

# Status and Conservation of Shorebirds in the East Asian-Australasian Flyway

Proceedings of the Australasian Shorebirds Conference  
13-15 December 2003, Canberra, Australia

Edited by Phil Straw



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# Gains and Losses in the New Zealand Shore Plover (*Thinornis Novaeseelandiae*) Recovery Programme 1993-2003

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## Abstract

The New Zealand Shore Plover (*Thinornis novaeseelandiae*) is an endemic plover with a total population of less than 200 birds. It disappeared from the mainland of New Zealand during the 19th century and has been confined to one or two small islands in the Chatham archipelago for the past 100 years. Because of its small population size, the Shore Plover is classified as Endangered. This paper outlines the recovery effort undertaken in recent years, with particular emphasis on attempts over the past decade to found new populations of shore plover on the Chatham Islands and around mainland New Zealand. On the Chatham Islands, birds have been re-introduced to Mangere Island and are breeding; however, the island has little suitable habitat and the long-term future of this population is not clear. A previously unknown population on a small reef was discovered in 1999 but had declined to effective extinction within four years of discovery. Around mainland New Zealand, first attempts to found a new population were made on Motuora Island, where a total of 75 birds were released between 1994 and 2000. Two pairs bred on Motuora but rates of dispersal were high and predation by avian predators occurred, and a population did not establish. The second attempt, on a privately owned island, began with a release in 1998 and has been successful, with a resident population of about 55 birds, including 11 breeding pairs present in autumn 2003. Modelling of demographic data suggests that in the absence of a predator irruption or a drastic fall in productivity, this population is established and self-sustaining. In 1993, the species totalled about 150 individuals, most of them in one location. There have been gains and losses, but in 2003 the total and effective populations in the wild were slightly larger than in 1993. Most importantly, the immediate risk of extinction has been reduced by the founding of a second population.

Keywords: Shore Plover, *Thinornis novaeseelandiae*, threatened species, Chatham Islands, translocation, conservation, recovery programme

## Introduction

The New Zealand Shore Plover (*Thinornis novaeseelandiae*) is a threatened endemic shorebird and one of the rarest plovers in the world. The present distribution of the species suggests that it is highly susceptible to predation by introduced mammals (Dowding & Murphy 2001). Until the 1870s it occurred on mainland New Zealand, but following the introduction of rodents and cats it became confined to the Chatham Islands, about 800 km east of New Zealand (Davis 1987). With the spread of predators to main Chatham Island and then to Pitt and Mangere Islands, its range became further restricted. For the past century, the species has probably numbered less than 200 individuals and, until very recently, been confined to one or two small islands.

In recent times, the bulk of the population has been on South East Island (Rangatira). Banding and monitoring of this population by the New Zealand Wildlife Service began in the 1960s (Flack 1976), and it has been studied and monitored more intensively since the mid-1980s (Davis 1994a, 1994b). The greatest threat to the South East Island population is undoubtedly the introduction of predators, although habitat changes have caused a gradual decline. Fire and disease are also potential threats. The urgent need to establish further populations has been repeated often (Flack 1976, Davis 1987, Dowding & Kennedy 1993).

