

# A five-year study of the use by Gould's Petrel of artificial nest boxes on Broughton Island, New South Wales

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In mid-2017, six artificial nest boxes were installed on Broughton Island, New South Wales along with a call-playback system and loudspeaker. The purpose of the installation was to encourage the nationally threatened Gould's Petrel *Pterodroma leucoptera leucoptera* to breed on the island. The small number of nest boxes, and their close proximity to one another, prompted a study of their utilisation on Broughton Island by Gould's Petrel. After their installation, the nest boxes were inspected several times each breeding season. The five-year study enabled insights into the early stages of Gould's Petrel colony establishment. Such insights had not been possible for other newly establishing Gould's Petrel populations, which have been on islands that were less frequently monitored, and which had more-dispersed nesting site locations.

The five-year study confirmed many of the findings about breeding behaviour from previous studies. Egg-laying occurred between late November and mid-December, with chicks hatching by mid-January and fledging in mid-March to mid-April. There was clear evidence of partner fidelity, and breeding pairs used the same nest box every time.

Breeding success rates were higher than found in other studies. From a total of ten eggs laid over the five breeding seasons, eight chicks hatched and all of those chicks successfully fledged. Four of the nest boxes were productive i.e., they yielded at least one fledged chick during the five-year study. For all six nest boxes there was at least one season with some breeding activity recorded.

The importance of the artificial nest boxes on Broughton Island for Gould's Petrel is highlighted by the fact that no breeding in natural nesting sites has been recorded on the island since the first record in 2009.

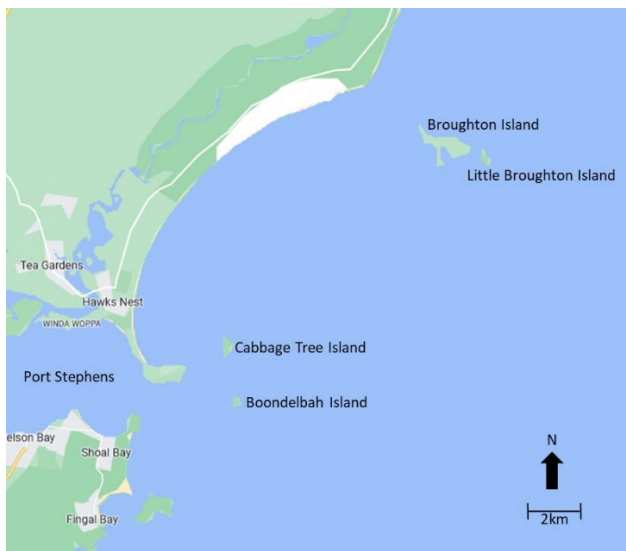
At one nest box, where a Gould's Petrel pair bred successfully in the 2021/22 season, they were displaced in the following season by a pair of Wedge-tailed Shearwater *Ardenna pacifica*. This highlights the difficulties faced by Gould's Petrel attempting to breed in competition with a substantial local population of a much larger seabird.

## INTRODUCTION

Gould's Petrel *Pterodroma leucoptera* is a small species of gadfly petrel (a genus of about 35 species, all having speedy weaving flight). There are two subspecies – *P. leucoptera leucoptera* ("Gould's Petrel") which breeds on Australian islands (Priddel *et al.* 1995; Carlile & Priddel 2004), and *P. leucoptera caledonica* ("New Caledonian Gould's Petrel") which breeds in mountainous areas of New Caledonia (Bretagnolle *et al.* 2021). Both subspecies are considered to have decreasing populations and are classified internationally as vulnerable (IUCN Red List 2018).

