Best practice techniques for the translocation of red-crowned parakeet (kākāriki, *Cyanoramphus novaezelandiae novaezelandiae*) and yellow-crowned parakeet (kākāriki, *Cyanoramphus auriceps*)

Rose Collen, Bill Cash, Lynn Adams, Luis Ortiz-Catedral, Matu Booth, Richard Gray, Denise Fastier, Kahori Nakagawa and Tamsin Ward-Smith

New Zealand Government

Department of Conservation
Te Papa Atawhai

Cover: Red-crowned parakeets. *Photo: Terry Greene.*

Published by the Terrestrial Ecosystems Unit, National Office, Science and Capability Group, Department of Conservation, PO Box 10420, The Terrace, Wellington 6143, New Zealand.

Produced by the Publishing Team, National Office, Department of Conservation, PO Box 10420, The Terrace, Wellington 6143, New Zealand.

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Rose Collen[1], Bill Cash[2], Lynn Adams[3], Luis Ortiz-Catedral[4], Matu Booth[5], Richard Gray[5], Denise Fastier[6], Kahori Nakagawa[7], Tamsin Ward-Smith[7]

[1] 62 Bain Street, Invercargill 9812. rcollen@doc.govt.nz

[2] Formerly Department of Conservation Sounds Area Office, Picton, New Zealand.

[3] Department of Conservation, National Office, PO Box 10420, Wellington 6143, New Zealand.

[4] Institute of Natural and Mathematical Sciences, Massey University, Private Bag 102904, North Shore Mail Centre, Albany 0745, Auckland, New Zealand.

[5] Zealandia, PO Box 9267, Marion Square, Wellington 6141, New Zealand.

[6] Department of Conservation Ahuriri / Napier Office, PO Box 644, Napier 4140, New Zealand.

[7] Cape Sanctuary, 2 Gow Avenue, Haumoana 4102, Napier, New Zealand.

Abstract

This document details best practice techniques for the translocation of red-crowned parakeet (kākāriki, *Cyanoramphus novaezelandiae novaezelandiae*) and yellow-crowned parakeet (kākāriki, *Cyanoramphus auriceps*). It contains methods used in the translocation process, from selecting the most appropriate population and time of year for translocation, and capturing, housing and transporting birds, through to post-release monitoring. It is intended that this information will help to increase the success of future translocations of parakeets.

Keywords: red-crowned parakeet, *Cyanoramphus novaezelandiae novaezelandiae*, yellow-crowned parakeet, *Cyanoramphus auriceps*, kākāriki, translocation, best practice, New Zealand

Collen, R.; Cash, B.; Adams, L.; Ortiz-Catedral, L.; Booth, M.; Gray, R.; Fastier, D.; Nakagawa, K.; Ward-Smith, T. 2014: Best practice techniques for the translocation of red-crowned parakeet (kākāriki, *Cyanoramphus novaezelandiae novaezelandiae*) and yellow-crowned parakeet (kākāriki, *Cyanoramphus auriceps*). Department of Conservation, Wellington, 37 p.

1. Introduction

The information presented in this document is the result of experience gained from 11 translocations of red-crowned parakeets (kākāriki, *Cyanoramphus novaezelandiae novaezelandiae*) and yellow-crowned parakeets (kākāriki, *Cyanoramphus auriceps*) from 2003 to 2012. This document is one of a series of reports outlining best practice techniques for the translocation[1] of New Zealand bird species. It is intended as an advisory document for those planning parakeet translocations, and for those assessing translocation proposals.

The methods described here are based on techniques that have been tested and have met with success in past translocations. Therefore, they are recommended as current best practice techniques for translocations of red- and yellow-crowned parakeets (hereafter referred to as kākāriki when referring to both species). Orange-fronted parakeets and other New Zealand parakeets are not included in this document.

Where there is no single best way of doing something, a range of techniques is described and, in these instances, the choice of technique will depend on the individual preference of the translocation team. Although we describe techniques that have been used for both species, the two species have different biology and could respond to the various techniques in different ways. It is also important to note that bird behaviour and reaction to capture, captivity and translocation can vary between locations, seasons and years. Good translocation practitioners will always closely monitor the birds in their care and respond to their needs accordingly.

Confidentiality of information in this document:

1. The information made available through this document is provided on the basis that it may assist with future translocations, and enables those carrying out translocations and researchers to share the information for that purpose.
2. All information referred to within this document remains the property of those reporting or contributing the information, and this report must be properly referenced if the information is cited in other publications.

Any new information or suggested improvements to this document can be sent to the Technical Advisor—Systems Improvement, Terrestrial Ecosystems Unit, Science and Capability Group, Department of Conservation (DOC) (coordinator of DOC's translocation process)—at present this is Troy Makan (email: tmakan@doc.govt.nz).

2. Animal welfare requirements

In order to ensure the welfare of animals during translocation and to maximise the chance of a successful translocation outcome, the team of people carrying out the translocation needs to include members with suitable training and experience in the capture, handling, holding and release techniques that will be used. These expert operators are needed on site to demonstrate techniques and provide advice to less experienced team members such as volunteers.

When handling wildlife, the animal welfare provisions of the Animal Welfare Act 1999 and its welfare codes[2] (e.g. Transport within New Zealand) must be met. Note that this best practice guideline has been produced to improve the likely success of kākāriki translocations, and thus promotes a high level of care of the birds and a consideration of general animal welfare. However, it does not attempt to address each of the minimum standards listed in welfare codes.

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[1] Translocation is defined by the Department of Conservation as the managed movement of live plants or animals (toanga) from one location to another. Translocation covers the entire process, including planning, transfer, release, monitoring and post-release management (up to some predetermined end point). A translocation can consist of one or more transfers.

[2] www.biosecurity.govt.nz/regs/animal-welfare/stds/codes

3. Types of translocation

Kākāriki have been translocated to new sites by wild-to-wild translocation (more often), or a combination of wild-to-wild and captive-to-wild translocation (less often).

3.1 Wild-to-wild translocation

Direct transfer from source to release site and immediate release is the most commonly used technique to establish new kākāriki populations. Typically, one or two transfers of a large number of birds have been carried out to establish a population at a suitable release site.

At present, it is not known how many kākāriki should be transferred to ensure the new population will have sufficient genetic diversity for long-term persistence; this needs further investigation, as it is something that must be considered when planning a translocation.

3.2 Captive-to-wild translocation

Translocation projects can involve captive breeding of kākāriki and release of offspring. This type of translocation is more likely to have benefits for a mainland release site where dispersal into adjacent habitat might be an issue.

Note that people holding captive red- and yellow-crowned parakeets must have an authority from DOC to hold the species in captivity[3]. **The birds must be of known wild origin and genetic provenance**, as hybridisation of red- and yellow-crowned parakeets has occurred in captivity in the past. The existing large, widespread captive population of red-crowned and yellow-crowned parakeets is **not suitable** for translocations into the wild and will not be considered for wild releases. Suitable captive populations will be formed from known-source birds or eggs taken from natural wild populations.

Possible advantages of releasing captive-reared birds include:

- It may be a relatively inexpensive way to supplement or 'top-up' an establishing population, if reliable local breeders are available and willing to provide pure-bred red- or yellow-crowned parakeets (i.e. birds of known wild origin that have never hybridised) at low cost.
- Sourcing captive birds is easier, and reduces impacts on source sites and the need for complex planning of capture teams.
- Captive-bred birds are accustomed to captivity and could therefore be held more easily in aviaries at the release site for a pre-release period, which may help to site-fix them and any previously released birds.
- The disease status of the birds may be more certain than that of wild-caught birds, because disease tests can be done more easily on every individual.

