tribution of the Thylacine (Marsupialia, Thylacinidae) in Australia. Journal of Proceedings of the Royal Society of Western Australia 57, 43-50.

Baird, R.F. 1984. The Pleistocene distribution of the Tasmanian Native-hen *Gallinula mortierii mortierii*. Emu 84, 119-123.

Baird, R.F. 1985. Avian fossils from Quaternary deposits in "Green Waterhole Cave", south-eastern South Australia. Records of Australian Museum 37, 353-370.

Baird, R.F. 1986. Tasmanian Native-hen *Gallinula mortierii*: The first Late Pleistocene record from Queensland. Emu 86, 121-122.

Baird, R.F. 1991. Avian fossil of pitfall origin from Holocene sediments in Amphitheatre Cave (G-2), south-western Victoria, Australia. Records of Australian Museum, 43, (3).

Corbett, L.K. & Newsome, A.E. 1987. The feeding ecology of the dingo. III. Dietary relationships with widely fluctuating prey populations in arid Australia: an hypothesis of alternation of predation. Oecologia 74, 215-227.

Frakes, L.A., McGowran, B. & Bowler, J.M. 1987. Evolution of Australian environments. Pp. 1-16 in Fauna of Australia, Vol. 1A. General Articles. Eds G.R. Dyne & D.W. Walton. Australian Government Publishing Service, Canberra.

Kershaw, A.P. 1981. Quaternary vegetation and environments. Pp. 83-101 in Ecological Biogeography of Australia. Ed. A. Keast. Dr W. Junk, The Hague.

Matthews, P.G. 1985. Australian Karst Index. Australian Speleological Federation Inc., Melbourne.

McNamara, G. & Baird, R.F. 1991. A Late Pleistocene geographical range extension for *Gallinula mortierii* (Aves, Gruiformes, Rallidae): Wyandotte Formation, northern Queensland. Alcheringa, 15.

Milham, P. & Thompson, P. 1976. Relative antiquity of human occupation and extinct fauna at Madura Cave, south-eastern western Australia. Mankind 10, 175-180.

Newsome, A.E., Catling, P.C. & Corbett, L.K. 1983. The feeding ecology of the dingo II. Dietary and numerical feeding relationship with fluctuating prey populations in south-eastern Australia. Australian Journal of Ecology 8, 345-366.

Ridpath, M.G. 1972. The Tasmanian Native Hen *Tribonyx mortierii* III Ecology. CSIRO Wildlife Research 17, 91-118.

Olson, S.L. 1975. The fossil rails of C.W. DeVis, being mainly an extinct form of *Tribonyx mortierii* from Queensland. Emu 75, 49-54.

Woodburne, M.O., Tedford, R.H., Archer, M., Turnbull, W.D., Plane, M.D. & Lundelius, E.L. 1986. Biochronology of the continental mammal record of Australia and New Guinea. Special Publication, South Australian Department of Mines and Energy 5, 347-363.

Breeding and Behaviour of the Herald Petrel *Pterodroma arminjoniana* on Raine Island, Queensland

B.R. King[1] and D.S. Reimer[2]

[1] Queensland Museum (North Queensland Branch), Flinders Street, Townsville, Qld. 4810
[2] Queensland National Parks and Wildlife Service, Northern Regional Centre, Pallarenda, Qld. 4810

