact ecotourism in the Wetlands, emphasising Coochie's point of difference from other islands in preserving its "Emerald fringe" along the coast, thus attracting visitors that appreciate and respect the natural qualities, and encourage operators to contribute physically or financially to conservation projects. Many guidelines for sustainable tourism involving native fauna can be found at www.wildlifetourism.org.au



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