

Results from surveys for terrestrial birds on Broughton Island, 2012–2016

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Insights into the terrestrial bird population of Broughton Island, New South Wales have been developed, mainly through a series of systematic surveys carried out over 2012–2016. Feral animals were eradicated from the island in 2009, with expectations that its vegetation and thus its terrestrial bird life may change as a result. The current study was initiated in order to establish baseline information about the Broughton Island bird population so that future changes may be assessed.

From the surveys, 30 species were found to be resident or regular visitors to the island. These included 13 land birds, three shorebirds, six raptors, six species that utilise the coastal and inshore parts of the island, and two seabirds. There also were 27 species which occurred as vagrants, although in many cases with more than one record. Two seabird species known to breed on Broughton Island were not recorded.

Tawny Grassbird *Cincloramphus timoriensis* and Golden-headed Cisticola *Cisticola exilis* were the two most common land birds; numerous Brown Quail *Synoicus ypsilophora* and Silvereye *Zosterops lateralis* were also present. Sooty Oystercatcher *Haematopus fuliginosus* was the most common shorebird. The most commonly encountered raptors were the White-bellied Sea-Eagle *Haliaeetus leucogaster*, Whistling Kite *Haliastur sphenurus* and Swamp Harrier *Circus approximans*.

Since the removal of feral animals, two honeyeater species, Yellow-faced Honeyeater *Caligavis chrysops* and Little Wattlebird *Anthochaera chrysoptera*, have begun to be recorded. The numbers of Silvereye seem to be increasing, and some other bird population changes may be happening.

INTRODUCTION

The Broughton Group of islands lie ~15 km north-east of the entrance to Port Stephens New South Wales (NSW) (**Figure 1**). The main islands, Broughton Island, Looking Glass Isle, Gandja-Baa, Little Broughton Island, North Rock and Inner Rock are well-known seabird breeding colonies especially for Wedge-tailed Shearwater *Ardenna pacifica*, Short-tailed Shearwater *Ardenna tenuirostris* and White-faced Storm-Petrel *Pelagodroma marina*, also Little Penguin *Eudyptula minor* and Gould's Petrel *Pterodroma leucoptera* (Carlile *et al.* 2012, 2013a, 2013b, 2013c, 2013d, 2013e). Broughton Island is part of the Myall Lakes National Park (NP); the other islands are managed as Myall Coast Reserves (North Rock and Inner Rock are grouped together as Stormpetrel Nature Reserve) (NSW National Parks and Wildlife Service 2002).

Most of the islands of the Broughton Group are rarely visited by humans because of their ruggedness and the restrictions on public access to Nature Reserves (S. Callaghan pers. comm.). The exception is Broughton Island, which has some sheltered coves and sandy beaches and a long history of human visitation (NSW National Parks and Wildlife Service 2002). At times there were small permanent settlements. Several fishing huts remain and are frequently in use, and other boat-based visitors are common. The total area of Broughton Island is 132 ha, including a vegetated area of 117 ha (S. Callaghan pers. comm.).

Prior to Broughton Island becoming incorporated into Myall Lakes NP in 1972, its natural vegetation was being severely impacted by feral animals and the effects from frequent fires (Carlile *et al.* 2012). These impacts lasted a very long time – as long ago as 1883 the island was described as

“entirely destitute of trees” (Pittman 1883). Since 2009, after completion of a program to remove rats and rabbits (Priddel *et al.* 2011), the island is free of feral animals, whilst fires should now mostly occur naturally. These recent improvements in land management are expected to benefit the various breeding seabird colonies of the Broughton Group (Carlile *et al.* 2012). However, it was less clear what the implications would be for all other bird species on Broughton Island. Very little has been documented about the populations of non-seabirds on Broughton Island.

