BREEDING OF THE CAPE PIGEON (Daption capense) AT THE SNARES ISLANDS*

By P. M. SAGAR

ABSTRACT

Large numbers of Cape Pigeons *(Daption capense)* breed at the Snares Islands. Egg laying occurs in the second week of November and is probably synchronous. Both adults incubate the single white egg. Hatching occurs from the third week in December to the first week in January. Chicks are brooded continuously for up to 10 days and guarded for up to 15 days after hatching. Weight increases until the chicks reach mean adult weight about three weeks after hatching. Adults continue to feed chicks until they fledge, from 47 to 57 days after hatching. The colonies are then deserted for a period while adults moult at sea. The birds remain around the islands throughout the year. There was no evidence of predation during breeding. Exposure of nest site to wind and rain affected breeding success. Band recoveries suggest a strong nest site attachment from year to year.

INTRODUCTION

The Cape Pigeon is a medium sized fulmarine petrel with a distinctive black and white pattern on its upper parts (Fig. 1). It has a circumpolar distribution and breeds on mainland Antarctica and many Antarctic and Subantarctic islands (Watson 1975). New Zealand breeding populations on the Antipodes, Bounty and Snares Islands are recognised as a distinct race, *Daption capense australe* (OSNZ, 1970).

The annual cycle and breeding biology of the southern race have been described from Signy Island (67°40'S 45°38'E), South Orkney Islands by Pinder (1966) and Beck (1969, 1970) and from Adelie Land (67°S 139°E), on mainland Antarctica by Prevost & Mougin (1970). These are two of the southernmost breeding sites. This paper is based on observations made at the Snares Islands (48°02'S 166°36'E), one of the northernmost breeding sites, from 9 November 1976 to 3 March 1977.

STUDY AREA AND METHODS

The Snares Islands are formed from granite with a gneissic structure (Fleming 1953). The group has precipitous cliffs with ledges and jumbles of rocks along most of its coastline.

An accessible Cape Pigeon colony (Fig. 2) was investigated on the north-west face of the North Promontory, North East Island

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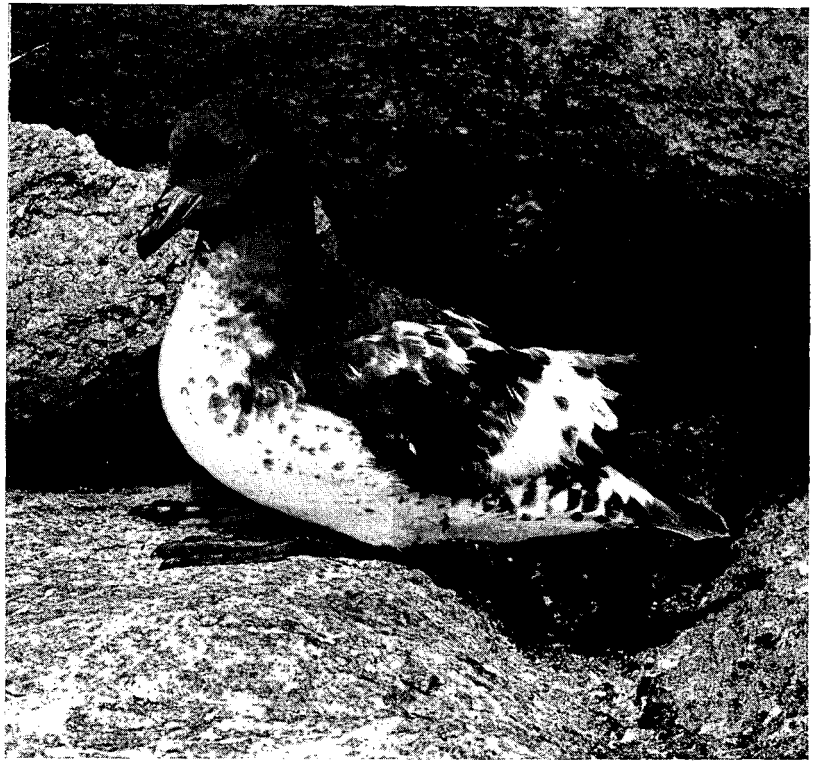

FIGURE 1 — Adult Cape Pigeon (**Daption capense**). Photo: P. M. Sagar

(Fig. 3). Access to all nests on the cliff face was possible, enabling a range of nest sites to be studied. G. J. Wilson (Zoology Department, University of Canterbury) and H. A. Best (Wildlife Service, Department of Internal Affairs) began some work on part of this colony in 1970-71 and 1974-75 respectively and their observations, incorporated in this paper, are gratefully acknowledged.

