Notornis, 2013, Vol. 60: 117-119
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SHORT NOTE

Survival of South Island robins (*Petroica australis*) after a reciprocal translocation to reduce inbreeding depression

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Translocation is one of the key methods for the conservation of endangered birds in New Zealand (Armstrong & McLean 1995). The purpose of most translocations of native birds has been the creation of new populations of the target species on offshore islands free from introduced mammalian predators (Armstrong & McLean 1995). More recently, a variety of translocations have been undertaken to re-establish endangered species on mainland sites with intensive predator control or predator-exclusion fences. Although some translocations involved multiple releases over a number of years to supplement the population and ensure it became established, a number of successful translocations involved only a single release. In some cases, the number of individuals released (and then subsequently survived to breed) was relatively small, raising concerns that the severe bottleneck experienced by the population during the translocation could lead to the loss of genetic variation and inbreeding depression (Frankham *et al.* 2010, Keller & Waller 2002).

In 1973, two island populations of the South Island robin (*Petroica australis*) were established on Motuara and Allports Is in the Marlborough Sounds through the translocation of 5 birds each from Nukuwaiata I and Kaikoura, respectively (Armstrong 2000). Both islands are isolated from the mainland (and each other) and are currently free of all introduced mammalian predators. They are covered by regenerating native forest. Despite the small size of the founder populations, both translocations were successful and today the islands hold some of the highest densities of robins found anywhere in their range (Heber *et al.* 2013). The high numbers of robins on the 2 islands would suggest that the small number of founders has not had a detrimental effect. However, high levels of hatching failure and reduced immunocompetence in island robins relative to their mainland counterparts suggests they are suffering from inbreeding

Received 9 Mar 2013; accepted 12 Mar 2013
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depression (Hale & Briskie 2007, Mackintosh & Briskie 2005).

One method for alleviating inbreeding depression in a bottlenecked population is to introduce new (and genetically different) individuals (Weeks *et al.* 2011). This is termed "genetic rescue" and has been highly effective in the management of some endangered species (*e.g.*, Westemeier *et al.* 1998, Madsen *et al.* 2004, Johnson *et al.* 2010), but the technique relies on the availability of outbred and non-bottlenecked populations as a source of donors. These are not always available for many endangered species, which instead survive only in small and fragmented populations. Thus, one is often left with only other bottlenecked populations to use as donors. To determine whether bottlenecked populations can be effective donors, we carried out a reciprocal translocation between robins on Motuara (59 ha) and Allports Is (16 ha). The objective was to determine if we could reduce the level of inbreeding depression through the translocation of birds between 2 already established but genetically different populations.

Translocations occurred over 2 years. In 2008, 15 female robins were translocated from Allports to Motuara I, while at the same time, 10 females were translocated from Motuara to Allports I. The translocations took place from 2 to 4 Sep. A second set of translocations occurred from 3 to 4 Sep 2009, and involved 3 females being translocated from Allports to Motuara, and 3 females from Motuara to Allports (a total of 31 females translocated over the 2 years). Birds were captured using either Potter or clap traps and transported in wooden holding boxes with one side being meshed. Boxes contained a perch and birds were given *ad libitum* water and mealworms (*Tenebrio* sp.). All birds were transported to the recipient island by boat and released on the same day as capture after a maximum holding period of 8 hours. Before release, we ensured birds were banded with unique coloured leg bands and a metal band for individual recognition. Birds were released in or close to the vacancies created by the removal of females translocated to the other island, although in some cases the translocated birds later dispersed to other sites on the islands. The objective was to translocate only female robins to ensure that they then subsequently paired up with a male on the recipient island. Birds were sexed initially by plumage but this was not always reliable (*unpubl. data*) and in addition to the 31 females, 3 males were accidentally translocated in 2008; 1 male was later transferred back to his native island while the remaining 2 males could not be relocated again in the subsequent 3 years of follow up study,and therefore only females were successfully translocated.

To determine survival and reproductive success of translocated birds, and thus the effectiveness of the "genetic rescue", the location of each translocated bird, their pairing status, and their nesting success were monitored for 3 breeding seasons from Sep 2008 to Jan 2011. Both islands are relatively small and were searched repeatedly for the translocated birds. Overall, only 54.8% (n = 31) of females survived the translocation to the first breeding season. The survival rate was similar for females on Allports (53.8% of 13 females) and Motuara I (55.6% of 18 females). If the 3 accidentally translocated males are included as mortality, only 18/34 birds were seen again after release on their recipient island (52.9%). None of the missing birds was observed on their source islands, and although we cannot rule out birds flying off the island to adjacent areas of the mainland, it is likely that most of them did not survive, or at least not long enough to contribute to the donor breeding populations.

