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Mortality, distribution, numbers and conservation of the Chatham Island Pigeon (*Hemiphaga novaeseelandiae chathamensis*)

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ABSTRACT

The Chatham Island Pigeon or Parea (*Hemiphaga novaeseelandiae chathamensis*), is the endangered subspecies, endemic to the Chatham Islands, of the New Zealand Pigeon or Kereru (*H. n. novaeseelandiae*). During the early period of European and Maori settlement, 1820s to 1870s, Parea were common on Chatham, Pitt and Mangere Islands, but by 1990 the population possibly comprised fewer than 50 birds, mostly in forest habitats of the southern part of Chatham Island. Between 1989 and 1994, the numbers of feral cats and brushtail possums (*Trichosurus vulpecula*) were reduced in areas occupied by Parea in the Awatotara and Tuku Valleys of south-western Chatham Island. The adult Parea population of these valleys increased three-fold from 27 in 1990 to 81 in 1994. The long-term future of the Parea is dependent on the exclusion of cattle, pigs and sheep from forest reserves, keeping cat and possum numbers at low levels in Parea habitat on Chatham Island, and the establishment of a population on Pitt Island once cats have been removed from one or more of its reserves.

KEYWORDS: Chatham Island Pigeon, fruit pigeon, *Hemiphaga novaeseelandiae chathamensis*, mortality, distribution, numbers, conservation

INTRODUCTION

The Chatham Island Pigeon or Parea (*Hemiphaga novaeseelandiae chathamensis*) is a large (c. 800 g), endangered fruit pigeon, endemic to the Chatham Islands, New Zealand. It was first described as a distinct species (Rothschild 1891), but is presently regarded as a subspecies (Turbott 1990). The only other extant subspecies belonging to the monotypic genus is the Kereru or New Zealand Pigeon (*H. n. novaeseelandiae*), which occurs in the lowland native forests of New Zealand (Clout *et al.* 1995a).

Subfossil bones of the Parea have been found more frequently than any other forest bird in dune deposits 1000 years or older on Chatham Island (Atkinson & Millener 1991), suggesting it was a common species before humans arrived. Travers & Travers (1872), the first European naturalists to publish an account of the Chatham Islands' birdlife, described Parea as common on Chatham, Pitt and Mangere Islands (Fig. 1) during 1871-72. Although the Chatham Islands had been occupied by Moriori (the first Polynesian settlers) for 300-350 years prior to the Travers' visit (McFadgen 1994), large scale destruction of the Parea's forest habitat did not begin until the islands were colonised by Europeans and Maori during the 1820s and 1830s (Ritchie 1970, King & Morrison 1990). In addition to burning and felling forest to create farmland, and hunting the larger birds, including Parea, the Europeans and Maori introduced several species of mammals. Cattle, sheep, pigs, horses and later brushtail possums (*Trichosurus vulpecula*) established wild populations which prevented regeneration of many forest species and killed some trees by ring-barking (Cockayne 1901). Dogs, cats and three rat species (*Rattus exulans, R. rattus* and *R. norvegicus*) have probably taken a heavy toll of many of the Chathams' endemic birds, which had evolved in the absence of mammalian predators. Feral cats are presumed predators of adult Parea (Powlesland *et al.* 1995), possums eat many of the same food items as Parea (Tisdall 1992), and probably take Parea eggs and nestlings (Brown *et al.* 1993, Clout *et al.* 1995b), and ship rats (*Rattus rattus*) are presumed nest predators (Clout *et al.* 1995b). By 1938 few Parea were seen north of Waitangi, Chatham Island (Fig. 1), but they remained moderately numerous in forested areas to the south (Fleming 1939). By 1975, Parea were seen only sporadically north of Waitangi and were considered rare in the southern forests of Chatham Island (Merton & Bell, unpublished).