Possible limitations include:

- It may not be possible to release large groups of birds at once. The release programme may be limited by the availability of birds in any given year.
- Significant numbers of unrelated pairs would have to be held to provide sufficient genetic diversity for any translocated population. One solution might be to take eggs from wild populations for captive pairs to rear.
- There will be an ongoing need to communicate with breeders, coordinate their efforts and undertake multiple releases over time.

[3] For more information visit the DOC website. http://www.doc.govt.nz/getting-involved/apply-for-permits/protected-wildlife-in-captivity/guidelines/

- Careful management of the captive population is needed to ensure breeding with unknown-origin captive birds is prevented, i.e. ensuring holders only hold birds of known wild origin.
- The existing captive parrot population may harbour disease, so it would be necessary to segregate kākāriki intended for release from all other parrots and carry out thorough disease screening. Holders intending to breed kākāriki for release would not be allowed to also hold other parrot species.

The limitations of the captive-to-wild translocation technique make it more likely to be used in conjunction with a wild-to-wild translocation (i.e. it is just one of the tools that can be used to achieve a specific goal).

4. Source population

Things that need to be considered when choosing a source population of kākāriki include:

- Impact of the translocation on the source population
- Impact of visitation on the source site and risk of disease transfer
- Relationships with landowners, local iwi
- Availability of infrastructure at remote sites (e.g. huts, campsites on islands)
- Accessibility (e.g. safe transport of teams and birds)
- Distance from the release site (e.g. transportation logistics)
- Proximity and/or similarity of climate and habitat to release site (i.e. birds are likely to adapt more readily to a new site if it is close to or very similar to source site)
- Canopy height of vegetation and ease of capture
- Genetic representation at other locations (i.e. representing as many source populations as possible will provide the most benefit to the species nationally)
- The origin of the source population (e.g. if it was a result of translocation itself, it may have low genetic diversity)

  Note that red-crowned parakeets on Tiritiri Matangi Island, Moutuhora (Whale) Island and Cuvier Island (Repanga Island) are not considered suitable as a source for translocation. This is because they were established from captive-bred stock that were hybridised with yellow-crowned parakeets (Cromarty & Hitchmough 2005).

DOC District Office staff and others with experience translocating kākāriki should be consulted about the practicalities of any potential source site.

5. Composition of transfer group

There is no specific recommendation on whether to transfer adults or juveniles. In reality, transfer groups usually consist of a mixture of ages (depending on what is caught and the time of the year). Dispersal and survival rates of translocated adults compared with juveniles have not been studied.

The most important thing is to aim for an even sex ratio in the released birds.

Males are often caught first, as females tend to be more cautious. Both males and females quickly learn about nets from watching other kākāriki being caught. Ideally, kākāriki should be sexed as they are captured, to avoid ending up with a very uneven sex ratio in the transfer group (refer to section 11.1 Sexing kākāriki).

6. Time of year for transfer

Kākāriki translocations should be undertaken during the non-breeding season, which is usually April to September.

The main breeding season for kākāriki is from October to March, although this can vary and they can breed at any time of year if food is abundant (e.g. in forests that have periodic mast events). Yellow-crowned parakeets may begin breeding much earlier and continue for far longer than red-crowned parakeets (Greene 1998). Sometimes kākāriki can have late clutches that finish in May, or they can begin breeding as early as August, so it is important that the source population is monitored before catching begins, to check for any evidence of nesting.

Another thing to consider with the timing of the translocation is the seasonal availability of native fruits and browse plants, because:

- Ideally, birds should be released into their new environment at a time when natural foods are plentiful.
- It is important to fill the temporary holding aviary at the source site (refer to section 12 Temporary housing) with plenty of native fruits, seeds and other browse plants, to sustain the birds during their time in captivity. You must ensure that there will be food material readily available at the source site during the bird collection period (Nakagawa 2013).

6.1 Autumn

Ortiz-Catedral et al. (2010) reported that on Little Barrier Island the months of April and May were ideal for catching red-crowned parakeets, but September was not as good because catch rates were very low. There are likely to be more birds available for catching at the end of the breeding season (during April and May), as there are more juveniles about (before natural winter mortality). This could also lessen the impact of the translocation on the source site population.

Weather conditions in April and May are also generally better for mist-netting than winter and spring. At some sites there may be a seasonal abundance of fruits or seeds that could make it easier to catch birds near those food sources (e.g. an abundance of grasses seeding on Little Barrier from April to June made it easier to catch kākāriki flying close to the ground).

6.2 Winter

Transfers during winter (i.e. June/July) are acceptable if the release site has a warmer climate (e.g. coastal, further north). This is because there is lower risk of kākāriki breeding during mid-winter.

A disadvantage of winter transfers is the shorter daylight hours for catching birds and, at the release site, the need to release birds earlier in the day. The time available to transport the birds on the release day for an early afternoon release is also likely to be shorter (refer to section 15 Release). There may also be fewer natural food sources available (depending on the site) and, potentially, lower survival for birds that have to cope with winter food shortages and cold.

6.3 Spring

Where kākāriki are being released at sites that have colder winter conditions (e.g. Boundary Stream, Hawke's Bay), spring transfers are preferred so that newly transferred birds do not have to endure a potentially harsh winter in a new place, and the weather is warming in the weeks immediately following the transfer.

Another advantage of spring (September) transfers compared with autumn transfers is that there may be less risk of breeding birds being caught (depending on the site), as it is before the main breeding season; although the source population must still be checked for signs of breeding activity before catching begins.

7. Transfer team

It is vital that the translocation team includes people that are experienced in catching, handling, banding and transferring birds and, because kākāriki are difficult to handle, some of the team must have experience in handling a kākāriki species.

At least two people on the team must be skilled and qualified to band and measure the birds, so that during busy catching times there is not a backlog of birds to be processed. Note that bands may only be fitted by approved (permitted) banding operators (refer to section 11.3 Banding).

It is strongly recommended that most of the team is skilled at mist-netting and bird handling. This is more important for kākāriki than other species because of their stress and handling responses (refer to section 9.3 Removing birds from the net and handling). Anyone on the team without mist netting experience should receive training[4] prior to any translocation operation, as this is not an appropriate species for inexperienced people to start learning with.

There will need to be enough people in the team to be able to closely monitor all mist-nets and remove birds quickly, and at every net site (or group of nets) there must be at least one person who is experienced at handling kākāriki and removing them from mist-nets. The number of people needed on the catching team can vary depending on the number of nets set up, the target number of birds and the source site. For example:

- For the translocation of red-crowned parakeets from Kapiti Island to Zealandia in 2010, to catch 57 birds a total of 14 people were involved in mist-netting over 6 days—up to 10 people on any one day. The first day was spent preparing and furnishing the aviary, and looking for possible net sites (Booth 2010).

[4] Monthly mist-netting sessions are held at Wellington Zoo from March to October. Contact Peter Reese, OSNZ Wellington, Email: ruth.peterr@xtra.co.nz. OSNZ may also carry out mist-netting sessions in other regions.

- When yellow-crowned parakeets were translocated from Mana Island to Boundary Stream, a team of six people spent one day setting up the temporary holding aviary, then caught 30 birds in 2 days (Fastier 2013).
- During the translocation of red-crowned parakeets from Kapiti Island to Cape Sanctuary (involving two transfers), to catch 44 birds a total of 13 people were involved over 10 days—from six to eight people per day (Nakagawa 2013).

8. Specialist advice

Translocation techniques for kākāriki are still evolving, because they are difficult species to handle and translocate and there has been significant mortality during past translocations. Translocation project managers should seek advice from local DOC District Office staff about who has been involved in the most recent kākāriki translocations and whether there is further information available about the latest techniques. Details of people involved in recent kākāriki translocations who can be contacted for further advice are provided in Appendix 2.

9. Capture

Kākāriki are captured using mist-nets.