Until recently, the Gould's Petrel was known to breed on only two islands near Port Stephens –

many hundreds of breeding pairs on Cabbage Tree Island and a translocated smaller population on nearby Boondelbah Island (Carlile & Priddel 2004; Priddel & Carlile 2004; Commonwealth of Australia 2023). However, small breeding populations have since established on Broughton Island (Carlile *et al.* 2012) and Little Broughton Island (Carlile *et al.* 2020; S. Callaghan pers. obs.), both about 10km away from the other two islands (see **Figure 1**), and on Montague Island near Narooma NSW (Carlile *et al.* 2020; E. Mowat pers. comm.). Importantly, feral rabbits and rats were removed from all of those three islands about 10-12 years ago (e.g. see Priddel *et al.* 2011; Gregory *et al.* 2014).



**Figure 1.** Location of Broughton Island and some other important islands off Port Stephens (original map sourced from Google Maps)

### Study site

Broughton Island (32° 37'S, 152° 19'E) is the main island of the Broughton Group, located north-east of Port Stephens in New South Wales. Broughton Island is an important seabird breeding location, each year hosting many tens of thousands of Wedge-tailed Shearwater *Ardenna pacifica* pairs plus lesser numbers of Short-tailed Shearwater *Ardenna tenuirostris* and Little Penguin *Eudyptula minor* (Carlile *et al.* 2012; Carlile *et al.* 2022).

In December 2009, Gould's Petrel was recorded on Broughton Island for the first time; a bird incubating an egg was found in a rock crevice within a scree slope at the base of Broughton Island's highest point, "Pinkatop" (Carlile *et al.* 2012). That area was searched again in 2020 but no Gould's Petrel nests could be located, nor have any of their nests been found in natural cavities elsewhere on the island despite intensive searching (NPWS records).

In 2017, to encourage Gould's Petrel to breed on Broughton Island, six artificial nest boxes and a call-playback system plus loudspeaker were installed on the upper slope of Pinkatop by the Hunter Coast branch of NSW National Parks and Wildlife Service (**Figure 2**). The nest box design had long been used with success for the Gould's Petrel colonies on Cabbage Tree Island and Boondelbah Island. Call playback is an established means for encouraging seabirds to use a restored or newly constructed site (e.g. Zhou *et al.* 2017).

The nest boxes on Broughton Island lie within an area of approximately three metres radius, a few

metres from a cliff edge. Each nest box has a tunnel ~250 mm long, leading to a small cavity underneath the false floor of the nest box. The tunnels, made of agricultural pipe, are 100 mm in diameter at their entrance. Most nest boxes have a 100 mm to 65 mm PVC reducer near the start of the tunnel, aimed at preventing access by the larger Wedge-tailed Shearwater. During each breeding season, Gould's Petrel calls were broadcast every night through a loudspeaker in order to attract birds to investigate the site.



**Figure 2.** Two of the Gould's Petrel nest boxes and the loudspeaker (photo: A. Stuart).

During the five years since installation, the nest boxes were inspected in the breeding season by Hunter Bird Observer Club (HBOC) members during their regular visits to Broughton Island to monitor its bird population (Stuart *et al.* 2017; Stuart 2020), and irregularly at other times. The frequent visitation to the nest boxes enabled a study which has yielded insights into Gould's Petrel breeding behaviour at a newly establishing breeding site. Here, we present results from the first five years of the study.

### METHODS

Adult Gould's Petrels begin to visit nesting sites in October although egg-laying does not occur until late November or early December, and chicks fledge in April (Marchant & Higgins 1990). Therefore, the nest box

inspections on Broughton Island spanned October to April each breeding season.

All nest box inspections were done in daylight hours. The time of day for inspections was tide-dependent (because of site access issues at high tide). After arrival at the nest box site, the boxes were inspected one at a time and the presence of an adult bird(s), egg or chick recorded. An individually numbered metal band was applied to every previously unbanded adult Gould's Petrel found in a nest box (under a permit obtained from the Australian Bird and Bat Banding Scheme). The band numbers of any previously banded birds present were recorded on each visit. A band was also applied to chicks when they had reached a sufficiently advanced stage of development.

