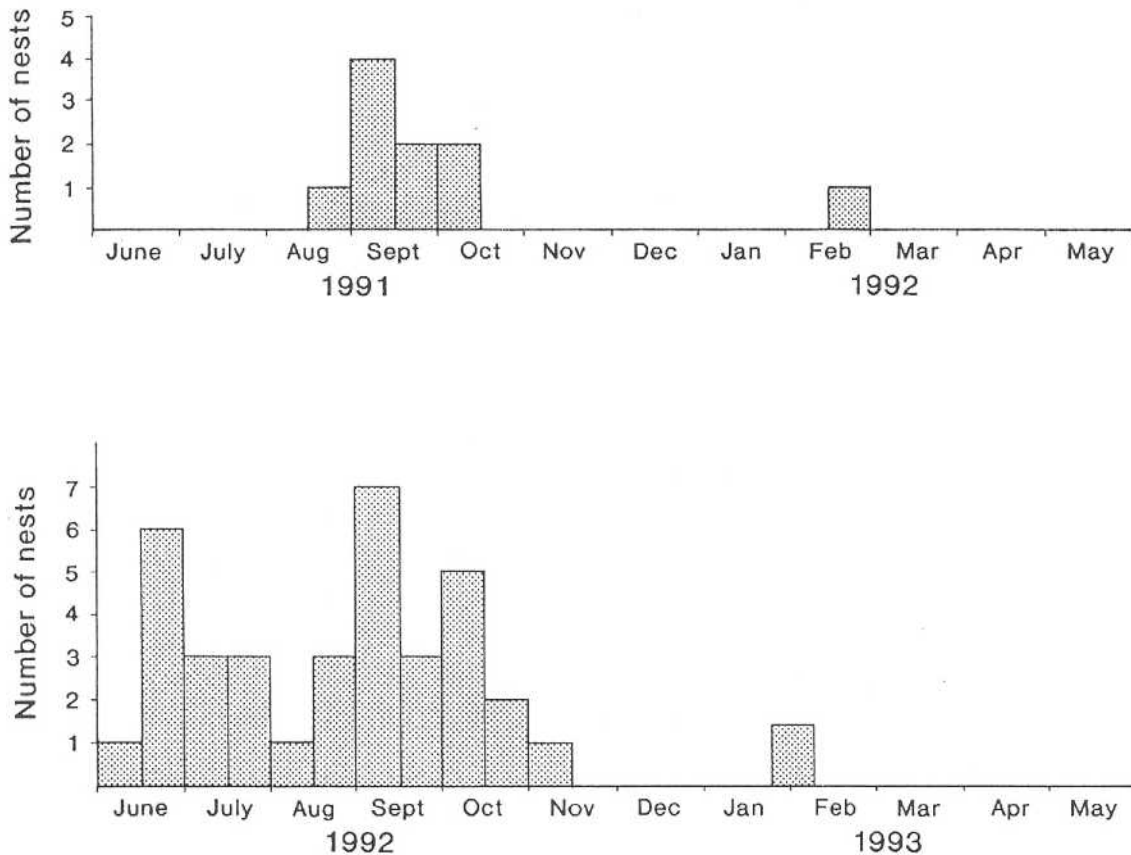


June. Thus, nesting in 1992-93 began two months earlier than in 1991-92 (Fig. 5). The last pairs to lay in 1992-93 probably did so in late January or early February because two pairs had young juveniles in April. Therefore, the nesting season extended over at least 10 months, with eight of the 16 pairs breeding continuously for at least six months (July-December 1992).

**3.6.2 Nesting effort** In total, 34 nests were found in 1992-93, and although not located, three other nests (one early and two late) were successful because the pairs were found with dependent fledglings or juveniles. Each of 16 pairs of *parea* nested at least once. Three pairs (two of which had jessed one-year old females) nested once each during the breeding season, seven pairs nested twice each, four pairs nested three times each and two pairs nested four times each. Of the two one-year old females, one began incubating in late July when only nine months old, and the other began incubating in early September when 11 months old.

On 12 occasions pairs fledged a chick and re-nested. At least six of these re-nestings involved females laying their next clutch 4-8 days **before** the nestling in their previous nest fledged. For example, one pair began nest-building when they had a 35-36 day-old chick. When this chick fledged 11 days later, its parents had already been



**Figure 5** Monthly distribution of egg-laying dates for *parea* in the 1991-92 and 1992-93 nesting seasons, southern Chatham Island.

incubating for seven days. Thus, during the entire incubation period of the re-nesting, the pair were also feeding a nestling or fledgling.