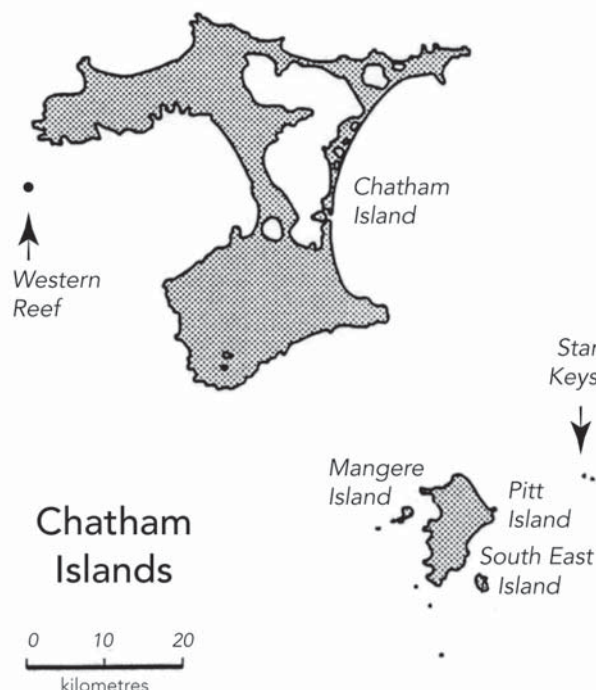


Figure 1. Map of Chatham Islands showing locations mentioned in the text.

The shore plover is currently recognised internationally as Endangered because of its very small population (BirdLife International 2000). In the New Zealand Department of Conservation's national threat classification (Molloy et al. 2001), the species is classed as Nationally Critical (Hitchmough 2002), the highest category of threat.

A recovery programme for the species has been set up with the aim of protecting existing populations and establishing new ones. As part of the programme, a captive population is maintained at two institutions and juveniles are bred for release. The current recovery plan (Aikman et al. 2001) sets out the programme for the ten years 2001-2011 and has a goal of maintaining or establishing shore plover at five or more locations with a combined population of 250 or more by 2011.

This paper outlines the recovery effort undertaken over the past decade, with particular emphasis on the successful establishment of a new shore plover population. In 1993, the species was clearly extremely vulnerable, with a total population of about 150 individuals, 85% of them in one location. There have been gains and losses, but in 2003 the total wild population is slightly larger than in 1993 and there are more breeding pairs. Most importantly, the immediate risk of extinction has been reduced by the founding of a second self-sustaining population on an island off mainland New Zealand. Further releases are planned on the Chatham Islands and around mainland

## Methods and study sites

### *Chatham Islands*

A map of the Chatham Islands (Figure 1) shows locations mentioned below. The population on South East Island (220 ha) is monitored annually. Counts of the total population and the number of territorial pairs are undertaken at the start and end of the breeding season. Band sightings are recorded and juveniles are banded.

Each January from 2001-2003 inclusive, 13-15 juveniles were captured on South East Island, banded and transferred to an aviary on Mangere Island (140 ha). Following a holding period of 1-2 weeks, the birds were released. Shore plovers on Mangere Island are monitored during the breeding season and juveniles are banded.

Following the discovery of a small, previously unknown population on the 8 ha Western Reef in 1999 (Bell & Bell 2000), it was surveyed nine times between February 1999 and June 2003. The reef lies 5 km off the north-western corner of Chatham Island and is exposed to the prevailing weather; access is difficult because landing requires calm seas.

### *Mainland New Zealand*

The release strategy was outlined by Aikman (1999). Eggs were transferred from South East Island to two institutions on mainland New Zealand in the early-mid 1990s and used to found a captive population (Aikman et al. 2001). Juvenile birds reared in captivity from this stock were transferred to aviaries at the release site and held for variable periods. Following release, birds were monitored intensively for one month, with less-intensive monitoring after that time. The two main factors governing the choice of release sites

were (a) the absence of mammalian predators and (b) the existence of suitable coastal habitat for feeding, nesting and brood rearing.

### *Motuora*

The Motuora Island programme was described and results were reported and analysed by Davis & Aikman (1997), Taylor et al. (1998) and Aikman (1999).

### *Release Site 2*

The second release site chosen was a privately owned island off the coast of mainland New Zealand. Permission to release and manage shore plover was granted by the owners on condition that the programme was not publicised, and the site is therefore referred to here as Release Site 2 (RS 2).

Since breeding began in 1999/2000, there has been intensive management and monitoring of shore plover each breeding season, with the island permanently manned from October or early November to February or early March. There have been numerous day trips outside this period, as well as trips of several days duration for annual releases.

