INTERSPECIFIC FOSTERING OF A WEDGE-TAILED SHEARWATER *ARDENNA PACIFICA* BY WHITE-NECKED PETRELS *PTERODROMA CERVICALIS* ON PHILLIP ISLAND, NORFOLK ISLAND GROUP

TERENCE W. O'DWYER[1,2], DEAN PORTELLI[1] & NICHOLAS CARLILE[1]

[1]*Office of Environment and Heritage, PO Box 1967 Hurstville, NSW 2220, Australia (Terry.ODwyer@environment.nsw.gov.au)*
[2]*School of Biological Sciences, University of Wollongong, NSW 2522, Australia*

Received 14 November 2017, accepted 24 November 2017

ABSTRACT

O'DWYER, T.W., PORTELLI, D. & CARLILE, N. 2018. Interspecific fostering of a Wedge-tailed Shearwater *Ardenna pacifica* by White-necked Petrels *Pterodroma cervicalis* on Phillip Island, Norfolk Island Group. *Marine Ornithology* 46: 43–45.

We report the cross-fostering of a Wedge-tailed Shearwater chick by White-necked Petrels during the 2016/17 breeding season in the Norfolk Islands. Our finding highlights the possibility that cross-fostering of these procellariids can be used in conservation applications.

Key words: cross-fostering, Norfolk Island, seabird conservation, Wedge-tailed Shearwater, White-necked Petrel

While the delivery of parental care by non-biological parents occurs naturally in a wide range of avian taxa (Riedman 1982), fostering of eggs or chicks is relatively rare in the Procellariiforms (albatrosses and petrels). Exceptions include the adoption of a chick by Southern Giant Petrels *Macronectes giganteus* (Archuby *et al.* 2010) and several reports that, although Procellariiforms invariably lay a single egg, the nests of Giant Petrels *M. giganteus* and *M. halli* (Northern Giant Petrels) and some species of albatross (e.g., Wandering Albatross *Diomedea exulans,* Yellow-nosed Albatross *Thalassarche chlororhyncos,* Black-browed Albatross *T. melanophris*) are occasionally found to contain two eggs or chicks (Warham 1962, Tickell and Pinder 1966, Ryan *et al.* 2007). Cases of interspecific fostering are even less common, with only one record found in the literature, that of a Fairy Prion *Pachyptila turtur* chick being raised by Cape Petrels *Daption capense* (Miskelly *et al.* 2001). This report describes a rare occurrence of natural interspecific fostering in a Procellariiform, in which adult White-necked Petrels *Pterodroma cervicalis* incubated the egg and provisioned the chick of a Wedge-tailed Shearwater *Ardenna pacifica* on Phillip Island, in the Norfolk Island Group.

As part of a study to track the movements of White-necked Petrels, 21 nests containing an incubating adult were located in January 2017. The presence of an egg was confirmed for each nest, but the egg was not removed or examined closely. On 18 February 2017, during periodic checks of the nests to try to capture the second incubating bird, we found one newly hatched chick and 19 incubating adult White-necked Petrels. Three additional chicks hatched over the next two days. The chick at one of the nests differed from the others in a number of morphological characteristics and was identified as a

Fig. 1. Comparison of newly hatched White-necked Petrel chick (left) and the Wedge-tailed Shearwater chick (right) that was incubated by White-necked Petrels.

Fig. 2. Comparison of the cross-fostered Wedge-tailed Shearwater chick at two months of age (left) with a similar aged White-necked Petrel chick (right).

Wedge-tailed Shearwater chick based on down colour and the shape and colour of the bill and feet (Fig. 1).

A motion sensing infrared camera (Reconyx Hyperfire HC600) was positioned facing the entrance to the nest to determine which species was provisioning the chick. The camera detected White-necked Petrels visiting the nest on 27 occasions; no images of an adult Wedge-tailed Shearwater were recorded. Only one of the adults at this nest had a logger attached to its leg, and the camera duly detected that bird as well as a bird without a logger, confirming that both adults were attending the nest.

During nest checks in April 2017, when the chick was approximately 60 d old, we observed that the chick had been provisioned successfully, which allowed us to make a physical comparison with similarly aged White-necked Petrels in nearby nests (Fig. 2). The body mass of the chick and a number of morphometric measurements were taken at this time. For comparison, the same measurements were taken from an additional 10 similarly aged Wedge-tailed Shearwater chicks located in other areas of the island. While the fostered chick was slightly smaller than the other Wedge-tailed Shearwaters measured (Table 1), it did not appear to be malnourished.

