

Success of translocations of red-fronted parakeets *Cyanoramphus novaezelandiae novaezelandiae* from Little Barrier Island (Hauturu) to Motuihe Island, Auckland, New Zealand

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SUMMARY

The red-fronted parakeet *Cyanoramphus novaezelandiae* is a vulnerable New Zealand endemic with a fragmented distribution, mostly inhabiting offshore islands free of introduced mammalian predators. Four populations have been established since the 1970s using captive-bred or wild-sourced individuals translocated to islands undergoing ecological restoration. To establish a new population in the Hauraki Gulf, North Island, a total of 31 parakeets were transferred from Little Barrier Island (Hauturu) to Motuihe Island in May 2008 and a further 18 in March 2009. Overall 55% and 42% of individuals from the first translocation were confirmed alive at 30 and 60 days post-release, respectively. Evidence of nesting and unassisted dispersal to a neighbouring island was observed within a year of release. These are outcomes are promising and indicate that translocation from a remnant wild population to an island free of introduced predators is a useful conservation tool to expand the geographic range of red-fronted parakeets.

BACKGROUND

The avifauna of New Zealand is presently considered to be the world's most extinction-prone (Sekercioglu *et al.* 2004). Currently, 77 of approximately 280 extant native species are considered threatened of which approximately 30% are listed as Critically Endangered (Miskelly *et al.* 2008). Many successful conservation programmes in New Zealand have involved the eradication of introduced mammalian predators such as feral cats *Felis catus*, Pacific rat (or kiore) *Rattus exulans*, ship (black) rat *R. rattus* and brown (Norway) rats *R. norvegicus*, and subsequent translocation to establish additional populations of threatened native species (Armstrong & McLean 1995, Veitch & Bell 1990). Here we report the recent translocation of red-fronted parakeets *Cyanoramphus novaezelandiae novaezelandiae* from a remnant natural population on Little Barrier Island (or Hauturu) to an island free of

mammalian predators and undergoing ecological restoration, Motuihe Island.

Little Barrier Island (c. 3,000 ha; 36°12'S, 175°04'E) lies in the Hauraki Gulf approximately 80 km north of Auckland City (North Island), and is New Zealand's oldest wildlife reserve, established in 1894 (Cometti 1986). The island is covered mostly by regenerating coastal and kauri *Agathis australis* forests (Hamilton 1961). Little Barrier Island holds a great diversity of native New Zealand birds including threatened species such as hibi *Notiomystis cincta*, kokako *Callaeas cinerea* and North Island brown kiwi *Apteryx mantelli* (Robertson *et al.* 2007).

Motuihe Island (180 ha), located 15 km east of Auckland City, is currently the focus of a community-led restoration project in partnership with the New Zealand Department of Conservation (DOC). This restoration

involved eradication of four introduced mammal species: brown rat, house mouse *Mus musculus*, feral cat and European rabbit *Oryctolagus cuniculus* (Hawley 2005, Veitch 2002). Also invasive exotic weeds such as barberry *Berberis glaucophylla* and banana passionfruit *Passiflora tripartita* are the target of ongoing vegetation management (Hawley 2005). Revegetation using native plant species has been a major component of the project. The reintroduction of native avifauna is yet another aspect of the restoration of Motuihe and 17 species have been identified as suitable for translocation (Hawley 2005). The first bird species to be translocated to Motuihe was North Island saddleback *Philesturnus rufusater* in 2005 (Parker & Laurence 2008).

The red-fronted parakeet, listed as 'Vulnerable' (www.iucn.org, www.birdlife.org), was identified as a potential species to be translocated to Motuihe Island because of its generalist dietary and nesting requirements, and because of previous successful transfers to other sites (McHalick 1999). Red-fronted parakeets have been successfully translocated to at least four offshore islands subject to rehabilitation since the 1970s (Dawe 1979, Higgins 1999). Historically, the species was widespread throughout New Zealand but it is at present confined to offshore islands (Juniper & Parr 1998, Robertson *et al.* 2007). Red-fronted parakeets make use of diverse nesting sites in regenerating vegetation, grasslands and forest remnants (Ortiz-Catedral & Brunton 2009). Thus, the species is considered suitable for translocation to sites with fragmented native vegetation communities, which is often the case on offshore and mainland islands subject to restoration efforts throughout New Zealand (Saunders & Norton 2001). Invasive species and large-scale habitat modification were also involved in the disappearance of the nominate subspecies *C. n. novaezelandiae* throughout New Zealand (Higgins 1999) and other *Cyanoramphus* taxa in the South Pacific (Taylor 1979, Hicks & Greenwood 1989).