**3.6.3 Nesting success** Only one of the 16 pairs failed to raise a fledgling. Seven pairs each produced two fledglings and one pair produced three. Thus, from the 37 nests, 24 nestlings fledged (1.5 fledglings/pair), a 65% success rate. The nesting success of the pairs differed markedly between their first and subsequent nests. From the 14 nests with eggs laid in before August, 13 (93%) produced fledglings. The one failure resulted when the egg presumably rolled out of the nest after it tilted during strong winds and rain. From the subsequent 23 nesting attempts only 11 fledglings were produced (48%). Of the 13 failed nesting attempts, one egg was abandoned early in incubation, one egg fell through its nest the day it was laid, one egg fell from a nest when the nest tilted during heavy rain and strong winds, two infertile eggs were abandoned after full-term incubation periods, the contents of two nests were preyed upon (an egg by an unknown predator and a late nestling by a harrier (*Circus approximans*)), and the reasons for the other six failures were not obvious. The two infertile eggs found after being abandoned represent 7.1% of the 28 nesting attempts for which fertility was ascertained. Both infertile eggs were laid by pairs that had already raised fledglings.

An effort was made to minimise the risk of rat predation at half of the nests by setting six rat traps about the base of each nest tree. Of 14 nests laid in before 1 August 1992, only one of seven protected nests failed (nest tilted) and none of seven unprotected nests failed (Table 3). However, of 18 nests laid in after 1 August 1992, six (60%) of 10 protected nests failed as a result of predations or possible predation compared with five (62%) of eight unprotected nests (Table 3). This difference is not significant (Fisher Exact test,  $p > 0.1$ ). Two other nests were not included in this analysis because one was in the Kawhaki Creek catchment (no possum or cat control) and the other was on the ground in the Tuku Valley about which cats, wekas and possums, as well as rats, were controlled.

**Table 3** Number of protected (six Ezeset rat traps baited with cheese at a 20-50 m radius about each nest tree) and unprotected parea nests that produced a fledgling or failed in 1992/93.

	Number of nests				Total
	Protected		Unprotected		
	Fledgling	Failed	Fledgling	Failed	
Nests found before 1 August	6	1	7	0	14
Nests found after 1 August	4	6	3	5	18
Total	10	7	10	5	32

<sup>1</sup> Two other nests were found, but were not included in this analysis; one located in the Kawhaki Creek catchment (no possum and cat control) and the other was on the ground in the Tuku Valley about which cats, wekas and possums, as well as rats, were controlled.

**3.6.4 Nests** Although tall canopy trees suitable for nesting in were available to each pair, 32% of the 37 nests found were in upper understorey shrubs or lower vegetation. The average nest height was 4.2 m (range = 0.0-8.9, s.d. = 2.47) compared with 5.9 m (range = 2.0-10.1, s.d. = 2.30) for the canopy height directly above the nests. Several nests were in trees and shrubs with almost horizontal trunks; these nests were readily accessible to cats, and even some to wekas (*Callirallus australis*). Two nests were on the ground and two were at about a metre high on fern and bracken fronds. As well as a high proportion of nests being readily accessible to possums, cats and rats, some were flimsy structures or were built in insecure locations resulting in tilting during incubation and loss of the egg.

Although no nests were re-used in consecutive attempts, two pairs used sites they had successfully used in the past. In both cases nests were rebuilt as all material had disappeared before the second nesting attempt. Pair A used the same site in each of the 1991-92 and 1992-93 breeding seasons. Pair B used the same site for their first and third nests of the 1992-93 breeding season.

Of the 34 nests found, 11 were situated on branches and/or twigs, 2 on branches and fern (*Cyathea* and *Dicksonia* spp.) fronds, 4 on branches and supplejack vines, 6 on fern fronds and supplejack vines, 5 on fern and bracken fronds, 2 in tree fern crowns, 2 on broad horizontal fern trunks, and 2 on the ground. Twelve (35%) of the nests were in patches of dense tree ferns, a habitat type that parea rarely otherwise use.

Thirty-two of the nests were thick platforms of twigs with a slight depression at their centres. However, the other two were inadequate structures, being small with no obvious depressions to restrict egg movement. Of the 21 successful nests monitored, 11 (52.5%) remained reasonably intact, five (23.8%) consisted of little material after the chicks fledged, but the other five disintegrated completely before the chicks fledged. In the latter cases the chicks were old enough to perch at the nest sites by the time most material had fallen from each site.