Thirty-six nests were marked with numbered metal squares placed under rocks adjacent to each nest. From 20 November 1976 to 20 February 1977 these nests were monitored at three-day intervals during the incubation and chick stages and daily during the hatching and fledging periods.

Two spring balances with capacities of 200 and 1000 g (accuracy ± 5 g) were used to weigh eggs, chicks and adults. Measurements were made with vernier calipers (accuracy ± 0.1 mm). Feeding data were obtained after the guard period (by which time chicks had become used to being handled) by weighing the chicks upon my

arrival at the colony. Chicks fed during my visit were reweighed. Chicks ejected small amounts (up to 10 ml) of oil and food material on occasions. Adults were not handled as they were liable to regurgitate large quantities of food material which would have been fed to the chick. The quantity of food fed to chicks was determined on 23 occasions. Three adult regurgitations were collected, preserved and analysed.

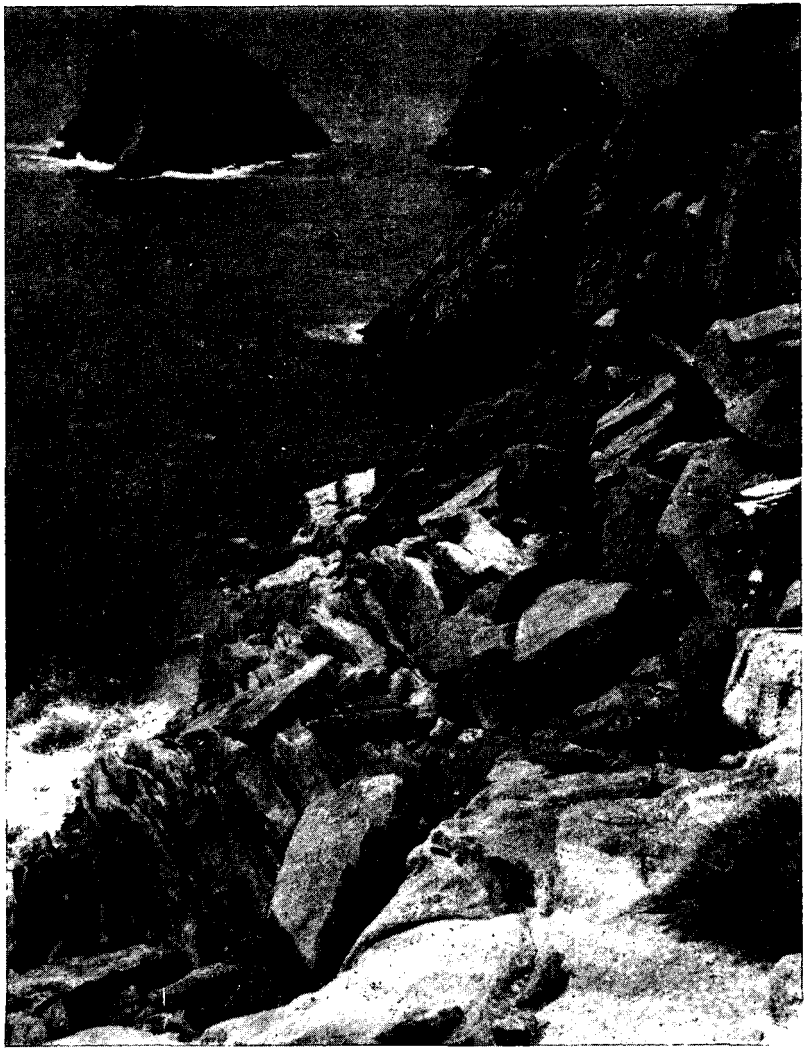

FIGURE 2 — Cape Pigeon study colony on the north-west face of the North Promontory, North East Island. Photo: H. A. Best