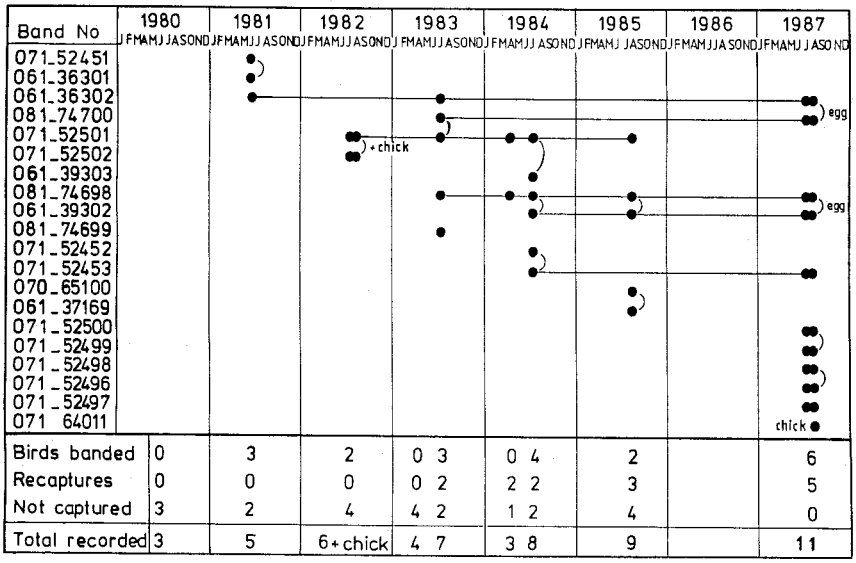
EMU Vol. 91, 122-125, 1991. Received 11-4-1990, accepted 17-7-1990

The Herald Petrel *Pterodroma arminjoniana heraldica* was first recorded at Raine Island in 1959 (Warham 1959), and bred there in 1982 (King 1984). Herald Petrels breed on a number of islands in the tropical Pacific Ocean and the Raine Island population, the only breeding population in Australia, is probably an extension of an unconfirmed range through the Coral Sea islands (King 1984).

Little is known of the biology of this species, except for the observations on behaviour and breeding by Gardner *et al.* (1985) at Round Island, Mauritius. The present paper summarises our observations on the Herald Petrel at Raine Island from 1980 to 1987 and provides new information on its breeding in Australia.

Methods

Raine Island (11°36′S, 144°01′E) is a large, vegetated coral cay in the far northern Great Barrier Reef and is noted for the variety and numbers of its breeding tropi-



Birds banded	0	3	2	0 3	0 4	2		6
Recaptures	0	0	0	0 2	2 2	3		5
Not captured	3	2	4	4 2	1 2	4		0
Total recorded	3	5	6+chick	4 7	3 8	9		11

Figure 1 Records of Herald Petrels on Raine Island, showing numbers banded, recaptured and recorded, plus associations among individuals.

cal seabirds. A full description of the cay and a summary of its seabird population are given by King (1986).

Herald Petrels were observed at Raine Island during visits in June 1980 (BRK and D. Seton), June 1981, July and August 1982, April and July 1983, April and July 1984, July 1985 (BRK), and July and August 1987 (BRK and DSR). On each visit, we made records of the number of Petrels on the island, birds banded, measured and recaptured, associations among individuals, behaviour and any breeding activities. Because of the small number of birds and nests, we minimised our handling of adults and made no measurements of chick growth, in order to reduce disturbance.

Results

Population size and composition

All birds captured or observed belonged to the intermediate colour phase of the subspecies *heraldica*. Our counts of birds in flight and observations of birds on the ground indicated that the population on the island was very small (Fig. 1). However, because the birds were difficult to locate under the dense ground cover, there might have been a greater number than our counts suggested.

Figure 1 shows the numbers of Herald Petrels recorded per visit, the history of individuals banded and recaptured, and indicates associations among individuals. From 1980 to 1987 a total of 20 birds were banded. Three band sizes were used until a band size (07) was agreed on. We were unable to determine the sex of individuals, but in recaptures on successive days the associations between pairs of birds appeared to be stable. Two sets of associations are of interest:

Bird 071.52501 had three different mates; it was captured with 071.52502 and a downy chick in August 1982, then was recaptured with 081.74700 in July 1983, and with 061.39303 in July 1984. Bird 071.52502 was not recaptured after August 1982, and 071.52501 and 061.39303 were not recaptured after July 1985. However, 081.74700 subsequently mated again and was with 061.36302 and an egg in July 1987.

On the other hand, 081.74698 and 061.39302 remained a stable pair over four years; they were captured together in July 1984 and July 1985, and with a nest and egg in July/August 1987.

Description of the nest and egg

Four nests were found, one in August 1982 and three in July and August 1987. Figure 1 shows the individuals associated with nests.

