CHATHAM ISLAND TAIKO *Pterodroma magentae* MANAGEMENT AND RESEARCH, 1987-1993: PREDATOR CONTROL, PRODUCTIVITY, AND BREEDING BIOLOGY

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ABSTRACT

Since the first burrows of Chatham Island Taiko *Pterodroma magentae* were found in 1987/88, trapping around the burrows has killed 204 feral cats *Felis catus*, 3053 Possums *Trichosurus vulpecula*, 1572 Weka *Gallirallus australis* and 589 rats *Rattus* spp. in 109,892 trap-nights to March 1993. No Taiko are known to have been killed by predators. Productivity was static at one fledgling per year until 1992/93, when two fledglings were reared. Unobtrusive studies of breeding biology indicated that mating occurred about 1 October, laying about 26 November, hatching about 20 January and fledglings departed about 4 May. The pre-laying exodus of females lasted up to 50+ days and chick-rearing took about 105 days.

INTRODUCTION

Chatham Island Taiko (Magenta Petrel) *Pterodroma magentae* are very rare: their population is numbered in tens rather than hundreds. During a radio telemetry operation in 1987, followed by ground searches, only three breeding burrows were found (Imber *et al.* 1994), although it was unlikely that there were many more to be found. There was, however, ample evidence of predators close to the burrows. Feral cats *Felis catus* were particularly common and the plentiful Possums *Trichosurus vulpecula* were known to be potential competitors for burrows.

Trapping of noxious animals in the general area thought to contain burrows began before all burrows had been located, but it became a matter of urgency around the burrows themselves after their discovery, as the most effective way to ensure the species' survival. Since then, staff of the Chatham Islands Field Centre, Canterbury Conservancy, Department of Conservation (DoC) have therefore concentrated on extensive predator control. The burrows have been monitored in conjunction with the predator control. Additional studies at the burrows, and searches for more burrows, were made by other DoC staff and volunteers. This paper summarises the results of the first six years' work.

