

BIRDS AND TUATARA ON NORTH BROTHER ISLAND, COOK STRAIT, NEW ZEALAND

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ABSTRACT

During a visit to North Brother Island in Cook Strait from 17 October to 6 November 1990, we estimated by quadrat sampling that the 4 ha island supported 1000 pairs of Fairy Prions, 600 pairs of Common Diving Petrels, and 225 adult tuatara. Most Diving Petrels nested below *Coprosma* scrub, and a few eggs were laid on the surface under dense shrubs. Many prion burrows were in more open vegetation. Burrows of both species were simple and were not shared with tuatara. Some evidence of tuatara preying on unattended eggs was found, but there was no evidence that the endemic *Sphenodon guntheri*, which is smaller than *S. punctatus*, fed on adults of either species. Many Diving Petrels, prions, Fluttering Shearwaters and Red-billed Gulls fed in tide rips close to the island. The position of each species in feeding assemblages was related to their dive depths. Diving Petrels in areas of strong currents submerged for only a few seconds at a time, but in areas of calm water dive durations averaged 29 seconds.

KEYWORDS: tuatara, Common Diving Petrel, Fairy Prion, breeding, coexistence

INTRODUCTION

North Brother Island is situated at the eastern entrance to Cook Strait, in central New Zealand (Figure 1). It is a nature reserve managed by the New Zealand Department of Conservation, about 4 ha, roughly conical in shape, and rising to 75 m above sea level. A fully automated lighthouse and a radio beacon are situated close to the highest point, and several buildings on the north side of the island, which previously provided accommodation for the light keepers, house the generators and other equipment associated with the light.

We visited the island from 17 October to 6 November 1990 to study the breeding seabirds, particularly Diving Petrels (*Pelecanoides urinatrix*). We carried out a census of the burrow-nesting petrels (*Pelecanoides* and *Pachyptila*), examined their nesting habitat preferences, and collected information on the timing of breeding and the length of incubation shifts for comparison with colonies elsewhere. We kept notes on interactions between seabirds and tuatara (*Sphenodon guntheri*), and on the feeding behaviour of seabirds around the island and adjacent islets and shoals. Tidal currents off The Brothers are very strong, reaching speeds in excess of 10 km h⁻¹ and producing eddies, whirlpools and standing waves. Seabird foraging adjacent to the islands was highly influenced by these currents. Seabirds passing in Cook Strait were observed daily for several hours.

