

by *Ch. lucidus* had been greatly enlarged but Gill (1983) found no damage to parasitised nests of the Grey Warbler *Gerygone igata* in New Zealand.

We conclude that neither Cuckoo has trouble entering dome-shaped nests composed of flexible materials such as dry grass and cobwebs. On the four occasions on which laying was observed, the Cuckoo appeared to be standing on the nest entrance, not within the nest. This means that as long as a Cuckoo can squeeze her shoulders into the entrance she can, apparently, lay in the nest.

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Responses of Pterodroma Petrels to Man-made Sounds

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It has long been known that gadfly- and other petrels may be stimulated to call in response to a footfall, a shout, or an imitation of their calls, e.g. the Providence Petrel *Pterodroma solandri* (Hull 1910, 1911; McCullough 1921), the Flesh-footed Shearwater *Puffinus carneipes* and Mottled Petrel *Pterodroma inexpectata* (Warham 1958; Warham *et al.* 1977). Some can also be lured from the wing by man-made sounds. The Cahow *Pterodroma cahow* seems to be the first gadfly-petrel to have been shown to be susceptible to such vocal lures. In 1603, a Spanish galleon under Diego Ramirez was storm-driven into a harbour on Bermuda and the hungry sailors found that the Cahows could be called from the wing to the ground. They could take 4000 'in a single bag' (Beebe 1935 p.187). In 1609, a British ship, the *Sea Venturer*, was wrecked on that island and William Strachey, writing in 1610, reported that 'Our men found a prettie way to take them which was by hollowing and laughing, with the noyse thereof, the birds

would come flocking to that place, and settle upon the very arms and head of him that so cryed, and still creepe neerer and neerer, answering the noise themselves...' (Beebe 1935 p.187). Verrill (1902) also described the similar methods used for capturing the Cahows by the early settlers on Bermuda.

According to Perkins (1913) another gadfly-petrel taken by calling to flying birds was the Hawaiian Petrel or Uau *Pterodroma phaeopygia*, a traditional food of the Polynesians of those islands.

In Australia the Providence Petrel is the only tubenose known to be lured to the ground by man-made calls and Hindwood (1940) reported that if the calls persist the grounded birds come right up to the caller and will even crawl onto his body.

According to Hindwood the lures used were imitations of the birds' call note (which he thought was 'coo-coo'), or by some unusual noise like shouting. The responses are said to decline after egg laying, with vocal luring impossible later in the breeding season (P. Beaumont pers. comm.).

During a stay at Lord Howe Island between 15 and 22 May 1981, early in the egg-laying period, my wife and I studied the responses of Providence Petrels to man-made sounds. Our calls and theirs were recorded with a Uher 4000IC tape recorder and a Nakamichi CM300 microphone and analysed on a Kay 6061B Sona-Graph. For conducting other experiments and assistance I am indebted to Paul Beaumont, Ted Simons and Colin Miskelly.

At this stage of the breeding cycle some Providence Petrels were circling the tops of Mt. Lidgbird from about 1000 h onwards, but at lower elevations flying birds were only numerous in late afternoon. That many of these were not flying directly to nests but patrolling above rather restricted areas was clear from the movements of birds identifiable by missing or displaced flight feathers. Towards dusk, layer after layer of circling birds were visible from close to sea level upwards as far as the eye could see. Many called with the harsh 'ti-ti's' typical of gadfly petrels, creating a chorus of animated chatterings. High-speed dual flights also occurred, with each bird twisting and turning in unison like displaying terns, but most petrels were in close proximity for only a few seconds before the chase was broken off.

Hand clapping lured some birds to alight, but much more effective was sustained hootings made by flapping a hand in front of the mouth while sounding a steady note at about 0.5 kHz. The response was dramatic. Those nearby and overhead replied immediately so that the background chorus was suddenly amplified (Fig. 1A). The nearest birds tended to drop their feet and brake with their wings as if about to alight. Some birds changed their flight paths to bring them back towards the source of the sound. If we continued calling the petrels began to alight on the beach or in nearby scrub and in response to our persistent hooting they gave strident and urgent 'ti-ti' calls and hurriedly tottered forwards over vegetation and boulders using outstretched wings to aid their balance. Upon reaching the caller's feet they clambered onto his or her body. They continued to reply to every hoot but now tended to peck at and mandibulate the caller's clothing, using movements similar to those of gadfly petrels during mutual preening, e.g. Great-winged Petrels *P. macroptera* (Warham 1956).