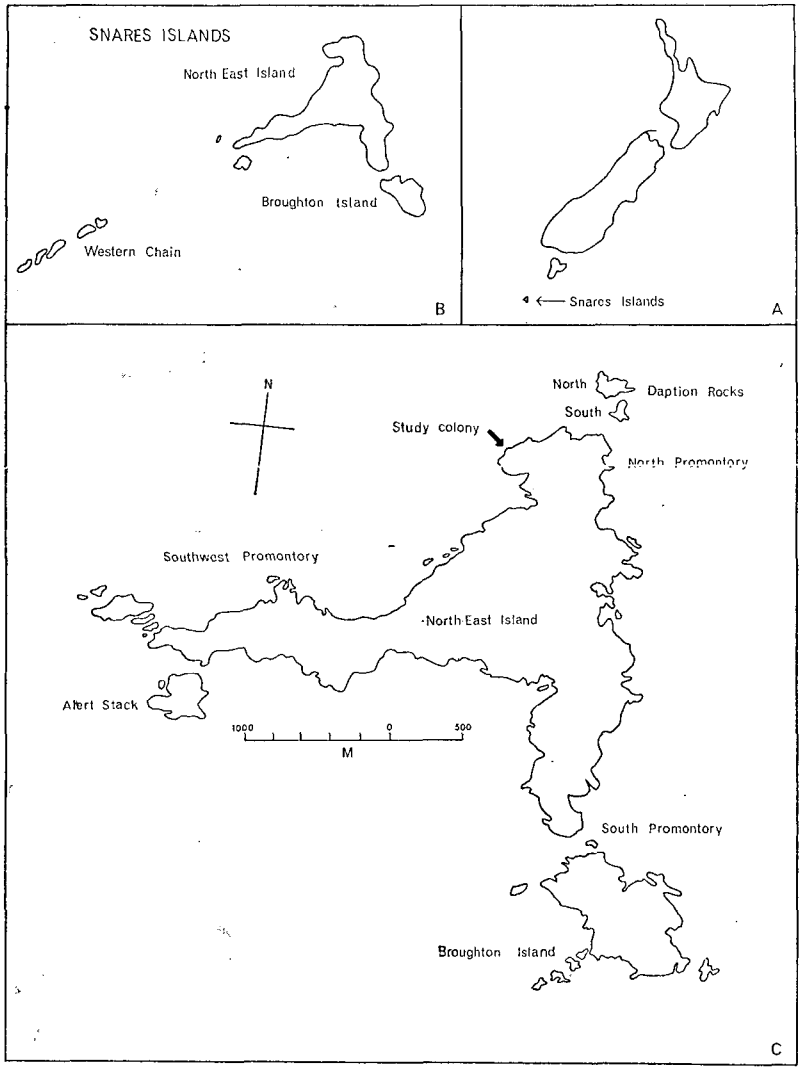

FIGURE 3 — Snares Islands, showing the location of place names mentioned in the text.

A. New Zealand, showing the location of the Snares Islands.
B. Snares Islands.
C. North East Island, showing location of the study colony.

An unsexed adult from each of 10 nests was banded with a stainless steel leg band. All chicks were banded 30 days after hatching.

To avoid unnecessary disturbance to the colony standard measurements were obtained from 30 adults caught at sea, 50 m off North East Island on 2 February 1977.

RESULTS

Nesting habitat. Rock ledges, crevices and jumbles of rocks on cliff faces were used extensively by Cape Pigeons at the Snares Islands. The most densely populated areas were the cliffs of the west coast of North East Island, the islets of the Western Chain, and North Daption Rock.

Nests on open ledges (17) and under rock overhangs (16) were used in the study colony. Three nests were in caves. Rock overhang and cave sites were more plentiful on the higher and less precipitous slopes of the cliff face (see Fig. 2). These higher nests were under jumbles of rocks surrounded by peat and *Poa astonii* tussock, about 50 m above sea level. Open ledges were used generally on the lower and more precipitous slopes of the cliff face, where they were the main sites available. The lowest nest was about 20 m above sea level.

Most nests were slight scrapes in granite fritter and peat washings, lined with granite chips and, especially in higher nests, *Poa astonii.* There was plenty of dead vegetation close to most of these higher scrapes. Bones of Buller's Mollymawk *(Diomedea bulleri),* Cape Pigeon, Sooty Shearwater *(Puffinus griseus)* and Fairy Prion *(Pachyptila turtur)* also have been found in Cape Pigeon nests (G. J. Wilson, pers. comm.).

On the sparsely vegetated Snares Western Chain, Fleming & Baker (1973) and Sagar (1977) reported only granite chips in Cape Pigeon nests. These observations indicate that Cape Pigeons build their nests only from materials at hand.

Nest site retention. Twenty-five breeding birds of unknown age were banded by G. J. Wilson in 1970-71. Nine of these were found breeding in 1976-77. At least three of these birds were using the same nest sites as in 1970-71, while at least two had changed to nearby nest sites. Three birds, banded as breeding adults by H. A. Best in 1974-75, were breeding at the same nest sites in 1976-77. None were found on different sites.

Egg laying and the egg. Cape Pigeons lay a single white egg. At the Snares Islands, the full egg-laying period has not been determined. Birds were found on eggs on 21 November 1974 (H. A. Best, pers. comm.) and 20 November 1976 (this study), the earliest visits made to the colony during breeding (no eggs were laid after 20 November 1976). However, by using the average incubation period of 45 days established by Prevost (1964) and Pinder (1966) and calculating back from the known hatching dates at the Snares, the egg-laying period was estimated as being from 7 to 20 November 1976 (mean 11 November).