**3.6.5 Eggs** Each parea clutch found during the 1992-93 breeding season ( $n = 29$ ) consisted of one smooth, white, oval egg. Four eggs were measured after being abandoned ( $n = 3$ ) or having fallen from an insecure nest. All four egg shells have been submitted to the Museum of New Zealand, Wellington. These four eggs and the three previously measured (Powlesland *et al.* 1992) had a mean length of 51.2 mm (s.d. = 1.38) and a mean maximum width of 34.5 mm (s.d. = 0.80) (Table 4).

**3.6.6 Incubation** On no occasion were we able to record the day an egg was laid and the day it hatched. Therefore, the following three cases can be used only as a guide to the duration of the incubation period. At Nest 1 a parea was first seen sitting on the nest on 26 October. On 21 November (day 26) the egg was seen during the morning changeover, and on 22 November the nest contents were obscured during the changeover and no egg shell fragments were found on the ground beneath the nest. However, the following day (day 28) a chick was seen and shell fragments were found under the nest. Shell fragments were first found under Nest 2 on 3 November, 29 days after a parea was first seen sitting on the nest. Similarly, at Nest 3 the interval between

when a parea was first seen sitting and the first shell fragments were found (11 November) was 27 days.

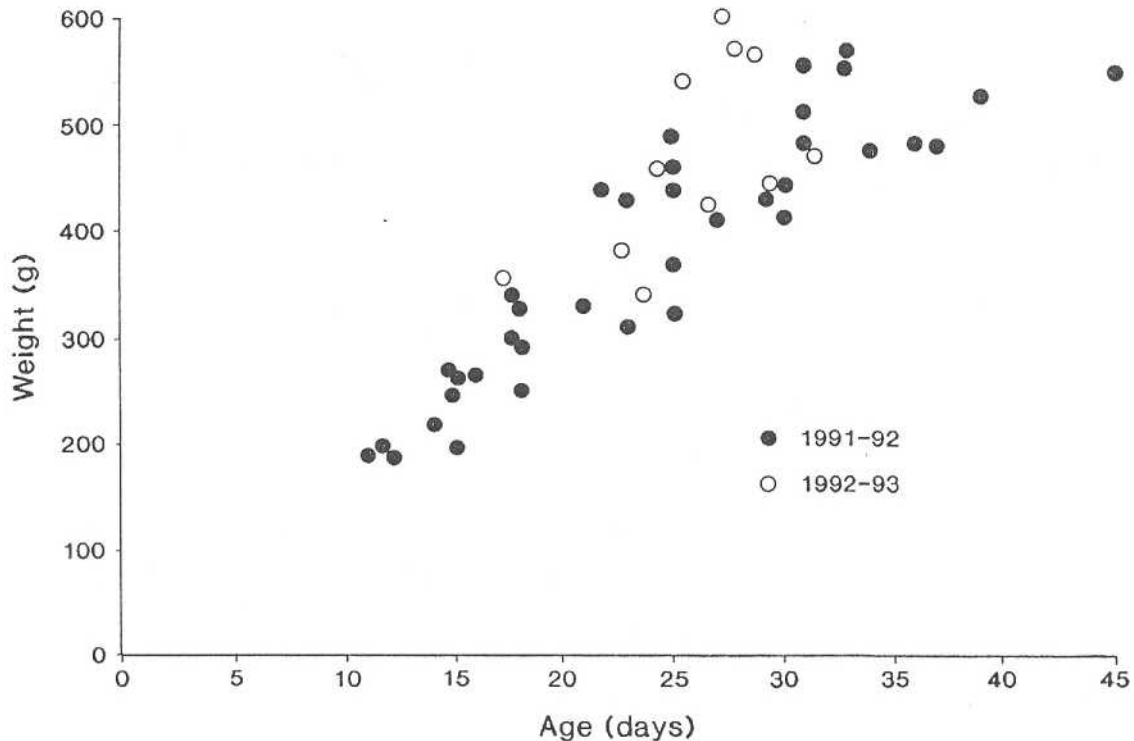
Changeovers at the nest occurred twice each day. During July to November, 23 morning changeovers were seen between 0909 and 1135 hours, with a mean time of 1021 (s.d. = 37 minutes). The 25 afternoon changeovers observed occurred between 1554 and 1845, with a mean of 1709 (s.d. = 51 minutes). From observations of two nesting pairs each with an identifiable member (radio-tagged and jessed), it was evident that the males (gender determined during copulation) incubated from mid-morning to late afternoon, and that females incubated the rest of the time. During incubation the relieving bird often brought a twig to the nest at changeover. Of the occasions when it was determined, 79% of 14 birds at morning changeovers each had a twig, and 80% of 10 birds at afternoon changeovers each had a twig.