Note that for most kākāriki translocations there will be a requirement for mist-netting equipment to be brand new, or thoroughly disinfected with TriGene™ or Virkon™ before use at the source site, because of the risks of avian disease transfer (e.g. Beak and Feather Disease Virus). Visitors to offshore islands will also be required to ensure that all gear is free of soil, seeds and vegetation, especially the ends of mist-net poles that are pushed into the ground.

9.1 Mist-net size

The appropriate mist-net mesh size for catching kākāriki is 30 mm or 38 mm. The two mist net sizes can be used for both species, and seem to have the same performance for both species despite yellow-crowned parakeets being smaller than red-crowned parakeets.

Mist-nets are available from the DOC banding office[5], and come in 6, 9, or 12 m lengths with each net having five pockets. The best length to use depends on the vegetation and terrain of the catching site. Having a variety of lengths on hand provides more set-up flexibility.

Nets with 30 mm mesh have an advantage in that the birds don't tend to get as entangled in them, so they can be extracted more quickly. Their disadvantage is that the birds can also bounce out of or escape from the nets more easily (often by running along the pockets). If this is occurring, increasing the pocket depth or lowering the net very quickly may help. In contrast, 38 mm nets are more successful at entangling birds, meaning that they are less likely to escape, but this may also mean that it takes longer to remove them from the net.

[5] DOC banding office—Email: bandingoffice@doc.govt.nz, Phone: 04 471 3248

9.2 Setting up and operating mist-nets

Mist-net sites need to be installed reasonably close to the place where the birds will be processed (banded and measured) and held, to keep the handling and commuting time to a minimum. Temporary holding aviaries must be fully set up and furnished before mist-nets are deployed (refer to section 12 Temporary housing) (DOC 2012).

Mist-nets are set up across likely flight paths and, depending on the forest type, may have to be raised to canopy height (Fig. 1). Depending on the height and density of the vegetation at the site, it can be useful to use more than one net to increase the height of the mist-net set. The usual strategy is to look for sites where the birds are feeding or regularly crossing and identify commonly used flight paths. Nets installed near water used for drinking and bathing (especially in dry locations with few water sources) and popular food sources can be particularly productive. Having local knowledge of the source site area and where kākāriki can be found is very useful, as is knowing what they are feeding on at particular times of the year.

The birds can sometimes be lured near to the nets by playing pre-recorded kākāriki calls, although this technique has not been needed in most transfers to date and could potentially put birds off coming near the net if not used skilfully. The team involved in the translocation to Cape Sanctuary found that playing loud, long chatter calls (ki-ki-ki-ki-ki-ki) was effective in luring the birds to the vicinity of the net, and soft contact calls or short calls resulted in successful capture (Nakagawa 2013).

To catch the target number of birds, it is often more efficient to operate lots of net sites at once (i.e. a 'site' may have several nets adjacent to each other within easy reach). However, there needs to be enough people at each net site to be able to closely monitor every net at all times, and remove any captured birds immediately, including flocks. It is important to be able to see which side the bird entered the net, as it is not possible to extricate it from the opposite side without cutting the net. **Never leave any net unwatched**.

At **every capture site** there must be at least one person experienced at, and comfortable with, removing kākāriki from mist-nets. Less-experienced catchers and handlers must be teamed up with more-experienced team members. There will need to be at least two people at each net site, so they can rapidly lower the net when a bird is caught and remove birds quickly if more than one is caught at a time.

Figure 1. Mist-nets set up to catch kākāriki on Kapiti Island. *Photo: Denise Fastier.*

Be careful when the net is operating where there are large groups of kākāriki. Catching flocks of kākāriki with only one or two people in attendance can result in birds dying from stress if they cannot be removed from the net fast enough.

When catching kākāriki at sites with weka (*Gallirallus australis*) (e.g. Kapiti Island), be aware that weka have been known to attack birds caught in mist nets (Adams et al. 2003).

Avoid netting in conditions where the net and birds will get wet, and bear in mind that catching birds can be difficult when windy conditions and sunshine make the net more visible to the birds.

Time of day can also be a factor in how easy the birds are to catch. Several teams catching red-crowned parakeets for translocation have noted that most birds are caught during early morning and late afternoon, when they are travelling between feeding areas and roost sites (Adams et al. 2003; Ortiz-Catedral 2009; Nakagawa 2013). Catching should be completed for the day while there is still sufficient time for processing the birds and getting them into the aviary while it is still light (e.g. 4 p.m. in winter).

If a net rig is to be left unattended (e.g. if catching is suspended), the net must be lowered and put away, i.e. not left on the rig. Even thoroughly furled nets (secured with flagging tape or similar) left for periods of time have been known to trap birds using them as perches (T. Greene, Department of Conservation, pers. comm. 2013).

9.3 Removing birds from the net and handling

Kākāriki are difficult to handle; they are known to be extremely stress-prone during capture and handling, and can readily die even with careful handling by mist netters and experienced handlers. Almost all translocation projects have experience of birds dying from stress. In nine transfers reported on to date, involving translocation of 348 red- or yellow-crowned parakeets, five birds have died while being removed from a net or handled, and a further 22 have died while in the temporary holding aviary.

Risks to the birds have been minimised (but not eliminated), by using only very experienced mist-netters, bird handlers, and aviculture staff. Minimising bird stress and improving survival is a priority and should be the focus of any new translocation.

During capture, it is essential that kākāriki are removed from nets immediately and processed as quickly as possible. Team members with less kākāriki handling experience must always be placed with experienced kākāriki handlers and mist-netters so they can quickly get assistance if needed. Anyone that gets into difficulty removing a bird from a net, needs to know they must ask for help sooner rather than later if they cannot manage (i.e. if it is taking more than a few minutes to untangle the bird) (DOC 2012).

Figure 2. Nikki McArthur taking a kākāriki out of a net. *Photo: Denise Fastier*.

Kākāriki are usually extracted from a mist-net by getting the head and wings out first, the birds then tend to automatically unclamp their feet from the net (Fig. 2).

A kākāriki is usually held with its head between the handler's index and middle fingers, with the rest of the hand across the bird's back (see Fig. 3). Kākāriki are difficult to handle and can inflict a painful bite, which can distract a handler from the more important job of caring for the bird. 'Vetbond' or 'Vetpro'[6] self-adhesive tape wrapped around fingers (as in Fig. 3) can give some protection from kākāriki bites. If a bird does manage to draw blood, the handler must be careful not to get too much of it on the bird's feathers, as it might have an impact on plumage insulation.

[6] Available from veterinarians or farm centres. Also known as horse bandage.

Figure 3. Holding a kākāriki. *Photo: Rob Cross.*

If several bird species are caught in the net at once, the kākāriki should be freed first. Release non-target species well away from the nets. Tūī (*Prosthemadera novaeseelandiae*) and other larger birds can often be tipped out—do this whenever possible to minimise handling, stress and damage to plumage.

9.4 Catch bags

Once a bird is captured, it must be transferred immediately to an opaque cotton catch bag.

Attach flagging tape (or a tag of some sort) to the bag, and on the tape write the time the individual was captured and an indication of how much time it took to extract it from the net, e.g. E (easy) if very quick, D (difficult) if it took a while, and M (moderate) for capture times in between (DOC 2012). This can help the processing team decide whether some birds might need to be processed first or more quickly.

Catch bags should be approximately 30 cm wide and 35 cm long. When making catch bags, remember that they should (A. Harvey, Contractor, pers. comm. 2012):

- Have enclosed seams, so there are no raw edges. There must be no loose bits of cotton that birds could get tangled in.
- Have a hem at the top (where the pull-cord is threaded through) that is considerably wider than the cord, so that it is easy to pull closed.
- Have a cord that is long enough to securely close the bag and then allow it to be attached or hung from a branch above the ground, if necessary.
- Be well sewn and finished firmly as they will be washed frequently.
- Be made of soft but heavy or thick cotton or natural fibre fabric, and not see-through (cotton nappies are a good material). Pillowcases are not suitable as the fabric is too light-weight and they are too large.