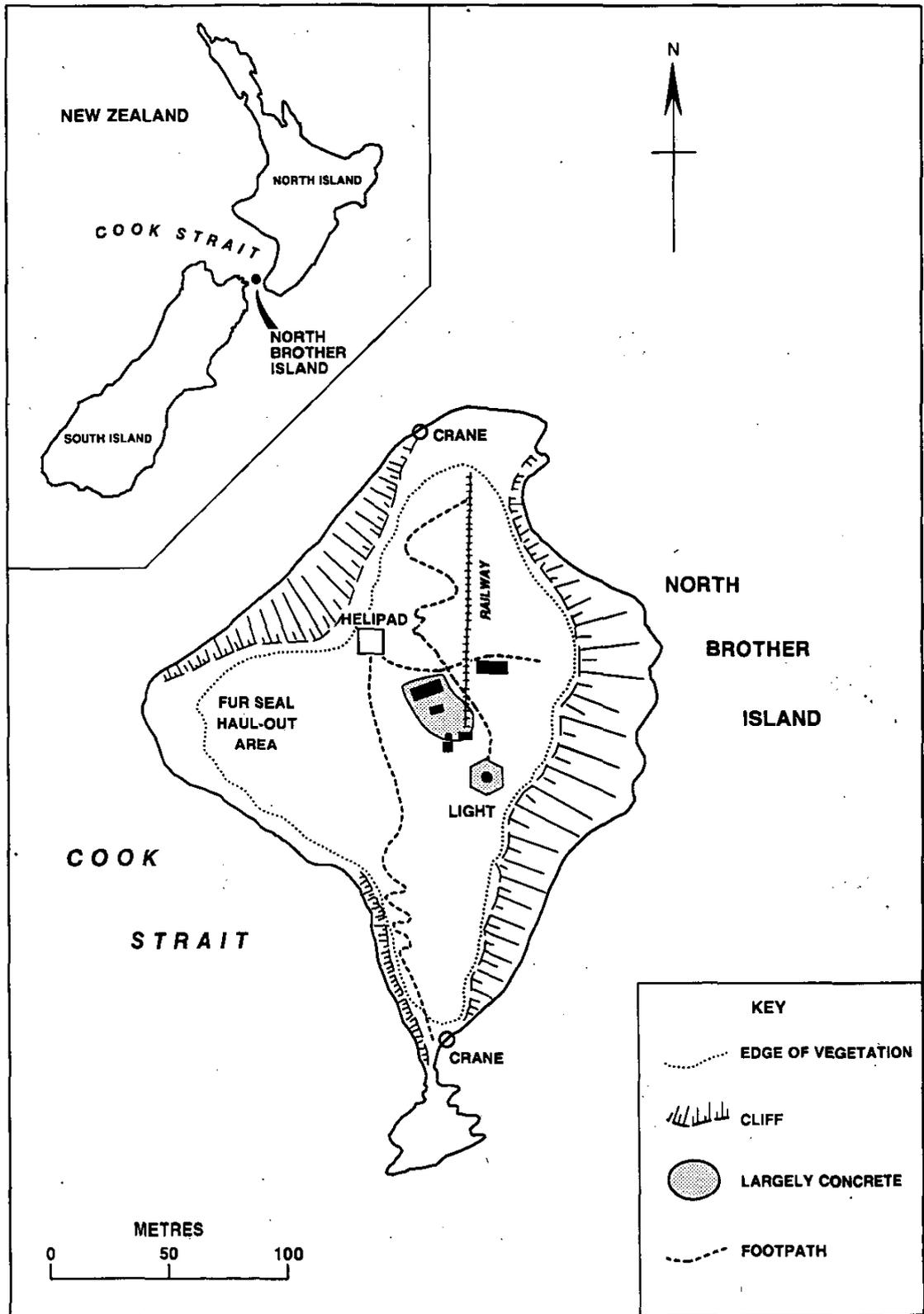


FIGURE 1 – The map of North Brother Island.

The tuatara on North Brother Island are the only known population of the species *S. guntheri* (Daugherty *et al.* 1990). At present all populations of tuatara coexist, often in the same burrows, with procellariiform seabirds (Crook 1975). Most previous information on interactions between seabirds and tuatara has been anecdotal (e.g. Reischek 1881, 1885; Buller 1877, 1879; Wright 1960, 1963, Bartle 1968), the principal exceptions being the work of Walls (1978, 1981) and Newman (1987) on *Sphenodon punctatus* on Stephens Island. Although our information on tuatara was largely anecdotal, we can combine it with systematic data on the abundance and distribution of seabirds and tuatara on North Brother Island to provide comparison with the work of Walls and Newman.

Before the light was automated, some of the keepers took an interest in the birds around the island, resulting in several published notes (Sutherland 1951, 1952; Wright 1961). The flora of the island was described by Gillham (1960), who visited the island from 15-22 May 1957. Thoresen (1969) visited the island for two weeks in June 1967 to study the behaviour of Diving Petrels in the pre-laying period. Department of Conservation staff occasionally visit the island briefly (W. Cash, pers. comm.), and there have been several recent visits by people studying tuatara (Daugherty *et al.* 1990). The present visit was the longest by biologists, and we were able to make a systematic survey of the island's seabirds and to make intensive observations of seabirds passing offshore.

METHODS

We reached the island on the evening of 17 October 1990 and left on the morning of 6 November 1990. We stayed in the unfurnished lightkeepers' house and many of our observations of seabirds offshore were made from the window of the living room, which provides an excellent view eastwards, over the strait.

Forty-five Diving Petrel nests were examined regularly in the mornings, usually every two days, as part of our study of breeding biology. However, some burrows proved unsuitable for repeated observations, some eggs were lost and some chicks died. Consequently, sample sizes varied for different breeding biology results. Sixteen burrows of Fairy Prions *Pachyptila turtur*, were examined daily, in the mornings, from 25 October, to obtain information on incubation shifts. All adult Diving Petrels and prions found incubating were banded and weighed. In addition, prions were weighed on the first day of their incubation shift and on the third and subsequent days, to provide weights at the start and end of incubation shifts. Eggs were weighed and measured. Prions and Diving Petrels were captured with a mist net set close to the house. Samples of 30 of each were examined in detail; various features of plumage, brood patch and soft-parts were recorded, and wing, tarsus, mid-toe, bill length, depth and width, and weight were measured. All measurements are given \pm 1 standard deviation.

The census of seabird burrows was carried out on 23 and 24 October. We used 5 m x 5 m quadrats (= 25m²), placed at 20 m intervals along parallel transects running 25 m apart. We used the railway track, running from the north landing to the buildings near the summit of the island, as