Avian predators have been controlled at RS 2. Southern black-backed gulls (*Larus dominicanus*) were considered a major threat to breeding success and a colony of about 200 pairs was controlled to very low levels in November 1999. Periodic control of small numbers of gulls, Australasian harriers (*Circus approximans*) and Australian magpies (*Gymnorhina tibicen*) has continued during each breeding season. Where possible, loss of nests to flooding has also been managed.

A database of annual survival was created. Presence or absence of each bird was recorded in late summer or autumn (from late February onwards) after most breeding activity was completed. A second database of productivity (chicks fledged per pair per season) was also set up. These databases were used to calculate estimates (mean and standard deviation) of productivity, juvenile (first year) survival, and adult (second and subsequent year) survival. The results presented below are based on sightings to 5 April 2003. The viability of the population was modelled using the programme Vortex 9.14 (Lacy et al. 2003; Miller and Lacy 2003). This programme incorporates demographic and environmental stochasticity and also allows for simulation of removal (harvesting) or supplementation (further releases). Based on the amount of habitat available at RS 2 and the density of birds on South East Island, the carrying capacity of RS 2 was estimated at about 200 birds. Trends were examined over a 50-year period.

## Results

### *Chatham Islands*

#### *South East Island*

Over the past three decades, the population appears to have been roughly stable, with 40-45 pairs breeding each year and a post-breeding total (including juveniles) of 110-140 birds. However, there is evidence that the population is at carrying capacity. Productivity has been high enough to allow population growth, but the constant number of pairs

and the presence of a pool of non-breeding adults suggests that all breeding territories are occupied (Davis 1994a). Within the past decade, a gender bias has developed among the non-breeding birds; this pool contained equal numbers of males and females in the mid-1980s (Davis 1987) and in 1992/93 (Dowding & Kennedy 1993). However, there is now a consistently higher proportion of males and only one of eleven colour-banded non-breeding adults seen in January 2002 was female (Dowding 2002).

### Mangere Island

There have been three recent transfers of wild-reared juveniles from South East Island to Mangere Island, of 15 birds in January 2001, 13 in January 2002 and 15 in January 2003. One pair bred successfully in 2001/02 and two pairs bred in 2002/03, fledging a total of four juveniles to date. Suitable habitat is probably limited on Mangere Island and dispersal rates have been relatively high. However, some birds that dispersed have returned to South East Island and a few of these have established.

### Western Reef

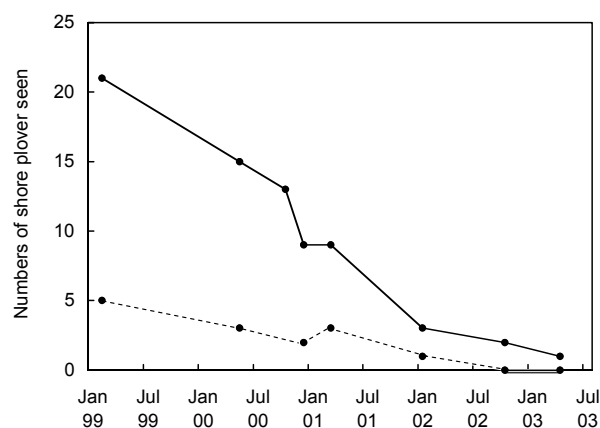
The discovery in 1999 of a previously unknown population of shore plover on Western Reef (see Figure 1) was documented by Bell & Bell (2000). When first surveyed in February 1999, the reef held 21 birds (15 adult males, 5 adult females and one juvenile). Relatively few trips have been possible since, but the population has declined to effective extinction within four years of discovery (Figure 2). Shore plover on Western Reef were genetically distinct from those on South East Island (Lambert *et al.* 2000). Following consideration of management options (Dowding 2003), the last surviving bird, an adult male, was taken into captivity in June 2003. Offspring of this bird will be used to produce juveniles for release on Star Keys (see Figure 1), in an attempt to re-integrate Western Reef genes into the wider Chatham Islands shore plover population.