A nest box was classified as *Active* (A) in a breeding season if at least one adult bird was present in it at any time, and as *Breeding Active* (B) if there was an egg or a chick present. A nest box was classified as *Productive* (P) if a chick hatched in it that season and the chick developed to a size large enough for it to be banded. If later the nest box was found to be empty, that banded chick was treated as having fledged.

The presence of a chick in a nest box was interpreted as an egg having previously been present, whereas the presence of an egg did not imply that a chick would be produced.

The nest boxes were arbitrarily numbered 1-6 during installation and we have used that numbering scheme for the present report.

## RESULTS

### Overview

During the 2018-2023 breeding seasons, the nest boxes were inspected a total of 30 times, ranging from 4-8 visits per season – details are in **Table 1**. The first record of an adult Gould's Petrel in a Broughton Island nest box was on 24 October 2018, and the first successful breeding record was in the 2019/20 season, from a different nest box. An egg was first discovered in that nest box (box #5) on 18 December 2019 and a chick subsequently fledged (**Figure 3**).

**Tables 2 and 3** summarise the overall results for each nest box, spanning five breeding seasons. By the end of the 2022/23 breeding season, chicks had fledged at least once from four of the six nest boxes, with a total of eight chicks fledging over the four years since the first confirmed breeding activity in 2019/20.

Sixteen different adult Gould's Petrels (including one dead bird) were recorded in the Broughton

Island nest boxes between October 2018 and February 2023. In addition, a Pycroft's Petrel *P. pycrofti* was found in nest box 2 in October 2019, together with an adult Gould's Petrel (Stuart & Clarke 2023).

**Table 1.** Number of nest box inspections during the 2018-2023 breeding seasons.

Year	No. of inspections
2018/19	4
2019/20	8
2020/21	7
2021/22	6
2022/23	5



**Figure 3.** The first Gould's Petrel chick from the Broughton Island nest boxes (photo: R. Kyte).

**Table 2.** Summary of the results for each Gould's Petrel nest box for 2018-2023.

Nest box No.	No. of individual adult birds	No. of eggs	No. of chicks hatched	No. of chicks fledged
1	4	1	0	0
2	2*	2	2	2
3	1	1 <sup>#</sup>	1	1
4	6	1	0	0
5	3	4 <sup>#</sup>	4	4
6	-	1 <sup>#</sup>	1	1

\*Does not include the Pycroft's Petrel found in October 2019

<sup>#</sup>Presence of an egg inferred from the later presence of a chick

**Table 3.** Summary of the results for each nest box in each breeding season from 2018/19 to 2022/23. (Codes: A: the nest box was active that season; B: the nest box had a breeding record (egg or chick); P: the nest box was productive that season i.e. a chick was considered to have fledged)

Nest box number	Activity	2018/19	2019/20	2020/21	2021/22	2022/23	Totals
1	A			✓	✓	✓	3
	B			✓			1
	P						0
2	A		✓	✓	✓	✓	4
	B			✓	✓		2
	P			✓	✓		2
3	A					✓	1
	B					✓	1
	P					✓	1
4	A	✓	✓	✓	✓	✓	5
	B			✓			1
	P						0
5	A	✓	✓	✓	✓	✓	5
	B		✓	✓	✓	✓	4
	P		✓	✓	✓	✓	4
6	A				✓		1
	B				✓		1
	P				✓		1
Individual adults		4	4	3	8	7	16
Total eggs		0	2	3	3	2	10
Total fledged chicks		0	1	2	3	2	8

## Results for each nest box

### Nest box 1

This nest box was active in three seasons, with an egg laid in one season, but it yielded no chicks.

An adult Gould's Petrel was recorded three times in the 2020/21 season; during the December and January visits it was in the nest box with a second bird – probably the same bird both times but banding equipment was not to hand during either visit. In the late December 2020 visit, there was an egg with the two birds, but it was cold. In the next inspection, four weeks later, the egg had disappeared but the two birds were again present.