A survey over southern Chatham Island in 1978 indicated that Parea probably numbered less than 100 individuals and were continuing to decline (D.E. Crockett pers. comm.). Subsequently, the Wildlife Service transferred four Parea to Rangatira Island in February 1984 and nine more in January 1985 in an attempt to establish a population on an island free of mammalian competitors and predators (Butler & Merton 1992). Although a pair, including at least one transferred (banded) bird, attempted to breed on the island (M. Bell, pers. comm.), they failed to establish a population there. In 1988-89, the Department of Conservation, with assistance from the Chatham Island Taiko Expedition, carried out surveys of the Chatham Island's fauna, particularly of forest and scrub-covered habitats. Results from these surveys, and other information available for areas not surveyed indicated that the Parea population possibly consisted of fewer than 50 birds. During 1990-94, an intensive research and management programme aimed at the long-term conservation of Parea was undertaken over south-western Chatham Island centred on the Awatotara and Tuku Valleys (Fig. 2). This paper presents the information obtained during 1978-94 on the distribution and numbers of Parea, and the management activities that have probably contributed towards the initial recovery of the subspecies.

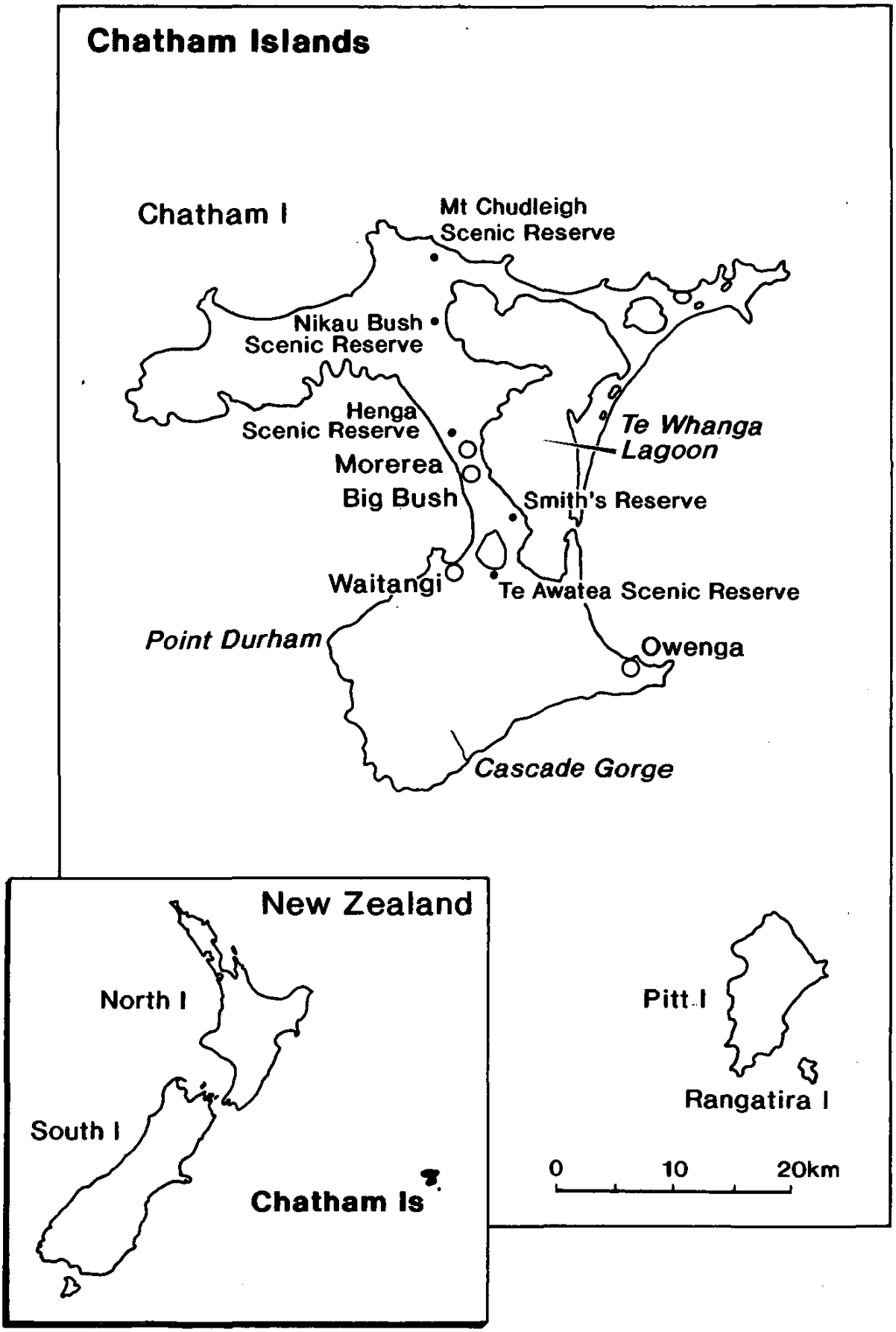

FIGURE 1 - Chatham Islands and the locations of some places mentioned in the text

