Attempts to establish Shore Plover (*Thinornis novaeseelandiae*) on Motuora Island, Hauraki Gulf

HILARY AIKMAN
Wellington Conservancy, Department of Conservation, P.O. Box 5086, Wellington, New Zealand

ABSTRACT

Fifty-three captive-bred New Zealand Shore Plover (*Thinornis novaeseelandiae*) were released on Motuora Island in the Hauraki Gulf, New Zealand in an attempt to establish a second population of this endangered shorebird in the wild. The birds were liberated in four releases between September 1994 and February 1997. In September 1997, eight (15%) of the released birds were still resident on Motuora Island. Dispersal to the mainland was the principal known cause of loss of birds from the island, with predation being the next most important cause. Differences were found between the use of adult and juvenile birds for release but there did not seem to be any difference between using hand- or parent-reared birds. Possible seasonal patterns of disappearance may become clearer once more birds have been released on the island. Recommendations for future management and research include continuing the transfer programme to Motuora Island with intensive monitoring during the first month after release, inclusion of more adult birds in releases, release of both hand- and parent-reared captive birds and conducting more research into Morepork predation of Shore Plover.

KEYWORDS: Shore Plover, *Thinornis novaeseelandiae*, shorebirds, captive-breeding, translocation, New Zealand

INTRODUCTION

Historically, the Shore Plover (*Thinornis novaeseelandiae*) was distributed throughout New Zealand in coastal and estuarine habitats (Davis 1987). Since the turn of the century the species has been confined to one sedentary population on Rangatira (South East) Island in the Chatham Islands (Davis 1994). Shore Plover declined quickly on the mainland last century, probably mainly as a result of introduced mammalian predators, in particular Norway rats (*Rattus norvegicus*) and cats (*Felis catus*) (Davis 1987). The limited distribution and restricted population size of Shore Plover (approximately 125 individuals in the wild in 1996-97 (Kennedy *et al.* 1997)), make it highly vulnerable to extinction. Shore Plover are ranked as a Category B priority for conservation management by the Department of Conservation (Molloy & Davis 1994) and is 'endangered' by international standards (Collar *et al.* 1994).

The draft New Zealand Shore Plover Recovery Plan outlines conservation management objectives for the species until 2002 (Kennedy *et al.* 1997). The long-term goal of management is to restore Shore Plover to as much of their original range as possible. Objectives for the next five years include the establishment and maintenance of at least one additional self-sustaining wild population (Kennedy *et*

al. 1997). The strategy being used to achieve this is to release captive-bred birds on a suitable island within the historical range of Shore Plover.

Significant progress towards these objectives has been made since the initiation of a captive-breeding programme in November 1990. Two captive populations have been established: at the National Wildlife Centre, Mt Bruce, and at Peacock Springs in Christchurch. Motuora Island was selected as the first liberation site. This 80 ha island is 5 km off the eastern coast of the New Zealand just north of Auckland in the Hauraki Gulf (36°30´S, 174°48´E). Motuora Island was selected because it is free of mammalian predators, has legal protection as a Department of Conservation reserve, has suitable coastal habitat (i.e. rocky wave platforms, sandy beaches and adequate coastal vegetation to provide cover for nesting), and has easy access for monitoring and management.

While the transfer of endangered birds to islands free of mammalian predators is a technique that has been successfully employed with a number of New Zealand forest bird species, this technique has rarely been attempted with waders (Aikman 1995). During the 1970s there were three unsuccessful attempts to establish a Shore Plover population on Mangere Island in the Chatham Islands. Birds were transferred directly from nearby Rangatira Island but failed to establish, with a number of birds flying straight home (Bell 1974, Flack 1976). It was thought that the use of captive-bred birds, which might not be strongly site-attached, might help to overcome the tendency of Shore Plover to return to its natal area. The use of captive-bred birds also allows new habitats to be stocked without placing undue pressure on the one remaining wild population (Davis 1987).