**3.6.7 Nestlings** Compared with information obtained about the nestling period in the 1991-92 breeding season (Powlesland et al. 1992), little detailed information was obtained during the past season. However, the information gained does concur with that from the previous season. The estimated ages of three nestlings when first seen unattended were 8-10 days old (October), 11-12 days old (November) and 16-17 days old (December). Weights of nestlings during the 1992-93 season were similar to those of nestlings at the same age in the 1991-92 season, except that four, when 25-29 days old, were heavier (Fig. 6). A nestling of unknown age weighed 242 g on 28 September 1992 and 580 g on 15 October, a mean weight gain of 20 g/day. During this 17-day period the weight gain varied inconsistently from one 2-day period to the next from 11 to 35 g/day, and was probably related to how recently the chick had been fed.

We were asked by staff at the National Wildlife Centre to regularly weigh one or two nestlings from hatching because this information is required for hand-rearing of injured

**Table 4** Measurements (mm) and weights (g) of parea eggs.

Identity	Locality	Date collected	Length	Breadth	Weight	Comments
Siberia A	Awatotara	24-7-92	52.0	34.9	32	Nest tilted, embryo c.1 week old.
Toyota B	Tuku	5-10-92	51.6	34.7	29	Abandoned, infertile.
L. Doubters B	Tuku	6-10-92	52.9	33.5	27	Abandoned, infertile.
Slip	Tuku	18-10-92	52.6	33.7	-	Abandoned, embryo c.1 week old.
-	Chatham Islands	-	49.0	35.4	-	-
-	Cascade Gorge	17-10-85	49.6	35.5	-	-
Waterfall	Tuku	4-10-91	50.6	33.6	31	Found below nest, embryo c.1 week old.



**Figure 6** Weights of parea nestlings at various ages, in the Awatotara and Tuku study areas during 1991-92 (n=7) and 1992-93 (n=10).

or orphaned nestlings. The pair chosen for this investigation were nesting on the ground. After one weighing of the chick it was decided not to repeat the procedure for the following reasons:

1. The parent struck out at the observer with its wing so vigorously that there seemed a good chance of it injuring itself or the chick.
2. The parent flew to a roost nearby and so a young nestling would get chilled if its parent did not return promptly to brood it.
3. The defensive actions of a parent are likely to result in a nest in a tree tilting or collapsing.

On only one occasion was a live nestling found on the ground. This particular nestling was 30 days old ( $\pm 1$  day), about a fortnight from fledging. Its nest, sited 1.5 m up on bracken, had largely disintegrated. The nestling was placed near its nest and remained there until at least 29 September, when it appeared ready to fledge. One radio-tagged nestling, that seemed sufficiently developed to leave the nest, did so when approached and landed on the ground. It was unable to fly from the ground and so was caught and placed on a sloping trunk. Later the same day it flew across the Tuku River and subsequently was not found on the ground.

A nestling was considered to have fledged (flown from the nest) when it was found in a tree other than the nest tree. The estimated age at fledging of five nestlings was 43.4 days old (s.d. = 2.01, range = 40.5-46.5).

**3.6.8 Fledglings** In the 1991-92 breeding season we found that fledglings foraged little for themselves until they were about 70 days old (about 25 days after fledging) and then remained with their parents for a further 10 to 30 days (Powlesland *et al.* 1992). However, because some pairs in the 1992-93 season renested before their nestlings had fledged, this resulted in the first chicks receiving a reduced period of parental care. In one case for which we have accurate dates for nest building, egg laying and fledging, the fledgling had been away from the nest for only 20 days before the chick from the subsequent nesting attempt hatched. It seems unlikely that a pair is able to feed a fledgling and a recent hatching as each require different food. Studies of a variety of pigeon species have indicated that pigeon milk, a secretion of the adult crop, forms the complete diet of nestlings for the first few days, after which an increasing proportion of the diet offered is food items (Goodwin 1970, Robertson 1985). Whether the fledgling received any food from its parents once their next nestling hatched is unknown. However, all fledglings whose parents renested and successfully hatched their next clutch survived beyond independence. Thus, the age of independence in such circumstances may be as little as 65 days.

Once a fledgling no longer receives food from its parents we refer to it as a juvenile. In the cases where a pair raised a fledgling and either did not renest (Powlesland *et al.* 1992) or their next nesting failed prior to hatching (1992-93 season), their juvenile often remained with the pair long after it was able to feed itself. In addition, there were cases during the 1992-93 season when a juvenile was kept away by its parents from the vicinity of their subsequent nest, but was tolerated in their home range. Such juveniles moved and fed independently from their parents. However, once a pair stopped nesting, their juvenile often rejoined them. In one case where the parents had a juvenile and a fledgling, all four birds were occasionally seen in close proximity to each other in the pair's home range.

