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Reintroduction of North Island robins to Paengaroa Scenic Reserve: factors limiting survival, nest success, and population viability in a mainland restoration area.

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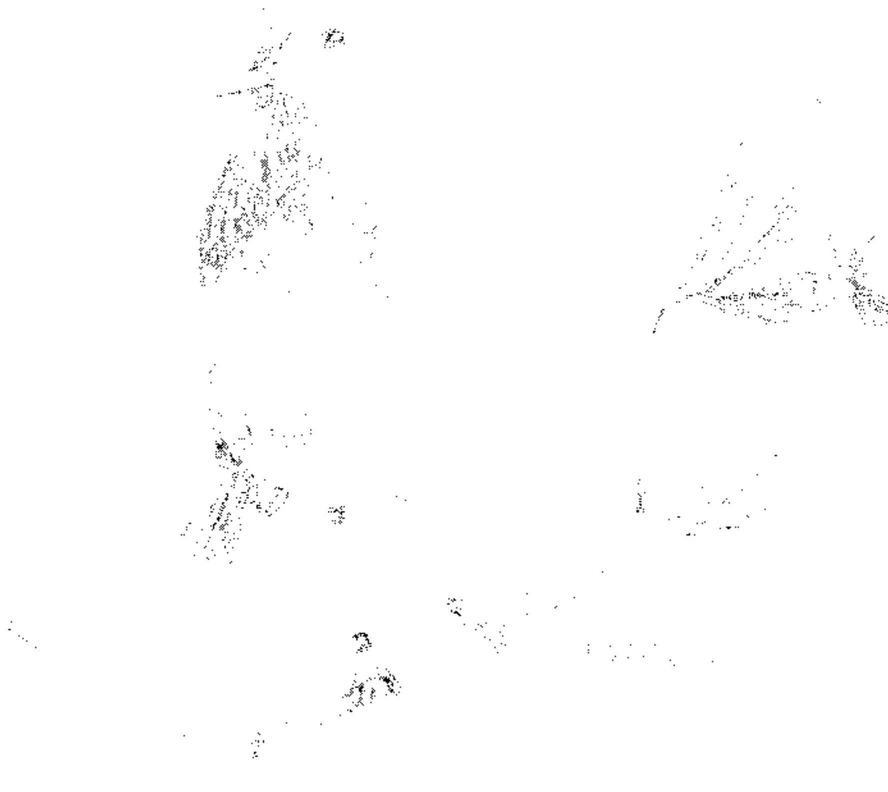

Drawing of North Island robin in Paengaroa Scenic Reserve (by author).

ABSTRACT

Forty North Island robins (*Petroica australis longipes*) were reintroduced to Paengaroa Scenic Reserve in March 1999. I monitored the survival and breeding success of this population for two years post-release. This study aims to assess survival, nest success, and population viability of robins in Paengaroa in an attempt to discover whether habitat in the reserve is likely to support a population of robins.

Survival from the time of release to the start of the first breeding season was lower at Paengaroa than at two other release sites, Boundary Stream Scenic Reserve and Tiritiri Matangi Island. This may be due to higher predator levels at Paengaroa or dispersal out of the reserve.

Methods of estimating nest success were compared, and Stanley's (2000) method was found to have advantages over the traditional and Mayfield methods. Daily survival rates of nests at Paengaroa depended on both the stage in the nesting cycle and stage of the breeding season, with the survival rate lowest for early nests at the incubation stage. Nest success for the first two breeding seasons after translocation was compared to that for the first two seasons after release at Tiritiri Matangi and Boundary Stream. Paengaroa had a similar nest success rate to Tiritiri Matangi (25% and 26% respectively), and both of these sites had lower nest success than Boundary Stream (47%).

Survival at Paengaroa was most affected by whether a bird was recently-translocated, a juvenile, or an adult. Recently-translocated birds and juveniles suffered similarly low survival rates, suggesting that this high mortality may be due to problems faced when finding and establishing a territory. The survival of juveniles from January to September was estimated to be 29%. The annual adult survival rate was also low (59%). Fecundity and survival estimates were used in a stochastic simulation model to predict the viability of the Paengaroa population. Under current conditions, the population was predicted to have a 17% probability of surviving 10 years. However, variation of parameters to lower and upper 95% confidence limits gave survival probabilities of 0% to 100% over 10 years. When data from the first year after translocation were excluded, the population was predicted to have a 100% probability of surviving 100 years. These results demonstrate the large uncertainty associated with small sample sizes and short-term studies.