Between 1994 and 1997 there were four releases of captive-bred Shore Plover onto Motuora Island: a trial release of five birds in September 1994; 15 birds in September 1995; 16 birds in February 1996 and 17 birds in February 1997. Intensive monitoring was carried out for one month after each of the releases (Aikman 1995, Davis and Aikman 1997, Taylor *et al.* 1998). Ongoing monitoring at other times has been carried by Department of Conservation staff on the island. In this paper I summarise data from all four releases and examine the retention of birds on Motuora Island after the initial month-long monitoring period. Birds that disperse to the mainland are apparently killed quickly by mammalian predators. Factors which might influence the length of time birds remained on the island after release are discussed, and recommendations for future management and research are given.

METHODS

The fate of released birds and the length of time they have remained on Motuora Island after release was investigated for all birds in the 1994, 1995, 1996 and 1997 releases on Motuora Island.

The majority of birds were released with radio transmitters attached (4 birds had transmitters in 1994, 10 in 1995, 11 in 1996 and 17 in 1997). However, due to difficulties with the method of attachment most transmitters dropped off within

the one month monitoring period. The radio transmitters were glued to the birds' backs using the method described in Aikman (1995) and modifications of this method (Davis and Aikman 1997). While this method seemed successful during the 1994 release, a number of problems developed during the 1995 release and again, despite modifications, during the 1996 and 1997 releases (Davis and Aikman 1997, Taylor *et al.* 1998). During the 1997 release four tail-mounted transmitters were used in addition to 'back-pack' type transmitters (Taylor *et al.* 1998).

Birds that were still carrying radio tags when last sighted, for which no signal could be received on Motuora Island are assumed to have dispersed. The fate of those birds which disappeared without radio tags attached has been recorded as 'unknown'. Two birds that are known to have died on the mainland after flying there have been recorded as having 'dispersed'.

Six birds dispersed from Motuora Island less than one month after their initial release and were caught and returned to the island. Only data from their initial release on the island has been used, and so their fate has been recorded as 'dispersed'.

Four birds were apparently preyed on. All were found away from the shoreline in scrub or pasture, habitat not used by Shore Plover. The remains consisted of piles of feathers and in one case, body parts. Traces of skin on the back of the transmitters suggested that they had been ripped from the body. A transmitter found after the 1997 release and described as a possible predation by Taylor *et al.* (1998) did not have the same strong circumstantial evidence as the previous four recorded predations. The sign was similar to a number of other dropped transmitters that birds, that were later seen alive, had managed to dislodge while preening. The fate of this bird has been recorded as unknown. Three birds were preyed on, possibly by Australasian Harrier (*Circus approximans*), in the pre-release aviary before the first release and have been excluded from all analyses.

The survival of birds on Motuora Island for the first month of intensive monitoring after release, for six months after release and ongoing residency on the island have been used as measures to assess the success of releases on Motuora Island. I have compared the proportion of birds released at different age classes and birds that have been reared by different methods that have remained on Motuora Island for these time periods.

RESULTS

Eight (15%) of the 53 birds released on Motuora Island during releases in 1994, 1995, 1996 and 1997 were still present on the island on 1 September 1997 (Table 1).

The fate of 60% of the released birds is known. For this group, dispersal has been the major cause of loss from Motuora Island, accounting for 53% of birds of known fate (n=32). The next major cause of loss was predation, probably by Morepork (*Ninox novaeseelandiae*), accounting for 13% of birds of known fate. Four predation events were recorded, two after each of the first and second releases. Three

TABLE 1 - The number of birds in each release and the number remaining on the island on 1 September 1997.

Release date	Number and age	Number remaining Sept. 1997
September 1994	5 juveniles	0
September 1995	15 juveniles	2
February 1996	16 (8 adults, 8 juveniles)	3
February 1997	17 (6 adults, 11 juveniles)	3
Totals	53 (14 adults, 39 juveniles)	8

TABLE 2 - Fate of Shore Plover released on Motuora Island in September 1994, September 1995, February 1996 and February 1997 releases (releases 1 - 4 respectively).

Fate	Release 1	Release 2	Release 3	Release 4	Totals
Still On Motuora	0	2	3	3	8
Dispersed	3	8	1	5	17
Preyed on	2	2	0	0	4
Unknown	0	3	11	7	21
Died or in captivity	0	0	1	2	3
Total	5	15	16	17	53

birds (9% of those of known fate) were unable to survive in the wild; two died of starvation within the first month in the wild, and one was returned to captivity after being found in an extremely weak state (Table 2).