A different pair was recorded in this nest box in three inspections spanning December–January in the 2021/22 season. There was no evidence of them breeding and there were no further records of either bird.

The original bird from 2020 was again present in the 2022/23 season but no breeding activity occurred. No other adult bird was recorded present.

### Nest box 2

This nest box was active in four seasons and produced two chicks from two eggs; both chicks successfully fledged.

In the 2019/20 season (in October 2019), an adult Gould's Petrel was found sharing the nest box with a Pycroft's Petrel. The Pycroft's Petrel was present for at least two days (Stuart & Clarke 2023), but it was never recorded again. The same individual Gould's Petrel was in the nest box again (alone) in the December 2019 visit.

There was no evidence of the presence of a second Gould's Petrel that season. However, a pair of Gould's Petrels, one of which was the individual previously seen with the Pycroft's Petrel, used this nest box across the three subsequent seasons – 2020/21, 2021/22 and 2022/23. The pair successfully raised chicks in both the 2020/21 and 2021/22 breeding seasons. They were also seen together in the nest box in February 2023, but no egg was laid that season.

### Nest box 3

This nest box was active in one season and produced a chick which successfully fledged.

There was only one record of an adult Gould's Petrel from this nest box (a single bird in October 2022) and the nest box was empty when inspected on 15 November 2022. However, in the next inspection, on 3 February 2023, a young chick was present. It was still there in the next visit, on 17 March 2023. In the subsequent visit on 16 April 2023, it had almost complete adult plumage (just a few small downy areas remained).

#### Nest box 4

This nest box was active in all five seasons, with an egg laid in one season, but it yielded no chicks.

Six different adult Gould's Petrels were recorded in this nest box. Five of those records were one-offs, including a dead bird in the tunnel in December 2019 – one of its wings had become caught as it was departing. We removed the dead bird.

One bird was present during every breeding season since it was initially banded in December 2019. In late January 2021, this bird was seen incubating an egg; however, in the next inspection six weeks later, the egg was cold and there was no longer an incubating bird present.

#### Nest box 5

This nest box was active in all five seasons and produced three chicks, all of which successfully fledged.

Two birds were regularly recorded visiting this nest box. Both birds were banded in December 2018 (on different dates), and they were first found together in the nest box in January 2019. In the 2019/2020 season, this pair laid the first egg recorded in the Broughton Island nest boxes, and a chick fledged successfully.

In the 2021/2022 season, a third adult bird was present in November 2021. The bird was alone, and there were no further records of it. The following month there was an egg, which, during inspections about two weeks apart, was observed being incubated in turn by the original pair of birds. A chick was successfully raised to fledging by the pair that season, as well as in the 2022/23 season.

#### Nest box 6

This nest box was active in one season and produced a chick which successfully fledged. The chick, which was first detected in mid-January 2022 and banded in late February, was at the end of an

excavated burrow which extended ~30cm beyond the floor of the nest box.

The nest box was inspected three times during November-December 2021 but the burrow was not investigated. Consequently, the incubating Gould's Petrel at the end of the burrow was not detected. A chick was heard vocalising from within the burrow on 20 January 2022 and it was confirmed to be a Gould's Petrel chick during a visit three weeks later.

During an overnight surveillance in late February 2022 an adult Gould's Petrel was seen to approach the tunnel entrance (S. Callaghan pers. obs., with N. Carlile).

Signs of an excavation from the nest box floor were first noticed in November 2020. At the time, the significance was not appreciated. However, in the 2022/23 breeding season, the excavated burrow was occupied by a Wedge-tailed Shearwater chick.

## **DISCUSSION**

The utilisation and successful breeding by Gould's Petrel in the Broughton Island nest boxes demonstrated the success of the sound attraction system in conjunction with provision of artificial nesting habitat. From 30 nest box inspections over five breeding seasons, several facets of Gould's Petrel breeding behaviour on Broughton Island became apparent. These are discussed below. Some of the interpretations are tentative, some support the findings from previous studies, and some appear to be new findings.