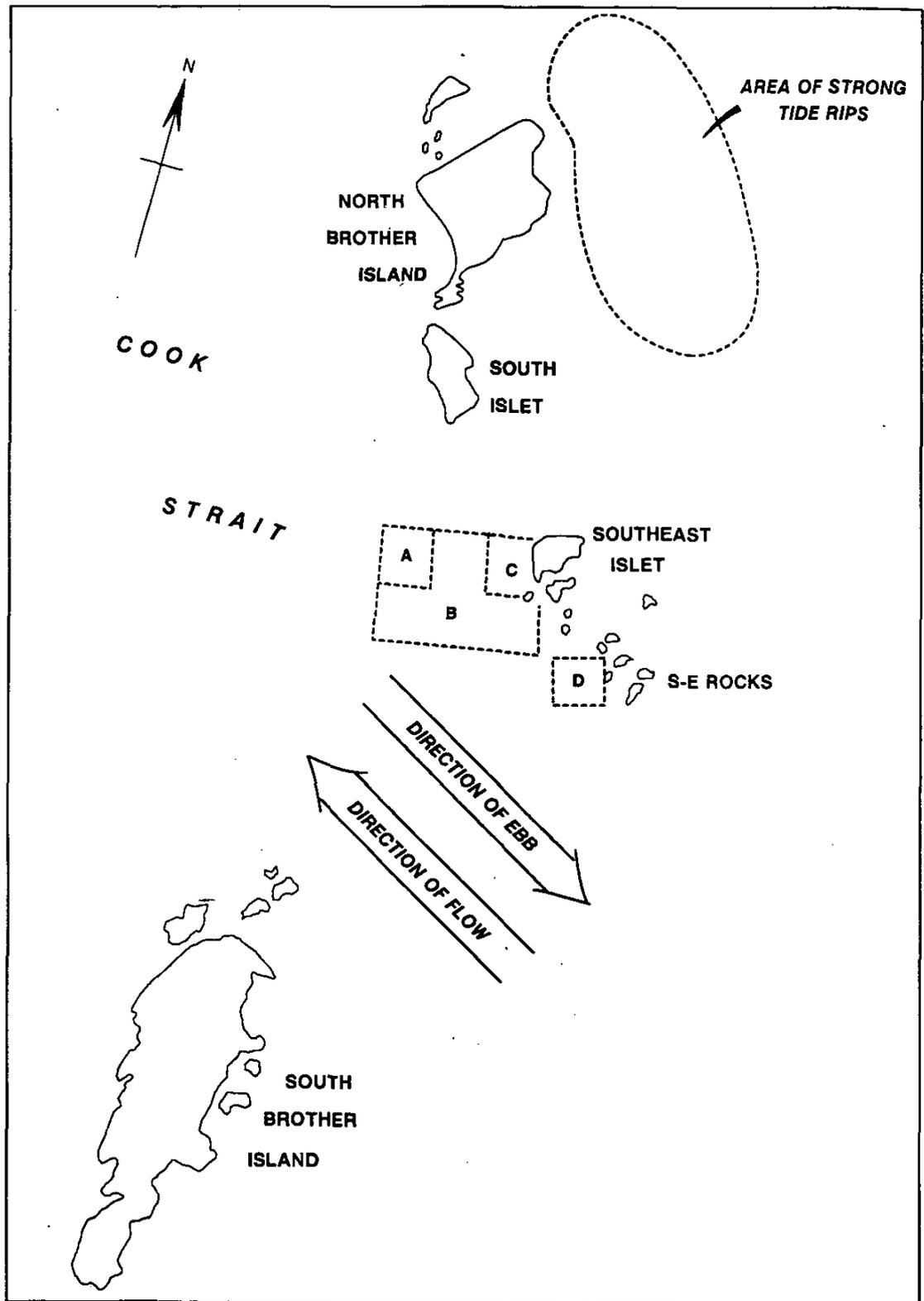


FIGURE 2 – The position of seabird feeding areas adjacent to North Brother Island.

the baseline for this survey, making the transect lines perpendicular to the railway, and to a continuation of the same bearing beyond the end of the track. Each quadrat was searched carefully for seabird burrows and all burrows were inspected by reaching in from the entrance and by digging an additional access tunnel if the nest chamber was out of reach. We also recorded the slope and aspect of each quadrat, the proportion of the ground covered by soil and vegetation, and the identity of the dominant plants. For each burrow, we recorded the length from the entrance to the nest chamber, the shape, the number of entrances, and the substrate (rock or soil). Because many burrows were unoccupied during the census we thought that some prions had not yet laid at that date. To correct for this, we resurveyed plots containing prions on 2 November. Tuatara, whether in burrows or on the surface, were noted, as were surface-nesting Diving Petrels.

We observed the feeding behaviour of seabirds periodically from the summit of the island, concentrating on the areas to the south and east of the south islet (Figure 2) and to the northeast of the main island. On 21 and 26 October we made observations of the south islet area at 06:30 and at intervals of 2 h from 08:00 onwards, to see how changing tidal conditions affected feeding. The area under observation was divided into subareas, and the number of birds actively feeding in each was recorded during each observation period, along with the direction and strength (estimated) of tidal currents. On several days we measured, with a stopwatch, the dive duration and frequency of Diving Petrels feeding under different current conditions, and kept general notes on the behaviour of other species feeding with them.

RESULTS and DISCUSSION

Census

During the census we examined 34 quadrats, with an aggregate area of 0.085 ha. From our survey, we estimated the total potential breeding area available to burrow nesters on North Brother Island as 2.12 ha. Shrubby taupata (*Coprosma repens*), up to 1 m high, dominated 11 (32%) quadrats, and prostrate mats of the succulent ice plant (*Disphyma australe*), mainly less than 10 cm high, dominated 10 (29%) quadrats. The rest were dominated by *Senecio lautus*, glasswort *Sarcocornia quinqueflora* (5 quadrats each), *Hebe elliptica*, bluegrass *Elymus rectisetus* and *Mesembryanthemum x carpophyllum* (1 each). *Muehlenbeckia complexa* was a prominent co-dominant in two quadrats.