To assess whether habitat quality is likely to account for the poor overall viability predicted at Paengaroa, the habitat quality at Paengaroa was compared to that at Waimarino forest, where robins still persist. Food supply and predator levels were used to assess habitat quality, as these are obvious factors that may limit viability. Data on food and predator levels provided no indication of why robins may be non-viable at Paengaroa. The power of statistical tests was low due to small sample size, but results suggest Paengaroa has more food as well as fewer rats and stoats than Waimarino. There is a need for further research to improve our understanding of why robins are present and common in some mainland areas but have disappeared from others without any obvious difference in habitat quality. Continued research is also required to reduce the uncertainty regarding population viability at Paengaroa and to determine whether improved management is needed.

CHAPTER ONE

General Introduction

New Zealand is a continental remnant that split off from Gondwanaland in the late Cretaceous period. Eighty million years of isolation has led to a distinctive biota with a high level of endemism, and no terrestrial mammals other than bats and seals reached New Zealand until humans arrived around 1000 years ago (King, 1995). The absence of mammalian predators has allowed traits such as gigantism, flightlessness, and loss of defensive behaviours to arrive and persist. The presence of these traits caused the rapid decline of endemic species after the arrival of mammals, which has had devastating effects on New Zealand's native flora and fauna (King, 1984; Daugherty *et al.*, 1993).

Polynesians settled in New Zealand around 850-950 A.D., bringing with them dogs and kiore (*Rattus exulans*), both of which successfully adapted to the New Zealand environment. Polynesian settlement led to a reduction in native forest area, which was reduced further following mass immigration of Europeans after 1840. This habitat loss has resulted in a highly fragmented forest cover. Europeans also brought with them 82 species of mammals, birds, and fishes (Atkinson & Cameron, 1993). Since human colonisation, at least 40% of New Zealand's landbird fauna have become extinct (Atkinson & Cameron, 1993). This history of habitat loss, fragmentation and extinctions led to the initiation of conservation programs (Saunders, 2000).

The first reserves were established in New Zealand over 100 years ago. However, these were generally focused towards scenic and historic features rather than ecological significance. In more recent years, the necessity of protecting areas for their ecological value has been recognised. In the early 1980s, the Protected Natural Areas Programme was started, aimed at preserving fragments of natural ecosystems on all land tenures (Saunders, 2000). Thirty percent of New Zealand's land area is now formally protected, as are most native vertebrates and remaining native forest areas (Towns & Ballantine, 1993).

Offshore islands have played an important role in New Zealand's conservation history. New Zealand has the highest proportion of threatened avifauna in the world (Clout, 1997). Early conservation efforts were made to move species (including hihi *Notiomystis cincta* and saddleback *Philesturnus carunculatus*) to predator-free islands where it was hoped they would survive. The increasing ability to remove pest mammals from offshore islands has meant that many islands are now used as sanctuaries for species that are continuing to decline on the mainland, and has also enabled the focus of management to change from preservation to restoration (Towns & Ballantyne, 1993). Over 120 successful pest eradications had been successfully carried out on New Zealand islands by the early 1990s (Veitch *et al.*, 1992), and these programs have continued.

Despite the important role of offshore islands in providing safe habitat for threatened species, they only represent a small proportion of New Zealand's environment (Saunders, 2000). Thus, there has been recent emphasis on the management of mainland areas. In 1995, the Department of Conservation allocated funding for 'mainland restoration' projects as part of the threatened species management scheme. Six mainland restoration areas were chosen using specified criteria (see Saunders, 2000). One of the main features of these restoration projects is that they have multi-pest control programs. A major focus of these programs is the intensive control of mammalian pests.