The majority of birds (74%) disappeared from the island during the first month after release. Of the 14 birds that remained on the island for at least one month, eight (57%) were still present on 1 September 1997, 6-23 months after their respective releases.

Four birds (8% of total) disappeared six months after release. All of these birds disappeared on different days in September 1996.

Fate of different classes of birds

There are some differences in the fates of birds released as adults and juveniles. Significantly more adults (71%, n=14) than juveniles (28%, n=39) had unknown fates ($\chi^2 = 12.91$, $P < 0.005$). No adults are known to have dispersed from Motuora Island, whereas 44% of juveniles dispersed. Only adults (21%, n=14) are known to have died of starvation or needed to be returned to captivity after their release (Fig. 1).

There was little difference between the fates of hand-reared and parent-reared birds. The four birds that were preyed-on were parent-reared rather than hand-reared as might have been predicted (Fig. 2).

Among the birds still resident on Motuora Island on 1 September 1997, there was a similar proportion of birds released as juveniles (18%, n=39) and as adults (7%, n=14) ($\chi^2 = 1.11$, $P = 0.29$). However, a much higher proportion of adults remained on the island for longer than one month (57% of 14 adults c.f. 26% of 39 juveniles; $\chi^2 = 7.29$, $P = 0.007$) (Fig. 3).

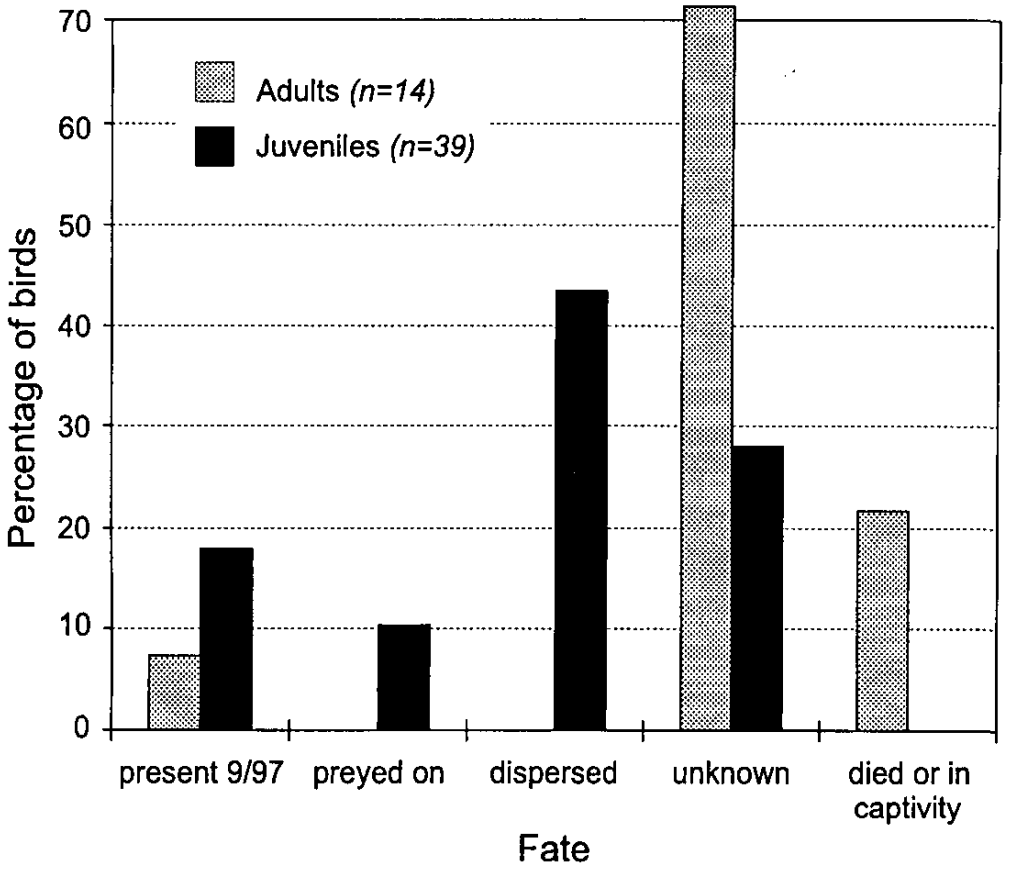


FIGURE 1 - The fate of Shore Plover released on Motuora Island as adults and as juveniles as at 1 September 1997. Juveniles are taken as birds that were less than one year old at the time of release.