Measurements of 36 eggs: 57.3-64.1 x 39.9-44.7 mm, mean 61.2 mm (s.d. ± 1.85) x 42.6 mm (s.d. ± 1.20). Weight of 36 eggs: range

48-67 g, mean 60 g (s.d. ±3.8). These measurements are smaller than those reported from Signy Island (range 57-67 x 40-47 mm, 51-75 g; mean 62 x 43 mm, 62 g) by Pinder (1966) and from Adelie Land (range 60.0-67.0 x 41.0-45.8 mm, 55-75 g; mean 63.0 x 43.6 mm, 67 g) by Prevost and Mougin (1970). These data confirm the suggestion by Oliver (1955) that eggs of the New Zealand race are smaller than those of the southern race.

Incubation and hatching. Both adults incubate, but observations were not made frequently enough to determine shift lengths.

Hatching occurred between 22 December 1976 and 4 January 1977 (Fig. 4), with a mode of 24 December 1976. The time taken from the first pipping of the egg to its hatching varied from 2 to 5 days. Egg shell remains were left either in or to one side of the nest. The chick was protected continuously, by at least one adult for 8-15 days after hatching. After 8-10 days the chick was too large to be brooded and sat beside the parent at the nest (Fig. 5).

Chick growth and development. Weight records for 20 chicks have been given in Figure 6 and for six chicks in Figure 7. Growth rates were linear during the first 8-9 days, followed by a decrease in the rate of weight gain from 9-17 days. This corresponded to the period when chicks were first left unguarded at the nest and probably coincided with the start of homeothermy. Considerable fluctuations in body weights occurred after 18 days, but chicks overall gained steadily in weight. Chicks reached mean adult weight about three weeks after hatching. The heaviest weights (up to 665 g) occurred 26 to 42 days after hatching. A gradual decrease to the mean fledging weight of 404 g followed.

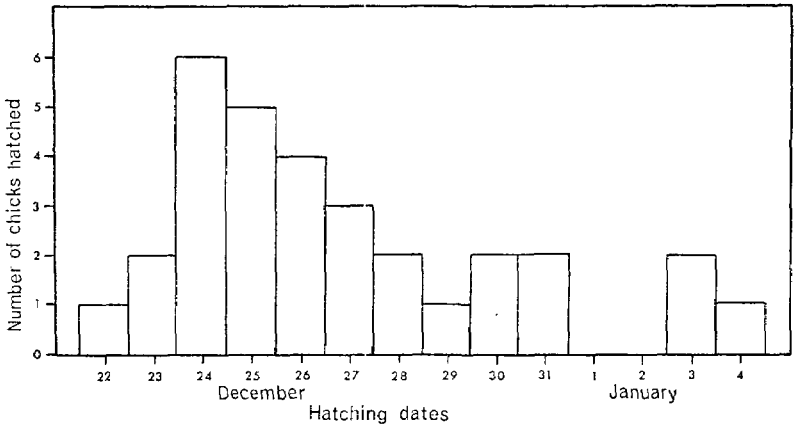

FIGURE 4 — Hatching dates for Cape Pigeons at the Snares Islands, 1976-77 (N = 31).

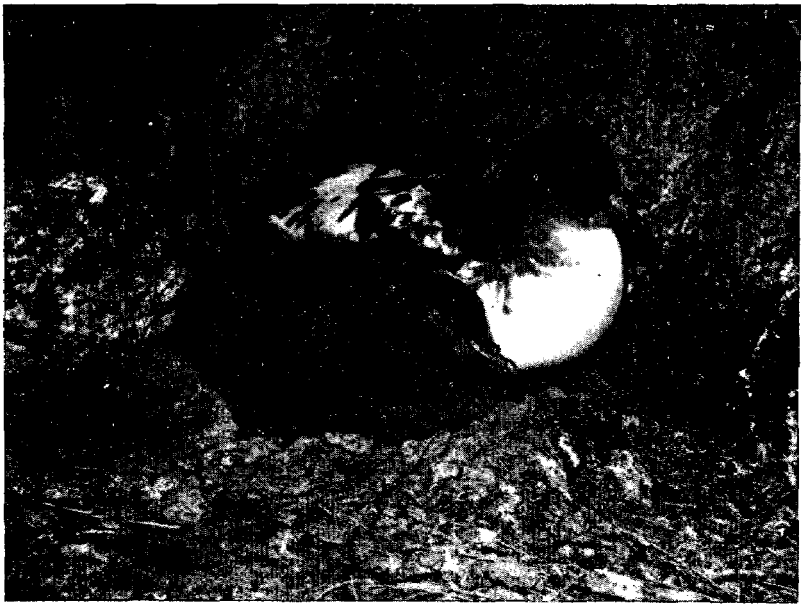

FIGURE 5 — Adult Cape Pigeon at nest with chick during the guard stage. Photo: H. A. Best

Bill and tarsus lengths of 20 chicks were measured throughout the nestling period. Plotted data (Fig. 8) show that both bill and tarsus grew at a steady rate; 30 days after hatching, mean chick tarsal lengths were almost of adult size, while bill length of chicks reached mean adult size at about 45 days.