ACTION

In 2006, an initiative to translocate red-fronted parakeets from Little Barrier Island to Motuihe Island was prepared by the Motuihe Island Trust, DOC and the authors. This initiative was consulted and approved by representatives of the local Maori *Iwi* community *Ngati Manuhiri* and *Ngati Wai*. Motuihe was considered an appropriate site for release as it

is free of introduced mammals and has suitable habitat for parakeets, including fragments of remnant coastal forest, re-vegetated patches and grassland. The translocation of parakeets to Motuihe was also considered to be beneficial as it was hypothesised by the authors that it would facilitate natural dispersal of parakeets to neighbouring islands undergoing ecological restoration such as Rangitoto, Motutapu and Rakino. The Motuihe Trust raised NZD \$ 28,482 to cover the costs associated with capture, pathogen screening, radio transmitters and transport of the parakeets.

Capture of parakeets: We captured parakeets on Little Barrier Island using mist-netting techniques based on previous sampling of the species in New Zealand (Ortiz-Catedral *et al.* 2009a). The capture aimed to reach a target number of 50 individuals (25 males, 25 females). This number was decided after consultation with DOC, *iwi* and the Motuihe Island Trust. Mist-netting took place from 6 to 16 May 2008, approximately two months after the end of the breeding season of the species (Ortiz-Catedral 2006). Parakeets were captured between 06:00-11:00 h and 15:00-18:00 h. Every parakeet was ringed with a single numbered steel ring and one to three coloured plastic bands (according to DOC regulations), and feather, blood and cloacal swab samples were collected for analysis of naturally occurring pathogens (Ortiz-Catedral *et al.* 2009b, Ortiz-Catedral *et al.* 2009c). Sex was determined by measuring the culmen (Sagar 1988). After processing, parakeets were transferred to an aviary built on site, and held in captivity for up to 6 days while additional parakeets were captured.

The aviary measured approximately 3 x 5 x 2 m high. Its interior was densely covered with branches of kanuka *Kunzea ericoides* and fronds of nikau *Rophaostylis sapida* and ponga *Cyathea dealbata*. Also, curtains made of plastic mosquito net (50 cm width x 50-80 cm length) were hung from the ceiling approximately 80 cm apart to provide a soft barrier to prevent flying parakeets from hitting the aviary walls. Clean water and a mix of suitable food (freshly chopped apple *Malus domestica*, green peas *Pisum sativum*, corn *Zea mays*, grapes *Vitis* sp. and millet *Sorghum* sp. sprays) were provided *ad libitum*.

When at least 15 parakeets were captured, the birds were transferred to individual pet-carry boxes (measuring approximately 25 x 35 x 20 cm) lined with kanuka branches. Water, millet

and a piece of raw corn were also provided. The boxes were loaded onto a helicopter and flown from Little Barrier to Motuihe (approximately 30 min). On arrival, members of the Motuihe Trust, Ngati Wai and members of the public transferred the boxes to an area of remnant forest where the birds were released.

In March 2009, another field trip to Little Barrier Island was organised to attempt to capture additional parakeets to reach our planned target of 50 individuals. From 3-9 March we captured 19 parakeets (9 males, 10 females) using the same techniques as the previous year; these were transferred in a single helicopter trip to Motuihe. On arrival, one of the females appeared very weak and unable to fly, and it was flown back and released on Little Barrier Island.

Monitoring: On the morning of the transfer, a 2 g single-stage transmitter (Holohil Systems Ltd., Ontario, Canada) was mounted on two central tail feathers of 12 individuals. After release, parakeets were radio-tracked once per week for three months, and once every two weeks for another four months. Once located, parakeets were observed from distances of 25-30 m and their unique band combination recorded. Parakeets were also searched for by walking along the tracks on the island, and also around the coastline at low tide. Searches for potential breeding pairs continued up to five months after release in and around gullies on the island known to contain potential nesting trees, such as pohutukawa *Metrosideros excelsa*, puriri *Vitex lucens* and ti kouka *Cordyline australis*. Identification of breeding pairs and inspection of nest cavities followed methods used in other parakeet populations throughout New Zealand (Ortiz-Catedral & Brunton 2009, Ortiz-Catedral *et al.* 2010).