10. Transfer to base for 'processing'

Once the bird is in a catch bag, it must be taken immediately to the processing base and processed as quickly as possible. Hanging the bag in a tree while more birds are caught (as is done with some other species) **is not appropriate** for kākāriki, as they can be highly stress-prone and the capture and handling process must not be prolonged any more than necessary.

Black cloth bags can be used to transport captured kākāriki short distances from the capture location to a central site or 'base', where people are set up to measure, band, examine and disease-screen the birds. Kākāriki should not be carried in bags for longer than 15 minutes or across difficult terrain where there is a risk of the carrier falling over and crushing the bird. There must be only one bird per bag, and the carrier must always have one hand free while walking to help avoid falls.

Ideally, the processing base should be near the capture site and adjacent to the temporary holding aviary.

11. Processing the birds

Figure 4. Processing room on Mana Island.
Photo: Denise Fastier.

Processing must be carried out in a dry, cool, sheltered and shaded area such as inside a building or under a tent fly. Tarpaulins would only be suitable in calm conditions, as they can be noisy in the wind. Ideally, processing should be done in a small room or enclosed space, so that if a bird escapes from its handler it cannot fly far and potentially injure itself, and can be recaptured easily. Figure 4 shows a large room made smaller for this reason.

Kākāriki can stress easily while being handled, and have been known to die in the hand while being banded (Booth 2010). Therefore, processing must be done by experienced personnel, as quickly and quietly as possible, and there should be at least two people in the team capable of carrying out all parts of the processing, so birds are not held up if more than one is captured at once. There must also be a quick and easy way for the processing team to maintain close communication with the catching team (e.g. radios, phones or 'runners'). If the processing team becomes overwhelmed with birds, the catching team should slow down (by closing some nets) or suspend catching until the processing team has caught up.

Kākāriki should first be weighed while still in the catch bag, then the bag weighed separately. Then bill measurements should be taken (Fig. 5) to determine the sex (refer to section 11.1 sexing kākāriki), and observations to determine whether it appears to be adult or juvenile. It may be easier to measure the bill with the bird still in the cloth bag with just its head protruding.

Figure 5. David Melville holding a kākāriki for measuring. *Photo: Graeme Taylor.*

Other processing should include a health examination, and may include checking for a brood patch (by experienced observers only who understand what to look for), before confirming the bird's suitability for transfer. The bird should then be banded (refer to section 11.3 Banding), samples taken for disease testing (if required, as agreed in your DOC-approved translocation proposal) and, if applicable, transmitters attached (refer to section 17 Post-release monitoring).

It can be useful to take feathers while a bird is being held for banding and measuring, in case they are needed at a later stage for DNA analysis to test for Beak and Feather Disease Virus (BFDV) or other diseases. If feathers are required for this purpose, information on how to obtain feather samples can be found in DOC's avian blood/feather and reptillian tissue sampling standard operating procedure (SOP), copies of which can be obtained from a local DOC office.

Note: taking blood samples for disease testing is highly invasive and stressful for kākāriki. It may be too risky to include this process on top of the banding, measuring and holding in captivity. If it is considered necessary to take blood samples from the source population, consider doing it on a separate catching trip some months before the planned transfer trip.

Figure 6. Banding and measuring equipment laid out, Kapiti Island. *Photo: Tamsin Ward-Smith.*

All of the handling (banding, measuring, disease screening, etc.) should be done immediately after removing the kākāriki from the cloth bag—repeat handling should be avoided. Good organisation of equipment (Fig. 6) and planning the order of tasks is essential to reduce handling time. Two pairs of hands will often be needed.

The handler should take note of each bird's response to the handling process. Once processing is completed, the bird should be released into the temporary holding aviary by placing it on the floor of the aviary, or in some dense vegetation. The bird should be held for a moment to calm it and then let go very slowly, with the aim that it will calmly walk or climb out from under the handler's hand. Unfortunately, kākāriki seldom do this, so the handler must ensure that the bird's path away is towards soft vegetation rather than hard surfaces. If possible, the bird should be observed until it moves under cover.

11.1 Sexing kākāriki

Bill length and width are the best indicators of sex for both adult and juvenile kākāriki. Males have a larger upper mandible than females, and are also usually a heavier weight. The difference in bill size can be quite easy to see when a male and female are side by side.

There is, however, some overlap between male and female weights and measurements. If the bill length measurement is in the overlap range, it can help to also measure the bill width (which is also generally larger in males than females), and take into consideration the bird's weight.

Post-release observations of breeding behaviour will reveal how many have been correctly identified, and as long as the sex ratio is reasonably close to 50:50 a small number of errors should not cause any issues for the translocation.

11.1.1 Red-crowned parakeets

Both bill length and bill width measurements are needed to sex red-crowned parakeets, and there is some overlap in the range of male and female bill measurements.

In this species, some size variation has been found between populations of different regions, which can make it difficult to sex birds accurately unless morphometric data has been collected previously from birds at that site.

During a study on Aorangi Island (Poor Knights Islands) (Sagar 1988), over 200 red-crowned parakeets were weighed and measured. Table 1 shows the bill size and weights that were recorded, alongside measurements of 120 birds translocated from Kapiti Island (Adams, unpubl. data 2008). The birds on Kapiti Island had a slightly larger mean bill size than those on Aorangi Island.

Table 1. Measurements of red-crowned parakeets on Aorangi Island, Poor Knights Islands (Sagar 1988), and Kapiti Island (L. Adams, unpubl. data, 2008).

MEASUREMENT	ASSUMED SEX	MEAN	RANGE
Bill length: Aorangi (mm)	Male	17.0	14.6–19.3
	Female	13.6	12.2–14.8
Bill length: Kapiti (mm)	Male	17.1	16.0–19.0
	Female	13.9	12.8–15.3
Bill width: Aorangi (mm)	Male	10.4	9.1–11.8
	Female	8.9	7.7–9.6
Bill width: Kapiti (mm)	Male	10.7	10.1–11.7
	Female	9.3	8.4–10.1
Weight (g): Aorangi	Male	82.1	63–113
	Female	67.9	50–90
Weight (g): Kapiti (46 birds only)	Male	75.9	68–85
	Female	63.3	59–69

This highlights the need to take care if using morphometric data from other locations to sex red-crowned parakeets at a site where data has not been collected before (e.g. some females on Kapiti Island could be incorrectly identified as males using Aorangi data). Specialist advice may be needed to help analyse measurements and correctly identify the sexes.

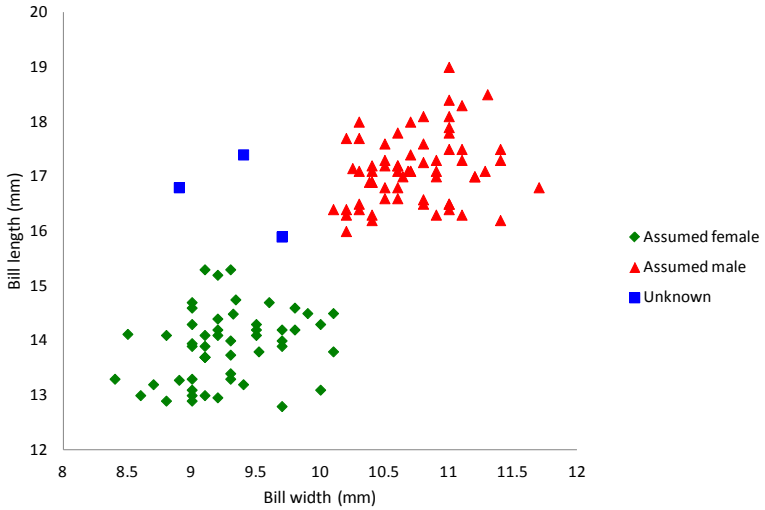

Figure 7. Measurements of 120 red-crowned parakeets on Kapiti and Matiu/Somes Islands (L. Adams, unpubl. data, 2013).