STUDY AREA

The Chatham Islands lie about 860 km east of Christchurch, South Island, New Zealand (Fig. 1). The climate is cool, cloudy, windy and showery, although the winters are relatively mild, with few frosts (N.Z. Meteorological Service 1983). The tableland of south-western Chatham Island, where most Parea research and management has been carried out, reaches only about 290 m a.s.l., but the land is deeply dissected by numerous valleys (Fig. 2). For a description of the vegetation of the study area, see Powlesland *et al.* (1997). The intensive fieldwork was carried out from July 1990 to December 1994, mainly in the forested Awatotara and Tuku Valleys (44° 04'S, 176° 38'E), with occasional visits to forest patches in the Kiringe, Blackberry, Macrocarpa, Kawhaki and Waipurua Valleys (Fig. 2).

METHODS

Marking and mortality

Adult and juvenile Parea were caught in mist nets erected at feeding sites, particularly where birds fed on pasture, and nestlings were removed from nests for marking when 20-35 days old. Each bird was marked with a numbered metal band and a unique combination of coloured leg tags for individual identification. The tags were strips of plastic-coated cloth, 13 x 120 mm, and were spliced around the leg so that a 50 mm length trailed from the back of the leg. A Parea was assumed to have died if not seen for a year.

Distribution and numbers

Data on Parea numbers were obtained from a variety of sources. Members of the Chatham Island Taiko Expedition led by D.E. Crockett provided estimates of Parea present during 1972/73 and 1987/88. The estimates are based on the maximum number of birds seen incidentally from day to day in each of the named locations (Table 1) during field work. The estimate by Morris (1979) was based on indentifying individuals by regularly noting the location and differences in the pattern of tail moult of birds during 12 days in Cascade Gorge (Fig. 1). In January 1978, there was a concerted effort by Taiko Expedition members to census the Parea population by having teams on five vantage points for three hours (10:00-13:00) in radio contact with each other. Likewise, during January 1985, members of a Wildlife Service party (Freeman 1994) during an operation to capture Parea in Cascade Gorge and about Murphy's Hill for transfer to Rangatira Island (Butler & Merton 1992), recorded the number of Parea seen from vantage points each day and from the figures concluded how many birds were likely to be in each area. Access to Cascade Gorge was prohibited after 1985, so no further data are available from that area.

In November 1988, Department of Conservation staff and Taiko Expedition members surveyed 164 one-kilometre squares (NZMS 260 series) that contained forest and scrub habitats. This survey covered much of Chatham Island south of a

