

Trial of burrow flaps to protect petrel chicks

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1. Introduction

Burrow competition between the critically endangered Chatham petrel (*Pterodroma axillaris*) and the locally abundant broad-billed prion (*Pachyptila vittata*) is the main cause of Chatham petrel chick mortality, and in an unmanaged situation between 50% and 70% of chick deaths are due to burrow competition (Gardner & Wilson 1999). Current management involves nightly patrols of the known breeding burrows and culling of all broad-billed prions found in Chatham petrel burrows. This has increased the survival rate of Chatham petrel chicks (Bancroft 1999) but it is labour-intensive, expensive, it disturbs Chatham petrels while they are feeding their chicks and involves killing a protected native species. In addition these patrols have only short-term effect, and prions can enter a burrow and kill or injure a chick during the hour or so between nest checks.

We have developed a simple, cheap neoprene flap that dissuades broad-billed prions from entering burrows but still allows Chatham petrels to enter their burrow (Sullivan 2000). The principle is simple. The hole in the flap is slightly smaller than the bird but the neoprene will stretch to allow either species to push their way through. It presents a barrier to both species. The Chatham petrels that have undergone courtship and incubation in that burrow and presumably can smell their chick inside thus have a high incentive to squeeze through the flap. Any broad-billed prion that had an attachment to that burrow has already been killed, so prions that investigate the Chatham petrel burrow should be deterred by the burrow flap and move on to an unprotected burrow, the vast majority of which are used by other prions.

Previous trials have shown that Chatham petrels will enter burrows to feed their chicks while the burrow flap is in place and that flaps placed on burrows previously visited by prions reduced the rate at which prions entered those burrows (Sullivan 2000). These trials had limitations. As the Chatham petrel is critically endangered, flaps could only be placed on burrow entrances while observers were present. If a returning Chatham petrel had not entered the burrow within about six minutes the flap was removed by pulling on an attached string. These trials were time-consuming and could not establish if the petrels could successfully raise their chicks if the flaps were left in place.

This report describes a trial conducted on a more common analogue species, Pycroft's petrel (*Pterodroma pycrofti*) on Red Mercury Island. The flaps designed for use on Chatham petrel burrows were put in place shortly after the Pycroft's petrel chicks had hatched and they were left in place until the chicks had begun fledging. The report was designed to answer the following questions:

- Does installation of the burrow flap designed to deter prions from entering Chatham petrel burrows adversely affect breeding success in Pycroft's petrel burrows protected by a burrow flap?
- Does the installation of the burrow flap affect feeding frequencies or fledgling weights of Pycroft's petrel chicks protected by a burrow flap?

2. Methods and study site

This trial was conducted at the Pycroft's petrel colony at von Luckners Cove, Red Mercury Island. There are probably several hundred Pycroft's petrel burrows in this colony alone, rather more than the total of fewer than the 300 pairs that Marchant & Higgins (1990) suggested bred on Red Mercury Island. I visited the island on two occasions: 18 - 27 January 2000 shortly after eggs had hatched and 13 - 23 March 2000 at the start of the fledgling period. During the January trip, burrow flaps were placed on 29 burrows, 27 of which contained a chick. An adult was incubating an infertile egg on the day flaps were installed on both remaining burrows. Twenty-four burrows were selected as controls. Experimental burrows all had entrances of a size and shape that allowed the flaps to be inserted and later removed with minimal alteration to the burrow entrance. Control burrows had a wider range of entrance characteristics. In all other respects selection of control and experimental burrows was random.

During both January and March chicks present in both control and flap burrows were weighed between 0930 and 1300 each day to determine if chicks had been fed. Toothpick fences were placed across all study burrow entrances. Displacement of the toothpicks indicated that a bird had entered or exited the burrow. Toothpick fences were replaced each time they had been broken down. As burrows containing chicks continued to be found over the entire duration of the January trip, chicks in some study burrows were first weighed on 19 January, while the last few study burrows were found the day before we left the island.

Chick survival was determined for both experimental and control burrows on 14 or 15 March. Two study burrows ceased to be part of this study on 14 March as they were required for other studies. Eight chicks fledged before 23 March, and were last weighed during the day prior to the night they fledged. All chicks from study burrows were banded before they first left their natal burrow.

During both the January and March trips I observed the behaviour of adult Pycroft's petrels as they returned to their burrows in the evening, and during the March trip I also observed the behaviour of chicks when they first left their natal burrow. Locations were chosen so that two or three burrows could be observed simultaneously. Observations were made using an Apple nightspy night vision scope while 3-7 m from the burrow entrances. Observations began shortly after dark and continued for two to three hours. As adults return to their burrows only once every few days and as they may return any time during the night, only a few adults were observed entering their burrows.

3. Results

3.1 CHICK SURVIVAL AND WEIGHT GAIN FROM JANUARY TO MARCH

All chicks in the 24 control burrows and all but one of the chicks present in the 26 experimental burrows were still alive when the burrows were inspected on 14 or 15 March. The mean weight of chicks when first weighed on our return to the island in March was 226.6 g for experimental chicks and 227.2 g for control chicks (Appendix 1).