The camera revealed that the White-necked Petrels visited the nest up until 13 May 2017 (e.g., Fig. 3). The chick was first observed outside the nest on 6 May 2013, when it was approximately 75 d old, and was last seen on 12 May 2017. At that time, the chick was not sufficiently developed to fledge (Fig. 4) and, while the camera may not record all visits, the lack of further observations of both parents and the chick suggest that the chick had departed the site and, without its presence, adults ceased attendance of the burrow. When the nest was last checked in June 2017, a month beyond the expected fledging period, there was no evidence of the remains of the chick.

How the Wedge-tailed Shearwater egg came to be in the White-necked Petrel nest is unknown. The nest was a natural cavity

Fig. 3. White-necked Petrel visiting the nest in which the cross-fostered Wedge-tailed Shearwater was present.

Fig. 4. The adopted Wedge-tailed Shearwater chick outside its nest on 12 May, the last date that the chick was seen on camera.

TABLE 1
Morphological measurements of 10 similarly aged Wedge-tailed Shearwater chicks compared with the Wedge-tailed Shearwater chick raised by White-necked Petrels

	Head + bill length (mm)	Culmen length (mm)	Bill depth at gonys (mm)	Tarsus length (mm)	Wing length (mm)	Body mass (g)
Mean (± SD) additional chicks	88.5 ± 1.3	39.9 ± 0.9	9.3 ± 0.4	51.6 ± 1.3	225 ± 14	588 ± 26
Range of additional chicks	86.6–90.2	38.7–41.7	8.5–10.0	49.8–54.8	202–255	520–>600
Fostered chick	85.2	37.0	8.9	49.5	195	480

TABLE 2
Breeding schedules of White-necked Petrels and Wedge-tailed Shearwaters

	White-necked Petrel	Wedge-tailed Shearwater
Incubation length (days)	55[a]	54[b]
Laying date	From 26 December[b]	From 13 December[b, c]
Hatching date	From 22 February[b]	From 6 February to April[d]
Chick departure date	19–30 May[c]	6–18 May[c]

[a] Based on similarly sized Providence Petrel *P. solandri* egg.
[b] Marchant & Higgins (1990).
[c] Priddel *et al.* (2010).
[d] Inferred from laying date and an incubation length of 54 days (Marchant & Higgins 1990).

beneath a boulder and, while the site appeared to be suitable for a Wedge-tailed Shearwater, there were few if any Wedge-tailed Shearwater nests within the vicinity, with the nearest known active nest being more than 100 m away. The nest was, however, among several other White-necked Petrel nest sites.

There is overlap in the recorded laying dates for White-necked Petrels and Wedge-tailed Shearwaters (Table 2). While data on incubation length does not exist for White-necked Petrels, their incubation length is expected to be similar to Wedge-tailed Shearwaters (approximately 54–55 d), based on the general relationship between egg size and incubation length in birds (Rahn & Ar 1974). The hatching date of approximately 21 February 2017 suggests that the Wedge-tailed Shearwater egg was laid in late December 2016. It is possible that a pair of Wedge-tailed Shearwaters had taken the site during their courtship, which commences 16–21 October (Priddel *et al.* 2010) before the arrival of White-necked Petrels in early November (Priddel *et al.* 2010). Perhaps the incubating Wedge-tailed Shearwater was evicted soon after laying its egg in late December, and the White-necked Petrels subsequently incubated the egg. Whether the White-necked Petrels had their own egg is unknown, but no second egg was seen in the nest when the White-necked Petrel was observed incubating, or during later observations of the chick. If the White-necked Petrels never had their own egg, then the finding that they incubated and fed the Wedge-tailed Shearwater chick is remarkable, given that their circulating levels of prolactin, a hormone that is strongly linked to the provision of parental care (Buntin 1996), is expected to be lower in non-breeding birds (Riou *et al.* 2010).

The absence of White-necked Petrels on camera after 12 May 2017 indicates that they prematurely ceased to feed the chick. Perhaps incompatibilities between the species in begging behaviour or bill morphology became more apparent as the chick grew larger. The slightly lower body mass and smaller size of the chick compared with other Wedge-tailed Shearwater chicks on the island may be an indication of this increasing incompatibility.

Examples of natural interspecific fostering in seabirds are rare. Miskelly *et al.* (2001) reported that Cape Petrels raised a Fairy Prion chick in the Snares Island, New Zealand. It is believed that, on that occasion, the Fairy Prion chick was adopted after it had wandered into the nest of the Cape Petrels.