**3.6.9 Juvenile colouration** Several features of juvenile *parea* enable them to be distinguished from adults for up to eight months after becoming independent. At independence, juveniles have a reddish-brown beak with a dark brown tip. Skin at the base of the beak is bare or in pin, giving the bird a beaky appearance; feathers grow there two to three weeks after independence. Although the base of the beak gradually changes to red within about three months, the tip remains brown for six to eight months. The irises of juvenile *parea* are initially brown-black, and become red when the birds are about eight months old. Likewise, the eye lids change from brown at independence to red by the time the bird is eight months old. Initially the feet are pink or pink-brown, but gradually change to crimson/bright red when the bird is six to eight months old. Two plumage features can be helpful in distinguishing juvenile *parea*:

1. An area in front of, or around the eyes is sometimes fawn coloured, instead of the blue-green on adults.
2. Some juveniles have variable amounts of fawn-cinnamon coloured feathers at the top of the white breast. The fawn colouring can be a 10-15 mm band, as irregular narrow markings, or may be completely absent. The demarcation of the dark chest and white breast feathering is uneven on juveniles compared with the straight line of adults.

Most juveniles exhibit one of these characteristics, although some show neither. Observers should be aware that no one feature can be used to distinguish juveniles from adults, and that it is necessary to check for all juvenile features on a bird before deciding on its age.

### 3.7 Rat index trapping

Results of the index trapping indicate that, in general, rats in each study area were most abundant in autumn (April 1991, 1992, and 1993) (Table 5). They declined to low numbers from winter to summer 1992 in the Tuku Valley and Macrocarpa Gully, but numbers increased during the same period in the Awatotara Valley. A dead rat found by Graeme Taylor and Mike Imber in November 1992 on the track to the southern taiko burrows, Chatham Island was confirmed to be a kiore (*Rattus exulans*). Thus a careful check was made to determine the species of each rat caught during subsequent trapping sessions. Of the 16 rats captured in January 1992 and 37 identifiable rats captured in April 1993, one (6.3%) and 16 (43.2%) respectively were kiore, the rest being ship rats (*Rattus rattus*). Mice (*Mus musculus*) were also caught, and wekas (*Gallirallus australis*) occasionally sprung traps.

**Table 5 Results of seasonal rat index trapping (captures per 100 trap nights) during 1991/93 in the Awatotara Valley, Tuku Valley and Macrocarpa Gully, southern Chatham Island.**

9-11 April 1991	-	14.6	19.6
29 July - 5 August 1991	14.0	18.0	5.3
26 September - 7 October 1991	1.6	13.5	11.4
3-8 February 1992	6.8	13.5	1.8
2-5 April 1992	7.1	22.0	25.2
12-18 July 1992	1.2	13.4	10.4
1-6 October 1992	5.3	11.5	3.6
6-11 January 1993	14.3	4.2	4.0
21-23 April 1993	6.9	18.8	19.0

## 4. DISCUSSION

### 4.1 Numbers of parea

Although no dead adult or juvenile parea were found, there was circumstantial evidence that at least one marked adult died. This female was marked in July 1990, remained quite sedentary, and disappeared in November 1992. Because so few adult parea were individually marked prior to the 1992-93 field season, the significance of the one bird's disappearance cannot be assessed yet. Now that parea marked as nestlings are maturing and becoming established on home ranges within the study areas, and six resident adults were jessed in April 1993, a reasonable number of birds are available to monitor their survival and longevity in future. To date there seems to have been a high survivorship of marked parea; five of the six 1991 fledglings were seen in April 1993.

There were three pairs in the Awatotara in both 1991-92 and 1992-93, but the population in the Tuku study area increased from 12-14 pairs to 16. In addition, there were unpaired birds in both study areas bringing the total to about 45 adults in 1992, compared with about 33-37 in 1991: a 22-36% increase. We expect that the adult population will increase further during 1993 because of the large number of fledglings produced in 1992 and there seems to be suitable unoccupied habitat in the study areas for at least some of them to occupy.

### 4.2 Fruit availability, diet and movements

From October 1991 until about December 1992 there was fruit of a variety of species available to parea. The fruits of the species ripened in succession (Fig. 3) such that the diet of parea consisted mainly of fruit or fruit and 'pasture' species during the 15-month period (Fig. 4). The availability of fruit over an extended period was probably an important factor in promoting the early start to breeding in 1992 (Fig. 5) and for the continuation of nesting activities until February 1993. Research into the ecology of kereru at Pelorus Bridge, Marlborough, has shown that kereru also prefer a fruit diet and that the start of nesting coincides with a change from a mainly leaf to a fruit diet (Clout 1990).