We found 22 occupied Diving Petrel nests in 10 quadrats, 26 prions in 13 quadrats, and nine tuatara in 6 quadrats. The maximum numbers of Diving Petrel and prion burrows found in a single plot were five and four respectively, representing densities of 2000 and 1600 burrows per hectare (Table 1). The census plots also contained 60 unoccupied burrows and 5 for which the contents could not be determined. In one quadrat a Little Blue Penguin (*Eudyptula minor*) nest was found under an old board.

Most Diving Petrel burrows were under dense vegetation more than 10 cm high, mainly taupata, while most prion burrows were in vegetation less than 10 cm high or in bare soil (Tables 2 and 3). Some prions occupied rock crevices, although none of these were within the quadrats. One Diving Petrel

TABLE 1 – Numbers of burrows, or nests and animals on the surface, found per 5 x 5 m plot during the census carried out on 23 and 24 October.

	No. of plots containing a given number of burrows														Mean	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13		14
Diving Petrel	24	4	3	1	1	1	-	-	-	-	-	-	-	-	-	0.65
Fairy Prion	21	5	5	1	2	-	-	-	-	-	-	-	-	-	-	0.76
Tuatara	28	3	3	-	-	-	-	-	-	-	-	-	-	-	-	0.26
Empty burrows	13	9	3	3	4	-	-	-	1	-	-	-	1	-	-	1.76
Cont. unknown	29	5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.18
All burrows	10	6	2	3	1	3	2	3	-	1	-	1	-	-	2	3.50

TABLE 2 – Dominant vegetation surrounding occupied burrows found during the census.

Plant genus/sp.	Number of Burrows		
	Diving Petrel	Prion	Tuatara
Taupata	13	3	8
Glasswort	2	10	0
<i>Senecio lautus</i>	2	2	2
<i>Tetragonia</i> spp.	0	0	2
<i>Hebe elliptica</i>	1	0	1
Ice plant	0	1	0
<i>Muehlenbeckia complexa</i>	1	0	0
Bluegrass	2	1	0
Bare soil	1	7	0

TABLE 3 – Vegetation height above occupied burrows found during the census.

Species	Vegetation Height (cm)				
	Bare	<11	10-29	30-59	≥ 60
Diving Petrel	1	2	7	11	1
Fairy Prion	7	11	6	1	1
Tuatara	0	0	0	7	2

nest was found on the surface, under dense *Muehlenbeckia*. Our general surveys outside the quadrats revealed four more surface nests, under taupata, bluegrass, or *Muehlenbeckia*. Combining the information from our census plots with general surveys over the whole island, suggested that Diving Petrels nested wherever there was some vegetation, whereas prions appeared to be absent from the south side of the island, but nested quite densely in bare muddy ground on the western slopes, below the path to the south landing (Figure 3). Although there were significant differences between the average breeding habitat of these species, there was considerable overlap; four out of ten census plots containing Diving Petrels also contained prions.

