

Little Shearwaters, *Puffinus assimilis assimilis*, breeding on Lord Howe Island

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Abstract. Little Shearwaters, *Puffinus assimilis assimilis*, were thought to have disappeared from Lord Howe Island during the early 1900s. This study reports Little Shearwaters breeding on Lord Howe Island between 1990 and 2001. A survey in 2000 recorded 85 nestlings. It is unclear whether this species has persisted on Lord Howe Island in low numbers throughout last century or whether it is recolonising. Adults, ashore between April and October, often occupied burrows previously used by Black-winged Petrels, *Pterodroma nigripennis*. Observations at a single nest showed the incubation period to be 55 days and the nestling period to be 72 days. Chick mass increased at a mean rate of 5.2 g day⁻¹ to a maximum of 272 g at 48 days old. The chick fledged on 5 November at 158 g after fasting for six days. During chick rearing, parents came ashore almost nightly, arriving just after sunset and remaining with the chick until shortly before dawn; occasionally they were ashore during the day.

Introduction

The Little Shearwater, *Puffinus assimilis*, has a pelagic distribution that includes the subantarctic and subtropical waters of the Pacific, Atlantic and Indian Oceans. The species is polytypic, with seven subspecies (Marchant and Higgins 1990). The nominate form, *P. a. assimilis*, breeds only on islands within the Lord Howe and Norfolk Island Groups and is non-migratory, remaining in the Tasman and Coral Seas throughout the year (Hindwood 1940). The Little Shearwater is the smallest of the shearwaters and appears unable to survive in the presence of rats, *Rattus* spp.; feral cats, *Felis catus*; dogs, *Canis familiaris*; or Weka, *Gallirallus australis* (Hindwood 1940; Fullagar and Disney 1975). These alien predators are believed responsible for the extinction of Little Shearwaters on Lord Howe Island, Norfolk Island, Raoul Island (Kermadecs) and Chatham Island (Schodde *et al.* 1983). Breeding colonies within these island groups are now restricted to the smaller islets (Marchant and Higgins 1990).

Little Shearwaters were last recorded breeding on Lord Howe Island in 1923, although a single dead adult was found ashore in 1936 (Hindwood 1940). Reports indicate that the species was once widespread (Hindwood 1940), and sub-fossil evidence suggests that it was common in some areas (Fullagar *et al.* 1974). The contemporary stronghold of Little Shearwaters within the Lord Howe Group is Roach Island, the largest of the Admiralty Islets, where an estimated 4000 pairs nested in 1971 (Fullagar *et al.* 1974). No subsequent count has been made. Little Shearwaters also breed on other

offshore islets within the Lord Howe Island Group, including Blackburn Island, Muttonbird Island and probably Balls Pyramid (Hindwood 1940; Fullagar *et al.* 1974; Hutton 1991). Owing to the restricted number of nesting sites, *P. a. assimilis* has been categorised, in accordance with criteria set down by the International Union for the Conservation of Nature (IUCN 1994), as vulnerable (Garnett and Crowley 2000).

Very little is known about the breeding ecology of *P. a. assimilis*. Observations at nests are scant, and there is no published information on breeding success. This paper reports observations of recent breeding activity by *P. a. assimilis* on Lord Howe Island, together with information obtained by monitoring a burrow throughout an entire breeding period. Although limited to a single nest, these data provide the first information on the duration of incubation, the chick-rearing period, chick growth and parental visitation rates.

Methods and Results

Observations of breeding activity

One of the authors (IH) first observed Little Shearwaters ashore on Lord Howe Island at Muttonbird Point (31°33'S, 159°02'E) in May 1989. Four burrows, previously used by Black-winged Petrels, *Pterodroma nigripennis*, were found to contain Little Shearwaters, presumably prospecting for nesting sites. The burrows were inspected regularly between June and October, but birds did not continue to frequent them. No eggs were found and no other evidence of breeding

activity was observed. Little Shearwaters were again detected on 10 April 1990 when a prospecting pair evicted a Black-winged Petrel chick from its burrow (Hutton and Priddel 2002) at the northern headland of Blinky Beach (31°32'S, 159°05'E). Although the shearwaters took over the burrow for breeding, the petrel chick survived to fledge 29 days later. Two other pairs of Little Shearwaters were also observed excavating burrows in the vicinity at that time.