3.2 FLEDGING DATES AND FLEDGING WEIGHTS

Five chicks from the 26 experimental burrows and three chicks from the 24 control burrows fledged before 22 March. The chick in one experimental burrow was not present when we returned to the island in March. It was the second lightest of all study chicks on 26 January 2000 so it would not have fledged before our return. The remains of this chick could not be found in the burrow.

Of those chicks that fledged before 22 March the mean weight of experimental chicks was higher than chicks from control burrows (Appendix 2) although the difference was not significant (two-tailed comparison of means $p=0.48$). However, the sample sizes were small and it does appear likely that chicks in flap burrows may have fledged earlier and at higher body weights than chicks in control burrows. Adult weight in Pycroft's petrel is 150-160 g (Dunnet 1985, Marchant & Higgins 1990) and chicks would not be expected to fledge until their fat reserves were utilised and their body weights had declined to about adult weight. The chick in experimental burrow VL34 weighed 197 g when last seen in its burrow (Appendix 2) and this exceeds the expected fledgling weight. On the other hand the chick in control burrow VL124 weighed 177 g when last present in its burrow, also greater than the expected fledgling weight. Several chicks still present in their natal burrows on 22 March had longer wing lengths than these two heavy chicks, further suggesting that both fledged early.

The chick from burrow VL79 was captured and its band read about 75 m from its natal burrow at 2130 on 21 March two nights after it left its natal burrow for the last time. On 21 March it weighed 132 g. Using a night vision telescope we watched it climb to the top of a tree and at 2215 fly in a north-westerly direction over the island. The chick from burrow VL140 was also seen on the ground away from its burrow the night after it fledged. The chick from burrow 25a was found dead in a stream about 100 m from its burrow several days after it fledged.

3.3 FREQUENCY OF VISITS BY ADULTS

The frequency with which adults visited experimental and control burrows during the January trip did not differ (Appendix 3). It was not possible to obtain data on adult visitation rates during the pre-fledgling period. On two occasions during March adults are known to have visited their chick, yet next morning the chick's weight was within a few grams of its weight the previous day. This suggests that adults may visit but not feed their chick or that the chicks may take only a very small meal. Very small weight changes from one day to the next were common during the pre-fledgling period. During this period the toothpick fence did not provide reliable data on adult visitation rates. Prior to fledging, chicks may leave their burrow for short periods, so either adults or chicks could have broken down the toothpick fence. Furthermore on several occasions these small, agile petrels are known to have entered or left a burrow without disturbing the toothpick fence.

3.4 POSSIBLE DETERENCE OF ADULTS BY FLAP

Appendix 4 shows the number of days that elapsed after a burrow flap was installed until the chick was next fed and the number of days after a control chick was first weighed until it was next fed. As the purpose of this analysis was to determine if adults were deterred from entering their burrow the first time they encountered a burrow flap, only the January data are relevant. One control chick and one experimental chick were not fed during the seven-day period data were collected. These chicks were both still alive in March. Excluding those two chicks, the mean time from flap installation to the next feed was 2.4 days, and for control chicks the mean time from first weighing to the next feed was 2.6 days (Appendix 4). As the mean for control chicks is greater than that for experimental chicks, the hypothesis that adults were deterred from entering their burrow when they first encountered a flap does not hold.

3.5 TIME RETURNING ADULTS TAKE TO ENTER BURROWS

The following observations were made of adult Pycroft's petrels returning to their burrows.

Experimental burrows

21 January, burrow VL128a, time elapsed from landing to entering burrow, 36 minutes 40 seconds, over half of this time was spent sitting still at the landing point. This was the first time the bird had encountered the burrow flap, and it entered the burrow on the seventh approach to the burrow entrance and after digging around the entrance had failed to dislodge the flap. This bird took 3 minutes 55 seconds from the time its head was visible on the inside of the flap to fully exit the burrow.

14 March, burrow VL128b, time elapsed from landing to entering burrow, about 1 minute.

17 March, burrow VL80, time elapsed from landing to entering burrow, 8 minutes 37 seconds.

18 March, burrow VL80, time elapsed from landing to entering burrow, about 12 minutes.

19 March, burrow 2000/10, time elapsed from landing to entering burrow, 5 minutes.

Control burrows

24 January, Un-numbered burrow near VL128, time elapsed from first sighting the bird walking toward its burrow to entering burrow, 2 minutes 4 seconds.