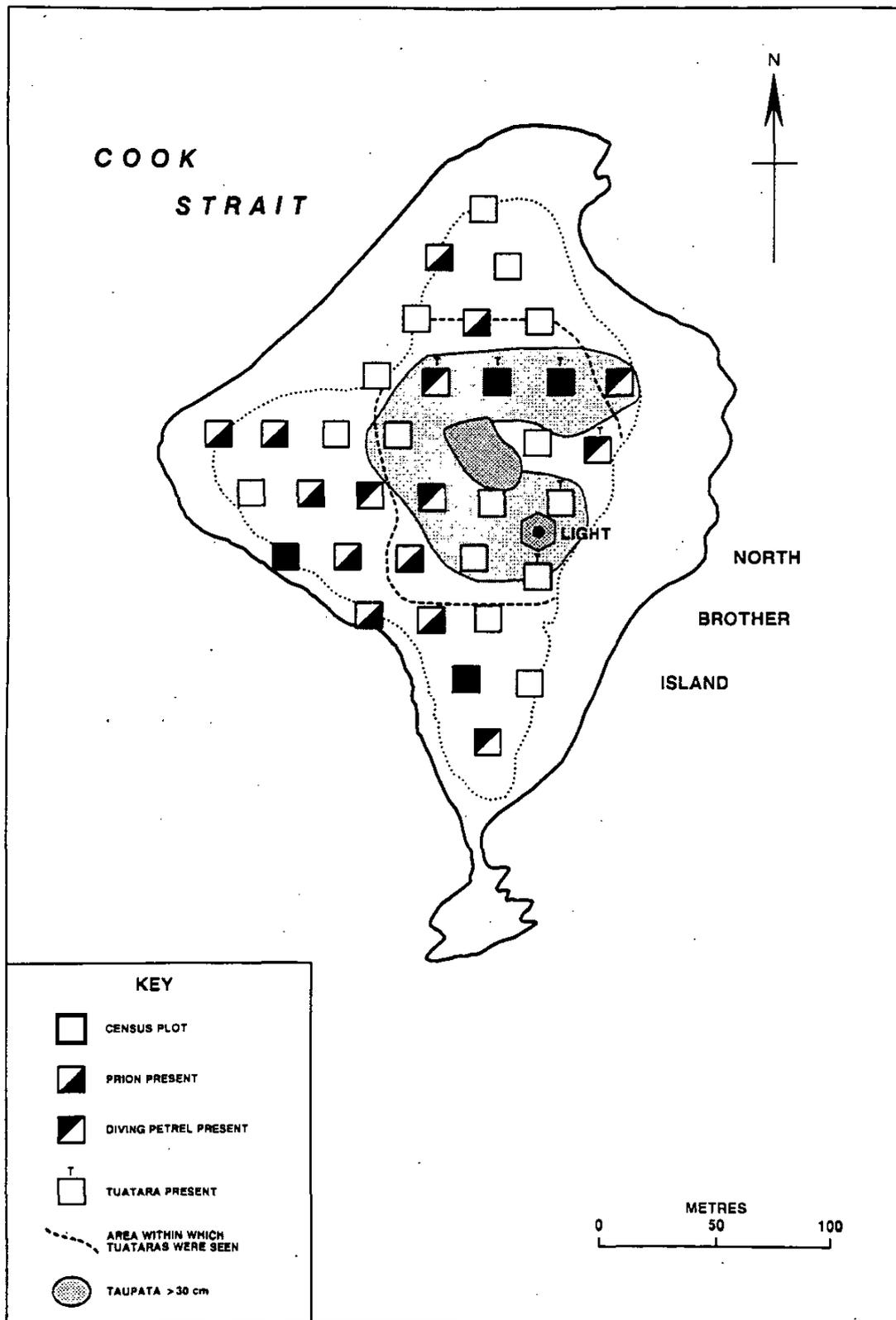


FIGURE 3 – The distribution of census plots containing occupied Diving Petrel and Fairy Prion burrows, and tuatara.

Diving Petrel burrows averaged 43 cm in length (range 0-80 cm), excluding one that was a shallow scrape with the bird protruding from the entrance (Table 4). Prion burrows averaged 64 cm, the longest being 120 cm. Sixty percent of Diving Petrel burrows and 73% of prion burrows were curved, so that little daylight would have entered the nest chamber. Two Diving Petrel and five prion burrows had two entrances. The two species nested equally in soil and rock substrate, but all five tuatara found in burrows were in rocky substrate (Table 5). Tuatara on the surface were all under dense taupata. They were closely associated with areas of vegetation > 30 cm high (Figure 3).

Assuming that our census plots represented 4% of available breeding habitat, we extrapolated our burrow counts to estimate 3050 burrows on the whole island, of which 550 contained Diving Petrels and 650 Fairy Prions, on 23-24 October. By 2 November, four out of 22 previously unoccupied burrows in three plots contained prions, increasing the number of prions in those plots from eight to 12. If we apply this correction to our estimate for prions, we obtain an estimate of 975 occupied burrows for the entire colony. A few more eggs may have been laid after 2 November. Diving Petrel eggs began to hatch on 20 October, so it seems unlikely that many Diving Petrel eggs would have been laid after our census. However, eggs disappeared from a few burrows, perhaps kicked out by prospecting prions, and so some empty burrows that we found may have been used earlier by failed Diving Petrels. Our estimates for both species must therefore be regarded as minima.

As we were unable to distinguish prion from Diving Petrel burrows on physical characteristics, we do not know what proportion of burrows of each species were unoccupied. For Fairy Prions, occupancy appeared to differ between areas. Ten out of 14 (71%) burrows examined to the west of the path from the north landing to the house were occupied by prions on 25 October, whereas on 2 November only 12 of 30 (40%) examined below the path to the south landing were occupied ($\chi^2 = 3.77$, $P = 0.05$). Many burrows in the latter area appeared to have collapsed, perhaps because of fur seals (*Arctocephalus forsteri*) hauling out in the area.

Overall, ignoring shallow scrapes, 17% of burrows contained Diving Petrels, 32% Fairy Prions (correcting for layings up to 2 November), 4% tuatara, and 43% were unoccupied. The status of the remaining 4% could not be determined. Because of the uncertainties in our estimates, we have rounded off the population figures to 600 pairs of Diving Petrels and 1000 pairs of Fairy Prions.

Breeding biology: Diving Petrels

Diving Petrel nests seemed to be spread fairly evenly over the whole island, the highest densities, based on the census results and the number of calls heard at night, being in the tall taupata and *Hebe* shrubs below the buildings on the north side of the island. At night, we regularly found large numbers of 'unemployed' non-breeders among grass tussocks just above and half-way along the path to the south landing. This may be an area of active prospecting. We found most surface nests in the same area. Sutherland (1952) found several surface nests on North Brother, and mentioned that the birds usually

TABLE 4 – Length of occupied burrows (cm) found during the census.

Species	Mean	s.d	N	Range
Diving Petrel	43.5	17.63	20	15-80
Fairy Prion	64.5	16.14	26	40-120
Tuatara	38.7	10.30	4	25-50*

TABLE 5 – Substrate in which occupied burrows were found.