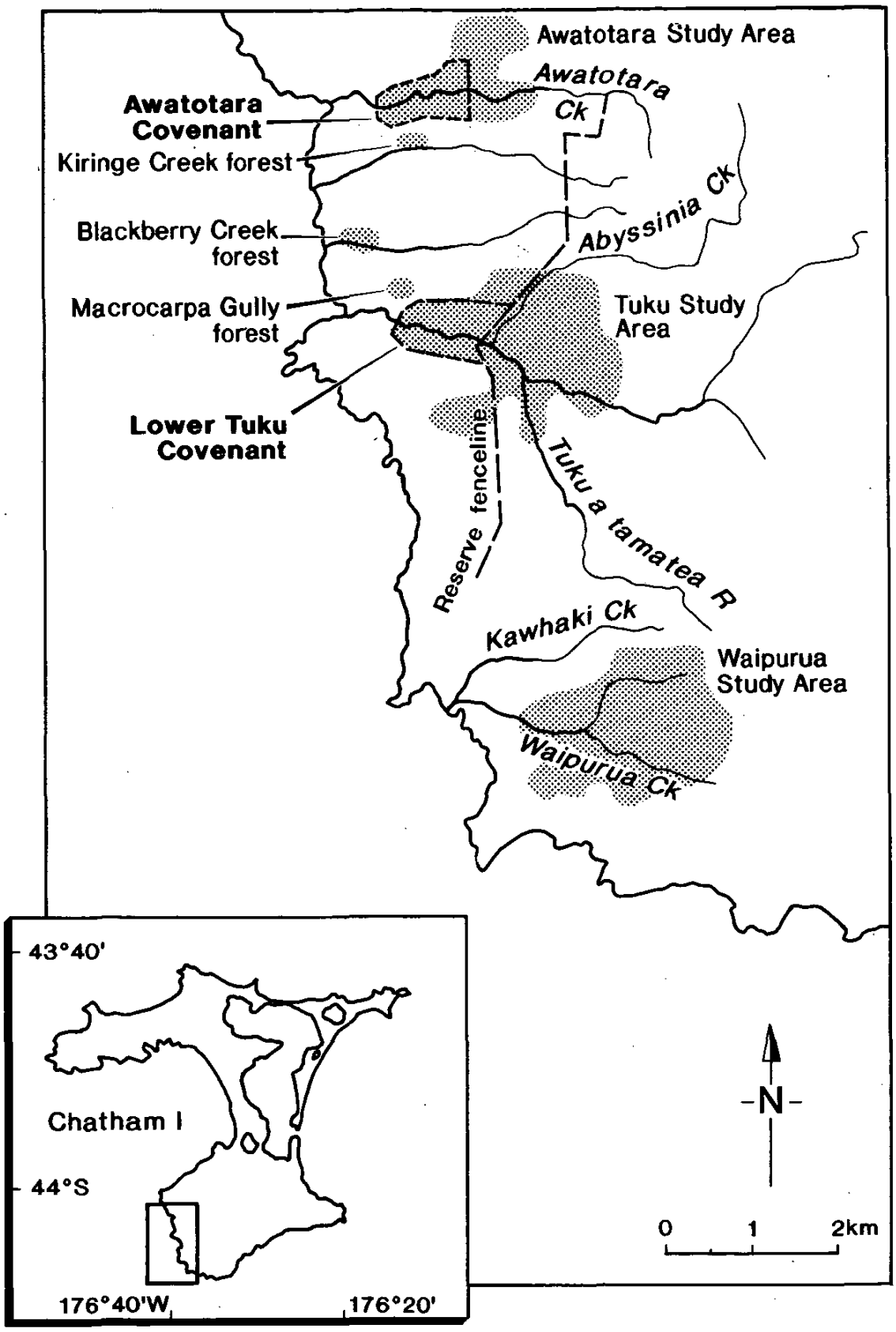

FIGURE 2 - Locations of some places on Chatham Island mention in the text

line from Point Durham on the west coast and Owenga on the east (Fig. 1). The locations of all Parea seen or heard, feathers and distinctive feeding signs were noted.

During 5-16 July 1990, M. Clout & C. Robertson (unpublished) spent up to two hours on various vantage points about the Awatotara, Tuku and Kawhaki Valleys, in part, to determine the numbers of Parea present. In October and November 1990, P. Pearson & G. Climo (unpublished) continued the counts of Clout & Robertson, but over a slightly more extensive area. Their counts were carried out during fine evenings from vantage points and each lasted for at least two hours.

From September 1991 to December 1994, censuses of Parea in the Lower Tuku, Upper Tuku and Abyssinia Valleys (catchments of the Tuku-a-tamatea River), Awatotara and Kiringe Valleys (these five localities being the study areas), and the Waipurua and Kawhaki Valleys (Fig. 2) were made by a Department of Conservation research team and volunteers during a study of the biology and ecology of Parea (Powlesland *et al.* 1995, Powlesland *et al.* 1997). The censuses were carried out early during breeding seasons (July-October) when pairs were fairly sedentary and conspicuous by roosting above the canopy on prominent perches, and giving display flights. Observers, in contact by two-way radios, were located on vantage points above a section of study area for up to four hours, mainly about mid-morning and mid to late afternoon when incubating birds changed over at nests (Powlesland *et al.* 1995). In order to locate all pairs and their nests, all sections of the study areas were observed in the above manner several times each month during breeding seasons. Thus accurate counts of pairs were obtained, but only a minimum estimate of the number of non-territorial birds (mainly immatures) present, because such birds were less conspicuous and occasionally moved in and out of the study areas (Powlesland *et al.* 1995). Department of Conservation staff stationed on Pitt and Rangatira Islands supplied information on Parea seen there.