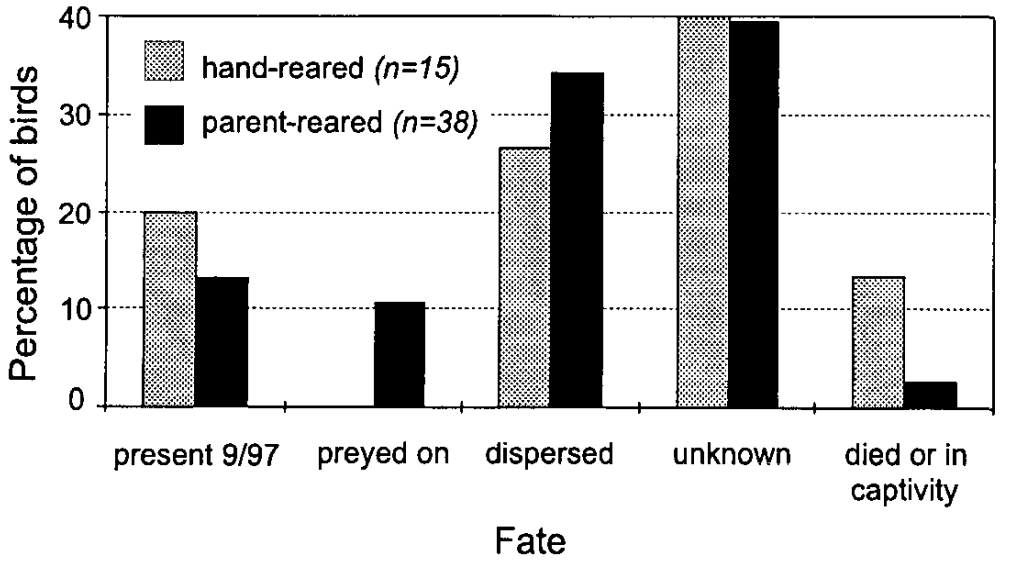
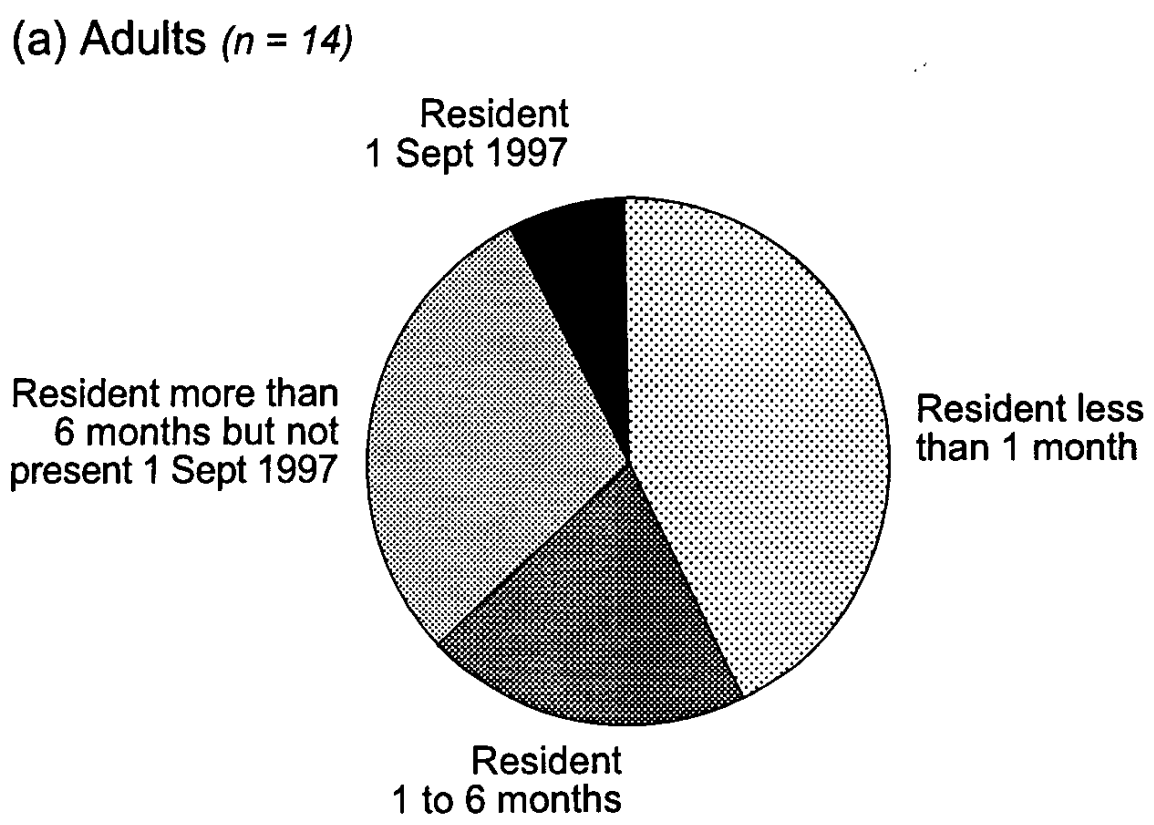