The preference of parea for a fruit diet was evident during the first two years of this study. Whenever fruit has been scarce or unavailable in the pairs' home ranges but has been available elsewhere, such as in isolated small forest remnants or in tarahinau forest on the tablelands (both habitat types apparently unoccupied by territorial pairs but less than 1 km away), adults have briefly left their home ranges in the valleys to feed on fruit. One to four birds flying to and from the valleys was a regular sight during the October 1992 and January 1993 trips. The main fruit species fed on during the nesting seasons of 1991 and 1992 was hoho. It was noticeable that when hoho fruit was available in July 1992 that the fruits of supplejack, matipo and hokataka were ignored. Nutrient analyses of the pulp of the main fruits eaten may indicate why parea prefer hoho fruit and have bred when it has been available. Circumstantial evidence of the importance of hoho fruit for parea breeding is indicated by the early start to the 1992 breeding season and its extended duration when an abundant crop was available. Thus the continued conservation of hoho as a significant component of parea habitat seems vital for the conservation of parea. The mixed broadleaf forest in the valleys and



tarahinau forest on the tablelands provide hoho fruit at different times of year ensuring a long period of availability. If breeding of parea is found to be largely dependent on hoho fruit, then the opportunity is available through phenology observations to predict good and poor parea breeding seasons and then take appropriate management actions (e.g., intensify predator control before a predicted good breeding season).

The importance to parea of fruit sources outside the breeding season is not clearly evident yet. However, because leaves of trees, in general, are a relatively 'low energy' food which can be difficult to digest (Clout 1990), and kereru do not breed when their diet consists mainly of leaves, it would seem that fruit is important for the breeding of *Hemiphaga* pigeons. Having a variety of habitats within a small area (2-3 km radius) is the best way to ensure parea have access to a variety of fruiting species and that fruit sources are available for as much of the year as possible. Maintaining the diversity of foods for parea can be promoted by: protecting large tracts of land containing a variety of habitats (e.g., Tuku Nature Reserve) by fencing-out farmed stock and eradicating, or controlling introduced herbivores like possums, feral sheep, and cattle; by protecting scarce habitats (e.g., Blackberry Creek forest); and by planting species that increase the variety of parea foods (Powlesland *et al.* 1992).

We suspect that the early start to parea nesting in 1992 was related to two factors. First, there was abundant hoho fruit that began ripening in winter. Second, the diet of parea from the end of the 1991 breeding season to the start of the next consisted mainly of fruit. We assume that as a result of the availability of this readily digestible and nutrient-rich food, compared with leaves, the birds were able to moult quickly and attain excellent body condition so that many pairs were ready to breed when hoho fruit began to ripen, even though it was winter. Since most pairs have completed a long breeding season, were eating mainly leaves and twigs in autumn 1993, and phenology observations indicate there will be little hoho fruit available in winter-spring 1993, the comparison of parea breeding efforts in 1993 with that of 1992 should enable us to learn much about the ecology of the subspecies.

### **4.3 Breeding**

**4.3.1 Timing and duration of breeding season** That food supply is the primary factor controlling parea breeding is apparent because most pairs start nesting when other environmental factors are expected to make it an inappropriate time to nest; shortest daylengths and coldest temperatures of the year. Although kereru have been recorded nesting in winter, most nests have been found during spring and summer (Dunn & Morris 1985, Clout *et al.* 1988). Results from other studies indicate that food has a major impact on the timing and duration of pigeon and dove nesting. Pink pigeons (*Columba mayeri*) that fed on food supplements nested three months earlier than those that do not (Jones *et al.* 1992). Captive kereru at the National Wildlife Centre, Wairarapa, with *ad libitum* access to nutrient-rich foods frequently raised two or three chicks per annum (M. Bell pers. comm.). Similarly, the super-abundant and persistent availability of grain to collared doves (*Streptopelia decaocto*) in England was considered to be the main factor enabling some pairs to nest for nine months and to fledge up to five broods in a season (Robertson 1990). The long and productive parea breeding season in 1992 is likely to result in a significant increase in the number of birds, a very

important result for an endangered population. Just how often such productive seasons occur will require long-term monitoring of the population.