In 2012, a systematic study of Broughton Island was initiated, with assistance from other members of the Hunter Bird Observers Club. The aims of the study were to document the terrestrial birds occurring on the island shortly after the eradication of rodents and rabbits and then identify changes in species assemblages and numbers in subsequent years. This paper summarises the 2012–2016 findings.

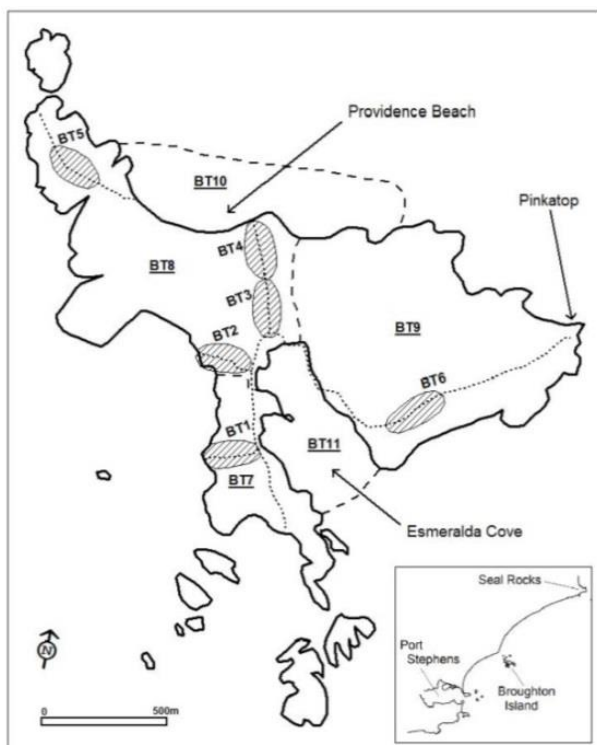


Figure 1. Broughton Island showing the survey areas BT1–BT11 and indicating the survey routes (Inset: location of the Broughton Group of islands)

Broughton Island ornithological history

The focus of all the reported previous visits to Broughton Island was breeding seabirds. Non-seabirds were occasionally mentioned in those reports. The first documented visit was in 1910 (Basset Hull 1910a). Wedge-tailed Shearwaters

and White-faced Storm-Petrels were found in burrows; the only other birds mentioned were the Swamp Harrier *Circus approximans*, Great Cormorant *Phalacrocorax carbo* and White-bellied Sea-Eagle *Haliaeetus leucogaster*. Basset Hull made three subsequent visits over 1910–1911 as did Rohu in 1912; they mostly discussed seabirds (Basset Hull 1910a, 1910b, 1911, 1922; Rohu 1914).

Hindwood and others visited for three days in December 1959 to band nesting shearwaters; the report of that visit also discussed *inter alia* a number of shorter visits over preceding decades (Hindwood & D’Ombrain 1960). They listed 25 species (including 18 terrestrial ones). Differences between their findings and the current study will be discussed later.

All the post-1960 reports about Broughton Island had a strong focus on seabirds. Gulls, terns and cormorants were discussed in several reports, and Sooty Oystercatcher *Haematopus fuliginosus* and Eastern Reef Egret *Egretta sacra* were mentioned in some. Three reports described visits in the 1970s (Lane 1976; van Gessel 1978; Lane 1979). Carlile and colleagues visited the island several times over 2008–9 and documented their findings in 2012 (Carlile *et al.* 2012).

METHODS

Over 2012–2016, Broughton Island was visited by teams of 4–8 surveyors for a total of six 2–3 day periods in autumn (March–April) and spring (September–October). Systematic surveys were conducted during these visits, mostly done in teams of two people per survey and involving 2–3 surveys simultaneously in different parts of the island. The results have been supplemented with bird lists for the overall island from 1–2 day autumn and spring visits in 2015 and at various other times (mainly by TC and AS).