### Mainland New Zealand

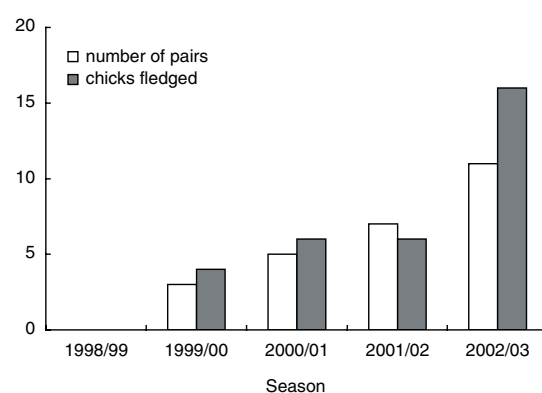
#### Motuora Island

The results of releases on Motuora Island were described by Aikman (1999). There were losses to predation by Moreporks (*Ninox novaeseelandiae*) and high rates of dispersal to the mainland, where most plovers were probably quickly killed by mammalian predators. However, breeding did occur on Motuora Island. Two pairs attempted to breed during the 1998/99 season (Watson 1999). The male of one pair disappeared during incubation and the female (a one-year-old) abandoned the nest, which contained fertile eggs. The second pair hatched two chicks and successfully fledged one of them, although the fledgling was probably later taken by a harrier (Watson 1999). This second pair bred again in 1999/2000 and again hatched two chicks and fledged one.

Two birds have survived from the Motuora programme. A captive-reared male released in 1998 and a wild-bred male (the chick fledged on Motuora in 1999/2000) are currently resident on Beehive Island, a very small island (0.8 ha) free of mammalian predators 6 km from Motuora.



**Figure 2** Decline of the shore plover on Western Reef, Chatham Islands, 1999-2003. Total population (solid line) and adult females (dashed line).



**Figure 3.** Number of pairs attempting to breed (open columns) and chicks fledged (solid columns) at Release Site 2 since releases began in 1998.

#### Release site 2

Table 1 summarises releases of captive-reared shore plover at RS 2 to March 2003.

Breeding was first recorded in the 1999/2000 season. Since then, the number of pairs attempting to breed has increased each season (Figure 3) and by autumn 2003 the total resident population was about 55 birds.

Data on first-year survival are now available for five cohorts of captive-reared birds and three cohorts of wild-bred birds. The sample of locally bred birds is still small, but to date there is no evidence that their survival to one year is significantly better than that of captive-reared birds (Fisher's Exact test,  $P=0.276$ ). Mean first-year survival (captive-reared and wild-bred birds combined) was 0.49.

There was no difference in first-year survival of hand-reared and parent-reared birds. Of 25 hand-reared birds released, 11 (44%) survived to one year compared to 19 (49%) of 39 parent-reared birds released; this difference was not significant (Fisher's Exact test,  $P=0.80$ ).

During analysis of first-year survival, an unexpected trend emerged. The data are limited, but first-year survival of released birds may be decreasing as the programme proceeds. Figure 4 shows that survival to one year was very similar for the first three release cohorts (0.55-0.60), but has subsequently fallen.

Mean annual survival from one year onwards was 0.85. However, survival from year one to year two may be lower than in subsequent years, and Vortex requires separate values for second-year and subsequent survival. Survival from one to two years was 0.81. From two years on, survival was 0.94, but it should be noted that this figure is based on a very small total sample, including the death of only one bird. Average productivity over the past four seasons has been 1.23 chicks fledged per pair per year (range 0.86-1.45).