FIGURE 2 - The fate of hand-reared and parent-reared Shore Plover released on Motuora Island as at 1 September 1997.



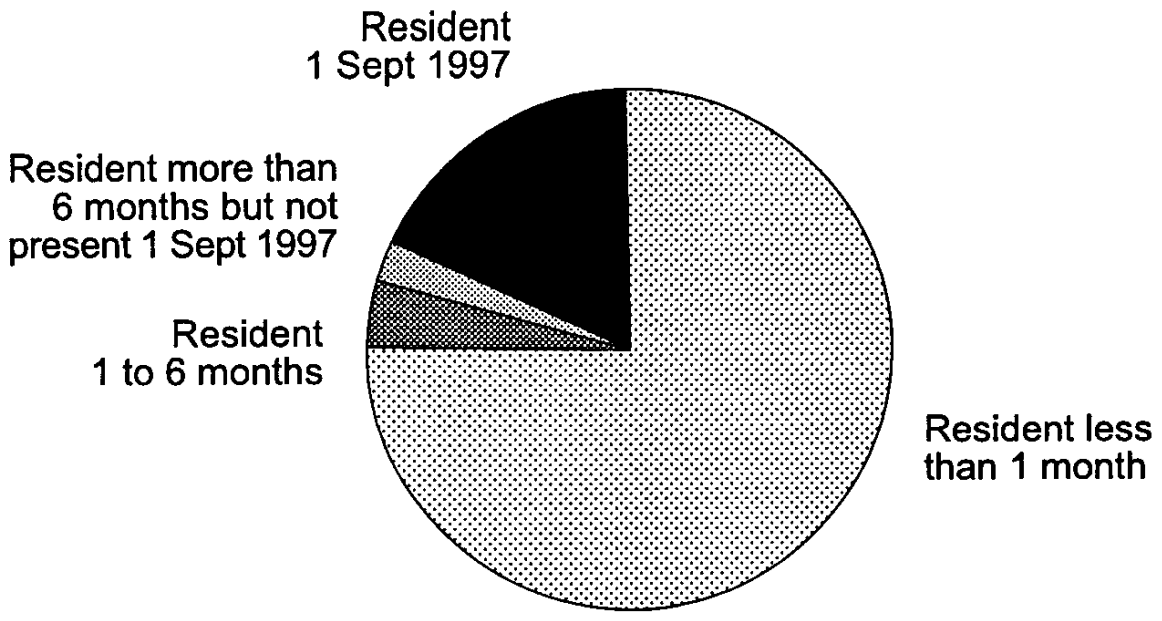


FIGURE 3 - The percentage of adult (a) and juvenile (b) Shore Plover that have remained resident on Motuora Island for different time periods after release.

There was no significant difference in the proportions of hand-reared (20%, n = 15) and parent-reared (13%, n = 38) birds that were resident on Motuora Island on 1 September 1997 ($\chi^2 = 0.614$, P = 0.43). There was also little difference in the proportions of hand-reared (33%) and parent-reared (34%) birds that remained on Motuora Island for more than one month after release (Fig. 4).