For the systematic surveys, the island including its inshore waters was surveyed as five sub-areas, each of approximately 500 m radius. Bird lists for each sub-area were generated over periods of several hours each day. Within the sub-areas, six 2-ha sites were delineated; overall these 2-ha sites provided a representative cross-section of the Broughton Island vegetation as it existed in 2012 (S. Callaghan pers. comm.). The 2-ha sites were surveyed for 20-minute periods once or twice per day.

The 11 survey areas are shown in **Figure 1**, while **Table 1** summarises their main characteristics. Observers recorded all bird species detected in each survey area. For the 2-ha sites, exact numbers were noted. For the 500-m area surveys, which often spanned several hours at various places within the survey area, observers were

Table 1. Broughton Island survey areas 2012–2016.

Area ID	Type	Mid-point	No. of surveys	No. of species	General description
BT1	2 ha	32° 37' 17"S 152° 18' 51"E	22	15	Grasses and heath, scattered small shrubs.
BT2	2 ha	32° 37' 05"S 152° 18' 49"E	22	24	Shrubs with some areas of grasses and heath, a small wetland.
BT3	2 ha	32° 36' 59"S 152° 18' 56"E	22	21	Shrubs including one large banksia.
BT4	2 ha	32° 36' 51"S 152° 18' 55"E	22	19	Shrubs and a large area of grasses and heath, and hind-dune swale.
BT5	2 ha	32° 36' 45"S 152° 18' 25"E	18	14	Grasses and heath, several small shrubs. An exposed elevated site affected by wind shear.
BT6	2 ha	32° 37' 12"S 152° 19' 06"E	15	8	Grasses and heath, a few small shrubs. An exposed elevated site affected by wind shear.
BT7	500 m	32° 37' 18"S 152° 18' 53"E	19	32	Grasses and heath with pockets of shrubs and trees; rocky foreshore and some inshore rock platforms.
BT8	500 m	32° 36' 56"S 152° 18' 44"E	23	40	Grasses and heath with pockets of shrubs and trees and a wetland; rocky foreshore and some inshore rock platforms.
BT9	500 m	32° 37' 03"S 152° 19' 16"E	17	32	Grasses and heath with pockets of shrubs and trees; rocky foreshore and some inshore rock platforms
BT10	500 m	32° 36' 46"S 152° 18' 51"E	23	26	Extensive sandy beach (Providence Beach) with some inshore rock platforms and open water.
BT11	500 m	32° 37' 08"S 152° 18' 59"E	17	37	Esmeralda Cove: open waters, extensive inshore rock platforms, small sandy beaches.

Table 2. Broughton Island survey details

Dates	18-20/9/2012	8-9/4/2013	23-25/9/2013	24-25/3/2014	18-20/4/2016	10-12/10/2016
No. of surveys	40	29	43	40	42	24
No. of species	35	30	36	37	35	30

requested to note the exact numbers if that was feasible, or otherwise to make an estimate. All of the core group of surveyors were highly experienced, and completely familiar with the species encountered on the island.

The two survey methods (500 m radius and 2-ha / 20-minute) correspond with the main methods used in the BirdLife Australia Atlas project. All the results from Broughton Island systematic surveys were entered into the Atlas database, and into an Excel database maintained by AS where breeding records and reports from third parties also were captured.

RESULTS

Survey dates and the number of species recorded per visit are given in **Table 2**. In total, 218 systematic surveys were conducted, with an additional 28 surveys done on other dates over 2012–2016. Overall 57 species were confirmed to be present. Of these species, 30 were recorded on many and in some cases all of the visits, and often recorded daily and at many sites. An additional two seabird species, Short-tailed Shearwater and Gould's Petrel, which are known to breed on the

island (Carlile 2012) were not recorded in the present study which focussed on diurnal surveys. These 32 species thus constitute the main birds of Broughton Island. They are listed in **Table 3** with their estimated population sizes.

For 27 other species, there have been only a relatively small number of records. In some cases, there has been more than one record but with gaps of a year or more at times. Those species are not discussed further in this paper but remain in the database; it is possible that some will eventually (re-)colonise the island as the vegetation recovers.