Species	Rocky	Soil	Roots	Surface
Diving Petrel	9	11	1	1
Fairy Prion	12	14	0	0
Tuatara	5	0	0	4

TABLE 6 – Egg measurements for Diving Petrels in New Zealand.

Locality/Study	Length,mm		Breadth,mm		Mass,g		N
	Mean	S.D	Mean	s.d	Mean	S.d	
North Brother I. (this study)	38.2	1.69	30.4	1.11	16.5	2.06	47
Green I. (Thoreson 1969)	37.9	-	30.6	-	16.6	-	15
Whero I. (Richdale 1945)	37	-	29.4	-	14.9	-	39

incubated only by night, and that the eggs never hatched. We also observed one nest where incubation occurred only at night. However, at three other surface nests, incubation was more or less continuous, and at one the chick hatched before we left.

Hatching was observed from 20 October onwards and 16 out of 26 eggs hatched by 5 November, with a further two eggs pipping. The median date of hatching was 1 November. Assuming an incubation period of 53 days (Thoresen 1969), this indicates that laying began about 29 August, with a median of about 8 September. Egg measurements (Table 6) were similar to those given by Thoresen (1969), and Richdale (1945). Incubation and brooding shifts lasted one day in 27 of 29 instances, and two days in the other two shifts. Incubation was intermittent at some burrow nests, but this may have been caused by our disturbance.

Six chicks measured on the first day after hatching had tarsi averaging 12.02 ± 0.51 mm, combined head and bill lengths of 26.07 ± 1.90 mm, and weighed 15.3 ± 4.96 g (range 10-24 g). The heaviest had clearly been fed before being weighed. Three chicks weighed at 9 days old averaged 48 g, and one, weighed at 15 days, was 80 g. Six chicks died within the first five days of observations; all but two were much lighter than average when first weighed and may never have been fed. In four cases we found the parent brooding the dead chick. We do not know whether our disturbance

contributed to this mortality, but the presence of brooding adults suggests that desertion was not the primary cause. For the earliest chick to hatch, brooding ceased at 10-11 days old. Incubating adults taken from burrows during the day weighed a mean of 138.9 ± 8.8 g ($N = 69$), while those brooding chicks weighed 139.7 ± 7.0 g ($N = 16$).

Breeding biology: Fairy Prion

The proportion of burrows containing Fairy Prion eggs increased during our stay on North Brother Island. A bird with a palpable egg was caught on 17 October. However, no incubating birds were found during searches of 30 burrows on 18 and 19 October and so laying had presumably just started. Most burrows on the north side of the island, near the path to the south landing, contained eggs on 25 October, and probably the majority of eggs had been laid by the time we left on 6 November. Because laying may not have been completed by the time we left, we could not be sure of the median date of laying, but it was probably during the last week of October.

Incubation shifts varied from 2 to 6 days, with a mean of 4.1 ± 1.3 days ($N = 11$). However, this figure may be biased against longer shifts, which may not have been completed before our departure. None of the complete incubation shifts was the first after laying as all eggs were laid before the start of observations. Birds weighed on the first day of their incubation shift averaged 135.7 ± 7.8 g ($N = 25$), and on the last day, 117.6 ± 6.4 g ($N = 13$), indicating a weight loss during incubation of 13% of initial weight. Eight birds weighed on the first and last days of incubation showed an average weight loss of $12.7\% \pm 6.7\%$ of initial weight and a daily rate of loss of $6.4 \pm 3.4\%$. Periodic neglect was observed at most burrows, amounting to an average of 22% of days at nine nests observed for 11 consecutive days. At least one day of neglect was observed at all but two burrows. Birds began to arrive on the island about 90 minutes after sunset.

Seabirds and tuatara

During our census, we found no burrows with both seabirds and tuatara resident. Unlike the multichambered burrows described by Walls (1978) on Stephens Island, where tuatara and seabirds frequently coexisted, practically all the burrows inspected on North Brother Island were single-chambered, giving little scope for simultaneous occupation. Reischek (1881), who recorded tuatara coexisting with petrels in the same nest chamber at the Chicken Islands, was dealing with larger birds (*Fluttering Shearwaters* *Puffinus gavia*, Grey-faced petrels *Pterodroma macroptera gouldi*, and *P. pycrofti*), with much larger nest chambers.

Overall, we found tuatara in 4% of 114 burrows examined during the census. This compares with an average of 11% of 50 seabird burrows occupied by tuatara at Stephens Island (Walls 1978). However, our night-time surveys seemed to show that on North Brother Island tuatara are absent from part of the area occupied by seabirds, where there is only a thin vegetation of ice plant and glasswort. In the 12 quadrats where shrubs greater than 29 cm high were dominant, we found tuatara in 11% of 44 burrows; a density similar to that reported on Stephens Island.