Mammalian predators are responsible for the widespread declines of many indigenous species. The four species of rodent in New Zealand (in order of arrival) are kiore, Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), and ship rat (*Rattus rattus*). Possums (*Trichosurus vulpecula*) and three mustelid species, stoats (*Mustela erminea*), weasels (*Mustela nivalis*), and ferrets (*Mustela furo*) are also widespread over New Zealand's mainland. The problem with controlling pest mammals on mainland areas is that reserves are susceptible to constant re-invasion from the surrounding landscape, so eradication is generally not feasible. Much of the predator control on the mainland has involved poison operations, and recent successes can be largely attributed to the development of anticoagulant poisons such as Brodifacoum (Taylor, 1992). Brodifacoum is routinely used for controlling possums, rodents and mustelids (Innes & Barker, 1999). Second generation poisons such as this are persistent and slow-acting, so not only can a lethal dose be consumed in a single feed, but secondary poisoning may be achieved by predators scavenging on poisoned carcasses (Mollër & Alterio, 1998).

Restoring an area's biodiversity involves the intensive control of predators, and may also include the reintroduction of species that have disappeared from that area prior to the start of management. It is very important when planning a reintroduction that the factors responsible for the original extinction are identified and reversed (Veitch, 1995; Kleiman, 1989; IUCN, 1998). Extinction is often associated with a range of simultaneous changes (e.g. habitat loss and introduction of mammals) so it can be difficult to know whether the factors responsible have been correctly identified. There is a large amount of evidence that predators were the primary cause of population declines of endemic species across the country (e.g. Bell, 1978; Saunders, 1992; King, 1995; Brown, 1997a; Brown, 1997b; Clout, 1997; Spurr, 1999; Spurr & O'Connor, 1999; Thomas, 1999). As a consequence, predator abundance is generally the main factor considered prior to a reintroduction in New Zealand.

Translocations have been defined as the intentional release of plants or animals to the wild in an attempt to establish, reestablish, or augment a population (IUCN,1987). A more recent variation on this definition considers translocations to be a "deliberate and mediated movement of wild individuals to an existing population of conspecifics" (IUCN, 1998). The first translocations in New Zealand took place as early as the 1890s when Richard Henry attempted to relocate several bird species to mustelid-free islands (Towns & Ballantyne, 1993). Since this time there have been over 400 translocations mainly involving birds (Armstrong & McLean, 1995), and reintroduction appears to have become an integral part of New Zealand's modern conservation effort.

It has become clear that translocation should be considered long before it becomes a last resort for a species. This is not only because translocations have a low chance of success with small numbers of individuals (Griffiths, 1989), but also because critically endangered species require disproportionately large amounts of resources to prevent extinction. Hence, there has been growing awareness about the sensibility of putting recovery programs in place even if a species is not yet classed as endangered. The increased emphasis on ecological restoration has meant that relatively common species can be reintroduced to areas with a restoration program before their numbers are reduced to levels that are considered critical in terms of conservation status.

The New Zealand robin (*Petroica australis*) is a small (~10cm tall, 35g) insectiverous forest-dwelling passerine. There are three subspecies of New Zealand robin – the North Island robin (*Petroica australis longipes*), the South Island robin (*Petroica australis australis*), and the Stewart Island robin (*Petroica australis rakiura*). They all have grey to black plumage with a white breast, long slender legs, and an upright stance. Robins are generally monogamous, and remain in their territory throughout the year (Flack, 1979). New Zealand robins are still found on the mainland, but have disappeared from much of their former range since European settlement. This is primarily due to habitat loss and predation by introduced mammalian predators (Powlesland, 1997). Robins are susceptible to predation by Norway rats, ship rats, stoats and weasels (Flack & Lloyd, 1978; Brown, 1997a). The species is currently considered to be "regionally threatened" (Bell, 1986), and has become an important part of restoration programs. Robins have been the first species released into some restored habitats due to the relatively low risk associated with their conservation status. Robins have also managed to survive in habitat that other bird species have disappeared from, and are thus useful for predicting the outcome of other proposed translocations to the target area.