Initially chicks were covered with grey protoptyle down, except under the wings and about the base of the bill and eyes. From 10 days after hatching this was gradually replaced by mesoptyle down, dark grey dorsally and off-white on the breast and abdomen. Primary and secondary pins were visible about 10 days after hatching and these burst their sheaths at about 16 days. Tail pins were visible about 19 days after hatching. Down was lost as feathers appeared, until the chicks were fully feathered about 40 days after hatching. At this time the dark grey and white plumage of chicks was easily distinguished from the dark brown and white plumage of the adults, which by then had worn plumage.

Food and feeding. The hyperiid amphipods *Hyperia luzoni* and *Parathemisto gaudichaudii*, the euphausiid *Nictyphanes australis* and the decapod *Munida gregaria* were identified from three regurgitations taken from breeding adults at the colony.

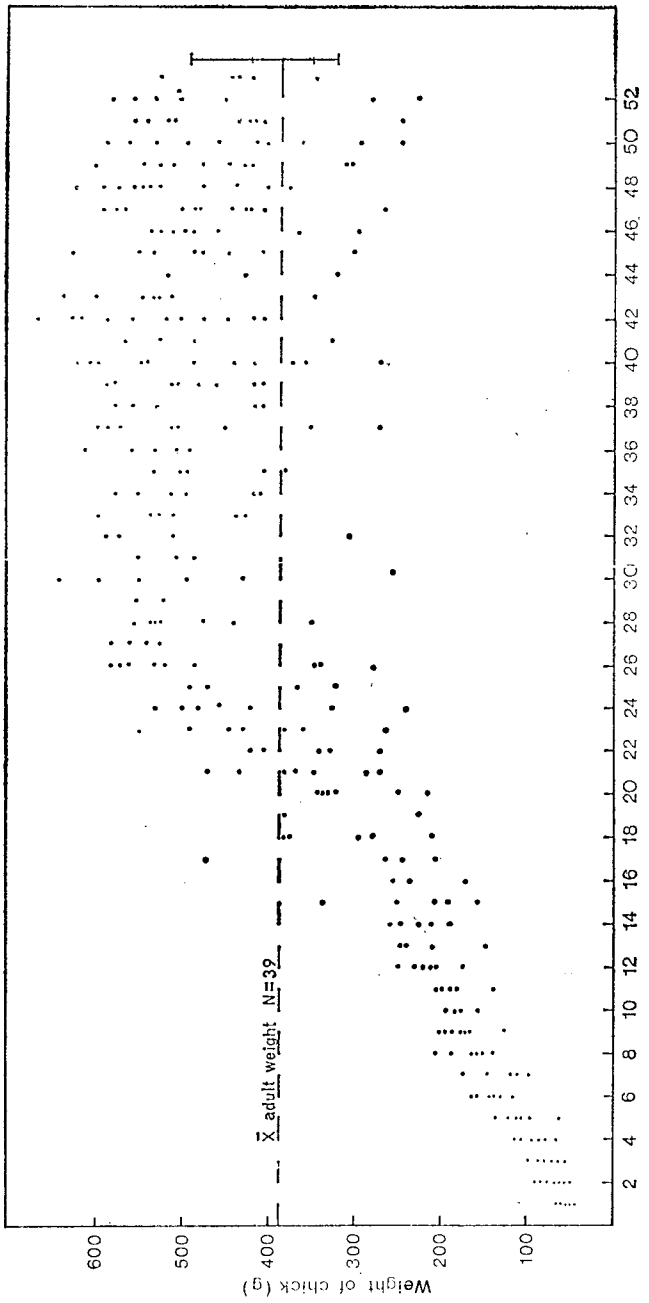

FIGURE 6 — Scattergram of weight records for 20 Cape Pigeon chicks.