Control of predators and browsers

Since November 1987, various methods have been used in the Tuku and Awatotara Valleys to reduce the numbers of introduced mammals, principally to improve the conservation prospects of the Chatham Island Taiko (*Pterodroma magentae*). Feral cats were targeted for control, but considerable numbers of brushtail possums and ship rats were also removed (Imber *et al.* 1994). For details of the types of baits used, details of control, and the numbers of various species removed, see Imber *et al.* (1994).

Following the legal protection (1991) and fencing (1992-93) of parts of the lower Tuku River and lower Awatotara Stream catchments (92 ha in total, Fig. 2), sustained possum control was begun in these blocks (Brown, unpublished). Permanent bait stations were set up at 75 m intervals along the perimeters, and at 250 m intervals along lines through the blocks. The stations were filled with pellets containing the toxin brodifacoum (Talon^{R}), at six-monthly intervals. Index trapping indicated that possum densities were reduced from 1-3 ha^{-1} to <1 ha^{-1} (Brown, unpublished).

Although dead rats were seen near bait stations, it is unknown whether the poison had a significant impact on the ship rat population or indirectly on the feral cat population (by eating poisoned rats).

After the fence along the western boundary of the Tuku Nature Reserve (Fig. 2) was completed in 1985, farm stock were prevented from entering the reserve, and feral cattle and sheep found within the reserve were shot. Most animals were shot near the fence as this was the area most often visited by people. This culling enabled better survival of tree seedlings in the forest than previously, but sustained improvements in regeneration were seen only in forest patches elsewhere which were fenced to exclude stock completely.

RESULTS

Mortality

Nineteen adult Parea were tagged between July 1990 and April 1994. For these birds the total time elapsed from the month of tagging to the month when each was last seen was 22.4 'bird-years'. None were found dead, but one is assumed to have died because it has not been seen for more than a year. This one 'death' represents a mortality rate of 0.04 deaths per bird-year, or an annual survival rate of 0.96. The mortality rate equates to a mean life expectancy (2-m/2m, where 'm' is the annual mortality, Landsborough Thomson 1964) of 24.5 years. Of six Parea marked as nestlings in 1991, none have been found dead, but two have not been seen for more than a year. The mortality of this cohort during 12.4 bird-years, assuming the two unsighted Parea were dead, was 0.16 deaths per bird-year (5.7 years mean life expectancy). Similarly, the mortality rate of the 1992 cohort of 26 Parea (23 jessed as nestlings and three as juveniles) was 0.13 deaths per bird-year (three known deaths and one disappearance during 30.5 bird-years). These mortality figures are maxima because only three of the seven Parea deaths were confirmed. Two Parea were seen in the study areas after being "missing" for more than a year.

Distribution and numbers

Anecdotal information suggests that by the 1970s Parea were seen only irregularly north of Waitangi, with the majority of birds confined to southern Chatham Island (Merton & Bell, unpublished). Although not all suitable habitat was surveyed in January 1978, the number of Parea seen or heard indicated that the population probably did not exceed 60 birds (Table 1). Comparison of the results of this survey with the January-February 1984 and January 1985 observations of a Wildlife Service team (capturing Parea for transfer to Rangatira Island, Butler & Merton 1992) suggests that during the intervening six years that the population had declined to less than 50 birds, and had become concentrated in Cascade Gorge (Table 1), on the southeast coast of Chatham Island (Fig. 1).

TABLE 1. Numbers of Parea seen at various locations on Chatham Island, Pitt and Rangatira Islands, 1972-94 The number of fledglings are in parentheses. See Figure 1 for locations.