14 March, Un-numbered burrow near VL128, time elapsed from landing to entering burrow, 15 minutes 40 seconds.

15 March, burrow 2000/23, time elapsed from landing to entering burrow, about 2 minutes 30 seconds.

17 March, burrow 79, time elapsed from landing to entering burrow, 1 minute 40 seconds.

Comparison

The time adult Pycroft's petrels took from landing to entering their burrow was variable for both experimental and control burrows. The data are sparse and some of poor quality. Despite these reservations I suspect that birds do take longer to enter their burrow when a flap is in place. Most petrels observed at experimental burrows were reluctant to push through the flap, and put their bill or head into the entrance several times before entering the burrow. When they did finally enter the burrow they pushed through the flap in only a few seconds. The only Pycroft's petrel that approached an experimental burrow and failed to enter was a bird that investigated both burrow VL128a plus other holes and hollows within 2 m of this burrow then began digging a new burrow about 0.5 m from burrow 128a. An adult entered burrow VL128a while the first bird was digging nearby but neither bird reacted to the other. The bird that did not enter was probably a non-breeder. Both times a bird was observed entering burrow VL80 in March the bird sat outside the burrow entrance for a while, then moved away from the entrance, only to return, delay further, then enter. This suggests that even after the flap has been encountered previously some birds are still reluctant to enter. When I returned to Red Mercury Island in March the birds had dug an alternative entrance to burrow VL80 entering alongside the flap. I had blocked the alternative entrance, forcing the birds to enter through the flap. This was possibly the first time they had returned since I had blocked the alternative entrance.

4. Discussion

Pycroft's petrels were able to raise chicks with the burrow flap in place that was designed to protect Chatham petrels from interference from broad-billed prions. The adult birds probably took longer to enter burrows when they first encountered a burrow flap and some birds may have still taken longer than control birds to enter burrows six weeks after the flap was put in place. However, the data to support this assumption are limited and the extra few minutes taken are hardly of consequence given that foraging trips are of at least several days' duration. Chatham petrels took longer to enter burrows when they first encountered a flap but it was not possible to determine if their hesitation lessened over time (Sullivan 2000). The survival rate of Pycroft's petrel chicks was high, with all but one study chick alive in January surviving to March. The chick that died was in a burrow which had a flap installed, but it is impossible to determine if the flap contributed to its loss. It was the second lightest of the study chicks when last weighed in January.

It is possible that some chicks in experimental burrows may have fledged earlier and at a higher body weight than chicks in control burrows. As only eight chicks fledged before I left the island (5 in experimental burrows and 3 in control burrows) the sample size is too small to obtain significant results. One chick from a flap burrow weighed 197 g when it was last seen in its burrow, and the morning it disappeared was the first time the toothpick fence had been dislodged during the March trip. This suggests that the chick had not previously left its burrow and was unwilling to return through the flap. Two other chicks from flap burrows and three from control burrows were seen outside their burrows one evening but were present in their natal burrow next morning. Thus at least some chicks will leave their burrow, explore their surroundings and return to their burrow while the flap is in place. The toothpick fences of some other experimental burrows were dislodged so frequently during the March trip that it is almost certain that other chicks also came and went from their burrow while the flap was in place.

5. Implications for Chatham petrel management

I recommend that these flaps be placed on at least half of the known Chatham petrel burrows during the 2001 season. The flaps are unlikely to provide total protection from broad-billed prion interference but they can be expected to reduce the incidence of entry by prions. They should allow less intensive patrols of the Chatham petrel burrows to take place, but I would recommend that during the 2001 season burrows be visited at times when prior interference is most likely.

It may be wise to remove the flaps once the Chatham petrel chicks begin leaving the burrows to explore their surroundings, although some, and prob-

ably most, Pycroft's petrel chicks were willing to come and go while the flap was in place.

I recommend that careful records be kept each time a prion is found in a Chatham petrel burrow and whether or not the burrow was protected by a flap. I also recommend that a sample of chicks in burrows with and without flaps be weighed each day to determine if chicks in flap burrows fledge earlier than chicks in burrows with no flap in place.

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Appendix 1. Mean weight of experimental and control Pycroft's petrel chicks on 26 January and on 14 or 15 March 2000.

	Mean weight 26 January	Weight range 26 January	Mean weight 14–15 March	Weight range 14-15 March
Experimental chicks	117.7 g, N = 23	62–198 g	226.6 g, N = 25	160–270 g
Control chicks	116.5 g, N = 21	36–186 g	227.2 g, N = 21	158–278g

Appendix 2. Fledging dates and fledgling weights for those Pycroft's petrel chicks that fledged before 22 March 2000.

	Date last present in burrow	Weight when last present, g	Wing length on 18 March, mm	Burrow number
Experimental chicks	14 March	160	-	25a
	16 March	162	-	VL19
	19 March	158	201	VL140
	20 March	197	210	VL34
	21 March	166	204	VL104
Mean		168.6 (SD 16.15)		
Control chicks	19 March	141	201	VL79
	19 March	160	202	2000/21
	20 March	177	209	VL124
Mean		159.3 (SD 18.01)		

Appendix 3. Frequency with which adult Pycroft's petrels visited chicks in burrows with and without flaps installed, January 2000.

	Flap burrows	Control burrows
No. burrow nights	118	120
No. adult visits	32	36
No. probable adult visits	3	1

Appendix 4. Number of days that elapsed after a burrow flap was installed until the chick was next fed and number of days after a control chick was first weighed until it was next fed.

No. of days	Burrows with flaps	Control burrows
1	5	5
2	7	6
3	5	2
4	1	1
5	2	2
6	0	0
7	0	1
Not fed	1	1
Mean	2.4	2.6
Total	21	18