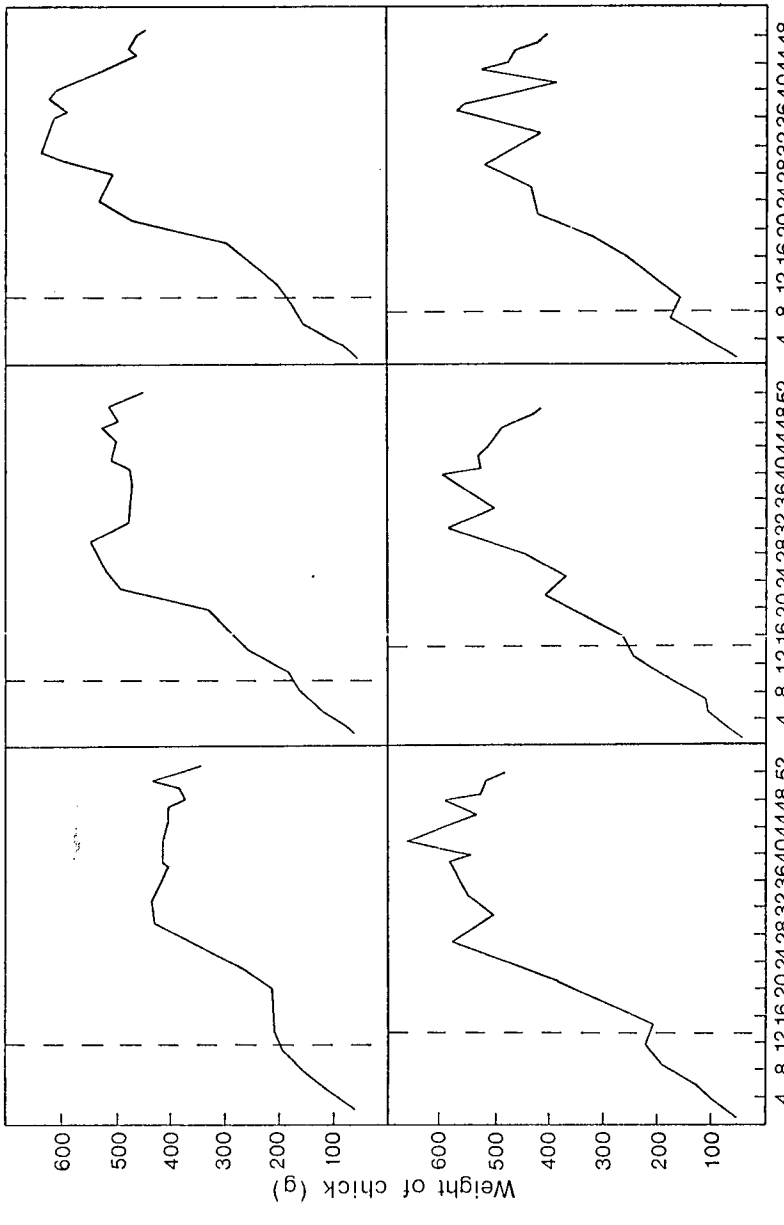

FIGURE 7 — Weight and age data for 6 individual Cape Pigeon chicks. The dashed line indicates the end of the guard period.