Figure 7 shows that when bill length and width are plotted on a graph, it is possible to see two main clusters of points that differentiate the sexes. Note that the sex of these birds was assumed based on their measurements and was not confirmed by DNA testing.

11.1.2 Yellow-crowned parakeets

The bill length measurement is used to determine the sex of yellow-crowned parakeets; bill width is less useful.

In a study of yellow-crowned parakeets in Fiordland (Elliott et al. 1996), 99 parakeets were measured and weighed. **Males were found to have bill lengths of ≥ 13 mm, and female bill lengths were < 13 mm.** This rule was found to also hold true for the Te Kakaho and Mana Island populations (Fig. 8), but note that there may be some overlap between male and female measurements in a small number of birds.

Figure 8 shows bill length and bill width measurements of 55 kakariki on Te Kakaho Island (Chetwode Islands, Marlborough Sounds) and Mana Island (off the west coast of the lower North Island). The sexing results shown on the graph as 'confirmed' were verified using DNA testing; while the sexes of the others were assumed based on their bill measurements. Note that some females had larger bill width measurements than some males, but there is no overlap in bill length between the sexes in this case.

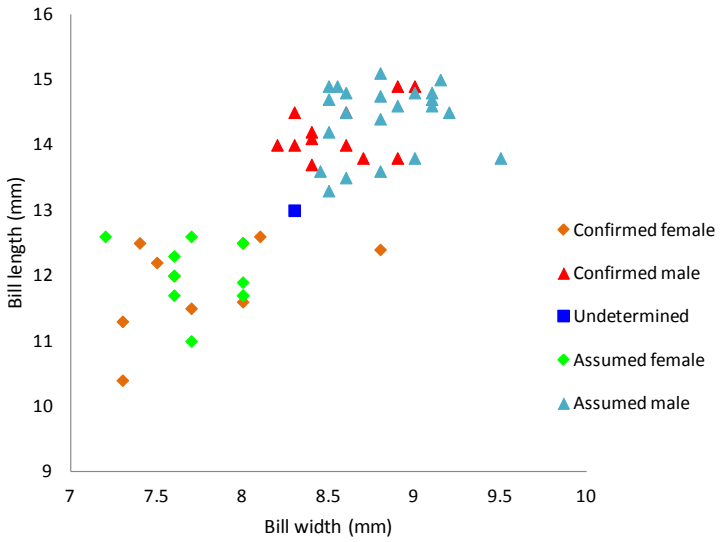

Figure 8. Measurements of 55 yellow-crowned parakeets on Te Kakaho and Mana Islands (L. Adams, unpubl. data, 2013).

11.2 Determining age of red-crowned parakeets

Juvenile red-crowned parakeets may be recognised by the difference in eye colour, which changes as the birds reach adulthood. Juveniles have an orange iris (left in Fig. 9) and adults have a scarlet iris (right in Fig. 9).

There is also a subtle difference in the bill colour, which is more pinky-yellow in juveniles. Recently fledged birds may also have shorter tails.

Information on the number of juveniles that are included in a transfer group is nice to have, rather than essential. Note that by winter, juveniles from the preceding breeding season will be fully matured and look like adults.

Figure 9. Juvenile red-crowned parakeet with orange iris (left) and adult with scarlet iris (right). *Photo: Denise Fastier.*

11.3 Banding

Usually, translocated kākāriki are given individual colour band combinations, to make it easier to monitor the survival of released birds, and identify pair members. The banding regime chosen will depend on the level of post-release monitoring planned (refer to section 17. Post release monitoring).

Birds can be banded with an individually numbered metal band on one leg, and two coloured plastic butt bands on the other leg. For red-crowned parakeets, 'D'-sized metal bands and butt bands are used, and for yellow-crowned parakeets 'C'-sized metal bands and butt bands are used. Alternatively, metal Incoloy™ bands can be used: DP for red-crowned parakeets, CP for yellow-crowned parakeets.

As kākāriki have a very short tarsus, it is **not possible** to include a colour band on the leg with a metal band (metal bands are slightly longer than the coloured butt bands). Use of filed-down colour bands over top of a metal band has been tried before and resulted in injury to the bird's leg (Nakagawa 2013).

The metal band can also be coloured (powder coated), but parrots have been known to chew the colour off metal bands, or it can wear off over time. With this in mind, if choosing to use coloured metal bands, do not use plain metal bands as well. It will then be obvious if the coating has come off any of the coloured bands (rather than them being mistaken for plain metal bands).

Kākāriki can be difficult birds to band, because they have very short legs, and because they tend to wriggle and bite. For this reason, the person carrying out the banding must be skilled and experienced. It may sometimes be easier to keep the bird in the catch bag during banding, with just the legs protruding, or have an extra person to hold the bird while the other bands. Some operators have found it is easier to fit the butt bands when the banding shoe is filed down to be shorter (so that it will fit on the bird's short leg at a point where the band will go around the leg rather than into it when the shoe is released).

Operators need to be mindful that kākāriki are difficult to monitor, being a canopy species, and it can be difficult to identify the bands of birds in the wild at the best of times. Therefore, care needs to be taken when band colours are chosen; for example, pale blue or yellow can fade to white very quickly, dark blue or green can easily be mistaken for black, and different shades of blue or green can be difficult to tell apart without seeing them together. It is very helpful to keep a sample of all the colours used on the birds, so that the people doing the post-release monitoring know what to look for.

If your project involves banding nestlings, note that they must be at least 25 days old (i.e. when their legs are fully grown) before they can be banded. This stage can be identified by the presence of red feathers on the crown and about the eyes. Be aware that there can sometimes be a large age spread between chicks in a single clutch.

For further information and to order bands, contact the DOC banding office[5]. Note that banding may only be carried out by approved (permitted) banding operators (Banding Certification Level 2 or 3)[7]. Refer to the DOC banding manual for further information about banding (banding permit holders will have a copy of the latest manual).

12. Temporary housing

Catching enough kākāriki for a transfer takes time, often several days. Because of this, it is usually necessary to house kākāriki temporarily in an aviary at the source site, while enough birds are captured for the transfer, especially when catching large numbers of birds, or when the source or release site is in a remote location.

A small portable aviary can be used; see section 12.1 below for design detail. Up to 29 birds have been held together in an aviary 1 m × 3 m × 2 m (height). They should be held this way for **no more than 5 days**.

12.1 Aviary design and set-up

The temporary holding aviary should be positioned away from foot traffic and other disturbance, in a sheltered and shady spot. Overheating can be a real issue at some sites, so placement of the aviary is important.

Tarpaulins could potentially be used to screen or shelter the aviary (although only in calm conditions, as they can be noisy in the wind). Aim to position the aviary so that it is always approached from the door end (i.e. so that people don't have to walk along the length of the aviary, disrupting the birds inside, to get to the door).

Ideally, at least one person involved in setting up the aviary should have participated in other kākāriki transfers and done it before.

The appropriate aviary set-up has been described as 'more like an oversized transfer box than a traditional aviary'. The most important aims of the aviary design and set-up of the environment inside are to reduce stress and prevent collision injuries that kākāriki have frequently suffered in aviaries during past transfers, by:

- Softening all of the aviary's internal structural surfaces and edges by lining it with shade cloth; and
- Furnishing the aviary fully so there is no space for flight, so the birds are unable to fly at speed and crash into things (Booth 2010). Four birds died from collision injuries before this technique was developed.

Portable aviaries are ideal, as they can be prepared in advance. A small portable aviary (shown in Fig. 10) was used for a number of transfers of yellow-crowned parakeets to and from Mana Island and within the Marlborough Sounds. Up to 29 birds have been held successfully together in an aviary of this size for up to 5 days.