### **Partner fidelity**

Gould's Petrel is known to be monogamous (Marchant & Higgins 1990; Department of Environment and Conservation NSW 2006). At two of the Broughton Island nest boxes there were clear demonstrations of partner fidelity. The same pair was recorded in nest box 5 in all five seasons, and they raised three chicks over that period. There was a one-off record of another bird at that nest box: perhaps it was an exploratory visit by that bird. The date of that visit was early in the 2020/21 breeding season; the original pair bred successfully later in that same season. In nest box 2, the same pair was recorded in three seasons (spanning 2020-2023) and they raised two chicks during that time. There were no records of any other adult Gould's Petrel at nest box 2 in the five-year study.

Two other nest boxes yielded chicks which fledged, which therefore meant that breeding pairs were using them. However, the infrequency of nest box inspections limited our opportunities to obtain additional information about partner fidelity.

### Nest box fidelity

No Gould's Petrel was ever found in a nest box other than the one in which it was first recorded. That seems an unsurprising finding in the cases where there was an established pair breeding or attempting to breed at a particular nest box, such as nest boxes 2 and 5. It was a more surprising result for the other nest boxes although of course some birds might have prospected in other boxes during times when we were not present on the island.

Mostly those other nest boxes only had one-off records for any individual bird, but the situations at nest boxes 1 and 4 were more complex.

At nest box 1, a Gould's Petrel was present in 2020/21 and was partnered with another bird (presumably the unbanded bird present with it during two nest box inspections in December/January) because an egg eventually appeared. The following season two different birds used that nest box. They were found together in three nest box inspections that season, thus presumably were a pair although there was no evidence of breeding. One of the birds which had been present in 2020/21 reappeared two seasons later. For the intervening season what is unknown is whether: it attempted to use nest box 1 and was driven off by the pair which had taken over; it investigated other nest boxes (because of the competing pair in nest box 1); or it did not return to Broughton Island that season.

At nest box 4, one particular Gould's Petrel was recorded in every breeding season except the first one (2018/19). It was part of a breeding pair, since it was recorded with an egg in the 2020/21 season. It is not known if the bird's partner was one of the four other Gould's Petrel found alive in that nest box at some time during our 5-year study.

We could not find any previous report about Gould's Petrel using the exact same nesting cavity although they undoubtedly return to the same general breeding site each season (O'Dwyer 2004; Priddel & Carlile 2007; Kim 2014). Breeding site fidelity is well-documented in many seabird species (e.g. Mariné & Cadiou 2019; Pagenaud *et al.* 2022).

### Incubation and fledging

There was clear evidence that both birds of a pair share the egg-incubation duties. That agrees with the findings of other studies (Marchant & Higgins 1990; O'Dwyer 2004).

Because the nest box inspections were relatively infrequent, details about the timetable for Gould's Petrel incubation and fledging on Broughton Island are somewhat uncertain. The earliest egg found was on 27 November (in nest box 5 in 2020). Nine days later, on 6 December, a second egg had appeared, in nest box 2. In other seasons, the early summer inspections fell within the period 16-18 December; there never were any eggs laid subsequent to those visits. Thus, the egg-laying period was late November to mid-December, which agrees with the timing at other breeding locations (Fullagar 1976).

In the late December inspections that occurred each year during 2019-2021, birds were still incubating eggs – there were no chicks at that stage. Also, on 2 January 2020, the sole egg that had been laid that season was still being incubated. In 2022, all three eggs had hatched by 20 January, while in 2021, two eggs had hatched by 30 January and one egg was still being incubated. However, several weeks later that egg was found cold in the nest box and thus it may not have been viable in the 30 January visit. Thus, all the hatchings seemed to be completed by about mid-January. That suggests an incubation period of about six weeks, broadly in line with previous findings (Marchant & Higgins 1990).