Location	1972-73	Mar 1977	Jan 1978	1984-85	1987-88	July 1990	Oct 1990	Nov 1990	Sep 1991	Feb 1992	Aug 1992	Sep 1993	Oct 1993	Aug 1994	Dec 1994
Awatotara Valley	6	-	6	-	6	4	7	6	8	7	8(1)[2]	11	11(1)	11(1)	11(5)
Kiringe Valley	-	-	-	-	1	-	-	-	-	-	-	2	4	2	2(1)
Lower Tuku	-	-	-	-	0	-	0	0	4	10	10	26	26	25(2)	25(8)
Upper Tuku	8	-	5	2	10	10	18	15	12	15	15(4)	12	12	14(2)	18(5)
Abyssinia Valley	-	-	-	-	-	-	-	6	9	8	15(3)	23	23(2)	24(3)	25(8)
Study area total	14		11	2	17	14	25	27	33	40	48(8)	74	76(3)	76(8)	81(27)
Murphy's Hill	-	-	4	4	-	-	-	-	-	-	-	-	-	-	-
Waipurua Valley	-	-	12	5	2	-	-	8	-	2	-	-	7	8	5
Kawhaki Valley	-	-	-	-	-	2	-	-	-	-	2	-	-	-	1
Rangaika Reserve	-	-	-	-	2	-	-	-	2	-	-	-	-	-	-
Cascade Gorge	-	10	9	10	-	-	-	-	-	-	-	-	-	-	-
Te Awatapu	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Te Awanaga	-	-	2	-	3	-	-	-	-	-	-	-	-	-	-
Upper Nairn River	-	-	4	-	2	-	-	-	-	-	-	-	-	-	-
Wharekauri	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Pitt Island	-	-	-	2	-	-	3	-	-	0	-	-	-	-	-
Rangatira Island	-	-	-	-	1	-	-	2	-	2	-	-	2	-	-

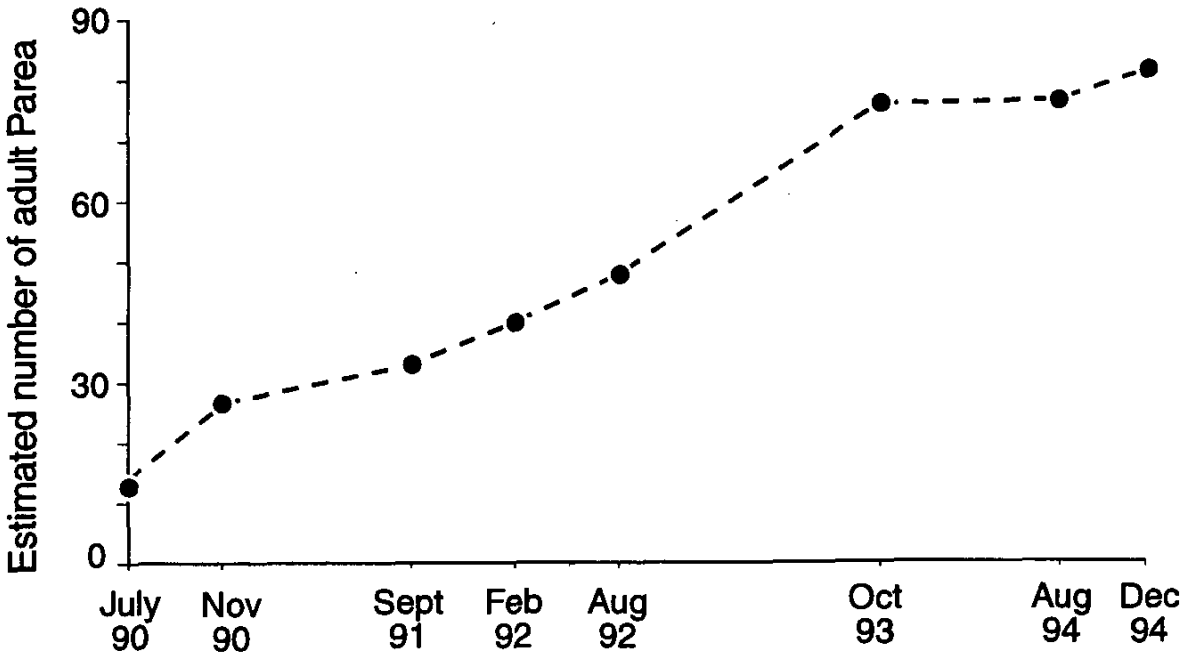

FIGURE 3 - Total number of adult Parea in the study areas (Awatotara, Kiringe, Abyssinia, Upper Tuku and Lower Tuku), Chatham Island, during 1990-94

In November 1988, the number of Parea seen in the Awatotara, Kiringe, Tuku and Abyssinia Valleys was similar to the counts in the 1970s. Even assuming that 10 birds still lived in Cascade Gorge, the counts suggest a population of about only 50 birds.