[7] DOC Banding Office Banding Certification: Level 1 = Trainee, may only operate under direct supervision of a Level 3 certified bander. Level 2 = Intermediate, may catch and band birds without direct supervision but still operates under a Level 3 who is responsible for their activities. Level 3 = Supervisor/Trainer, has extensive experience, may be authorised to train others, and in whose name the bands are issued.

Figure 10. A—Portable temporary aviary for kākāriki; B—View inside packed aviary (*Photos: Denise Fastier*).

The walls and ceiling are made in advance, and can then be bolted together at the catching site. The aviary set up is as follows:

- Size is 1 m × 3 m × 2 m (height).
- The interior is lined with shade cloth.
- The roof is waterproof, usually plywood.
- The back wall (opposite end to the door) is plywood, to give strength to the structure.
- There is a double door entrance to prevent birds escaping when people enter the aviary.
- It is useful to install a small hatch at the bottom of the internal door, so that when the birds are captured (initially or on the transfer day), they can be passed in or out through the small hatch, rather than the whole door having to be opened each time.
- Soft vegetation (mainly kānuka (*Kunzia ericoides*), if available) is securely attached to all corners, hard surfaces and edges, and the plywood back. The stems should be both ways up so the soft tips are oriented both to the ceiling and the floor.
- The floor is lined with a thick layer of leaf litter.
- Edible browse (flowers and fruit kākāriki have been seen feeding on) can also act as cushioning, branches and perches, and is tied securely (attached into vegetation by cable ties or poked through). Some can be placed in tubes of water to keep them fresh and prevent wilting (with the tubes completely filled so that there is no possibility of a bird falling into one and drowning).
- The aviary is packed with vegetation so that the birds are unable to fly but can move around inside by walking, climbing or fluttering. Stems can be poked into the ground, or propped up against each other, and secured so they do not fall over (Fig. 10).
- Flexible vegetation is placed in the centre of the aviary, so that it can be moved out easily when it comes time to re-catch the birds.
- A few sticks (such as flax flower stalks minus the flower heads) of appropriate diameter (thick for kākāriki) should be inserted horizontally into the vegetation for perching.
- The aviary should be furnished by starting at one end and working back towards the door, with food put in at the same time (because it cannot be put in afterwards).

When the aviary is being furnished, it is important to consider how the food and water will be topped up during the holding period and how the birds in the aviary will be re-caught on the transfer day. See Appendix 1 for further details on how to set up and furnish a portable aviary.

A double door entrance is essential for all holding aviaries, to help prevent birds escaping when the outer door is opened. The entranceway inside the first door is also a good place to do the pre-transfer checks of the birds and to put them in their transfer boxes on the transfer day.

The recommended size of the portable aviary may seem small; however, larger aviaries are not recommended because it is much more difficult to furnish them to the extent needed to prevent bird injuries. People involved with transfers need to be aware that it takes a lot of time to set up and furnish even a small holding aviary, so enough time needs to be allowed for this at the start of the catching trip; for example, it could take 4–6 people a full day (at least two people putting up the aviary and setting up food and vegetation, and at least two people collecting the vegetation).

At sites where weka or ruru (morepork, *Ninox novaeseelandiae*) are present, the holding aviary must be predator-proof and have sufficient screening to prevent avian predators harassing the birds inside the aviary (thereby increasing their stress levels).

12.2 Other aviary designs

During translocations from Kapiti Island and to Matiu/Somes Island, existing aviaries have been used for temporary holding of red-crowned parakeets. These aviaries are described below, and while they are not currently recommended best practice, they are mentioned here because they were fairly successful at the time. They are included in the interests of eventually improving and refining current best practice techniques.

12.2.1 Kapiti Island aviary

Several transfers of red-crowned parakeets have been carried out from Kapiti Island, which has an aviary containing several flights, each 3 m × 3 m × 2.4 m (height). The size of these flights is not ideal, because they are not large enough for birds inside to move away from danger (e.g. people entering, weka outside), but are large enough for birds in them to fly and suffer collision injuries. While the aviary is larger than recommended, it can be modified for kākāriki, but the work involved in setting up an aviary of that size is considerable (e.g. at least 2 days for four people), so future transfer projects may find it easier to use a small portable aviary.

During previous translocations, the Kapiti Island aviary was prepared as follows (Booth 2010):

- Shade cloth was stretched as tightly as possible over all potentially dangerous surfaces inside and stapled to the underlying timber.
- A gap of at least 25 mm (50 mm where possible) separated the shade cloth and underlying mesh (i.e. the wire mesh was attached to the outside of the framing and the shade cloth attached to the inside).
- Care was taken to secure the shade cloth against the timber so that there were no gaps between the shade cloth layer and the mesh into which birds might crawl and become trapped. Similarly, where shade cloth was gathered or folded, care was taken to make sure that birds would not become trapped.
- Bundles of soft cushioning vegetation (such as kānuka or māpou (*Myrsine australis*)) were tied to the underlying timber framing. The vegetation was top and tail bundled and then pulled in tight to the wooden frame. Alternatively, framing can be padded with 'sausage' rolls of shade cloth.
- Bare plywood walls were softened by stapling several layers of nīkau (*Rhopalostylis sapida*) fronds to them.

- Insect screen mesh (available as a 900-mm-wide roll) was stapled to hang from the roof framing so that the upper aviary was divided into compartments of about 1 m square (i.e. drops were not right down to ground level, allowing birds to move between partitions). This material was chosen because it is relatively soft and forgiving if flown into. Some lengths of shade cloth were used in the same way, with close attention paid to ensuring there were no ragged edges that might ensnare birds.
- Two or three tiers per compartment were created by using shadecloth to make hammocks, which were lined with browse vegetation (not too much, so that they didn't become heavy) and flax flower stalks for perching (Fig. 11).
- Soft foliage and browse was then placed throughout the aviary.
- Up to 35 birds were housed together in one flight.
- A lot of cable ties, staples and a gas-powered staple gun were used during the set up of this aviary.

By partitioning the space inside the aviary, kākāriki are prevented from flying at speed and injuring themselves on hard surfaces. They can only move from place to place by fluttering, walking or climbing. A side-effect of this design is that the aviary is quite dark, which may affect how much the birds feed.

Figure 11. A—Hammocks and drops set up inside the Kapiti Island aviary. B—Image showing vegetation in hammocks, millet seed and flax flower stalks for perching. *Photos: Rob Cross*.

12.2.2 Matiu/Somes aviary

During a translocation of red-crowned parakeets, an aviary on Matiu/Somes was used successfully as a pre-release holding aviary. The dimensions of the aviary were 6 m × 4 m × 2 m (height). While an aviary of this size may be prohibitively large for most projects to build as a holding aviary, it was used at the time because it was already there, and found to be suitable for the transferred red-crowned parakeets. Unlike the Kapiti aviary, it was large enough for birds to be able to retreat from perceived threats (such as people entering), so it was therefore possible for people to move through the aviary slowly to replace food and water without startling the birds. Consequently, the elaborate set up required to furnish the smaller aviaries was not needed. Instead, a large amount of browse vegetation was provided to maximise encounter rates with food, and perches were fixed in corners with flight space between areas.

12.3 Feeding

Food must be presented **throughout the whole aviary at all levels** (e.g. tied into vegetation (using cable ties or flax leaf strips), laid in hammocks, on the floor, in cage bird water bowls (from a pet shop) hung on the walls) rather than on any solid structures such as feed platforms. The aviary must be loaded with enough food (especially millet sprays) to last the entire holding period before any birds are placed in it. Ideally, no-one should have to re-enter the aviary until the birds are re-captured (Booth 2010).