The black robin (*Petroica traversi*) is in the same family as the New Zealand robin (Eopsaltriidae), and was considered "the world's most endangered bird" (Butler & Merton, 1992). A translocation was planned for the black robin population from Little Mangere Island to Mangere Island. In 1972 and 1973, South Island robins were used to trial transfer techniques to be used in the black robin translocation, and to evaluate the success of releasing small numbers of birds. Populations were successfully established from five birds on Motuara and Allports Islands, both of which were free from robin predators.

Since these initial translocations, New Zealand robin reintroductions have been carried out as part of restoration projects. During the 1980s, translocations to offshore islands were carried out with varying success. These releases were made into naturally regenerating habitat, and reasons for success or failure are unclear (Armstrong, 2000). During the 1990s, the first reintroductions were done in the context of intensive ecological restoration (including extensive re-vegetation, weed control and pest control). Robin populations were successfully established on Tiritiri

Matangi Island in 1992 and Mana Island in 1996, neither of which had predators likely to threaten robins. In accordance with the increasing trend of mainland restoration, the first mainland robin reintroduction occurred in 1994 to Hinewai Reserve. Robins disappeared within 6 months of release. The reserve had no predator control, but it is not apparent whether this was the cause of failure (Armstrong, 2000). Predator control has been in place for all sites used for subsequent mainland reintroductions (Table1.1).

Table 1.1. North Island robin reintroductions to mainland sites.

Release site	Year
Trounsen Kauri Park, Northland	1998
Boundary Stream Scenic Reserve, Hawkes Bay	1998
Paengaroa Scenic Reserve, Taihape	1999
Wenderholm Regional Park, Nth Auckland	1999
Kakepuku Mountain, Sth Waikato	1999
Mangaokewa Reserve, Te Kuiti	2001
Barnett Reserve & Stephenson covenant, Waikato	2001
Hunua Ranges, SE Auckland	2001
Karori Wildlife Sanctuary, Wellington	2001
Bushy Park Scenic Reserve, Wanganui	2001

Paengaroa Scenic Reserve is a 101 hectare, predominantly broad-leaf/podocarp forest remnant selected by the Department of Conservation to be one of the six original mainland restoration areas. The reserve was chosen as it has a unique botanical assemblage, characterised particularly by the wide diversity of divaricating shrubs. One of the primary goals of the project is to "restore and enhance the outstanding biodiversity" of the reserve (Barkla, 1996). North Island robins were named as a target species for reintroduction in the management strategy for Paengaroa. In March 1999, 40 robins were released into Paengaroa Scenic Reserve.

North Island robins are the first species being reintroduced to many mainland habitats. However, there is little information available about what mainland habitat features are required to establish a viable population of robins. Monitoring the outcome of the translocation to Paengaroa was therefore important, as this was the first reintroduction to a site covering a relatively small area with low-intensity predator control. If a robin population could be successfully established under the current management regime, it would suggest that future robin reintroductions to sites of similar size and habitat quality are likely to be successful.

The aims of this study are: (1) monitor the survival and nest success of a recently translocated population of North Island robins; (2) determine which habitat features are most likely to be affecting survival and nest success rates; and (3) assess whether the habitat quality at Paengaroa is sufficient to establish a self-sustaining population of robins.

This study is presented in four chapters and the conclusions are summarised in the final chapter (Chapter 6). Chapter 2 explains the background to the translocation, and methods used to capture and transport the robins. Survival of robins during the establishment phase at Paengaroa is compared to survival after translocation at Boundary Stream and Tiritiri Matangi Island. Possible reasons for any differences are discussed. Chapter 3 assesses methods used to estimate nest success. A modelling approach is used to compare nest success estimates at Paengaroa to estimates calculated for Boundary Stream and Tiritiri Matangi over the first two breeding seasons after reintroduction. Likely reasons for any differences are explored. Chapter 4 uses a modelling approach to obtain survival estimates for robins in Paengaroa. Parameter estimates are used in a computer simulation program to predict the viability of the Paengaroa robin population. Chapter 5 looks at the foraging behaviour of North Island robins, and explores possible reasons for the low viability found at Paengaroa. Aspects of habitat quality thought to be important (food supply and predator levels) are measured at Paengaroa and the source site (Waimarino) where robins are known to persist. The possible impacts of these factors on robins at Paengaroa are discussed.