Annual censuses of Parea in the study areas (Table 1) indicated that the number of adult and fledgling Parea in the study areas increased four-fold over the four-year period from November 1990 (27 birds) to December 1994 (108). Even if adult Parea only are considered, the increase is three-fold (Fig. 3). By late 1994, when our monitoring ceased, the total population was estimated at 140-150 birds.

As well as the marked increase in the number of Parea in the study areas after the 1992-93 breeding season (June-February), sightings of Parea were reported by the public from sites where they had not been seen for several years, including Waitangi, Owenga, Moreroa and Henga Scenic Reserve (Fig. 1; S. Sawyer pers. comm.). However, on Pitt and Rangatira Islands, Parea numbers during 1990-94 remained at less than five on each (Table 1).

DISCUSSION

Mortality

The mortality rates of the three groups of Parea are possible maximums because birds that were assumed to be dead after not being seen for a year may have been alive for all or part of that year. Dispersal of juveniles out of the study areas may partially explain why the calculated mortality of the young birds was greater than that of adults. Most adults marked were members of territorial pairs which remained

in or around the areas where they were captured. In contrast, some of the marked nestlings dispersed several kilometres (Powlesland *et al.* 1995) and those not seen for a year may have moved to the extensive forest areas outside the study areas that were not searched for Parea.

A mean life expectancy of 24.5 years for adult Parea is consistent, in part, with their low reproductive rate (one chick/nest, not all pairs breed each year; Powlesland *et al.* 1997). By comparison, the mean life expectancy of adult radio-tagged Kereru at Pelorus Bridge during 1983-91 was 5.4 years (Clout *et al.* 1995a), and in Northland about 1.2 years (Pierce & Graham 1995). Given the breeding effort and success of Parea in 1991-94 (Powlesland *et al.* 1997), the high survival of adults and reasonable survival of juveniles during the study, it is not surprising that the population increased in the study areas.

Initial recovery

During the 1970s and 1980s, the total Parea population probably declined to about 50 birds, with the majority in Cascade Gorge, Awatotara Valley and the upper Tuku-a-tamatea River catchments (Table 1). Annual censuses of Parea in the study areas (Awatotara, Kiringe, Lower Tuku, Upper Tuku and Abyssinia Valley catchments) from 1990 to 1994 indicate that the population there began increasing in 1990 or earlier, coinciding with extensive trapping and shooting of introduced mammals, particularly feral cats, brushtail possums, and feral cattle and sheep. It is possible that the marked increase in Parea numbers counted in the study areas (44%) from July to October 1990 (Table 1) resulted from birds immigrating from other areas, such as Waipurua Valley, where the habitat was deteriorating due to browsing by stock and possums. This is suggested because Parea breeding effort varies annually, depending on fruit availability (Powlesland *et al.* 1997), and neither of two radio-tagged females nested and no fledglings, with their distinctive bill and plumage coloration (Higgins & Davies 1996), were seen during or immediately after the 1990-91 breeding season (P.E. Pearson pers. comm.). Whether a significant number of Parea lived in Cascade Gorge after 1985 is unknown, but by 1993 the catchment of the Tuku-a-tamatea River contained the majority of the known Parea (Table 1, Figs 1 & 2).

Predators and browsers

Unfortunately, the exact reason(s) for the improved status of the population is not known. This is because intensive efforts to reduce the numbers of introduced mammals in the study areas began in 1989, a year before our research did. Few Parea lived in the Waipurua and Kawhaki Valleys (Table 1) and so we were unable to mark and monitor sufficient Parea in an area where no mammal control was occurring. However, Parea numbers increased in the study areas once most cats and possums were removed. It is now evident that a Parea population has the potential to increase fairly rapidly when predation is low and certain fruits are readily available, resulting in high nesting success; many pairs have reared two, and rarely three, fledglings in a season (Powlesland *et al.* 1997).

During spring and summer Parea spent much time feeding on the ground (Powlesland *et al.* 1997) at the forest edge and in forest gaps. The fresh remains of two cat-eaten Parea found in forest gaps during the study suggest that, prior to the control programme, feral cats sometimes killed Parea feeding on the ground.