Nests and roosting birds were all located on the south-western portion of the vegetated sand ridge that surrounds the central depression of the cay. All nests were well concealed under the low, thick canopy of grass *Lepturus repens* and shrubs *Achyranthes aspera*, *Abutilon indicum* and *Sesbania cannabina* that covers

the sand ridge. In the two cases where chicks were found, no nest structure was discernible, and the adults and chicks sat on the sand under the vegetation cover.

The two nests containing eggs were each a shallow scrape (diameter 200 mm and depth 20-40 mm) in the sand under overhanging vegetation; no lining material was used, but each had a small amount of leaves of *L. repens* and *A. aspera* flattened by the adults in and around the scrape. The height of the space between the ground and the vegetation canopy was no more than 10-15 cm, and a small passage through the canopy gave access to the nest site.

Clutch size at the two nests was one, as was the brood size of the other two. The eggs were white, with a smooth shell surface. One egg had been damaged prior to discovery. Only one bird (061.39302) was seen incubating the second egg, which, however, failed to hatch when the chick died while breaking out of the shell. The remains of the egg with its unhatched chick were preserved (Qld. Museum No 028733). Measurements of that egg were: maximum length 61.3 mm, maximum width 43.3 mm and weight 57.5 gm.

Calls

Two calls were recorded, and correspond to those described by Gardner *et al.* (1985).

(a) Rattle Call: A high-pitched, sharp, single note, repeated rapidly for up to ten seconds, slightly longer in duration than the 3-6 s at Round Island (Gardner *et al.* 1985). This call is given frequently in the display flight and occasionally on the ground. It might function as a contact call among individuals or mates.

(b) Mew Call: A drawn-out, low-pitched nasal note. This has been heard on only four occasions — once in flight before an individual flew at an approaching Silver Gull *Larus novaehollandiae*, once on the ground at the end of a rattle call, once by a bird in the hand and once by a member of a pair on the ground facing each other with bills almost touching. It might function as an alarm or distress call.

Behaviour

(a) Diurnal: birds not incubating were absent from the island during the day, presumably feeding at sea, and returned from mid-afternoon to dusk. After arrival, single birds, pairs and sometimes trios made Display Flights (Gill *et al.* 1970) over the island before settling on the ground under the vegetation canopy for the night. The birds climbed and dived at great speed, rarely beating their wings, and occasionally gave the Rattle Call. As dusk approached, their flight pattern centred over a particular part of the vegetated ridge, where, after repeated passes they eventually landed. This behaviour might be to locate a particular area for roosting, or to locate a mate concealed under the vegetation. The Display Flight might also be involved with pair-bonding and maintenance.

(b) On the ground, birds roosted alone or in pairs, occasionally in trios. They sat quietly on the sand under the vegetation canopy, and showed few movements or interactions with one another, apart from giving occasional Rattle Calls. They rarely reacted or attempted to escape when approached and were easily captured by hand. In the hand they were quiet and only occasionally bit or struggled.

Food

Only two recognisable items of food were regurgitated. One was a single, partly-digested squid (length 40 mm, weight 4.5 gm), collected in August 1982, and the other was a well-digested, unidentified fish, collected in August 1987.

Discussion

The Herald Petrel is now confirmed as a breeding species in Australia, albeit in small numbers and in a restricted locality. The breeding period should be considered to be from July to September, with some pairs remaining stable for several years. We believe that searching on other Coral Sea cays at that time of year may show that the species breeds there also. This would define the Australian breeding population and would fill the gap in breeding distribution between Raine and Chesterfield Islands (King 1984).

We found four nests in July and August. Nesting is later at Round Island (Indian Ocean) where, although egg laying can occur all year, the main breeding period is in October and November (Gardner *et al.* 1985). At Raine Island we found no evidence of earlier nesting, and only roosting individuals were present during visits in April and June. However, Warham (1959) found a broken petrel egg in the vicinity of his captured bird in early February 1958. As this egg was near a burrow, it could have belonged to a Wedge-tailed Shearwater *Puffinus pacificus* that nest in burrows all over the vegetated sand ridges used by the Herald Petrels.