Of the six 2-ha survey areas, BT2 and BT3 yielded the most species (**Table 1**). Both sites include sizable areas of shrubs/small trees. The least productive 2-ha site was BT6, with only eight species recorded in 15 visits. Note that this list includes fly-over species such as Welcome Swallow *Hirundo neoxena* and raptors.

For the 500-m radius sites, the most productive ones were BT8, with some groves of well-established shrubs and trees, and BT10 which

often had shorebirds on Providence Beach and also coastal/inshore birds utilising the area.

Detailed results for individual survey areas are not provided in this paper. They have been captured in a database for future analysis of changes. This paper focusses on delivering an overview of the bird populations of the overall island.

Table 3. The main birds of Broughton Island.

Species	Est. Population*
Brown Quail	100-200
Bar-shouldered Dove	5-10
Wedge-tailed Shearwater [#]	50,000-100,000
Short-tailed Shearwater [#]	400-600
Gould's Petrel [#]	<10
Little Penguin [#]	50-80
Great Cormorant	20-30
Little Black Cormorant	5-10
Pied Cormorant	20-50
Eastern Reef Egret	4-8
Osprey	4-6
Black-shouldered Kite	1-2
White-bellied Sea-Eagle	4-6
Whistling Kite	2-4
Swamp Harrier	2-4
Peregrine Falcon	2-4
Lewin's Rail	10-20
Buff-banded Rail	5-10
Sooty Oystercatcher	10-20
Red-capped Plover	5-15
Ruddy Turnstone	4-6
Crested Tern [#]	50-100
Silver Gull [#]	100-200
Pheasant Coucal	4-6
Little Wattlebird	2-4
Yellow-faced Honeyeater	5-10
Australian Raven	2-4
Golden-headed Cisticola	200-400
Tawny Grassbird	150-250
Silvereye	50-100
Welcome Swallow	20-30
Australasian Pipit	6-10

*Estimated numbers of individual birds

[#]From Carlile *et al.* (2012)

DISCUSSION

Land birds

Five species, Brown Quail *Synoicus ypsilophora*, Golden-headed Cisticola *Cisticola exilis*, Tawny Grassbird *Cincloramphus timoriensis*, Welcome Swallow and Silvereye *Zosterops lateralis*, were recorded at every land-dominated site (BT1 to BT9) and with very high reporting rates at most of those sites.

The reporting rates for Golden-headed Cisticola and Tawny Grassbird were slightly greater in the spring surveys, which probably reflected their increased detectability during the breeding season due to territorial behaviour. The reporting rate for Welcome Swallow was greater in autumn; possibly involving migrating birds.

When Silvereyes were able to be identified to sub-species level, most were the non-migratory *cornwalli* sub-species ('Eastern Silvereye'). There was only one confirmed record of the sub-species *westernensis* ('South-eastern Silvereye').

Australian Raven *Corvus coronoides*, Pheasant Coucal *Centropus phasianinus*, Bar-shouldered Dove *Geopelia humeralis* and Australasian Pipit *Anthus novaeseelandiae* were regularly recorded in low numbers, as were Yellow-faced Honeyeater *Caligavis chrysops* since 2012 and Little Wattlebird *Anthochaera chrysoptera* since 2014. The two latter species are further discussed below (see *Indications of change*).

The surveys produced the first known records of Lewin's Rail *Lewinia pectoralis* on Broughton Island. However, it is a cryptic species, likely to be overlooked by those unfamiliar with its call. It was found at most of the land-based sites, although apparently in small numbers overall. It appears to be resident and perhaps has been so for a long time. The reporting rate for Lewin's Rail was higher in spring when birds presumably call more often. The similarly cryptic Buff-banded Rail *Hypotaenidia philippensis* was recorded in September 2013 and April 2016, and then in the October 2016 surveys birds were detected calling at many different parts of the island. There were several prior records over 1998–2012 (N. Carlile pers. comm.).