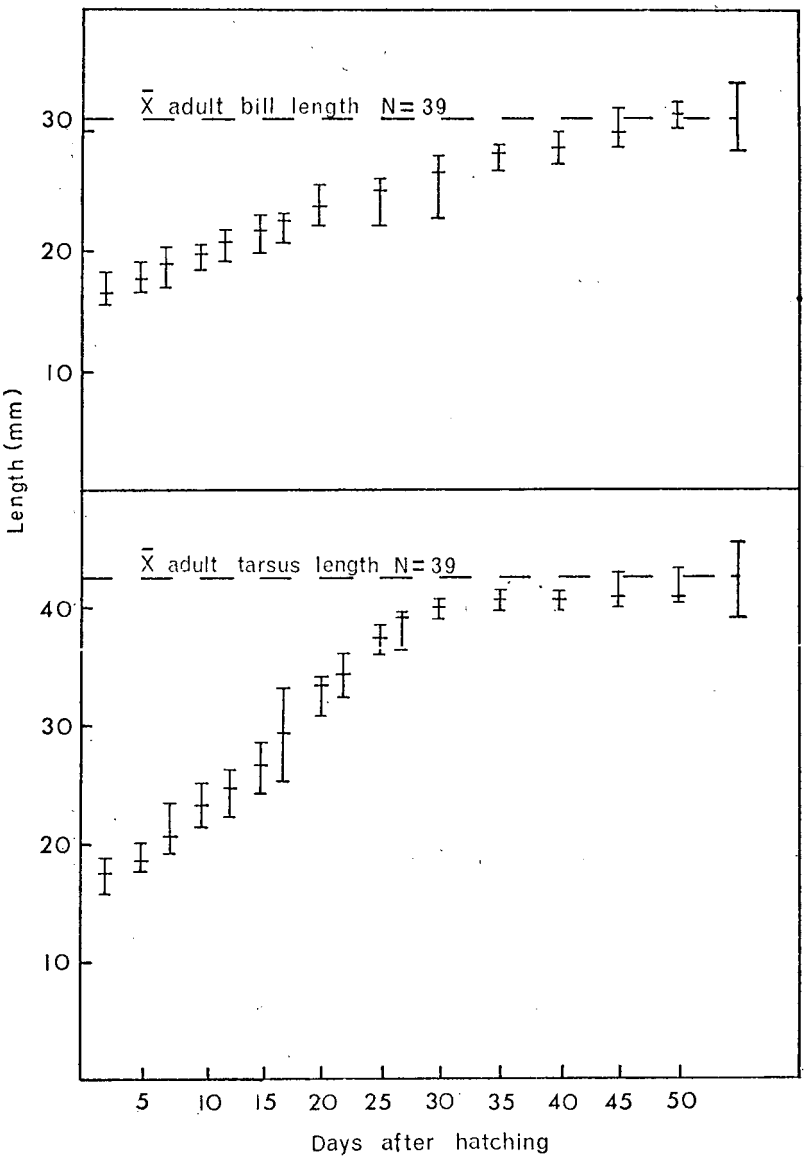

FIGURE 8 — Changes in bill and tarsus length with age for 20 Cape Pigeon chicks.

Chicks were fed at intervals throughout the day; no time preferences were recorded. Adults arriving at the colony to feed chicks appeared to have difficulty landing, making several low approaches over the colony before trying to land near the nest. In windy conditions a bird sometimes made many passes over the nest and if unsuccessful glided down to the sea. Several minutes later the bird would return to the colony to attempt landing again.

On landing by the nest the adult moved in a shuffling gait to the chick and, while "clucking," pecked the chick lightly about the head. The chick responded by fencing its bill with that of its parent, and feeding would then begin. Adults stayed at the nest for 2-20 minutes. The chick frequently became somnolent after being fed and the adult either departed immediately or stopped to preen and doze.

Feeding techniques varied with the age of chicks. The cross-bill technique, described by Harper (1976), was used until chicks were about 40 days old, by which time their bills were almost fully grown. Older chicks usually fed by facing the adult and placing their bill directly into the adult's open gape.

Twenty-three weight increases (range 5-75 g, mean 54 g) were obtained from chicks 36 to 45 days old. Four records of only 5 g increases in weight were from chicks that responded poorly to stimulation from their parents and possibly indicated that the chicks were already satiated.

Nine small pieces of granite (largest 1 cm^2) were found in the gizzard of a dead 34 day old chick. A food bolus measuring 10 x 50 mm and containing *Poa astonii* leaves and rootlets (60% by volume), feathers (15%), white rubbery organic material (15%) and unidentified (10%) was in the crop. All these materials could be found around the nest.

Fledging. Twenty chicks flew from their nest sites between 12 and 20 February 1977, 47-57 days after hatching. Six chicks were still unfledged from 24 nests on 19 February 1971 (G. J. Wilson, pers. comm.) and three chicks were still unfledged from 37 nests on 18 February 1975 (H. A. Best, pers. comm.). These data indicate that there was little variation in the timing of the breeding cycle in those three years.

Chicks exercised their wings several days before fledging. Most chicks from nests under rock overhangs and in caves moved out just before fledging and had to negotiate large rocks before being able to take off. After the young had left the colony no birds were seen there again that season, and few were seen immediately offshore.

Mortality. Thirty-one eggs (89%) hatched and 20 chicks (55.5%) fledged from the 36 nests studied. Of the remaining eggs, two disappeared, two failed to hatch and were found to be infertile, and one chick died after first pipping the eggshell. Eight chicks died

within 10 days of hatching and three chicks from 11 to 34 days after hatching.

One dead chick came from a nest which, although under a rock overhang, was dampened by water seeping from the rock face behind. The rest, however, were from nests on rock ledges, fully exposed to the prevailing north-west winds and rain. This included the chicks of seven of the ten pairs breeding on the open-ledge sites of the lower and more precipitous slopes of the colony.

In 1974-75 24 eggs (64.5%) hatched and 21 chicks (56.7%) fledged from the 37 nests observed (H. A. Best, pers. comm.).