The dates for when chicks fledged are uncertain. In all the mid-March nest box inspections over the five seasons, every known chick was still present. On 20 April 2020, the sole chick that season had gone – it had been present when last checked on 9 March. In 2023, the two chicks from that season were still present on 17 March. By 16 April, one of those chicks had fledged. The other chick was still present, but it was in almost fully developed adult plumage and probably would have departed the nest box 1-2 days later. Thus, the fledging period on Broughton Island seems to have been between mid-March and mid-April, which again is broadly in line with other studies (Fullagar 1976; Marchant & Higgins 1990).

### Breeding success and the fate of chicks

Ten eggs in total were laid in the Broughton Island nest boxes during the study period, with eight chicks hatching. In nest box 1 in December 2020, two birds were together in the nest box plus there was a cold

egg. This suggests that the pair was inexperienced and had mistimed their incubation shifts, leading to the egg having been left unincubated for too long. The reason for the hatching failure in nest box 4 is unclear. However, the female's partner may have been inexperienced, since the circumstantial evidence (i.e., there only being one-off records of any other bird) suggests that they had not been paired for long.

All eight chicks which hatched eventually fledged. The 100% fledging success rate for chicks and the overall 80% breeding success rate are much higher than has been found in studies on Cabbage Tree Island, where the main Gould's Petrel breeding colony is located (for example, Priddel *et al.* 1995; Priddel & Carlile 2007). The higher success rates on Broughton Island possibly reflect the absence of predators such as Pied Currawong *Strepera graculina* and the greater protection of eggs and chicks from unfavourable weather conditions provided by the artificial nest boxes. Importantly though, this result is from only a small sample size.

None of the chicks fledged from the nest boxes have yet been recorded returning to Broughton Island. Gould's Petrel are thought to begin breeding at around twelve years of age, and to start returning to their natal grounds from around five years old to begin to establish pair-bonds (Priddel & Carlile 2007). However, data on age of first breeding are limited (Department of Environment and Conservation NSW 2006). Continued monitoring will determine whether the former chicks start visiting the island, and any data on age of first return and first breeding will add to knowledge of the species' biology.

### **Nest prospecting by non-breeders**

We found 16 different adult Gould's Petrel in nest boxes over the five-year study, ten of which were one-off records. The ten birds with one-off records possibly were exploring for nesting opportunities but had not yet found a partner. The actual duration of these one-off visits is uncertain, because the nest box inspections usually were well-spaced in time.

Sometimes in those seasons we found a prospecting bird in one of the nest boxes that was already being used by an established pair. A Gould's Petrel exploring for nesting opportunities might have been chased off from a particular nest box the that pair's "owners". We found no evidence that those prospecting birds explored any of the other nest boxes. However, our inspections were infrequent.

We inspected the nest boxes 30 times across five breeding seasons, which equates to about three per cent of the available dates (five seasons each of 212-213 days for October-April inclusive). It is therefore very likely that additional individuals would have visited the nest boxes for short periods, with their presence going unrecorded.

### **Natal origins of adult birds**

None of the adult birds found in Broughton Island nest boxes were already banded when they were first encountered. Thus, their natal origins are uncertain. It seems probable that they were born on Cabbage Tree Island, which in many years hosts up to 1,000 breeding pairs (Commonwealth of Australia 2023). The next largest breeding colony is on Boondelbah Island, which is estimated to host 70 or so individuals (Commonwealth of Australia 2023) - about 35 pairs.

Each breeding season, bands are placed onto some Cabbage Tree Island Gould's Petrel chicks, but only to a small proportion of the overall cohort (T. Clarke pers. obs.). Thus, there is only a low probability of encountering a banded Cabbage Tree Island bird on Broughton Island.