Release date	Number of birds released	Days held in aviary
22-08-98	15	10
15-07-99	11	3
03-05-00	13	1
16-05-01	13	1
25-05-02	9	2
22-10-02	4	1
13-03-03	10	2
Total	75	

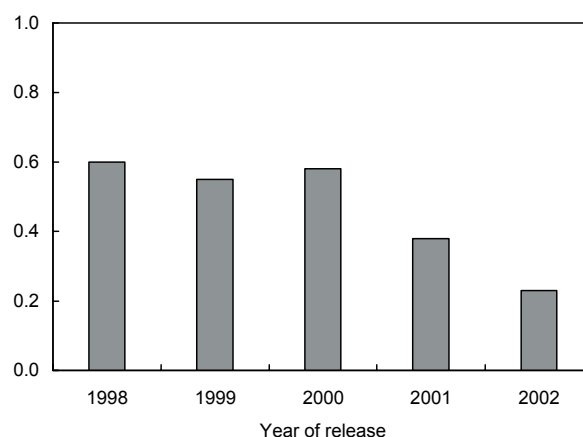
The capacity of the population to increase ( $r$ ) was estimated at a range of productivity values; when  $r$  is positive, the population has the capacity to increase, and when  $r$  is negative, it will decrease. Vortex also calculates a percent probability that the population will become extinct within the stipulated time. This basic model (Figure 5) assumed no supplementation (i.e. no further releases). This suggests that if productivity remains at its present level (1.23), the population will continue to grow ( $r=+0.078$ , an average growth rate of 8.1% per year) and the probability of extinction is 0%. This is the 'basic' scenario.

A second set of simulations was run, assuming that there is further supplementation (releases of about 12 juveniles per year for the next two years are planned); this is the 'basic+supp' scenario. Under this scenario the population will grow slightly faster ( $r=+0.084$ , average growth rate of 8.8% per year) and the probability of extinction is again 0%.

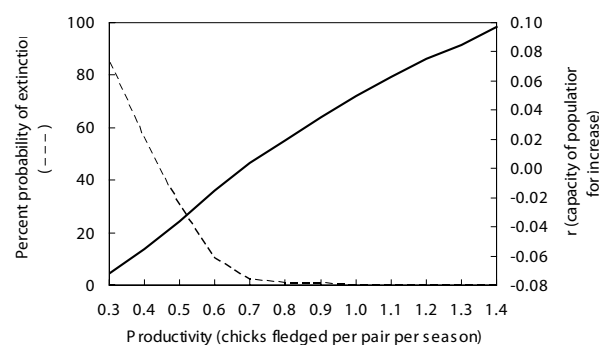
Population growth over a 50-year period under the 'basic+supp' scenarios was estimated; the model suggests that with two further releases the population will reach 100 birds in about 4 years and plateau at about 190 birds in 25-30 years. Under current conditions, the shore plover population at RS 2 is therefore already self-sustaining, with or without further releases. However, it seems very unlikely that productivity will remain as high as 1.23, once intensive management throughout the breeding season is discontinued.

Unfortunately, the extent to which productivity will fall cannot be reliably estimated. However, Vortex can be used to assess what average level of productivity is required if the population is to persist. The 'basic+supp' scenario was repeated at a range of productivity values, and the size of the population estimated over a 50-year period for each productivity level (Figure 6). This suggests that at average

productivity of 0.6 or lower, the population will not persist in the long term. At productivity of 0.7 the population may stabilise at about 100-110 individuals. At 0.8 and above, the population will persist and will stabilise at between 130 and 190 individuals.



**Figure 4.** First-year survival of juvenile shore plovers released at Release Site 2, 1998-2002



**Figure 5.** Probability of extinction (PE) and capacity for increase ( $r$ ) of the shore plover population at Release Site 2 during the next 50 years