Parea were common on Pitt Island in the 1870s (Travers & Travers 1872), but within 100 years had been all but exterminated (Table 1). The only predators likely to have killed Parea there were feral cats and people. While forest clearance for farms and hunting by people would have been partly responsible for the decline of Parea on Pitt Island, it is likely that predation by feral cats was a significant additional factor; possums and rats have not reached the island. Even as early as 1867, Travers & Travers (1868) noted that cats were common in the bush of Chatham and Pitt Islands, and attributed the decline of land birds to this predator. The brushtail possum is a relatively recent colonist of southern Chatham Island, having been uncommon there until the 1950s; it was not seen in the Waipurua catchment until 1970 (D. Holmes pers. comm. *in* Tisdall 1992). It too may have contributed to the decline of the Parea. Although we have no evidence of possums having eaten Parea eggs or nestlings, they are known to take Kereru eggs (Pierce & Graham 1995). If the possum was a significant predator of Parea, then the removal of thousands from the study areas during 1989-94 to levels of less than one per 100 trap-nights has been sufficient, in conjunction with reduced feral cat numbers, to enable the Parea population to increase.

Although competition for hoho fruit has not been demonstrated, possums frequently ate ripe hoho fruit (Tisdall 1992), which is vital to promote and sustain nesting of Parea (Powlesland *et al.* 1997). It therefore seems likely that hoho fruit consumption by possums could reduce breeding opportunities for Parea by increasing the frequency of years when insufficient hoho fruit is left to promote breeding and by reducing the number of clutches per pair. Possums are also responsible for bark-stripping of hoho and hokataka (*Corokia macrocarpa*) trees, reducing fruit production and increasing tree mortality (Tisdall 1992). Therefore, until more definitive evidence is available on the impacts of feral cats and brushtail possums on Parea, it is vital that managers continue to maintain the numbers of these two mammals to the lowest possible levels in Parea habitat.

Parea and forest regeneration

The diversity of fruiting tree species in the forests of Chatham Island may be dependent on seed dispersal by Parea, particularly those species with medium to large fruits (minimum diameter of >10 mm), such as the supplejack (*Ripogonum scandens*), nikau (*Rhopalostylis sapida*) and kopi (*Corynocarpus laevigatus*). The Parea was the only species seen swallowing whole fruit of supplejack and kopi. Both species are widespread in Chatham Island forest patches. Even though these species are a minor component of Parea diet (Powlesland *et al.* 1997), they should continue to regenerate well as long as stock are excluded and possum numbers controlled to low levels in reserves. Fruit-bearing nikau palms are now restricted

largely to areas infrequently visited by Parea (e.g. Nikau Bush Scenic Reserve and Mt Chudleigh Scenic Reserve). The establishment of a network of protected areas of forest habitat north of Waitangi (Te Awatea Scenic Reserve, Smith's private reserve, Big Bush Covenant, Henga Scenic Reserve, Nikau Bush Scenic Reserve, and Mt Chudleigh Scenic Reserve; Fig. 1) could assist the recolonisation by Parea of the northern part of Chatham Island. These forests are beginning to regenerate now that stock are fenced out, and further improvements in habitat quality can be expected in response to the Department of Conservation's possum control operations in some of these reserves. This requires a long-term commitment to maintain the fences and keeping possum numbers at low levels.

Many of these areas are not yet ideal Parea habitat because important food species have become locally extinct or rare. For example, hoho was formerly abundant in forests north of Waitangi. Tree-felling, and bark-stripping and browsing by horses and other introduced herbivores (D. Holmes pers. comm.) have resulted in mature hoho trees being rare in Henga Scenic Reserve and Mt Chudleigh Scenic Reserve. At Big Bush Covenant they are confined to a few steep bluffs inaccessible to stock. Nikau palms have disappeared for similar reasons from many areas, including the Tuku Valley. Seed dispersal by Parea from one isolated forest patch to another will increase the plant species diversity of individual patches, ultimately improving the habitat for Parea and other fauna. In the long-term, it is hoped that each forest patch will support several resident pairs of Parea, but this may not happen for several decades where mature hoho trees are currently rare or absent.

The immediate conservation of the Parea is dependent on the survival of the population in south-western Chatham Island. It is therefore important to establish a second population, preferably in a predator-free environment. This would ensure that the conservation of at least one population of the Parea was not dependent on an ongoing and costly predator and browser control programme. The most suitable site to establish another Parea population is in the forest reserves of Pitt Island, once feral cats have been removed. The removal and exclusion of cats from those reserves is underway.

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