DISCUSSION

On 1 September 1997, eight of the Shore Plover that had been released on Motuora Island since September 1994 were still present. As a result of 15-17 captive-bred birds being released annually since 1995, the resident population gradually increased over this period. This increase was entirely due to the input of new birds as there was no successful breeding during this period*. Given that this was one of the first attempts in the world to establish a strong-flying shorebird species on an island, it should be expected that establishment would be a more difficult process than that with forest birds, and that considerable persistence would be required to achieve success.

Dispersal, especially of juveniles, has been the major cause of loss of Shore Plovers from Motuora Island. There has been no direct evidence of adults dispersing from the island, but this may be due to the small numbers of adults that have been released and the difficulty in establishing the fate of birds that remain longer than one month, when all transmitters have either fallen off or failed.

It is difficult to determine the reasons for dispersal. While a lack of suitable habitat on Motuora Island may be a factor, this seems unlikely. It is worth noting that, excluding the four birds preyed on, only three birds (6%) were found dead or apparently unable to survive on the island. By 1 September 1997, two birds had survived 23 months on the island. A wide variety of seemingly suitable habitat types are available for Shore Plover on Motuora Island. The released Shore Plover have shown a preference for areas with a mix of rock platform and sandy beach and areas of exclusively sandy beach (Davis & Aikman 1997, Taylor *et al.* 1998). Davis & Aikman (1997) assessed habitat availability and quality on Motuora and estimated a carrying capacity for Motuora Island combined with nearby Moturekareka Island, where Shore Plover were frequently observed feeding, of a minimum of 15 pairs.

A group of four birds disappeared in September 1996, six months after their release. The fate of these birds is unknown. It is noted that the four known predation events were recorded after the first and second releases, in September 1994

*Another 18 Shore Plover were released on Motuora Island between December 1997 and February 1998. These birds were transferred to Motuora just before fledging and were released in three groups. The planned release of another group of young fledglings was abandoned due to concern regarding the number of Morepork predations (Shaarina Boyd, pers. comm.). During the 1998/99 breeding season, two clutches of fertile eggs were laid on Motuora Island. Two chicks hatched successfully from one clutch. The second clutch was abandoned when the male disappeared during incubation (Sylvia Watson, pers. comm.).