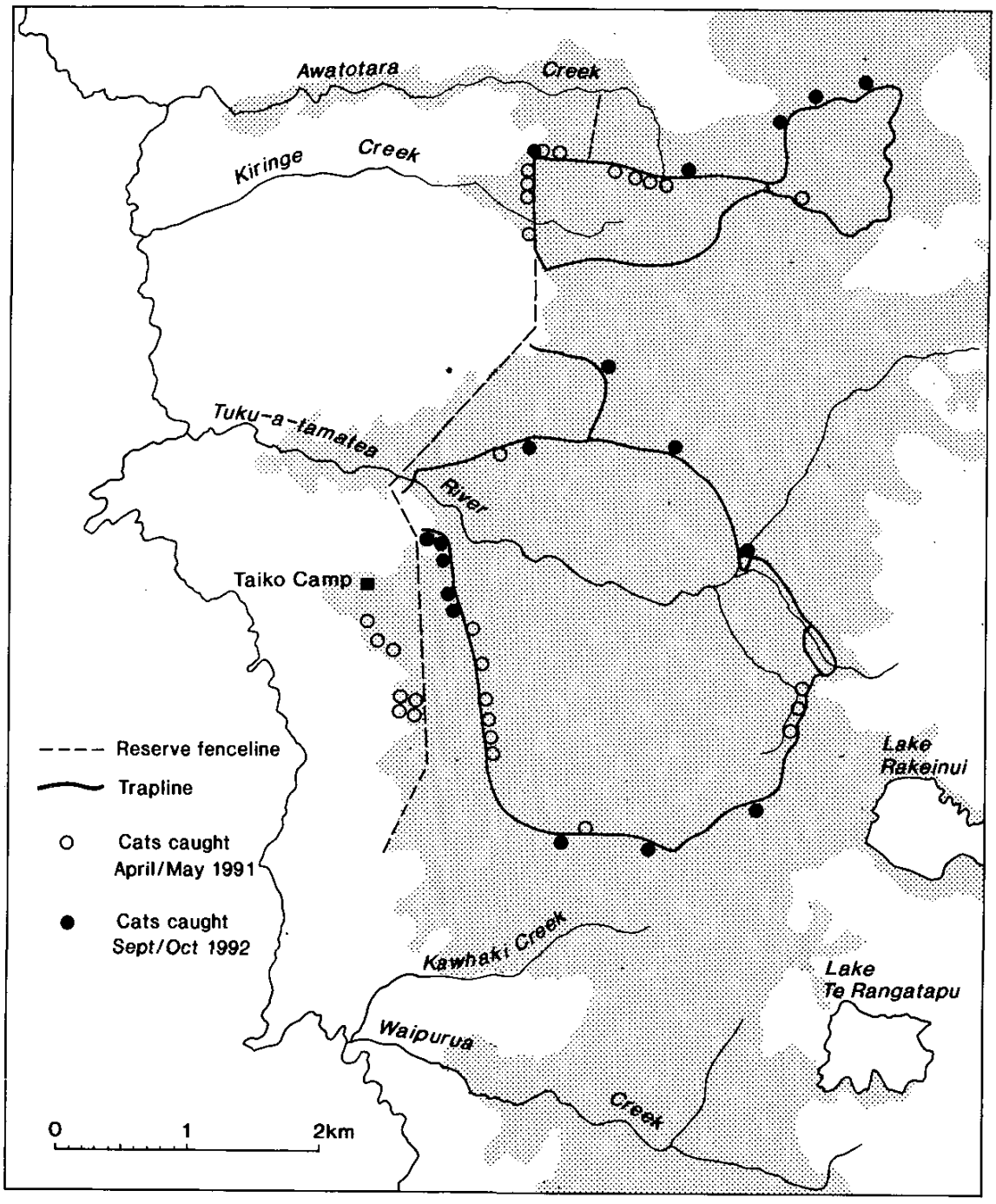

FIGURE 1 – South-west Chatham Island, showing places mentioned in text, predator traplines, and trapline positions where feral cats were caught in April-May 1991 and September-October 1992.

METHODS

The DoC Animal Ethics Committee approved the use of leg-hold traps specifically for the management operation on Chatham Island. Trapping, primarily for feral cats and using 10-30 leg-hold traps began in November 1987. Trapping continued on this small scale in the 1988/89 breeding season. In 1989/90 existing tracks, made to assist previous searches for burrows, were used for extensive trapping.

In September 1990, a 12 km circuit track (the Southern Loop) was cut from the coastward boundary of the Tuku Nature Reserve (Figure 1) to allow a more extensive area to be trapped. Another track, 9 km long, was developed around the northern burrows (the Northern Loop), partly within the Reserve and partly on land owned by the Daymond family of Waitangi. Leg-hold traps were spaced at irregular intervals of 50-100 m along these tracks. In 1991/92, 390 traps were in use. The trapping circuits passed within 50 m of all known burrows but also far southwards in the Tuku River catchment so as to protect possible, but undiscovered, burrows there.

Traplines were checked, cleared, and re-set daily by two people, one to each circuit, during two 4- to 9-week sessions (September-November and January-May) each breeding season. Baits were changed as demanded by their state of decay. An advantage of the manufactured baits was that they lasted for weeks if kept reasonably dry. Numbers of traps in operation and kills made were recorded daily.

Various baits were used. In 1987/88 food scraps were used until Possums and Weka *Gallirallus australis* were caught; then parts of their corpses were used for bait. Weka was more attractive to feral cats. The same baits, as well as a paste consisting largely of sardines, were used in 1988/89. In 1989/90 and 1990/91, to cater for the large numbers of traps in use, and the need to replace baits frequently, fish skeletons, normally used as bait for crayfish *Jasus edwardsii*, were used.

In 1991/92 and 1992/93, a manufactured pig bait (fishmeal/cereal, polymer-bound, in cylindrical biscuit form, Du Pont, USA), under trial by NZ Forest Research Institute Ltd as a bait for cats, was used. The biscuit was suspended above each trap in a wire-mesh cage to prevent theft by rats; a plastic cover reduced rain damage. It appears to have been successful.