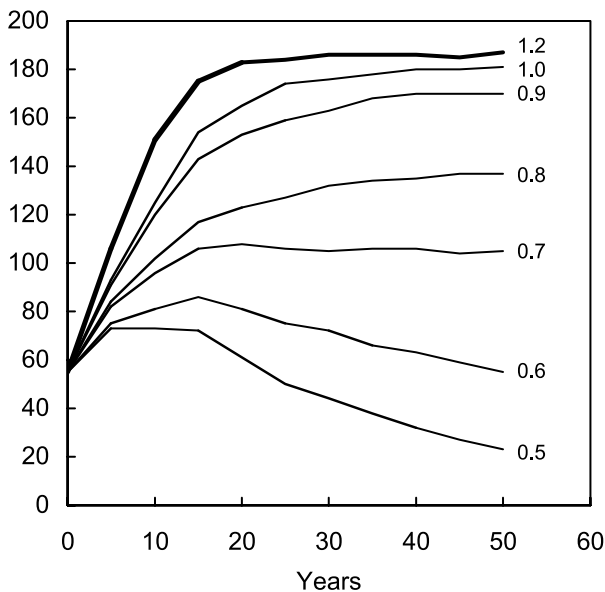
Two other aspects of breeding biology noted at RS 2 are of interest. During the 2001/02 season, one pair double-brooded, fledging one chick from their first breeding attempt and two from a subsequent attempt. Second, at least two birds have bred at one year old. A female raised in the 1999/00 season first bred in 2000/01; she hatched two chicks but neither survived. A male raised in the 2001/02 season first bred in 2002/03, when he successfully fledged two chicks. Both birds that bred at one year were wild-bred on the island.

### Summary

The changes in total numbers and in pairs breeding at each of the sites described above are summarised in Table 2. Largely due to the successes at RS 2, the total population has grown, as has the number of pairs (the effective population).

**Table 2:** Changes in numbers and distribution of the New Zealand shore plover between 1993 and 2003.

Location	1993		2003	
	Birds	Pairs	Birds	Pairs
South East Island	130	43-45	130	43-45
Mangere Island	0	0	6	2
Western Reef	~21	~5	0	0
Motuora Island	0	0	0	0
Beehive Island	0	0	2	0
Release site 2	0	0	50	11
<b>Totals</b>	<b>151</b>	<b>48-50</b>	<b>188</b>	<b>56-58</b>



**Figure 6.** Projected size of the shore plover population at Release Site 2 over the next 50 years at a range of productivity values

## Discussion

### Chatham Islands populations

#### South East Island

Over the past decade, the population on South East Island has been roughly stable. However, it has declined over the past 40 years. Fleming (1939) estimated that 70 pairs were present on the island in 1937. South East Island was farmed until 1961, at which time shore plovers were breeding on pasture in the central part of the island. Following the removal of stock, pasture became overgrown and the number of pairs declined (Flack 1976). There is continuing encroachment of vegetation, particularly on The Clears, an area of exposed salt meadow above the southern coast. Breeding and feeding habitat on the south coast are also being degraded as a large fur seal rookery expands. Together, these factors seem likely to result in a further gradual decline in the number of breeding pairs and in the overall carrying capacity of South East Island. The gender bias that has developed among non-breeding adults may also reflect this resource limitation. Other predator-free islands nearby (Mangere Island and Star Keys) are small or have limited habitat. The most effective long-term measure to secure the future of the Chatham Islands shore plover population would be the removal of mammalian and avian predators (cats, pigs and weka *Gallirallus australis*) from Pitt Island so that shore plovers can establish there.

### Mangere

Much of the coastline of Mangere Island consists of cliffs or steep boulder beaches, which are not suitable breeding habitat for shore plover. There is a small area of rock platform which, based on the density of pairs on South East Island, may hold 4-6 pairs. Unless birds begin breeding on the small area of salt meadow or on other vegetated areas of the island, it seems likely that the shore plover population on Mangere will always be small. Flack (1976) considered that the shore plover population on Mangere in the 19<sup>th</sup> century was too small to be self-sustaining and was probably maintained by dispersal from nearby Pitt Island.

### Western Reef

Almost the entire shore plover population on South East Island is banded. None of the 20 adult birds seen on Western Reef in February 1999 were banded; coupled with the genetic evidence, this suggests that there has been little (if any) recent interchange between the populations. The two islands are about 80 km apart; shore plovers are probably quite capable of flying this distance but in doing so are likely to encounter Pitt Island and Chatham Island, both of which have introduced mammalian predators. It is possible that the Western Reef population is a relict population from main Chatham Island and has been isolated there since the arrival of cats and rats on Chatham Island about 1840.