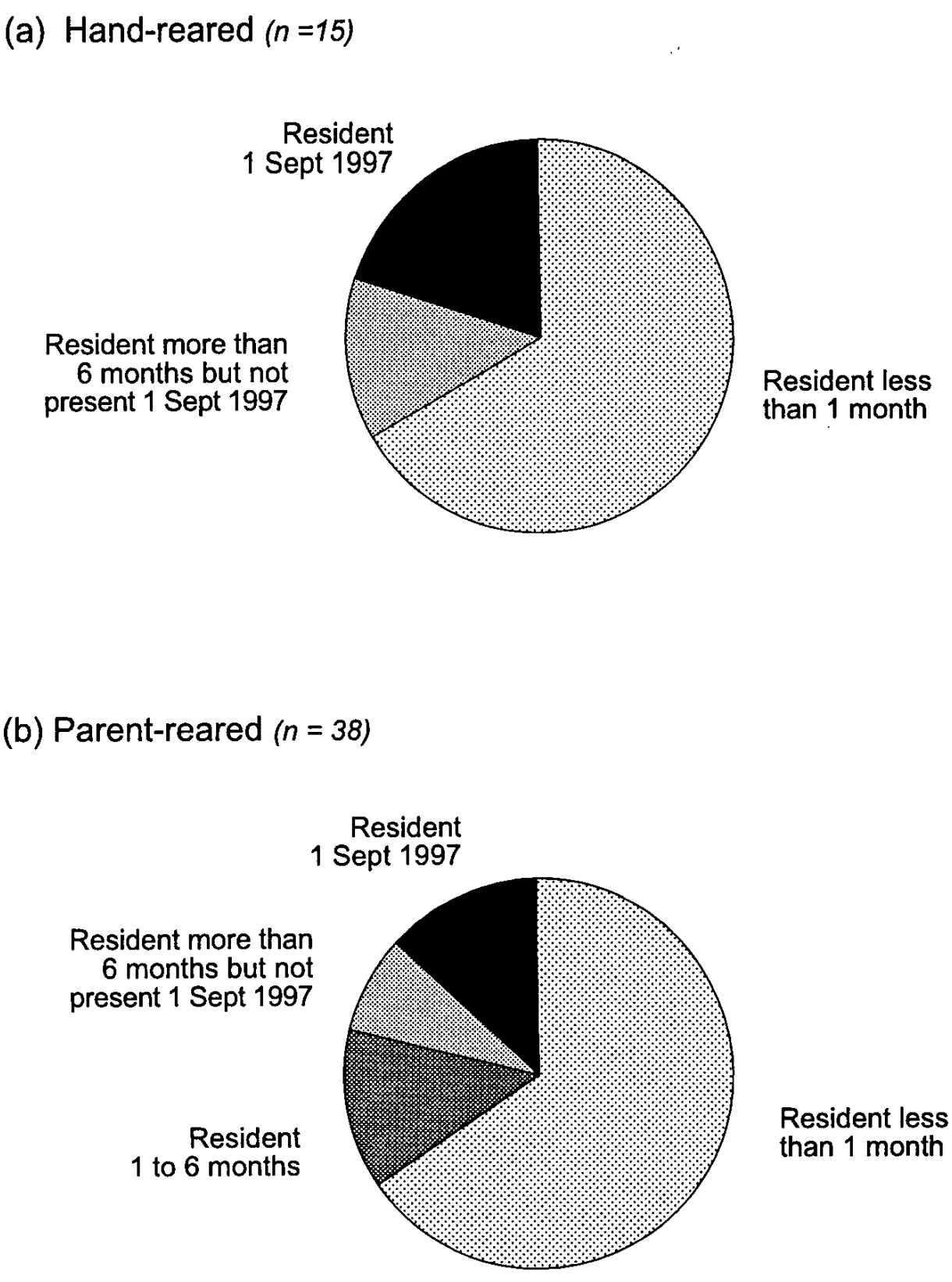


FIGURE 4 - The percentage of hand-reared (a) and parent-reared (b) Shore Plover that have remained resident on Motuora Island for different time periods after release.

and 1995 respectively. Since there have been only four releases it is not possible to draw any conclusions from this, although future releases may show some seasonal patterns.

Predation was the second most important cause of loss of birds of known fate. There is strong circumstantial evidence that Moreporks were the predator involved. It is possible that the high level of Shore Plover dispersal from Motuora Island has been provoked by Moreporks. Moreporks are not found in the Chatham Islands; however, Shore Plover live sympatrically with Brown Skua (*Stercorarius skua lonnbergi*), another effective avian predator, on Rangatira Island. Historically, Shore Plover would have encountered Morepork on mainland New Zealand. Once Shore Plover have established in sufficient numbers and individual birds have learnt predator avoidance behaviour it may be possible for a Shore Plover population to co-exist with Morepork on Motuora Island. Predator avoidance training of birds before release could be considered.

If it proves impossible to establish Shore Plover in the presence of Morepork there will be very few off-shore island options available for establishing additional populations of this species without ongoing management of the Morepork population. Morepork control is not currently possible on Motuora Island due to the spiritual significance that the local iwi place on Morepork.

Although only a small population of Shore Plover survives on Motuora Island, much has been learned from the transfer programme. Dispersal from the island has been the most important known cause of loss of birds followed by predation. The results suggest that adults may be less likely to disperse than juveniles, however, significantly more adults than juveniles had unknown fates and so these missing adults may have dispersed undetected. Adults were more likely to remain on the island for longer than one month, therefore a larger proportion disappeared after the intensive monitoring period and so no longer had transmitters attached.

Fifty-seven percent of birds that remained on Motuora Island for one month or more were still present on 1 September 1997, 6-23 months after release. Increasing the number of birds that remain for the first month may be crucial to the successful establishment of a Shore Plover population on the island. If more birds could be induced to remaining during the initial establishment phase, the population may achieve a critical mass, providing benefits such as a supply of suitable mates, improved predator avoidance and territorial competition to stimulate breeding behaviour. Adults were significantly more likely than juveniles to remain longer than one month and so might be more suitable for release, particularly during the difficult establishment phase.