The nesting site at Blinky Beach headland was inspected on several occasions each year between 1991 and 2000. Though present each year, no attempt was made to assess the size of the Little Shearwater population until late October 2000, when a thorough search was made. In total, 85 active (or recently active) Little Shearwater burrows were located along a 75-m stretch of headland: 42 contained near-fledged chicks, and 43 contained large quantities of down, indicating that a bird had recently fledged from the burrow. The burrows were close to the cliff edge, extending no further than 25 m into the vegetation dominated by 1–2-m-high *Melaleuca howeana*. In September 2001, a brief inspection of this site located 13 adults with eggs.

In October 2000, a search was also made of the headland between Neds Beach and Hells Gate, where Little Shearwaters had been heard calling, but no burrows were found. Little Shearwaters were seen flying above the cliffs overlooking Georges Bay (where they had nested previously: D. Hiscox, personal communication), but inclement weather precluded any search of this area.

Nest monitoring

An occupied burrow, about 0.5 m long and situated in rocky basaltic soil, was inspected at various times almost daily between April and October 1990 and the contents recorded. On first inspection one adult was removed and marked with a coloured dot on the forehead. At each burrow inspection after hatching, the chick was removed, placed in a cloth bag and weighed (to ± 1 g) using a spring balance. (The chick was not handled on the day of hatching.)

Egg laying and incubation

An egg (33 g) was laid on 1 July 1990. Both parents took turns during incubation. Lengths of attendance shifts are not known since adults were not handled during incubation, and the forehead of the sitting bird was not always visible from the burrow entrance. The egg hatched on 25 August after an incubation period of 55 days and the chick fledged on 5 November, 72 days after hatching.

Chick growth

When first handled (one day after hatching) the chick weighed 28 g. Chick mass increased at a mean rate of 5.2 g day⁻¹ to a maximum of 272 g at 48 days old (Fig. 1). The maximum detectable daily mass increment of the chick was 68 g, of which 46 g (68%) was shed within 20 h. The initial

rise in mass was followed by a decline before fledging (at 158 g). The chick lost weight consistently during the six days immediately before fledging, indicating that it probably fasted throughout this period.

Parental visitation

The burrow was inspected 83 times during chick-rearing. The chick was attended by one or more parents during 94.1% of 34 inspections made between 1831 and 2400 hours, 50.0% of four inspections made between 0001 and 0400 hours, and 6.7% of 45 inspections between 0401 and 1830 hours (Table 1). These data suggest that parents came ashore almost nightly, probably arriving just after sunset and remaining with the chick until shortly before dawn. Neither parent was found ashore during the six days immediately before the chick fledged.

Discussion

Contrary to recent reports that Little Shearwaters have been extinct on Lord Howe Island since the early 1900s (Garnett and Crowley 2000) Little Shearwaters are currently breeding there, and have been since at least 1990. They are present on the Island between April and October. Their occurrence on Lord Howe Island is surprising given the presence of Black Rats, *Rattus rattus*, on Lord Howe Island. Rats were thought

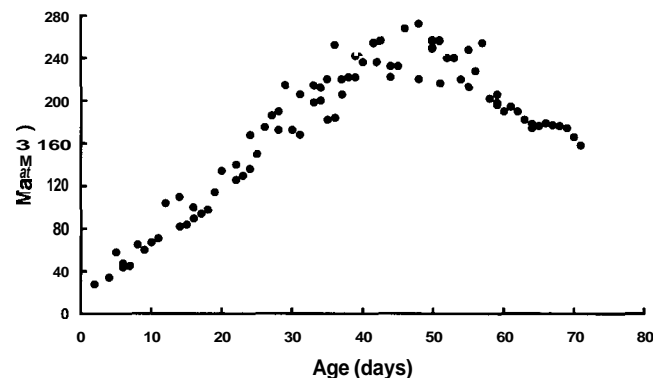


Fig. 1. Plot of the mass (g) of a Little Shearwater chick from hatching to fledging.