The presence of the two rail species on Broughton Island may have implications for the island ecology. The diets of both species include frogs and bird eggs (Marchant & Higgins 1993). The island is a refuge for the Green and Golden Bell Frog *Litoria aurea* (S. Callaghan pers. comm.) which is classified as Endangered under the *Threatened Species Conservation Act 1995* of New South Wales. Broughton Island is also an important seabird breeding colony. The Buff-banded Rail is known to predate eggs and young at Sooty Tern *Onychoprion fuscata* colonies (Taylor & van Perlo 1998). They have been described as 'may be a significant predator at tern breeding colonies, taking many eggs' (Taylor & van Perlo 1998). At Lady Elliot Island Queensland in 2001

and 2012, Buff-banded Rail was observed to take eggs of Bridled Tern *Onychoprion anaethetus* (FvG pers. obs.). It is unclear if a Buff-banded Rail would enter burrows, especially ones defended by aggressive shearwaters. However, White-faced Storm-Petrel eggs might be at risk if breeding resumed on Broughton Island.

Shorebirds

The most common shorebird was the Sooty Oystercatcher, with several pairs or small parties scattered around the shoreline and occasionally larger groups being recorded, particularly in spring. The highest count was 17 birds (including some immatures) in September 2012. This was a noteworthy count from a regional perspective (Stuart 2013). The Red-capped Plover *Charadrius ruficapillus* also was common, although it was not seen away from Providence Beach. Mostly 4-6 birds have been present; however, in March 2014 there were 13 birds. Most other shorebirds have appeared only as vagrants, except for Ruddy Turnstone *Arenaria interpres*, a migratory bird which was frequently found foraging along Providence Beach in the spring visits.

Coastal and inshore birds

Pied Cormorant *Phalacrocorax varius* and Great Cormorant were often seen hunting offshore or roosting on rock platforms, Little Black Cormorant *P. sulcirostris* less frequently. Eastern Reef Egret were frequently seen foraging on rock platforms; with a peak count of six birds on Providence Beach in January 2014 (L. Crawford pers. comm.). Silver Gull *Chroicocephalus novaehollandiae* and Crested Tern *Thalasseus bergii* also were widespread, although the Silver Gull generally favoured the Esmeralda Cove area whenever people were staying at the huts. In September 2012, large numbers of them (200-300 birds) were recorded in the BT7 survey area and ~70 birds in October 2016, but in the four other sets of surveys they either were absent from BT7 or were recorded in very low numbers.

Raptors

The main birds of prey recorded were White-bellied Sea-Eagle, Swamp Harrier, Whistling Kite *Haliastur sphenurus* and the Osprey *Pandion haliaetus*, all with reporting rates above 10% and

seen all over the island. Peregrine Falcon *Falco peregrinus* (usually 1-2 birds, sometimes more) was common in the area around Pinkatop (in the BT9 survey area) and 1-2 Black-shouldered Kite *Elanus axillaris* in the western parts of the island. Five other raptor species were recorded less frequently.

Seabirds

Carlile *et al.* (2012) studied the breeding seabird colonies on Broughton Island. The main species were Wedge-tailed Shearwater (an estimated 55,000 pairs) and Short-tailed Shearwater (200-270 pairs), with 24-43 pairs of Little Penguin also found nesting, and at least one Gould's Petrel on a nest in 2009 (Carlile *et al.* 2012). The current project's objectives did not include surveying the nesting seabirds, particularly since the surveys were outside the main seabird breeding season. However, it was easily confirmed from casual observations that many Wedge-tailed Shearwater and some Little Penguin continue to breed on the island.

Population estimates and population densities

Estimates were made of the numbers of individual birds for each of the main species occurring on the island (see **Table 3**). These estimates were based on the consensus views of the authors and are not underpinned by any rigorous scientific method. However, they give an indication of the relative abundance of each species, for future comparisons.