Because Taiko breeding failed repeatedly in Taiko Stream Valley (see Table 2: burrows Tuku 1 and 10) possibly as a result of rat predation, brodifacoum poison baits were laid immediately next to the burrows from the 1990/91 breeding season. A grid of permanent poison bait stations was set up during 1991/92 and this was replaced by a more extensive grid with improved bait holders in 1992/93. Possums and Weka were also poisoned by the baits.

Each burrow was examined to see if it was feasible to make an opening for occasional access to the nest chamber. All except one were too deep or too protected by tree roots. On 29/9/90, muted calls of a Taiko led to the nest chamber of Tuku 10 burrow being found: it was opened and then sealed for subsequent inspection (Taylor 1991). Although the nest was about 2.8 m from the entrance, it was only 0.3 m under the surface. Even with ready

access to this nest, the inspection lid was opened as infrequently as possible. Twigs or leaves placed over the burrow entrance sufficed for most observations of bird movements.

Taiko burrows were checked at about monthly intervals, or more frequently near the estimated time of laying and fledging. Before 1990, screening of burrow entrances with leaves or twigs began in October. In 1990, Taylor (1991) found that activity at burrows began in late September. More intensive observations of burrows were made from 25 October to 13 November 1988, 17 September to 3 October 1990 and on 14 January and 8 February 1991 (Taylor 1991); 14 January to 5 February 1992; and 26 October to 12 November 1992 (Taylor & Imber unpublished data).

All burrows were examined annually between 18 April and 5 May. They were screened, if necessary, to find whether a fledgling had been reared. All fledglings caught were banded. During the survey in early 1992, a ground search by seven people failed to find any further breeding burrows. They did find a possible new burrow near Tuku 1 burrow, a disused burrow in Taiko Valley, and another (much older) burrow in an adjacent valley.

Taiko were enticed out of their burrows several times at night by "war-whooping" vocalisations (Tennyson & Taylor 1990). A Taiko on the ground also responded to these calls.

TABLE 1 – Number, and number/100 trap nights (N/100), of predators trapped and killed around burrows of Chatham Island Taiko and in adjacent Tuku Nature Reserve, August-May 1987/88-1992/93.

	YEAR						
	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	TOTAL
Trapping periods	17 Nov-14 Dec	5 Nov-11 Dec; 22 Apr-5 May	30 Aug-30 Oct; 27 Feb-27 Apr	14 Sep-3 Nov; 4 Apr-8 May	5 Sep-8 Nov; 2 Apr-6 May	8 Sep-28 Oct; 29 Jan-24 Feb	
Trap nights	451	947	28,610	31,772	21,906	26,206	109,892
Cats	10	11	56	56	46	25	204
% of all kills	19.6	7.6	4.1	3.2	3.3	3.3	
N/100	2.22	1.16	0.20	0.18	0.21	0.10	
Possums	18	93	890	730	882	440	3053
N/100	3.99	9.82	3.11	2.30	4.03	1.68	
Wekas	20	24	309	716	285	218	1572
N/100	4.43	2.53	1.08	2.25	1.30	0.83	
Rats	3	10	90	223	173	90	589
N/100	0.66	1.06	0.31	0.70	0.79	0.34	
Other animals	0	6[1]	26[2]	23[3]	14[4]	12[5]	81
N/100	0	0.63	0.09	0.07	0.06	0.05	

[1] 5 Blackbirds *Turdus merula*, 1 Song Thrush *Turdus philomelos*; [2] 5 Blackbirds, 1 Song Thrush, 7 Harriers *Circus approximans*, 1 Hedgehog *Erinaceus europaeus*, 6 feral piglets *Sus scrofa*, 6 not recorded; [3] 3 Song Thrushes, 1 Dunnock *Prunella modularis*, 6 Harriers, 6 Hedgehogs, 5 pigs/piglets, 2 lambs *Ovis aries*; [4] 3 Blackbirds, 3 Harriers, 3 Hedgehogs, 5 lambs; [5] 10 Blackbirds, 1 pig, 1 lamb.