There does not seem to have been any difference between using hand- or parent-reared birds for the release programme on Motuora Island. Producing both hand- and parent-reared birds for release will enable captive managers to achieve higher productivity from the captive population than if only parent-reared birds were used, thus boosting the numbers available for release.

Recommendations:

The transfers of Shore Plover to Motuora Island should be continued and the following aspects should be modified in light of the results to date:

- All future releases should continue to be followed by a month of intensive monitoring. Particular attention should be given to learning the fate of any adult birds released. The relative success of different classes of birds at establishing on the island should continue to be assessed. A more reliable method of attaching transmitters to Shore Plover needs to be developed.
- More detailed research should be carried out into the interaction between Morepork and Shore Plover on Motuora Island and into possible management solutions to reduce impacts on Shore Plover. As well as the direct threat of predation, Morepork may be implicated in Shore Plover dispersal from the island.
- Local iwi involvement with the Shore Plover programme should be encouraged and discussion should continue regarding the implications of Morepork predation on the Shore Plover population and possible management options to reduce this threat.
- Future releases should include equal numbers of adult and juvenile birds. Results to date suggest that adults may prove more suitable for establishing a new population, however, continuing to release a proportion of juvenile birds is recommended because juveniles are cheaper to produce in captivity. Once the Shore Plover population on the island reaches a certain critical mass, both adult and juvenile birds may begin to settle more readily.
- Future releases should use a mix of hand- and parent-reared birds in order to allow for maximum productivity from the captive population. An annual production target of 40 birds for release should be set.
- Breeding pairs should be held in aviaries on the island to allow birds to breed before release. Rearing chicks *in situ* could be one technique to encourage birds to remain on the island.

ACKNOWLEDGEMENTS

I would like to thank all the people who have participated in the Shore Plover monitoring on Motuora Island and on the adjacent mainland coast. In particular, thank you to Sylvia Watson and her family on Motuora Island for their support of the programme and generosity to everyone involved. Thanks also to the staff at the National Wildlife Centre and Peacock Springs and to Alison Davis and John Dowding for their hard work and support of the programme. I am grateful to Jason Taylor, Shaarina Boyd and Sylvia Watson for allowing me to include unpublished information regarding the 1997 Shore Plover release and recent breeding on Motuora Island.

Thank you to Colin Miskelly, Hugh Robertson, Raewyn Empson and an anonymous referee for their helpful comments on the manuscript and to Chris Edkins for assistance with the graphs.

LITERATURE CITED

AIKMAN, H. 1995. Reintroduction of New Zealand Shore Plover (*Thinornis novaeseelandiae*): A release strategy. University of Otago Wildlife Management Report No. 68, Dunedin.

BELL, B.D. 1974. Mangere Island. Wildlife - A review 5: 31-34.

COLLAR, N.T.; CROSBY, M.J.; STATTERSFIELD, A.J. 1994. Birds to Watch 2: the world list of threatened birds: Birdlife International, Cambridge.

DAVIS, A.M. 1987. The behavioural ecology and management of New Zealand Shore Plover *Thinornis novaeseelandiae*. Unpublished MSc thesis, Auckland University.

DAVIS, A.M. 1994. Status, distribution and population trends of the New Zealand Shore Plover *Thinornis novaeseelandiae*. Notornis (Supplement) 41: 179-194.

DAVIS, A.; AIKMAN, H. 1997. Establishment of Shore Plover on Motuora Island. Part 1: Second release, September 1995, Part 2: Third release, February 1996. Science for Conservation No. 46. Department of Conservation, Wellington.

FLACK, J.A.D. 1976. The Shore Plover. Wildlife - A review 7: 41-44.

KENNEDY, E.; REED, C.; DAVIS, A. 1997. Draft New Zealand Shore Plover Recovery Plan. Department of Conservation, Wellington.

MOLLOY, J.M.; DAVIS, A. 1994. Setting priorities for the conservation of New Zealand's plants and animals. 2nd edn. Department of Conservation. Wellington.

TAYLOR, J.; WATSON, S.; BOYD, S. 1998. New Zealand Shore Plover (*Thinornis novaeseelandiae*) release on Motuora Island, February 1997. Auckland Conservancy Technical Report Series No. 17. Department of Conservation, Auckland.