Attempts to improve the population estimates for the two most common species, Golden-headed Cisticola and Tawny Grassbird, were unsuccessful. During the surveys in spring 2013, observers tried to identify specific territories for these species in each of the 500-m-radius survey areas. Another effort involved trying to count the territories within the 2-ha sites. It proved very difficult to track the movements of individual birds whilst also doing the standard surveys. Better results possibly could be obtained by conducting the population counts separately.

The estimated population density for Golden-headed Cisticola was 1.7-3.4 birds/ha (averaged across the 117 ha of vegetated area) and for Tawny Grassbird, 1.3-2.1 birds/ha. These densities are comparable with the values obtained elsewhere in favourable habitats for these species (Higgins *et al.* 2006).

Breeding records

In addition to seabirds, several other breeding records were obtained, although this was not a primary objective of the study. Initially the spring surveys were in mid to late September which may have been too early for most species to have begun breeding. Also, surveyors generally did not have time to look closely for evidence of breeding whilst doing a census. Several of the breeding records have been for birds near the huts at Esmeralda Cove, where surveyors spent their leisure time, and many others have been from visits to Broughton Island outside of survey periods.

One or more Osprey was regularly seen at a nest in April 2016 and October 2016. Breeding was confirmed in December 2016 when a near-fledged chick was in the nest (N. Carlile pers. comm.). There were regular breeding records for Welcome Swallow (up to four pairs nesting at the huts in spring) and Silver Gull. For the latter, there were several records of newly fledged birds begging and being fed on the beach in front of the huts at Esmeralda Cove. In October 2016, at least three pairs were on eggs on the adjacent rocky headland, and two pulli were present with adults on the beach in the following month. However, the main breeding activity occurred elsewhere. Carlile *et al.* found ~70 pairs breeding at Snapper Rocks (in the BT7 survey area) in 2009 and another ~30 pairs on rocks further to the south-west (Carlile *et al.* 2012). The 2012–2016 surveys did not find direct evidence of breeding by Silver Gull at either of those sites, but in October 2016 many birds were occupying and defending an area north-east of Snapper Rocks and were suspected to be breeding. This was confirmed in December 2016 when ~100 pairs had nests with young or were with pulli (N. Carlile pers. comm.). It seems that the breeding sites for Silver Gull on Broughton Island are variable.

Pairs of Golden-headed Cisticola and Silvereye had nests with young in January 2014 (L. Crawford pers. comm.) and October 2016 respectively. A Buff-banded Rail had three chicks in November 2016 (S. Callaghan pers. comm.). Australian Pied Oystercatcher *Haematopus longirostris* had a nest with one egg along Providence Beach in September 2012. The outcome is unknown (only one of the pair was found in a November 2012 visit, and there have been no subsequent records of this species).

Thirty pairs of Crested Tern were breeding at an area north-east of Snapper Rocks in December 2016, with over 250 birds attending the site (N. Carlile pers. comm.). There is a past record of Sooty Oystercatchers breeding on Broughton Island (S. Callaghan pers. comm.) and they have also bred on nearby Gandja-baa (Carlile *et al.* 2013d). A pair was defending an area on the north-western side of the island in mid-January 2014 (L. Crawford pers. comm.) which suggests they may have been breeding.

Prior to the surveys commencing, pairs of Red-capped Plover had nests with eggs on Providence Beach in September and November 2010 (TC pers. obs.). These were two separate breeding records, although the fate of either is unknown.