Table 1. The frequency of occurrence of adult Little Shearwaters at their nest on Lord Howe Island during the chick-rearing period (25 August to 5 November 1990)

Data are based on near-daily inspections, and are grouped according to time of each inspection. The last column shows, for each time interval, the proportion of inspections where the chick was accompanied by one or both parents

Time (hours)	n	Number of parents present			Accompanied (%)
		0	1	2	
0001-0400	4	2	2	0	50.0
0401-1830	45	42	2	1	6.7
1831-2400	34	2	18	14	94.1
Total	83	46	22	15	44.6

to be the reason why Little Shearwater colonies have disappeared or been severely reduced on other Pacific islands (Schodde *et al.* 1983; Imber in Marchant and Higgins 1990).

It is unclear whether Little Shearwaters persisted on Lord Howe Island in low numbers throughout last century or whether the species is now recolonising. The use of burrows previously occupied by Black-winged Petrels (Hutton and Priddel 2002) suggests that they may be recolonising; however, it is not uncommon for Little Shearwaters to share burrows with other species. In the early 1900s, Little Shearwaters on Lord Howe Island often used the burrows of Wedge-tailed Shearwaters, *Puffinus pacificus* (Hindwood 1940). In New Zealand, burrows are shared with Black-winged Petrels and Pycroft's Petrels, *Pterodroma pycrofti* (Imber in Marchant and Higgins 1990), and in Western Australia, with skinks, *Egernia kingii* (Glauert 1946).

Breeding success in Procellariiformes is highly variable, but typically 40-50% of eggs laid produce fledged young (Warham 1990). On the basis of this level of breeding success and the number of fledglings found (85), the size of the breeding population of Little Shearwaters on Lord Howe Island is estimated at about 200 pairs, but allowing for some likely areas that were not searched, the population could be as many as 300 breeding pairs. An apparent increase in frequency of anecdotal sightings suggests that the population may be expanding, although, if so, the reasons for this are unclear. It may be due to recent, more effective control of rats or the eradication of feral cats during the 1980s. The large number of seabirds breeding on Lord Howe Island during summer would have provided cats with an abundant supply of prey, but during winter few seabirds breed there and predation on Little Shearwaters - the only winter-breeding seabird on the lowlands - may have been particularly severe.

Breeding in the Little Shearwater is less synchronous than in other Procellariiformes, presumably because the species is non-migratory (Booth *et al.* 2000b). The breeding period found during this restricted study on Lord Howe Island is similar to that of *P. a. tunneyi* in south-western Australia (Glauert 1946), *P. a. kermadecensis* in the Kermadec Islands (Oliver in Marchant and Higgins 1990) and *P. a. haurakiensis* in New Zealand (Booth *et al.* 2000b). For these subspecies, most eggs are laid between late June and mid-July. On the Chatham and Antipodes Islands, however, *P. a. elegans* breeds at least two months later (Warham and Bell 1979; Imber 1983). The 55-day incubation period and the 72-day fledging period for *P. a. assimilis* on Lord Howe Island are within the ranges reported for *P. a. tunneyi* (52-58 and 70-75 days respectively; Glauert 1946) and *P. a. haurakiensis* (54-57 and 69-77 days; Booth *et al.* 2000b). Comparative data are not available for the other subspecies.

On most nights (94%) the chick was attended by one or both parents; parents also occasionally accompanied the chick during the day. Similar visitation rates have been reported for other subspecies of Little Shearwater:

P. a. kermadecensis chicks are visited by one or two parents each night (Warham 1955), *P. a. baroli* chicks receive food from their parents on 95% of nights (Hamer 1994) and *P. a. haurakiensis* chicks are fed on 90% of nights (Booth *et al.* 2000b). In contrast, chicks of *P. a. tunneyi* are visited only every second night for the first two weeks after hatching then only once or twice in every five nights thereafter (Glauert 1946). This finding, however, was based on the contents of burrows inspected only during the day and early evening (before 2100 hours), and so almost certainly underestimated visitation rates. Other burrowing Procellariiformes that come ashore nightly tend to be much smaller, such as storm-petrels and diving petrels (Warham 1990).