RESULTS

Predator trapping

The results of trapping over the first six years are shown in Table 1. Trapping was first directed against feral cats because there was extensive evidence of them in Taiko Stream Valley when the first burrow was found there in 1987 (Imber *et al.* 1994). During the first widespread trapping in 1989/90, traps were often set in areas less favoured by cats, so fewer cats were caught per 100 trap-nights (Table 1). When extensive trapping began, more cats were caught along the tracks near the coastal boundary of the Reserve than inland (Figure 1), suggesting that cats were more common in the scrublands adjacent to farmland. Although the number of feral cats killed per 100 trap-nights, and as a proportion of all kills, declined, the total number killed annually increased with the greater effort in 1989/90 and remained relatively constant until 1992/93.

At first, all rats caught were identified as Ship (Bush or Black) Rats *Rattus rattus*. However, after a dead Kiore (Pacific or Polynesian Rat) *R. exulans* was positively identified on the Southern Loop track in 1992, it was concluded that a proportion of the rats killed previously had been Kiore. Until 1992, Kiore had been thought to be extinct on Chatham Islands.

Weka are endemic to the New Zealand mainland, and were introduced to the Chatham Islands from the South Island in 1905 (Turbott 1990). As it was an introduced bird and a potential threat to Taiko, particularly if it could enter a burrow, we considered it necessary to kill them.

Hedgehogs *Erinaceus europaeus* eat eggs (King 1990), but they were trapped along the seaward boundary of the Reserve and not in the bush. Their spread along the coast to the study area from Waitangi (introduced early 20th Century) was relatively recent.

Productivity

Although (to May 1993), 12 burrows were known to have been visited by Taiko since November 1987, an egg had been laid in only four of these over that period. The inferred or known breeding results in these burrows are shown in Table 2. Only breeding attempts in North 1 and Tuku 4 burrows were successful.

In 1993, of the other eight burrows visited, two were no longer in use, five were at an early stage of being dug (all first active in 1992), and one was in the final stages of being dug (or re-dug, probably after a period of disuse). Breeding may have been imminent in that burrow.

No adult Taiko was found dead from predation around the burrows from 1987 to 1993. Cessation of activity at two burrows may have resulted from adult mortality at sea, birds shifting to another burrow, or interference (possibly by a dog or possum, from evidence of digging by downward scratching) at one burrow.

Breeding biology

Mating and the pre-laying exodus The earliest sighting of a Taiko visiting the breeding grounds – passing over the light used to catch Taiko by the

TABLE 2 – Breeding attempts in four Taiko breeding burrows over 6 years, 1987-93

	YEAR					
Burrow	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
Tuku 1	Breeding uncertain	Digging in progress	Breeding unlikely	Breeding unlikely	Young chick died	Breeding uncertain
Tuku 4	Not in use?	Not in use?	Not in use?	Re-opened, digging	Digging in progress	Fledgling banded
Tuku 10	Egg did not hatch	Failure, cause unknown	Failure, cause unknown	Young chick died	Young chick died	Failed near hatching
North 1	Fledgling not banded	Fledgling banded	Fledgling not banded	Fledgling banded	Fledgling banded	Fledgling not banded

Tuku Valley – in any year was on 15 September 1980 (R. Cotter, pers. comm.). In the 1990/91 breeding season, Taylor (1991) made the first observations of Taiko at their burrows at the time of mating. At first inspection on 18 September, GAT considered that the burrows had not been visited that breeding season. Taiko first visited one of the three main burrows on 24 September; all three had been visited by 30 September.

At North 1 burrow, a pair spent at least 2 and 3 October continuously in the burrow, during which time copulation probably occurred. The pair occupying Tuku 10 was probably in the burrow on 29 September, though only one was caught, because GAT heard muted calling of Taiko in response to the physical disturbance of people passing. Grey-faced Petrels *Pterodroma macroptera gouldi* call in this way only when there is a pair in the burrow (MJI, pers. obs.). Screens at all three breeding burrows were disturbed often between 1 and 15 October. Pairs seem to mate around 1 October, but occasionally as late as 15 October.

Taiko visited the breeding burrows in the month after mating. These birds were probably males (cf. Imber 1976), but may also have been other Taiko prospecting for burrows. Tuku 10 burrow was not visited from 16 October to 18 November, but the burrow had been reoccupied and laid in by 28 November (Taylor 1991). However, in 1992 both Tuku 1 and Tuku 4 were visited by the breeding males between 30 October and 3 November.