**4.3.2 Clutch overlap** Clutch overlap, whereby a pair starts another clutch while continuing to attend the nestling from their previous clutch, has been recorded for several species of the family Columbidae (Robertson 1985), including the kereru (Clout *et al.* 1988). It is regarded as a means by which a species can increase its reproductive output when it cannot increase clutch size (one egg) and/or has a brief energetically-limiting phase in the nesting cycle (production of crop milk for the young chick from a herbivorous, low-protein diet) (Clout *et al.* 1988). Presumably, parea are able to produce overlapping clutches only when food is particularly nutritious and readily available. Certainly, clutch-overlap decreased the time taken for a pair of parea to complete two nesting cycles from about 240 days (nest-building - 3 days, prelay - 5, incubation - 27, nestling - 45, fledgling - 40) to about 185 days, a 23% reduction. To determine the exact timing of when pairs start re-nesting in relation to their first cycle and for how many days the first fledgling is fed, a more detailed study of parea nesting would be required. The incidence of clutch overlap by parea in 1992 was at least 50% of the 12 occasions that pairs fledged a chick and re-nested. This seems a high incidence given that of 43 occasions that collared doves (with access to super-abundant and persistent grain) fledged a chick and re-nested, only 3 (7%) instances of clutch overlap were recorded (Robertson 1990).

The first fledglings raised by parea pairs involved in clutch overlap seemed to be fed by their parents for only about 20 days, compared with the 40 days indicated in 1991 when pairs raised only one brood each (Powlesland *et al.* 1992). Similarly, pink pigeons with access to food supplements provided only 10-20 days of parental care to their fledglings, whereas those pairs without access to such food cared for their fledglings for 60-90 days (Jones *et al.* 1992).

**4.3.3 Nesting success** The fledging success of 65% from 37 nests in 1992 is much the same as 60% from 10 nests in 1991. The low success of the 1992 nests in which eggs were laid after 1 August (37% from 19 nests, Table 3) was caused by a variety of factors. Of the six nests that failed where there was definite or possible predation, at only one was the predator identified (a harrier). Trapping of rats about nests did not improve the fledging success at late nests (Table 3). Perhaps this was, in part, because all nests were accessible to possums, and some were to cats and wekas as well. One way of determining the identity of predators of parea eggs and nestlings would be to set up time-lapse video cameras at some nests, as has been done at kokako (*Callaeas cinerea*) nests in Rotoehu Forest (J. Innes pers. comm.). We hope to determine the value of possum and cat control operations in the Tuku and Awatotara study areas by comparing the nesting success of parea pairs in these study areas with that of pairs in the Kawhaki and Waipurua study areas, where there has been no mammal control. For this comparison to accurately reflect the difference between the treated and untreated areas, it is important that no rat control be carried out near any parea nests. A feature of the rat index trapping results for the Tuku Valley, where 10 of the 16 monitored pairs lived, is that rat numbers remained fairly constant (1991-92) or decreased

(1992-93) during the parea breeding season (July-January) rather than increased, as would be expected then (Table 5).

That parea can nest successfully without rat control being carried out around nests was evident from the production from unprotected nests, and by the number of unjessed juveniles we saw (progeny of unstudied pairs). During October to December 1992, one to two unjessed juveniles were seen for every jessed one. This result also indicates that there were probably at least 20 breeding pairs of parea beyond, but in the vicinity of, the Awatotara and Tuku study areas that contained the 16 pairs we studied. That parea bred more successfully than usual in 1992 is suggested by the reports of parea being seen elsewhere on Chatham Island (Owenga, Waitangi, Big Bush and Henga) where they had not been for a few years (Gilmour 1993).

## **5. RECOMMENDATIONS**

1. A census of paired parea should be carried out in the Awatotara, Tuku, Kawhaki and Waipurua study areas just before or early in the nesting season (July-September) to provide comparative information about the number of parea present. To obtain the most accurate results, these censuses should be carried out by personnel familiar with the location of parea home ranges.
2. To determine whether parea nesting success needs to be bolstered by protecting eggs and nestlings from rat predation, all nests found during the 1993-94 season should be left unprotected. Occupancy of such nests should be determined from as far away as possible so as to reduce the likelihood of attracting predators to them. Any abandoned nest should be closely checked for any sign of predation.
3. Trapping and/or poisoning of cats and possums should be continued twice annually (March-April and September-October) in the Awatotara and Tuku conservation covenant areas and Abyssinia Valley.