The presence of one or both adults ashore each night may provide evidence for either of two alternative provisioning strategies. Both parents may feed locally on a resource that is relatively plentiful, and deliver food to the chick independently of each other, as in *P. a. baroli* on Selvagem Grande in the north Atlantic Ocean (Hamer 1994). Alternatively, both parents may adopt a dual foraging strategy involving both long and short trips, but coordinate their feeding shifts such that the chick is not left unfed. A coordinated foraging and provisioning strategy is atypical of Procellariiformes, but has been reported for *P. a. haurakiensis* on Lady Alice Island, New Zealand (Booth *et al.* 2000a).

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References

- Booth, A. M., Minot, E. O., Fordham, R. A., and Imber, M. J. (2000a). Co-ordinated food provisioning in the little shearwater *Puffinus assimilis haurakiensis*: a previously undescribed foraging strategy in the Procellariidae. *Ibis* 142, 144-146.
- Booth, A. M., Minot, E. O., Imber, M. J., and Fordham, R. A. (2000b). Aspects of the breeding ecology of the North Island little shearwater *Puffinus assimilis haurakiensis*. *New Zealand Journal of Zoology* 27, 335-345.
- Fullagar, P. J., and Disney, H. J. (1975). The birds of Lord Howe Island: a report on the rare and endangered species. *Bulletin of the International Council for Bird Preservation* 12, 187-202.
- Fullagar, P. J., McKean, J. L., and Van Tets, G. F. (1974). Appendix F. Report on the birds. In 'Environmental Survey of Lord Howe Island'. (Eds H. F. Recher and S. S. Clark.) pp. 55-72. (New South Wales Government Printer: Sydney.)
- Garnett, S., and Crowley, G. M. (2000). 'The Action Plan for Australian Birds 2000.' (Environment Australia: Canberra.)
- Glauert, L. (1946). The little shearwater's year. *Emu* 46, 187-192.

- Hamer, K. C. (1994). Variability and stochasticity of meal size and feeding frequency in the Little Shearwater *Puffinus assimilis*. *Ibis* **136**, 271–278.
- Hindwood, K. A. (1940). The birds of Lord Howe Island. *Emu* **40**, 1–86.
- Hutton, I. (1991). 'Birds of Lord Howe Island: Past and Present.' (Ian Hutton: Coffs Harbour.)
- Hutton, I., and Priddel, D. (2002). Breeding biology of the Black-winged Petrel, *Pterodroma nigripennis*, on Lord Howe Island. *Emu* **102**, 361–365.
- Imber, M. J. (1983). The lesser petrels of Antipodes Islands, with notes from Prince Edward and Gough Islands. *Notornis* **30**, 283–298.
- IUCN (1994). 'IUCN Red List Categories.' (IUCN: Gland, Switzerland.)
- Marchant, S., and Higgins, P. J. (Eds) (1990). 'Handbook of Australian, New Zealand and Antarctic Birds. Volume 1: Ratites to Ducks.' (Oxford University Press: Melbourne.)
- Schodde, R., Fullagar, P., and Hermes, N. (1983). 'A Review of Norfolk Island Birds: Past and Present.' (Australian National Parks and Wildlife Service: Canberra.)
- Warham, J. (1955). Observations on the little shearwater at the nest. *Western Australian Naturalist* **5**, 31–39.
- Warham, J. (1990). 'The Petrels: Their Ecology and Breeding Systems.' (Academic Press: London.)
- Warham, J., and Bell, B. D. (1979). The birds of Antipodes Island, New Zealand. *Notornis* **26**, 121–169.

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