Fruiting branches of as many natural browse species as possible must be offered (e.g. *Coprosma* spp., fuchsia (kōtukutuku, *Fuchsia excorticata*), seven finger (patē, *Schefflera digitata*)), as these are likely to be the birds' main food sources. Having these available is important, as wild-caught kākāriki tend to be neophobic and it takes them a while to learn to eat new or unusual foods.

Note that for yellow-crowned parakeets in particular, invertebrates are an important part of the natural diet. This is also true for red-crowned parakeets during late winter and early spring. Invertebrates (such as scale insects, leaf miners) can most easily be supplied by providing the types of foliage that have lots of insects living on it, e.g. kanuka, broadleaf (*Griselinia littoralis*). A thick layer of leaf litter on the floor (including dead hollow twigs and soft rotting branches) will also provide invertebrates for red-crowned parakeets, as they will happily forage on the ground.

In addition, the following supplementary foods have also been used in previous kākāriki translocations:

- Millet sprays. Large amounts (up to 15 kg) are used because it has proven to be the most popular supplemental food with kākāriki, and it should be spread throughout the aviary to prevent aggression between the birds.
- Canary and cockatiel seed mix, sunflower seeds. These can be scattered on the floor or placed in shallow dishes (e.g. pot plant bases) on the floor.
- Seed bells—available from pet shops.
- Fruits—a selection from: apples, pears, persimmons, grapes, kiwifruit, berries, bananas, mangos, oranges, mandarins.
- Corn cobs, peas, silverbeet.
- Wombaroo honeyeater mix. Millet sprays and seed bells could be dusted with Wombaroo to provide extra nutrition.

Much of this supplementary food will not be eaten; however, it is important to provide a good variety and volume of food throughout the aviary so that all birds regularly encounter food and have the opportunity to feed. It can help to hang up millet sprays at potential net sites at the source site during the week before the catching trip, to help the wild birds get used to the food before they will need to feed on it inside an aviary.

Two to three shallow water dishes must be available on the floor of the aviary. Kākāriki will use these for bathing as well as drinking. Large plastic pot-plant bases are ideal (e.g. 5 cm deep × 32 cm wide), and paint trays have also been used. Stones may need to be placed in the dishes to keep them stable. Water dishes tend not to get particularly dirty during the captive holding period but, ideally, at least one should be placed near the door so it can easily be cleaned out or topped up if needed (by someone reaching in from the doorway while crouching on the ground). Care must be taken to position the water dishes so that millet won't rain down into them and they are not below frequently used perches. Ideally, they should be placed on the part of the floor where the light is brightest.

Previous translocation reports indicate that kākāriki favour the millet and black sunflower seeds during their time in captivity. They have also taken smaller amounts of apple, green peas and corn.

Note that providing seeds might pose a biosecurity risk on certain islands. When kākāriki were housed on Little Barrier Island, the seeds were baked first to kill the seed embryos. Some companies will heat treat (to MPI quarantine standards) commercial seed mixes (e.g. Tui Products Ltd.). Another option is to use seed blocks where the seeds have been ground and are non-viable.

Food and water should be checked once per day and topped up if necessary, by carefully reaching in from the doorway or crawling a little way in. In larger aviaries, it may be possible to enter the aviary to replenish water and food by moving quietly and slowly, as long as the birds are able to move away through a network of soft compartments and/or vegetation without undue panic. The key to being able to enter an aviary is having the infrastructure of compartments/dense vegetation that allows the birds to hide, being sensitive to how the birds are reacting to your presence, and responding accordingly.

12.4 Care of kākāriki during captivity

If the aviary is well positioned, and the door end is well screened with plenty of vegetation, the birds inside will not be disturbed too much whenever someone approaches to put a newly captured bird in. The aim must be to keep disturbance to the birds in the aviary to a minimum, but if a lot of disturbance is unavoidable, consider having one non-disturbance day after the last bird is added to the aviary, so the birds have a chance to settle and feed before the transfer.

Generally, the captive holding period should be as short as possible (2–5 days) for the following reasons:

- Stress and weight loss. In all translocation projects reported so far, kākāriki have lost weight while in captivity, so a shorter holding period may minimise this weight loss.
- It is not usually feasible to monitor the birds in the darkened aviary, i.e. to check that they are feeding and that there are no aggression issues, injuries, illness or other problems (Booth 2010).
- After a few days, the browse and other vegetation will start to wilt, and it is not feasible to replace it while the birds are still in the aviary.

With this in mind, weather conditions will need to be monitored and taken into consideration when deciding on the day to do the transfer, so that it is not delayed (and the captive holding period extended) for long periods due to poor weather.

During the entire captive holding period, the birds must be treated with the utmost care and consideration to help reduce their stress levels. They need to be kept in a quiet environment and there should be no visitors. Loud noises and activity nearby will scare them, so make sure that people do not have loud conversations, slam car doors or make other loud noises around the aviary. Ideally, just one person should go near the aviary when it is necessary to put newly captured birds in, or to replenish food and water.

Once the kākāriki have been transferred out of the aviary, the aviary should be emptied and cleaned out. If a second catch/transfer is planned, the aviary must be replenished with fresh vegetation, leaf litter on the floor, and food and water before the next lot of birds are put in. The shade cloth lining must also be checked for any frayed or nibbled bits and repaired to prevent birds becoming tangled in it.

13. Transfer preparations

13.1 Transfer box design

Cardboard cat carry boxes and white Corflute boxes (340 mm long × 240 mm wide × 200 mm high) have been used successfully for short-distance transfers (Booth 2010; Nakagawa 2013); however, **plywood boxes are recommended for most transfers**.

The plywood boxes used during the translocation of kākāriki from Mana Island to Boundary Stream are ideal (Fig. 12). Each plywood box has two compartments; one bird is housed in each compartment. Each compartment is 225 mm long × 280 mm wide × 340 mm high (i.e. total box length is approx 450 mm).

A good transfer box has the following features:

- Ventilation holes—a portion of one side of the box is cut out and covered with shade cloth (internally) and wire mesh/ventilation grate (externally), to provide ventilation.
- No holes large enough for a bird's beak or head to poke through.
- Vertical sliding door with a handle, to make it easier to put the birds in and also to release them.
- A handle on top of the box, for easy carrying.
- Sturdy but lightweight—the boxes shown in Fig. 12 each weigh approximately 4 kg.
- Stackable if being transported by helicopter, where space is limited. Baffles may need to be attached to prevent loss of ventilation.

The advantages of using plywood rather than cardboard or Corflute boxes are that they are:

- Weather-proof
- Sturdy, so unable to be chewed by parrot beaks
- Quieter and darker for the birds inside
- Cleanable and can be re-used for future transfers.

Figure 12. Kākāriki transfer boxes. *Photo: Denise Fastier.*

Some of the transfer boxes shown in Figure 12 may be available for borrowing on request from the DOC Ahuriri/Napier Office[8].

Hinged doors/lids are not recommended because they can make it more difficult to get birds into the box safely, without catching any feathers or body parts in the door. Sliding doors are recommended, as they can be partly closed onto the handler's arm as a bird is placed in the box, leaving only a small gap while the bird is put in. For increased safety, the door should have a smaller arm-sized hole (with a securable over-sized cover), to provide access with even less of a gap. Ideally, the sliding door should be on the side of the box rather than the top, to make releasing the birds easier. If the opening is on the top, the bird may fly upwards on release, into the face of the person releasing it. A side opening helps direct released birds towards a safe escape route.

[8] Denise Fastier, Ahuriri/Napier Office, Conservation House, 59 Marine Parade, Napier.

Attaching closed-cell foam to the outside of the transfer boxes could be worth trialling, to reduce noise and vibrations during long-distance transfers in noisy vehicles or helicopters.

If cardboard or Corflute carry boxes are used, ventilation holes must be covered with breathable mesh or fabric, to prevent birds being able to get their beak through (see Fig. 13), chewing a larger hole and escaping or being injured.