The reason for the rapid decline on Western Reef is unknown, but the fact that there were only five females present among 20 adult birds (Figure 2) suggests that the population was not healthy at the time of discovery. There is no evidence of introduced mammals on the reef, but there is a large and rapidly expanding fur seal rookery, which may have degraded shore plover habitat.

## Mainland New Zealand

### Motuora Island

A high proportion of shore plovers released on Motuora Island disappeared quickly after release. Dispersal (possibly related to harassment by Moreporks (*Ninox novaeseelandiae*) and other avian predators) were the main factors identified by Aikman (1999).

Although a shore plover population did not establish on Motuora Island, information useful to the recovery programme was gained. The project confirmed that captive-reared birds were capable of breeding successfully in the wild. The two chicks produced in 1998 were probably the first shore plover chicks hatched around mainland New Zealand for about 130 years. It also demonstrated that in addition to the rock platforms and salt meadow used for breeding on South East Island, shore plovers readily use sandy beaches. The project also served to highlight the importance of avian predators, at least in the early stages of a re-introduction attempt.

### Release site 2

Early releases of adult shore plovers on Mangere Island were unsuccessful (Flack 1976). However, the release strategy proposed by Aikman (1995), involving the soft release of captive-reared juveniles, has apparently been successful to date on RS 2. Control of avian predators (particularly

southern black-backed gulls and Australasian harriers) appears important, at least during the establishment phase of the new population. Ongoing monitoring at RS 2 should reveal the extent to which this control is necessary in the longer term.

The finding that survival of hand- and parent-reared birds did not differ on Motuora Island (Aikman 1999) or at RS 2 (this paper) is a positive result for the recovery programme. The number of juveniles bred for release can safely be increased each season (without compromising their later survival) by removing first clutches from pairs in captivity, raising these broods by hand and allowing pairs to re-lay and raise second broods themselves.

The apparent decline in first-year survival of released birds may be an artefact of the small sample sizes involved ( $\leq 15$  birds per year), or it may be real. There are no obvious reasons why such a decline should occur, but it could be related either to increased levels of avian predation (as predators increasingly key into shore plover as prey) or to increasing social pressures (resulting in higher dispersal rates) as the shore plover population grows.

Double-brooding has not previously been recorded in the much-studied population on South East Island, probably because that population is at carrying capacity and resources are believed to be limiting. Breeding in the wild at one year has also not been recorded on South East Island, although it has occurred in the captive population. Two one-year-old birds (a male and a female) have bred at RS 2 and a female bred at one year of age on Motuora Island, demonstrating that both sexes may be physiologically capable of breeding at that age in the wild. Both RS 2 birds were locally bred, while the Motuora bird was captive-reared. Again, breeding at one year of age is likely to have occurred because the space limitations and resource constraints that exist in a population at capacity probably did not yet exist at RS 2 or Motuora Island.

The possibility of harvesting wild-bred juveniles from RS 2 in future to assist with the founding of new populations will depend on productivity levels there once the intensity of management is reduced. Preliminary modelling (data not shown) suggests that the removal of 5-6 juveniles per year for three years would not affect the viability of the population as long as productivity at RS 2 remained above 0.8.

#### Outlook

With a total population of less than 200 individuals, the shore plover is still highly endangered. However, in the past decade the total number of birds has increased, the number of breeding pairs has increased, and a second secure population has been established. Most importantly, a technique for founding new populations is available and there is a better understanding of the factors governing the success of releases. Additional populations are required, however, to reduce the threat of extinction further and increase the total population size. The recovery plan (Aikman *et al.* 2001) requires establishment of a self-sustaining population at one new site by 2005 (already achieved at Release Site 2), and at two further sites by 2011. Ensuring the long-term survival of all shore plover populations will require strict quarantine measures to prevent the arrival of mammalian predators as well

as contingency plans to deal with any invasions that do occur.

## Acknowledgements

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