DISCUSSION

The timing of the breeding cycle of Cape Pigeons at the Snares Islands differs from those reported from other localities. The estimated egg laying period (mean 11 November) at the Snares Islands is 17 days earlier than that reported at Signy Island (mean 28 November) by Pinder (1966). In Adelie Land eggs are laid from 27 November to 9 December (Prevost & Mougin, 1970), while at Heard Island (53°06'S 73°30'E) the first eggs were reported on 26 November 1949 and 25 November 1950 (Downes, Ealey, Gwynn & Young, 1959). Thus birds in higher latitudes lay later than birds in lower latitudes. This has been shown also for the Southern Skua *(Catharacta skua lonnbergi)* by Young (1977).

This study indicates a fledging period of 47 to 57 days, similar to the mean of 49 days suggested by Pinder (1966) at Signy Island and the 45 to 50 days suggested by Prevost & Mougin (1970) at Adelie Land.

Cape Pigeons at the Snares Islands breed with timing as closely synchronised as birds breeding further south. Beck (1970) considered this to be related to food supply, synchronised breeding allowing time for a complete post-nuptial moult in the breeding area before food became scarce in the autumn. The exodus of birds from the colonies at the Snares Islands after breeding could have been associated with moult. Horning & Horning (1974) reported that there was no seasonal fluctuation in Cape Pigeon numbers at the Snares Islands, indicating that there was no post-breeding exodus. These observations show that despite the post-breeding exodus from the colonies, some birds are present close inshore throughout the year.

Warham (1968) reported that in the Procellariiformes, populations of larger adults lay larger eggs. Cape Pigeons from Adelie Land are heavier than those from the Snares Islands, with means of 472 g (Prevost & Mougin, 1970) and 385 g respectively. Therefore the smaller eggs of the Snares Island Cape Pigeons are probably associated with lower body weight and may also reflect further differences between the two races. Egg size in the Fairy Prion also decreases from south to north (Harper, 1976).

Regurgitated food consisted essentially of neritic species. Fenwick (in press) described the behaviour of Cape Pigeons feeding on a shoal of *Parathemisto gaudichaudii* off the Snares Islands and suggested that the occurrence of amphipod shoals could affect breeding success.

Weight changes of chicks near fledging (Fig. 7) show that they are still being fed despite their general decline in weight. Both Harper (1976) and Harris (1976) concluded that the decline in weight of Fairy Prions and Puffins *(Fratercula arctica)* respectively prior to fledging was due not to reduced feeding but rather to physiological changes and increased activity at the nest.

Although Southern Skuas bred to within 50 m of Cape Pigeon colonies at the Snares Islands, there was no evidence that they preyed upon Cape Pigeons. However, Pinder (1966) reported that Cape Pigeon eggs were common in Southern Skua middens at Signy Island. He also recorded indirect evidence for predation on chicks of all ages.

Nest site appears to be significant for the breeding success of Cape Pigeons. Birds with nests under rock overhangs and in caves are more successful than those using open ledges. Perhaps older, more experienced breeders establish their nests first and in more favourable sites than younger, less experienced breeders.

All banded adults from earlier seasons were nesting either under rock overhangs or in caves. Band recoveries suggest both a strong nest-site attachment and a low adult mortality. Even when the same nest site was not used, the same area was used. Pinder (1966) provided evidence for both a strong nest site attachment and a strong pair bond.

ACKNOWLEDGEMENTS

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SHORT NOTE

NEW ZEALAND DOTTERELS CATCHING FISH

On a visit to Opoutere, eastern Coromandel Peninsula, on 6 February 1978, I spent some time watching a group of New Zealand Dotterels *(Charadrius obscurus)* feeding on the harbour flats at low tide. My interest quickened when I saw one of them flip over an empty shell with a sideways flick of its bill. After examining the spot thus bared and finding nothing of interest, the bird moved on to another shell where it stopped, cocked its head and seemed to listen intently. The shell was then flipped over in the same way as before, this time revealing a small 'cockabully' *(Forsterygion sp. varium?)*. These little fish commonly spend low tide 'high and dry' below the single valves, concave side down, of such molluscan species as the Pipi *(Paphies australis)*, Common Cockle *(Chione stutchburyi)* and the Wedge Shell *(Tellina liliana)*.

The dotterel made a quick stab at the fish, then stepped back smartly as though afraid of it as it leaped about. After a short wait the bird stabbed again, then twice more. The fish was then taken in the bill and battered on the ground a few times before being swallowed whole, head first.

During the hour or so that I watched this bird it fed almost entirely in this way, catching and eating four fish. Three more of the twelve New Zealand Dotterels present were seen to catch fish in the same manner.

P. C. M. LATHAM, *c/o Papamoa Beach P.O., via Te Puke, Bay of Plenty*