The success of other New Zealand robin translocations has been variable. For example, Armstrong *et al.* (2002) reported that 43/44 North Island robins (*P. longipes*) translocated to Tiritiri Matangi I in Apr survived to at least the start of their first breeding season in Sep. In contrast, South Island robin translocations to Maud I and a mainland site near Christchurch both failed (Gaze & Cash 2008). Given the success of the initial translocations to Motuara and Maud Is (in which most birds survived; Flack 1973), we were surprised that only half of the birds we translocated were subsequently resighted. However, unlike most other translocations, which involved the releases of birds into unoccupied (but presumed to be suitable) habitat, our translocations resulted in birds being released into already occupied and high-density populations in which they likely encountered strong competition from resident robins. This could have resulted in higher mortality or increased dispersal off the islands.

Despite the loss of half of the translocated birds, the "genetic rescue" experiment was successful, with the offspring of "hybrid" pairs (mother and father from different islands) showing higher juvenile survival, pairing success, and immunocompetence and lower levels of sperm abnormalities (Heber *et al.* 2013). Our results confirm that translocations for the genetic management of fragmented populations are worthwhile, even when the only donors are other bottlenecked and inbred populations. However, translocations undertaken for the purpose of rescuing already established populations may need to involve more individuals than may otherwise be the case to ensure that a minimum number survive (or do not disperse) and that their alleles are potentially added to the donor gene pool.

ACKNOWLEDGEMENTS
We are grateful to the Cougar Line Ltd for helping to finance this project by providing complimentary boat transport between the 2 island study sites. This project was financially supported by the University of Canterbury, the Max Planck Society, the JS Watson Conservation Trust, the Frank M Chapman Memorial Fund and the Brian Mason Science and Technical Trust. Permits covering all aspects of the study were obtained from the Department of Conservation (#NM-23477-FAU) and the Animal Ethics Committee at the University of Canterbury (#2008/16R).

LITERATURE CITED

Armstrong, D.P. 2000. Reintroduction of New Zealand robins: a key component of ecological restoration. *Reintroduction News 19*:44-47.

Armstrong, D.P.; Davidson, R.S.; Dimond, W.J. Perrott, J.K.; Castro, I.; Ewen, J.G.: Griffiths, R.; Taylor, J. 2002. Population dynamics of reintroduced forest birds on New Zealand islands. *Journal of Biogeography 29*: 609-621.

Armstrong, D.P.; McLean I.G. 1995. New Zealand translocations: Theory and practice. *Pacific Conservation Biology 2*: 39-54.

Flack, J.A.D. 1973. Robin research - a progress report. *Wildlife - a review 4:* 28-36.

Frankham, R.; Ballou, J.D.; Briscoe, D.A. 2010. *Introduction to conservation genetics*. 2nd edition. Cambridge, U.K.: Cambridge University Press.

Gaze, P.; Cash, B. 2008. *A history of wildlife translocations in the Marlborough Sounds*. Occasional Publication No. 72. Nelson: Department of Conservation.

Hale, K.A.; Briskie, J.V. 2007. Decreased immunocompetence in a severely bottlenecked population of an endemic New Zealand bird. *Animal Conservation 10*: 2-10.

Heber, S.; Varsani, A.; Kuhn, S.; Girg, A.; Kempenaers, B.; Briskie, J.V. 2013. The genetic rescue of two bottlenecked South Island robin populations using translocation of inbred donors. *Proceedings of the Royal Society of London, B. Biological Sciences 280*: 2012-2228.

Johnson, W.E.; Onorato, D.P.; Roelke, M.E.; Land, E.D.; Cunningham, M.; Belden, R.C.; McBride, R.; Jansen, D.; Lotz, M.; Shindle, D.; Howard, J.; Wildt, D.E.; Penfold, L.M.; Hostetler, J.A.; Oli, M.K.; O'Brien S.J. 2010. Genetic restoration of the Florida panther. *Science 329*: 1641-1645.

Keller, L.F.; Waller, D.M. 2002. Inbreeding effects in wild populations. *Trends in Ecology and Evolution 17*: 230-241.

Mackintosh, M.A.; Briskie, J.V. 2005. High levels of hatching failure in an insular population of the South Island robin: a consequence of food limitation? *Biological Conservation 122*: 409-416.

Madsen, T.; Ujvari, B.; Olsson, M. 2004. Novel genes continue to enhance population growth in adders (*Vipera berus*). *Biological Conservation 120*: 145-147.

Weeks, A.R.; Sgro, C.M.; Young, A.G.; Frankham, R.; Mitchell, N.J.; Miller, K.A.; Byrne, M.; Coates, D.J.; Eldridge, M.D.B.; Sunnucks, P.; Breed, M.F.; James, E.A.; Hoffmann, A.A. 2011. Assessing the benefits and risks of translocations in changing environments: a genetic perspective. *Evolutionary Applications 4*: 709-725.

Westemeier, R.L.; Brawn, J.D.; Simpson, S.A.; Esker, T.L.; Jansen, R.W.; Walk, J.W.; Kershner, E.L.; Bouzat, J.L.; Paige, K.N. 1998. Tracking the long-term decline and recovery of an isolated population. *Science 282*: 1695-1698.

Keywords translocation, genetic rescue, survival, density-dependence