Behaviour is similar to that described by Gill *et al.* (1970) and Gardner *et al.* (1985). The daily activity pat-

terns at Raine Island are similar to those described by Gardner *et al.* (1985).

Herald Petrels have been recorded at Raine Island from April to August (BRK) and in February (Warham 1959) but not in October, November or December (BRK) nor in January (C.J. Limpus pers. comm.). These observations agree with the suggestion that the birds have a period of residence and breeding on Raine from February to at least September, followed by a post-breeding period of dispersal and feeding at sea by both adults and juveniles (King 1984). No long-distance band recoveries have been received, and records of wrecked birds or birds at sea have so far indicated no pattern of movements during the dispersal period (Gould & King 1967; King 1984).

Acknowledgements

Research was funded by the Raine Island Corporation. A number of persons assisted in field work at various times: M. Baddley, J. Cornelius, C. Daniell, E. Edinger, L. Harris, P. Matthews, L. McIllwain, D. Seton, A. Taplin and G. Tomes. These contributions are gratefully acknowledged.

References

Gardner, A.S., Duck, C.D. & Greig, S. 1985. Breeding of the Trinidade Petrel *Pterodroma arminjoniana* on Round Island, Mauritius. Ibis 127, 517-522.

Gill, F.B., Jouanin, C. & Storer, R.W. 1970. Notes on the seabirds of Round Island, Mauritius. Auk 87, 514-521.

Gould, P.J. & King, W.B. 1967. Records of four species of *Pterodroma* from the Central Pacific Ocean. Auk 84, 591-594.

King, B.R. 1984. The Herald Petrel *Pterodroma arminjoniana heraldica* breeding at Raine Island, Queensland. Emu 84, 246-247.

King, B.R. 1986. Seabird Islands No 43/1. Raine Island, Great Barrier Reef, Queensland. Corella 10, 73-77.

Warham, J. 1959. The Trinidad Petrel *Pterodroma arminjoniana*, a new bird for Australia. Emu 59, 153-158.

Honeyeater Plucks Koala for Nest Material

Martin L. Cody

Department of Zoology, University of Queensland, St. Lucia, Qld. 4072
Present address: Department of Biology, University of California, Los Angeles, CA 90024, USA

EMU Vol. 91, 125-126, 1991. Received 19-3-1990, accepted 28-6-1990

In clear, sunny weather on 16 September 1989, I was censusing populations (using 10x50 binoculars) in woodland near Fairyland, south-east Queensland (26°33'S, 150°55'E), some 28km NE of Chincilla at 320 m asl. The woodland was dominated by Cypress Pine *Callitris columellaris*, some *Casuarina* spp., and emergent Spotted Gums *Eucalyptus maculatus* in the overstorey, and by wilga *Geijera parviflora* and several *Acacia* spp. in the understorey (especially *Acacia crassa*, with *A. spectabilis* and *A. harpophylla* less common). My survey of a 4.8 ha site produced 21 bird species with an overall density of 14.6 individuals/ha; two thornbills *Acanthiza pusilla* and *A. nana* and the Yellow-faced Honeyeater *Lichenostomus chrysops* were the most abundant species present at the site.

A Yellow-faced Honeyeater was seen making repeated trips between two Spotted Gums 36m apart. Three rounds trips were made between 0745 and 0755, and seven round trips between 0850 and 0920. The termini of these flights were a nest under construction 18m high in one gum, and a Koala *Phascolarctos cinereus* 23 m up in the second gum. The bird flew to a perch on the Koala's head, neck or shoulders, plucked the hair vigorously from it, attending particularly to the longer hair on or around the ears. A beakful of hair was accumulated in this fashion in 1.5-2.5 min. The bird then flew to its nest, incorporated the hair within it, and returned directly to the koala with an average turnaround time of 5.0 ± 3.1 min. (n = 10). On several occasions the plucking bird was accompanied from the nest to the Koala and back by a second individual, presumably the mate, but just one bird was involved in the hair-plucking activity. During these ministrations the Koala was apparently unperturbed, remaining immobile with eyes