Females of the closely related Grey-faced Petrel departed on their pre-laying exodus immediately after mating, and males usually visited again after mating, before leaving on their pre-laying exodus (Imber 1976). It therefore seems that the pre-laying exodus of female Taiko lasted about 40-55 days, and that of male Taiko between 25 and 45 days.

Laying Laying dates were determined, approximately, by the date of first disturbance of the burrow mouth screen after the pre-laying exodus. However, in Grey-faced Petrels, the male, rather than the laying female, sometimes returns first (Imber 1976). In 1988, screens were displaced at the three main burrows on 24, 26, and 27 November. The egg in Tuku 10 burrow was just starred (first stage of pipping) on 14 January 1991 (Taylor

1991). Allowing 5 days to hatching (cf. Imber 1976), and possibly 54 days for incubation, the egg was probably laid about 25 November.

Hatching The only information on hatching was for the egg in Tuku 10 burrow. It was starred on 14 January 1991 and hatched about 18-19 January. The egg measured 64.8 x 47.0 mm and weighed 66 g on 14 January. On 2 February 1992, Tuku 10 contained a chick about 10 days old.

Chick development The chick in Tuku 10 was examined on 8 February 1991, at about 20 days old. It weighed 240 g; bill length was 23.5 mm (Taylor 1991). The down was brownish-grey above and light grey on the underside. The bill was black; the tarsus and foot flesh-coloured but greyish-black on the distal part of toes and webs, and on all of the outer toe.

Fledging and departure of young Fledging dates at North 1 burrow were: probably about 5-10/5/88; 5-10/5/89; after 1/5/90; 4/5/91; 28/4-2/5/92; 25-27/4/93. At Tuku 4 it was after 5/5/93. From hatching in mid to late January, to fledging about 4 May, would give a fledging period of about 105 days, similar to that of White-headed Petrels *Pterodroma lessonii* (Warham 1967). Fledgling Taiko were as strictly nocturnal in their activity above ground as were the adults, and spent about 7 to 15 nights sometimes outside the burrow before leaving. They were usually very cautious when emerging, and often waited just inside the burrow for hours.

DISCUSSION

Of the predators present near the Taiko burrows, cats are potentially the most dangerous to petrels. Given the continuing relatively high numbers of cats trapped, even without supporting evidence, cats appear to have been moving into the trapped area from surrounding country. Therefore, the continued security of Taiko probably requires that trapping continues at or near current levels.

We did not analyse the effectiveness of the different baits. The change to an artificial lure in 1991/92 had little effect on capture rates of cats that year, but capture rates dropped the following year. This may have resulted from a decline in the animal's populations over a wider area in response to the trapping and poisoning operations. Methods of predator control were, and are, re-assessed annually. In future, management is likely to change from trapping to the use of appropriate poisoned baits at permanent sites.

The current annual productivity of one or two juveniles could support only a minute population of Taiko. At present the population may be declining, or there may be burrows elsewhere. The latter possibility should be explored by further radio telemetry. Six of seven fledglings known to have been raised since 1987 probably are from the same parents which raises concerns about maintaining genetic diversity. There were, however, encouraging signs of increasing activity at the known sites. Whereas in 1987/88 only six burrows were used and an egg was laid in only two or three of them, during the 1992/93 breeding season 9-10 burrows were used and four of them may have been laid in. It is possible that some of the non-

breeding Taiko, identified during the radio telemetry operation (Imber *et al.* 1994), have been attracted into the existing, probably safer, breeding sites by those Taiko already active there.

The sparse data obtained so far suggest that the breeding season and cycle of the Taiko are most similar to those of the White-headed Petrel (Warham 1967). The pre-laying exodus up to 55 days made by female Taiko shows that a long exodus is not restricted to winter-breeding *Pterodroma* such as Grey-faced Petrels (Imber 1976); it may be a feature of all members of subgenus *Pterodroma*, regardless of their breeding season. A protracted period at sea may allow breeders to feed without interruption far from the breeding place, in preparation for the high energy demands of laying and incubation.

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