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**APPENDIX I**  
**Details of all parea banded**

Band No.	Name	Date Banded	Jess Colour		Age	Pair/Nest	Notes
			Left .	Right			
K-8151	Floyd	10/07/90	Red	Red	A <sup>1</sup>	Awatotara (mn) <sup>2</sup>	
K-8152	Hadlee	10/07/90	Dk blue	Dk blue	A	Awatotara (mn)	
K-8153	Greenpeace	14/07/90	Green	Green	A	Generator Shed (mn)	
K-8154	Puke	15/10/91		Yellow	N	Motupuke (Pigeon Alley?)	
K-8155	Sporrin	15/10/91		Dk blue	N	Bumbag	
K-8156	Tbomas	02/11/91	Lime		N	Doubters	
K-8157	Metallica	18/10/91	Orange		N	Hadlee	
K-8158	T.P.	28/11/91			N	Siberia	DEAD
K-8159	Otago	28/11/91	Yellow	Dk blue	N	Toyota	
K-8160	Vicky	03/12/91	Lime	Pink	N	Punga	
K-8161	Dagg	12/12/91	Pink		A	Woolshed Bush (mn)	
K-8162	Toni	07/04/92	Yellow	Lime	N	Catch-22	
K-8163	Chris	30/07/92	Lime	Orange	N	Hadlee I	
K-8164	Alle	21/08/92	Dk blue	Pink	N	Pigeon Alley I	
K-8165	Pango	21/08/92	Lime	Dk blue	N	Punga I	
K-8166	Kerry	21/08/92	Yellow	Pink	N	Bike Park I	
K-8167	Ralph	21/08/92	Yellow	Orange	N	Bumbag I	
K-8168	Greensleves	21/08/92	Red	Lime	N	Toyota I	
K-8169	Littlepeacc	21/08/92	Yellow	Yellow	N	Greenpeace I	
K-8170	Cascade	28/08/92		Red	N	Waterfall I	
K-8171	Kadel	10/09/92	Pink	Orange	N	Eastenders I	
K-8172	Tegal	13/09/92	Dk green	Yellow	N	Lower Tuku I	
K-8173	Clockwork	18/09/92	Orange	Orange	N	Catch-221	
K-8174	T.P.	22/09/92	Pink	Pink	N	Siberia II	
K-8175	Breeze	15/10/92	Dk green		N	Greenpeace II	
K-8176	Lynn	15/10/92	Pink	Red	N	Bike Park II	
K-8177	Terra	15/10/92	Lime	Lime	N	Bumbag II	
K-8178	Merk	27/10/92	Yellow	Red	N	Puke	
K-8179	Sandy	03/11/92			N	Punga II	DEAD
K-8180	Mike	10/11/92	Red	Orange	N	Pigeon Alley II	
K-8181	Lou	28/11/92	Pink	Dk blue	N	Siberia III	
K-8182	Tuku	08/12/92			N	Lower Doubters III	DEAD

Band No.	Name	Date Banded	Jess Colour		Age	Pair/Nest
			Left	Right		
K-8183	Satch	21/12/92	Orange	Dk green	N	Bumbag III
K-8184	Eddy	13/01/93	Orange	Dk blue	N	Waterfall IV
K-8185	Sib	15/01/93	Orange	Yellow	A	Siberia adult (mn)
K-8186	Tangles	28/04/93			J	Waipurua (mn) DEAD
K-8187	Spike	28/04/93			J	Waipurua (mn) DEAD
K-8188	Bruce	28/04/93	Yellow	Black	A	Waipurua (mn)(#1) <sup>3</sup>
K-8189	Liz	28/04/93	Lime	Black	A	Waipurua (mn)(#1)
K-8190	Shorn	02/05/93	Lime	White	A?	Woolshed (mn)(#2)
K-8191	Fadge	02/05/93	Orange	White	A	Woolshed (mn)(#2)
K-8192	Folly	03/05/93	Pink	White	J	Toyota (mn)(#3)
K-8193	Olly	03/05/93	Yellow	White	A	Toyota (mn)(#3)
K-8194	Molly	03/05/93	White	Blue	A	Toyota (mn)(#3)
K-8195	Abby	05/05/93	Red	White	J	Slip (mn)
K-8196	Wart	05/05/93	Dk Green	White	A	?? (mn)
K-8197	Briar	20/07/93	Red	Blue	A	Blackberry (mn)
K-8198	Col	21/07/93	Red	Dk Green	A	Bumbag (mn)
K-8199		26/07/93	Blue	Lime	A	(mn)
K-11303		27/07/93	Blue	Dk Green	A	(mn)
K-11304	Canterbury	27/07/93	Red	Black	A	Pigeon Alley (mn) (#4)
K-11305	Dumbo	27/07/93	Lime	Dk Green	A	Pigeon Alley (mn) (#4)

2 (mn) = mist netted

3 (#number) = family association, i.e., member of pair or offspring of pair