Artificial cross-fostering of petrels has taken place for conservation and research purposes. For example, the eggs of Newell's Shearwaters *Puffinus newelli* were placed under Wedge-tailed Shearwaters on Moku'ae'ae Rock, Kaua'i, in an attempt to establish a breeding colony of Newell's Shearwaters (Byrd *et al.* 1986). The chicks were successfully raised by the Wedge-tailed Shearwaters, and, while surveys in 2013 and 2015 found no evidence of breeding Newell's Shearwaters on the rock (Raine *et al.* 2017), a small number of birds, believed to be from the translocated population, now breed on the adjacent mainland just a few hundred metres away from the rock (B. Zaun *in* Griesemer & Holmes 2011; K. Uyehara, pers. comm.). In addition, hatchling South Georgia Diving Petrels *Pelecanoides georgicus* were switched with hatchling Antarctic Prions *Pachyptila desolata* to investigate the importance of stomach oil in the development of petrel chicks. The Diving Petrels did not successfully raise Antarctic Prion chicks, whereas the prions raised Diving Petrel chicks, but their development was delayed (Roby *et al.* 1997).

Although the Wedge-tailed Shearwater chick in this study presumably did not survive to fledge, the White-necked Petrel foster parents incubated the egg to hatching and fed the chick for a prolonged period. These and other observations of natural and artificial interspecific fostering among procellariids highlight the potential for heterospecific cross-fostering as a conservation tool for threatened procellariids.

REFERENCES

ARCHUBY, D.I., CORIA, N.R., HARRINGTON, A., FUSARO, B., MONTALTI, D. & FAVERO, M. 2010. Is it possible for a Procellariiform to raise two chicks? A case of chick adoption in Southern Giant Petrels *Macronectes giganteus* in the South Shetland Islands, Antarctica. *Marine Ornithology* 38: 125-127.

BUNTIN, J.D. 1996. Neural and hormonal control of parental behavior in birds. *Advances in the Study of Behavior* 25: 161-213.

BYRD, G.V., SINCOCK, J.L., TELFER, T.C., MORIARTY, D.I. & BRADY, B.G. 1986. A cross-fostering experiment with Newell's race of Manx Shearwater. *Journal of Wildlife Management* 48: 163-168.

GRIESEMER, A.M. & HOLMES, N.D. 2011. *Newell's Shearwater Population Modeling for Habitat Conservation Plan and Recovery Planning.* Technical Report 176. Honolulu: Hawai'i-Pacific Islands Cooperative Ecosystem Studies Unit & Pacific Cooperative Studies Unit, University of Hawai'i at Manoa.

MARCHANT, S. & HIGGINS, P.J. 1990. *Handbook of Australian, New Zealand and Antarctic Birds. Vol.1: Ratites to Ducks*. MARCHANT, S. & HIGGINS, P.J. (Eds.). Melbourne, Australia: Oxford University Press.

MISKELLY, C.M., SAGAR, P.M., TENNYSON, A.J.D. & SCOFIELD, R.P. 2001. Birds of the Snares Islands, New Zealand. *Notornis* 48: 1-40.

PRIDDEL, D., CARLILE, N., EVANS, O., EVANS, B. & McCOY, H. 2010. A review of the seabirds of Phillip Island in the Norfolk Island Group. *Notornis* 57: 113-127.

RAHN, H. & AR, A. 1974. The avian egg: incubation time and water loss. *Condor* 76: 147-152.

RAINE, A.F., McFARLAND, B., BOONE, M. & BANFIELD, N. 2017. An updated avifauna of Moku'ae'ae Rock Islet, Kaua'i. *Pacific Science* 71: 67-76.

RIEDMAN, M.L. 1982. The evolution of alloparental care and adoption in mammals and birds. *The Quarterly Review of Biology* 57: 405-435.

RIOU, S., CHASTEL, O., LACROIX, A. & HAMER, K.C. 2010. Stress and parental care: prolactin responses to acute stress throughout the breeding cycle in a long-lived bird. *General and Comparative Endocrinology* 168: 8-13.

ROBY, D., TAYLOR, J.R.E. & PLACE, A.R. 1997. Significance of stomach oil for reproduction in seabirds: an interspecies cross-fostering experiment. *Auk* 114: 725-736.

RYAN, P.G., CUTHBERT, R.J. & COOPER, J. 2007. Two-egg clutches among albatrosses. *Emu* 107: 210-213.

TICKELL, W.L.N. & PINDER, R. 1966. Two-egg clutches in albatrosses. *Ibis* 108: 126-129.

WARHAM, J. 1962. The biology of the Giant Petrel *Macronectes giganteus*. *Auk* 79: 139-160.