### **Nest boxes approaching capacity**

Within the first three seasons, some nest boxes had established pairs or possible pairs using them, but in every breeding season there were unoccupied nest boxes available for use by other birds. For example, there were no records of a Gould's Petrel in nest box 1 in the 2018/19 or 2019/20 seasons. Similarly, there were no records from nest box 6 until 2021/22, and none from nest box 3 until the 2022/23 breeding season.

Perhaps during the first three breeding seasons, only a few Gould's Petrel had identified that there were potential breeding sites on Broughton Island. In each of those three seasons, we only found totals of four different individuals in nest boxes. However, in the following two seasons, the numbers of visiting birds increased. We recorded 7-8 individuals in nest boxes each season and those totals did not include any birds from the breeding pairs in nest boxes 3 and 6. In both cases, we never encountered an adult bird during our inspections, only chicks which later fledged.

The results suggest that the nest boxes were nearing capacity by the end of the fifth breeding season. Four nest boxes had hosted successfully-breeding

pairs, while nest boxes 1 and 4 had each contained an egg that did not hatch.

## Competition with Wedge-tailed Shearwater

The Gould's Petrel chick in nest box 6 in 2021/22 was at the end of a burrow excavated ~30cm beyond the cavity underneath the floor of the nest box. An important consideration is how that burrow was formed.

Although the New Caledonian subspecies *caledonica* is known to dig burrows, the Australian subspecies *leucoptera* usually does not (Marchant & Higgins 1990). Therefore, it seems unlikely that an Australian Gould's Petrel would have excavated a burrow ~30cm in length.

The Wedge-tailed Shearwater is a burrow-digging species (Marchant & Higgins 1990). Over the study period, there were an increasing number of Wedge-tailed Shearwater burrows in the area around the nest boxes, in line with the overall increase in their population on the island (Carlile *et al.* 2022). Trail cameras were deployed occasionally in the area around the nest boxes – these captured many overnight comings and goings by shearwaters. It seems likely that, during their explorations to find sites for burrows, shearwaters would inspect the tunnels of the nest boxes. The tunnel at nest box 6 lacked a 100 mm/65 mm diameter reducer and a Wedge-tailed Shearwater would have been able to pass all the way through into the nest box.

A plausible scenario is that a shearwater excavated the new burrow at the beginning of the 2020/21 breeding season but for some reason did not breed there that season or the following one. That allowed the opportunity for a pair of Gould's Petrels to use the box in 2021/22, and they successfully raised a chick. However, they could not compete with the larger Wedge-tailed Shearwater pair which used the burrow in 2022/23 and thus they were not able to breed.

The intention is to install a 100mm/65mm diameter reducer into the entrance burrow before the start of the 2023/24 breeding season to prevent access by shearwaters.

## CONCLUSIONS

The small number of nest boxes on Broughton Island has enabled a close study of their utilisation by Gould's Petrel. Given that the nest boxes can

easily be accessed and monitored, and likely contain most if not all of the breeding activity on the island, this has given us a valuable insight into the early stages of Gould's Petrel colony establishment. This has not been possible in other newly establishing populations such as on Boondelbah and Montague islands, which are less frequently monitored and have more-dispersed nesting site locations.

The importance of the artificial nest boxes on Broughton Island for Gould's Petrel is highlighted by the fact that no breeding in natural nesting sites has been recorded on the island since the first record in 2009.

The five-year study confirmed many of the findings about breeding biology from previous studies. Breeding success rates were much higher than found in other studies, including 100% of the chicks which hatched, eventually fledged.

All six nest boxes were active in at least one breeding season i.e., they were visited by adult birds even if those birds did not breed. Four of the nest boxes were productive i.e., they yielded at least one fledged chick during the five-year study. For all six nest boxes there was at least one season with some breeding activity recorded.

Based upon the frequency of nest box visitation and use for breeding, and the high breeding success rate for pairs utilising the boxes, the installation of additional artificial nest boxes on Broughton Island should be considered. Additionally, because of the high breeding success rate in the artificial nest boxes, their use should be considered for Little Broughton Island, where currently none have been deployed.

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