CONSEQUENCES

Survival and establishment: A total of 32 parakeets (16 males, 16 females) were caught and transferred in three helicopter trips on 14 and 17 May 2008 (15, 13 and 4 parakeets/trip, respectively). One female died shortly after arrival on Motuihe. Post-mortem revealed head trauma and concurrent infection of beak and feather disease virus (BFDV) and avian malaria (*Plasmodium relictum*) (Ortiz-Catedral, unpubl.). Seventeen (55%) of the 31 remaining parakeets were observed alive and their band combinations recorded 30 days after release, including 10 of the parakeets with

transmitters. One of the transmitters was located high on a tree and remained in exactly the same position for two months, suggesting it had fallen off the bird and lodged in vegetation. Another transmitter was lost within a week of release but it is unclear if the transmitter failed or if the parakeet flew away from the island. At 60 days after the release, 13 individuals were recorded alive (42%) including 10 with transmitters. It is likely that the survival was higher than recorded given the numerous sightings of parakeets whose band combinations could not be accurately recorded.

One nest was found five months after release (October 2008) in a cavity on a dead branch of a puriri tree. Eight months after release two family groups were recorded: one consisting of three unbanded juveniles and an adult, and another of two adults and a juvenile. Another, 18 individuals were released on Motuihe in March 2009, bringing the total number of translocated parakeets to 49 (25 males, 24 females). This second flock of parakeets was not monitored immediately after release due to limited funds.

Dispersal to other islands: Within a year of the first release, sightings of parakeets on adjacent island sites such as Rangitoto and Motutapu Islands were reported. On 29 November 2009, we visited Motutapu (less than 1 km away from Motuihe) and recorded a male released on Motuihe eight months earlier paired with an unbanded adult female and accompanied by three recently fledged juveniles. We also recorded a dead, unbanded adult on Motutapu, but it is unclear if it hatched at this site or if it originated from Motuihe. Conservation volunteers working on Motuihe and Motutapu Islands have reported sightings of banded and unbanded parakeets indicating survival of members of the founder flocks and locally hatched parakeets.

Costs: The overall cost per parakeet transferred from Little Barrier Island to Motuihe Island was \$580 NZD (approximately € 298). The cost included screening for selected pathogens such as *Campylobacter*, *Salmonella*, *Yersinia*, *Plasmodium* and BFDV (see Ortiz-Catedral *et al.*, 2009a, 2009d for details). Also, the funds were used to cover the food and accommodation of teams of 14-16 volunteers involved in the capture, processing and care in the aviary of parakeets, as well as transportation to and from Little Barrier Island by boat and helicopter.

Discussion and conclusions: Our observations on Motuihe Island show that wild parakeets are able to survive and successfully pair after translocation to a restoring ecosystem free of introduced mammalian predators. It is still unclear what founder number is the minimum required to establish a new population via translocation. Previous translocations of the species have released between 30 and 80 individuals (McHallick 2005), thus our founder flock can be seen as intermediate in terms of numbers of released parakeets. The number of parakeets released on Motuihe appears to have been enough at least for the short-term establishment of an additional population of red-fronted parakeets, and successful breeding has been confirmed.

Experience from another translocated population indicates that the long-term persistence of parakeets on Motuihe is likely. On Tiritiri Matangi Island, 80 captive-bred parakeets were released between 1974 and 1976 (Dawe 1979; Higgins 1999). The Tiritiri Matangi population has persisted for 36 years without management intervention, and recent research indicates periodic breeding (Ortiz-Catedral & Brunton 2008) and local recruitment of juveniles into the breeding population (Ortiz-Catedral 2006). The translocation of wild red-fronted parakeets to Motuihe was an inexpensive exercise considering the benefits obtained, which include an additional population of a vulnerable species, natural dispersal to a nearby restoring site (Motutapu Island), and the opportunity to engage scientists and conservation volunteers in a translocation project with potential for education and scientific research.

The translocations of red-fronted parakeets may also serve as a model for management of closely related threatened parakeets, such as the Norfolk Island green parakeet *Cyanoramphus cookii*, a species with a current population of around 160 individuals (Hill 2002).

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