Once, a prion was heard calling loudly from a burrow from which a tuatara was seen emerging; presumably some interaction between the prion and the tuatara had just taken place. Wright (1963) recorded a similar interaction, during which prions apparently expelled a tuatara from their burrow. Newman (1987) twice saw prions expelling *Sphenodon punctatus* from burrows on Stephens Island. On two occasions prion burrows in which an egg was unattended one day contained a tuatara the next day, and the remains of a broken egg, from which the contents had been eaten, on the third day. If the tuatara were responsible for eating the eggs, they did not swallow them whole, as Walls (1978) suggested, but apparently broke them and consumed the contents. We introduced a tuatara into a burrow where a prion egg was found broken. The next day we found the contents eaten and the eggshell remains discarded. These three observations took place in an area where tuatara were common on the surface at night, and where most burrows were occupied by incubating prions. The incidence of natural egg-eating represented 2 out of 16 prion nests over 11 days. The tuatara involved were all less than 200 mm from snout to vent, and hence in the lower half of the size range for those that we saw. Some seabird burrows on North Brother Island may be too small for the largest tuatara to enter.

On three occasions we found female tuatara digging holes, presumably to lay eggs. These holes were very similar in size to Diving Petrel and Fairy Prion burrows. In some areas several of these holes were dug to a depth of up to 12 cm and then abandoned. Some were close to occupied seabird burrows. These incipient burrows appeared suitable for enlargement and subsequent occupation by seabirds. In addition, those in which eggs were laid and covered up may be later excavated by seabirds, as they would provide easy digging. One excavation was found from which an old tuatara egg had been expelled. We do not know whether the excavation was by a seabird or a tuatara.

Reischek (1881), Walls (1978) and Newman (1987) mentioned that tuatara sometimes bite off the heads of prions and other seabirds that they kill, or scavenge. However, the corpses of two prions and one Diving Petrel, found in areas frequented by tuatara, were all intact. We placed a racing pigeon *Columba livia*, which died on the island, in front of an occupied tuatara burrow. It remained there for seven days, but we found no sign that it had been touched. We also found no feathers in 30 tuatara droppings that we examined.

Our observations suggest that, within areas of suitable habitat, the incidence of tuatara in seabird burrows on North Brother Island is similar to that found by Walls (1978) on Stephens Island. Like Walls, we found evidence that tuatara eat prion eggs, where these are left unattended. In our study eggs were left unattended fairly frequently, perhaps because of our daily inspections. Prions seem to be able to drive off tuatara, and so most eggs are probably safe from predation while being incubated. Scavenging of bird corpses by tuatara may be less common on North Brother Island than elsewhere.

Seabird feeding behaviour

Feeding Diving Petrels, Fairy Prions, Fluttering Shearwaters and Red-billed Gulls *Larus novaehollandiae* were regularly concentrated around the islets and rocks between North and South Brother. A consistent pattern was seen during all observation periods. During the ebb, with the current flowing southwards between the southeast islet and South Brother, moderate numbers of birds fed in area D (Figure 2). On the flow, with the current moving north, large numbers fed in areas A-C, downstream of a shallow shelf projecting to the west of the southeast rocks. At slack water birds were generally less concentrated, and only small numbers were seen feeding.

During periods of intensive feeding off the Southeast Islet, Red-billed Gulls fed close to the islet (area C), often mixed with Fluttering Shearwaters, while Fairy Prions and more Fluttering Shearwaters fed further out (areas A-B) and Diving Petrels fed further downstream (area A).

Diving Petrels also fed in hundreds in strong tide rips to the east of North Brother Island, especially during the ebb. This pattern was also noted by Thoresen (1969). Feeding birds were carried rapidly southwards by the current and then flew back to just north of North Brother to start again. On 25 October, return flights averaged 11 ± 4.7 s ($N = 14$), indicating that birds travelled 100-200 m (assuming a flight speed of 12 m s^{-1}). On 2 November, return flights were between 1-2 minutes, with birds travelling 0.7-1.4 km. Most dives made in this area were short. In areas of high turbulence they averaged 3.0 ± 1.8 s ($N = 8$), while in less turbulent areas they averaged 14.6 ± 5.4 s ($N = 17$). Some birds dived repeatedly for 1-2 s, surfacing for less than 1 s between submergences. Diving Petrels feeding at slack water generally dived for longer, averaging 28.8 ± 9.1 s ($N = 11$) during one observation period on 25 October. Surface intervals between dives were 2-8 s.

Systematic list of birds seen

WANDERING ALBATROSS *Diomedea exulans*. A maximum of five were seen on 30 and 31 October and 5 November, all passing southeastwards. All age plumages were seen, including one stage 2, three stage 3, two stage 4, three stage 5, and one stage 6.

ROYAL ALBATROSS *D. epomophora*. Singles in adult plumage were seen on 31 October and 3 November. In eastern Cook Strait in autumn, Bartle (1974) found this species much more common than the Wandering Albatross.

BLACK-BROWED MOLLYMAWK *D. melanophrys*. One seen on 31 October.

WHITE-CAPPED MOLLYMAWK *D. cauta steadi*. Up to 12 were seen on six dates, the maximum being on 31 October.