With several converging towards one source of sound, some birds came close to one another. Such birds then interrupted their advances to attack each other vigorously, using loud cries and flailing wings as they tried to grasp

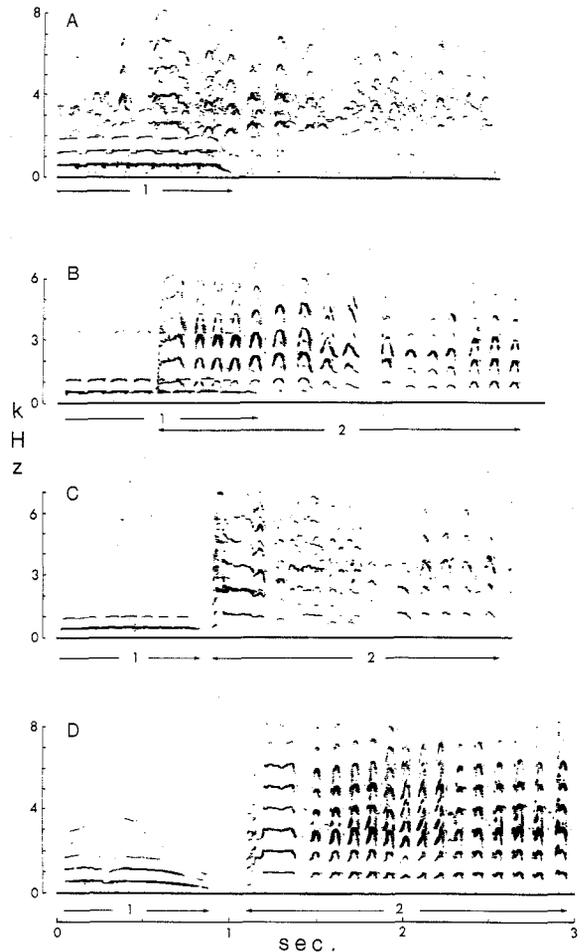


FIGURE 1 Stimuli (1) and responses (2) of *Pterodroma solandri* to vocal lures, (A) by a flock of flying birds, (B-D) by different grounded birds moving towards the human caller.

their opponent's heads and necks in their bills. No damage seemed to result and the first to recover would continue its progress towards the caller.

Figures 1C-D show analyses of lure and response from three different grounded birds. Note that their replies followed fast on the commencement of the lure call — within 0.5 sec in some instances — or broke into the decoy call itself, as in Figures 1A & B. These replies were loud, even vehement: in Figure 1B they reached the microphone at a greater amplitude than that of the human caller, although she was closer to it. Most of these responses were built from trains of cries showing as arcuate forms on the sonagrams, as for other gadfly-petrels (e.g. the Mottled Petrel, Warham *et al.* [1977]).

At first sight the decoying calls have little in common with those of the respondents, being of lower pitch and less interrupted. But the hand movements did generate a shallow pulsing to these man-made sounds, best shown in the fundamental and first overtone of Figure 1B, and at a rate rather similar to that of the syllables of the petrel calls. Such a pulsed pattern may prove to be a key factor in an effective lure for these birds, and perhaps help explain why hand-clapping and even playing a mouth-organ work. The response in Figure 1D to an unpulsed call may perhaps run against this idea, but this bird may have been so stimulated by previous 'talk-back' that it was ready to reply to any loud sound.

Furthermore, the low frequency and drawn out character of our lure calls are quite similar in acoustic structure to the 'moaning' cries of some other gadfly-petrels like the Soft-plumaged *P. mollis*, Murphy's *P. ultima* and the Hawaiian Petrels (Warham 1979, pers. obs.; Simons 1985). We occasionally heard similar calls from the Providence Petrels, but never from close at hand and they could have come from the ground or from the air. The absence of ground-calling birds in the general area of Little Island where we worked was expected because there were few nests at this low altitude and we saw no birds on the surface except the ones that we enticed there. However, whether there is any ground-to-air communication among gadfly-petrels seems as yet undetermined, although recently shown for the Manx Shearwater *Puffinus puffinus* (Storey 1984).

Most, but not all, of the flying Providence Petrels responded to our calls. The breeding status or sexes of the lured birds were unknown. None of the 15 examined had a palpable egg or swollen cloaca, as would be expected of breeding females at this time. Nine had well developed brood patches but were not necessarily breeders, while two had partially developed and the rest feathered brood patches.

A prominent feature of the grounded birds' behaviour was the contrast between their docility when handled and their aggressiveness towards one another: it was as if each was trying to defend the human caller from the advances of the other bird!

The 1986/87 University of Canterbury Expedition at the Snares Islands lured some Mottled Petrels to the ground during trials around the time of egg laying. The birds responded with the 'gor-wik' cry but none would come

right up to the human caller. None of the lured birds had a distended cloaca. However, a similar attempt by T.R. Simons to call down Hawaiian Petrels at Mt. Haleakala on Maui by hooting (as described above), failed to evoke a response but this was attempted rather late in the breeding season and at a colony with quite small numbers of birds.

Clearly the response of gadfly-petrels to man-made or artificial sounds requires proper experimental investigation using standardised sounds, both pulsed and unpulsed, the determination of the sexes and status of the respondents, and the pattern of response throughout the time that the birds are ashore. As a provisional hypothesis, I suggest that the lured birds at Lord Howe Island were unpaired, pre-breeding males responding to sounds resembling those of unpaired females, sounds that acted as super-optimal stimuli.

Should vocal lures prove effective for gadfly-petrels in general, amplified tape recordings could prove useful in the field. For instance, they might help to locate the nests of rare species like the Taiko *P. magentae* or provide a means of capturing birds for banding or examination without having to disturb them in their burrows.

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