Comparisons with other islands

The Tawny Grassbird has been recorded on many of the islands in northern Australia (Higgins *et al.* 2006) but there are no records from islands further south (www.birddata.birdlife.org.au; accessed 16 February 2017). Golden-headed Cisticola and Silvereye are known from several offshore islands including Montagu Island and Gabo Island (Fullagar 1987; Reilly 1978). There are post-1997 Birddata records for them from those locations plus many islands off the Queensland coast (www.birddata.birdlife.org.au; accessed 10 December 2016). Brown Quail had not been recorded on Montagu Island in 1987 (Fullagar 1987) and their presence on NSW islands was not discussed in the NSW Atlas (Cooper *et al.* 2014). However, there are post-1997 Birddata records from Montagu Island and Boondelbah Island off Port Stephens as well as Broughton Island and many Queensland islands (www.birddata.birdlife.org.au; accessed 10 December 2016). Movement across open seas has been documented; for example, MacGillivray noted that they landed on Booby Island in Torres Strait each spring as they moved between Papua New Guinea and Australia (MacGillivray 1914).

Although generally considered to be sedentary and a relatively poor flyer, the Pheasant Coucal is known sometimes to make long distance movements although movements across open seas appear not to have been documented (Higgins 1999). Their presence on NSW islands is not discussed in the NSW Atlas (Cooper *et al.* 2016). A review of Birddata records for Pheasant Coucal on islands offshore from NSW only shows records

for Broughton Island and nearby Cabbage Tree Island (www.birddata.birdlife.org.au; accessed 10 December 2016). However, there are Birddata records for them from many islands off Queensland.

Indications of change

In the current study, some changes already are evident. A pair of Yellow-faced Honeyeater was recorded in the first surveys in 2012, at a large banksia in the BT3 survey area. There were no known previous records (TC pers. obs.; J. Pettifer pers. comm.) although some birds were found on Little Broughton Island in 1959 (Hindwood & D’Ombrain 1960). In the surveys since 2012, the numbers of Yellow-faced Honeyeater increased, to ten or so birds in 2016, and they spread to other parts of the island. Similarly, a pair of Little Wattlebird was recorded in March 2014, with no known prior records. They were present in every subsequent visit, mainly in the BT3 survey area.

The Silvereye was recorded on every visit. In the 2012–2013 surveys it was estimated that 20–40 birds were present each visit. The numbers were much greater in the autumn and spring 2016 surveys, and more than 100 birds were estimated to have been present in October 2016. The birds seemed attracted to the berries of *Monotoca elliptica* which were prolific at that time.

It is suggested that some changes have occurred between 1959 and now. Neither Brown Quail nor Silvereye were recorded in 1959 (Hindwood & D’Ombrain 1960); both now are very common on the island. Also, the Little Grassbird *Poodytes gramineus* was listed (there are no current records) but not Tawny Grassbird which now is common. It seems improbable that those two capable ornithologists would have mis-identified the species, nor does it seem to be a typographical error as they used both the then scientific name and the common name. The Little Grassbird is resident on some other islands off south-east Australia (Fullagar 1987; Reilly 1978).

CONCLUSIONS

Thirty-two species were resident or regular visitors to Broughton Island; this includes four seabirds (two of which were not recorded in the present study), three shorebirds, six raptors, six coastal and offshore birds, and 13 land birds. An additional 27 species were recorded as vagrants. Because the vegetation on Broughton Island is expected to

continue to recover under the current Plan of Management, it seems possible in future that some vagrant species will decide to stay.

A baseline has been developed through the current study, which will allow future changes to the Broughton Island bird population to be identified. Some changes already seem to be occurring. Two honeyeater species, Yellow-faced Honeyeater and Little Wattlebird, have colonised (or re-colonised), and the numbers of Silvereye seem to be increasing. Possibly some other changes also are happening (e.g. rails).

The monitoring program should continue although the frequency of visits seems of secondary importance. Future changes in bird populations are likely to happen slowly from now on, driven by gradual changes to the vegetation.

It is also recommended that consideration be given to undertaking a banding study of the terrestrial birds of the island. This should generate insights about movements to and from Broughton Island and perhaps allow population estimates to be refined.

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