FLESH-FOOTED SHEARWATER *Puffinus carneipes*. One or two were seen on three dates. Medium-sized black shearwaters seen frequently behind distant fishing boats were probably this species. We found the remains of one bird on the island.

BULLER'S SHEARWATER *P. bulleri*. At least six flew westwards on 5 November, in strong southerly winds.

SOOTY SHEARWATER *P. griseus*. Recorded every day flying past the island. Highest numbers were on 30 October, when hundreds moved westwards in strong southwest winds. Small numbers fed in tide races off the East Islet on a few days.

FLUTTERING SHEARWATER. Seen daily feeding within 1 km of the island and passing in numbers up to hundreds per hour.

HUTTON'S SHEARWATER *P. huttoni*. One seen flying east on 1 November. Possibly we overlooked some birds of this species among Fluttering Shearwaters.

LITTLE SHEARWATER *P. assimilis*. Singles were seen on 27 and 28 October and two on 3 November, all passing westwards.

COMMON DIVING PETREL. Abundant breeder, seen feeding around the island daily.

WESTLAND PETREL *Procellaria westlandica*. Up to 20 were seen on 5 days, mainly in association with passing fishing boats. Some of these birds may have been White-chinned Petrels *P. aequinoctialis*.

CAPE PIGEON *Daption capense*. Singles were seen on 29 and 31 October.

GIANT PETREL *Macronectes* spp. Up to 12 were seen on 16 days, often in association with passing fishing boats. Only one, a Northern, *M. halli*, could be identified to species.

FAIRY PRION. Common breeder, and present close to the island in hundreds most of the time.

LITTLE BLUE PENGUIN. We found three nests containing clutches of two eggs. One was in a stone wall beside the path between the house and the light. A tuatara was seen entering the same cavity on several occasions. On one occasion it was angrily ejected by the incubating bird, but at other times it was ignored.

AUSTRALASIAN GANNET *Morus serrator*. Up to five were seen on ten days, sometimes feeding close inshore.

PIED SHAG *Phalacrocorax varius*. One or two seen on nine days.

NEW ZEALAND KING SHAG *Leucocarbo carunculatus*. One adult was seen on rocks near the island on 19 and 20 October.

WHITE-FACED HERON *Ardea novaehollandiae*. One was seen on tidal rocks on 25 October.

CANADA GOOSE *Branta canadensis*. Two flew north on 25 October.

AUSTRALASIAN HARRIER *Circus approximans*. One visited the island and adjacent islets on most days, usually in the late afternoon. On 1 November, two were seen flying steadily eastwards, towards the North Island, about 50 m above the sea. Wright (1963) saw a Harrier take a Fairy Prion on the island in daylight.

VARIABLE OYSTERCATCHER *Haematopus unicolor*. One was seen on 23 and 28 October.

ARCTIC SKUA *Stercorarius parasiticus*. Two juveniles were seen passing eastwards on 1 November, both pausing to chase Red-billed Gulls. A light-phase adult, probably of this species, flew west on 3 November.

SOUTHERN BLACK-BACKED GULL *Larus dominicanus*. Up to four adults were present on islets or rocks adjacent to the island every day.

RED-BILLED GULL. Up to 200 were seen daily on the East Islet, where some seemed to be sitting on nests by early November. Up to 100 roosted on North Brother Island every night, and several nest cups were built near the north landing, but no eggs were found. Up to 400 fed around the island and adjacent rocks.

WHITE-FRONTED TERN *Sterna striata*. Several dozen roosted at night on the island on our arrival, but numbers built up, and about 120 were roosting by early November. The first egg was found on 31 October and at least seven clutches had been started by 5 November. Eggs measured 47.9 ± 1.09 mm by 33.4 ± 0.40 mm, and weighed 27.6 ± 0.89 g ($N = 5$). All eggs were incubated from laying, and no second eggs were seen.

SKYLARK *Alauda arvensis*. One seen on 26 October.

WELCOME SWALLOW *Hirundo tahitica*. Up to four were seen on 7 days, hawking over the island. The species was first recorded on the island in 1964 (Wright 1964).

NEW ZEALAND PIPIT *Anthus novaeseelandiae*. The remains of one, long dead, were found near the lighthouse.

HEDGE SPARROW *Prunella modularis*. A resident, with at least two and possibly more, males singing daily. No evidence of nesting was seen.

BLACKBIRD *Turdus merula*. One male was seen on three days, and heard singing on several others.

YELLOWHAMMER *Emberiza citrinella*. Up to three were seen on five days.

CHAFFINCH *Fringilla coelebs*. Single males were seen on three days.

GREENFINCH *Carduelis chloris*. Singles were seen on three days.

GOLDFINCH *C. carduelis*. Up to 15 were seen daily feeding on the island.

REDPOLL *C. flammea*. Singles were seen on two days.

HOUSE SPARROW *Passer domesticus*. Up to four were seen on eight days, but no evidence of breeding.

STARLING *Sturnus vulgaris*. Seen daily, feeding or flying past. Up to 20 roosted on cliffs on the south side of the island. One was seen carrying nest material.

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