Figure 13. Kākāriki chewing on cardboard transfer box. *Photo: Rob Cross*.

13.2 Transfer box preparation

Transfer boxes need to be prepared the day before the transfer occurs. This involves lining the floor and sides of the box with soft vegetation (e.g. soft kānuka tips, soft dried grass); there must be no hard woody material or sharp sticks. The vegetation should be bent over so that the ceiling of the box is lined. A kākāriki-sized hole in the centre of the vegetation should then be made and lined with dry grass and other vegetation to make a nest (e.g. Fig. 14).

Millet sprays or other soft fruiting vegetation can also be put around the nest, so the birds can feed during their journey.

To ensure the birds will remain clean and dry during transportation, do not put water or fruit slices in the transfer box.

Figure 14. Prepared kākāriki transfer box with kānuka and millet.
Photo: Denise Fastier.

For transfers over **short distances** within the Marlborough Sounds, empty wooden boxes have been used successfully (i.e. vegetation is not put in the boxes). Department of Conservation staff involved in these transfers prefer not to place vegetation in the boxes, to reduce the risk of disease transfer between islands. The boxes have, instead, a 1-cm-diameter (approx.) perch secured inside, at a height that ensures that when the bird is perched its tail touches the floor and its head does not touch the ceiling. For longer distance transfers (i.e. more than 1 hour travel time), lining the box with vegetation (and no perch) is the recommended method.

13.3 Catching the birds on transfer day

The process of catching the birds from the aviary and getting them into transfer boxes is very stressful for the birds and those catching them. This operation requires experienced kākāriki catchers and handlers. At least two hours must be allowed for an aviary of 30 birds.

Two to three people are needed for the catching process. It is important that no more people than necessary are around the aviary talking and making noise. Only the people that are needed to deal with the birds should be present. Before the catching process starts, the best way to divide up the tasks of processing the birds must be worked out (this is described below). The aim should be for each person to have roughly the same workload, so that there is not a 'bottleneck' with one person that will hold up the capture process. Ideally, the catchers that go into the small holding aviary will be short and skinny (as their impact will be less than that of larger people).

The outside door of the aviary must be kept closed at all times when the birds are being handled, to prevent any escaping.

It will be necessary to remove some of the vegetation in the aviary (and hammocks, if set up) to gain access to the birds. Any water bowls or food trays should also be removed from the floor.

The kākāriki can be captured by hand or using a hand-net with a short handle (Booth 2010). The birds may try to escape by burrowing into the bundles of vegetation—a behaviour that can be an advantage as it makes it possible to catch them by hand. The catcher should try not to move about in the aviary too much, and should just reach out to catch the birds. Usually the first and last birds are the most difficult to catch.

Once caught, each bird should be checked for injuries and their leg bands checked and recorded, then weighed in a catch bag, before being placed in a transfer box.

Weighing is recommended, because if any birds have lost significant body condition during their time in captivity, consideration should be given to releasing them at the source site rather than transferring them. They will have a much better chance of recovery in their home range, as they will know where the food sources are. Birds transferred in poor condition are likely to have a much lower chance of survival.

Kākāriki must be transported one bird per box. When the bird is put into the transfer box, the handler must make sure that there is vegetation cushioning the door or lid as it is closed. Each box must be labelled with the bird's identification bands and the time it was put in the box.

The carry boxes must be kept in a dry, cool (not draughty), shady, quiet and sheltered place, preferably indoors, until the transfer. The boxes must be placed slightly apart to allow for good air circulation. If cardboard carry boxes are being used, a dark sheet draped over them may help to quieten the birds so that they don't spend time trying to chew their way out.

14. Transport

The birds must be treated with the utmost care and consideration to help reduce their stress levels during handling and transportation. This may mean frequently reminding people to keep quiet around the birds and not make any other loud noises that will scare them.

Kākāriki have been transported by boat, road vehicle, chartered plane and helicopter during previous translocations. Key points to remember about transporting the birds:

- Overheating is a greater risk than chilling; birds should be held and transported in conditions that feel cool or cold to humans. Throughout the transfer, the birds should be kept in shady, cool places, out of draughts. The boxes must never be left in the sun or where they might get wet.
- If the birds are being transported by road, unless the weather is overcast, the vehicle windows should have shades on them to ensure the sun doesn't shine directly onto boxes and air conditioning, if available, should be used to keep temperatures cool.
- Noise and vibrations should be minimised as much as possible; for example, the boxes should be transported inside the main cabin of helicopters.
- The boxes must be secured and stable, but the ventilation holes must not be covered up (by adjacent boxes or walls etc.). It may be wise to have baffles on the outside of the boxes to prevent loss of ventilation if the boxes need to be packed into a tight space (such as a helicopter).
- The transfer should be arranged so that transportation is as quick as possible. During previous transfers, the time from capture in the aviary to release was up to 4–6 hours.

15. Release

Once the kākāriki have been transferred to the release site they can be released immediately.

Kākāriki have also been held successfully for short periods in pre-release aviaries at release sites at Zealandia and Matiu/Somes Island. However, there is not conclusive evidence about the advantages or disadvantages of pre-release captive holding, or whether it improves translocation outcomes, to recommend it as best practice.

Kākāriki should be released during fine weather (i.e. reasonably calm, not raining or extremely cold), and as early as possible in the morning or by early afternoon, rather than late afternoon. An early morning release gives the birds plenty of daylight hours to find food, water and shelter before evening—as a minimum they should have 4 hours before dark. During winter, when daylight hours are the shortest, the birds must be released by 2 p.m.

Releasing birds on the same day as capture might be possible for short-distance transfers; but only do so if the birds can be released by mid-afternoon.

Ideally, the release site should be near water and a good natural food source.

When the time comes to release the birds, the boxes must be facing towards a clear, uninterrupted suitable escape route, with the releasers, spectators and any photographers **behind** the boxes. It is not appropriate to release birds in the middle of a circle of people, i.e. where there is nowhere safe for the birds to go, which would be very stressful for them.

To release the birds, simply open the boxes and let them fly out. If the vegetation doesn't drop away when the door is opened, part the vegetation or remove some so the bird can see a clear way out. Sometimes, the birds will not leave the box immediately—if possible, it is best to leave them for a while to let them find their own way out. Check the boxes very carefully after the birds have been released to make sure that all birds have left.

16. Post-release management

Once released, translocated kākāriki appear to quickly establish a breeding population with minimal management required (Ortiz-Catedral et al. 2010). However, there is potential for kākāriki to disperse at mainland sites that have suitable habitat nearby, hence a number of techniques have been trialled in an effort to try to anchor the birds to the release site.

16.1 Supplementary feeding

It is not yet known whether supplementary feeding, which aims to anchor birds to the release site, actually improves the chances of translocation success. At some sites, it has been a useful monitoring tool, but further monitoring and evaluation is needed before a clear recommendation can be made about supplementary feeding.

During recent translocations, millet has been offered at the release site, as it has proven a popular food with kākāriki in captivity. Results have been mixed—at some sites, birds have been highly attracted to the millet provided, while at other sites no birds (or just a couple of individuals) have been seen eating it. Birds that are attracted to the supplementary food are easier to monitor.

Millet can be tied in bunches high in the trees, or offered on hanging platforms near the canopy (on a pulley system). The length of time the food is provided has varied between projects—from one week to ongoing—depending on the released birds' response and whether they have fed on it.

If supplementary food is offered, the feeding site must be monitored to make sure kākāriki predators (e.g. falcon, rats) or competitors (e.g. mice) are not being attracted to the site.

16.2 Nest boxes

Installing nest boxes at the release site may aid monitoring of the released birds. However, most translocation projects to date have reported that only low numbers of nest boxes are used by the birds, as they readily make use of any natural nest sites (such as tree holes and rotten logs). If the release site does not have a lot of natural cavities then nest boxes should be offered as a precaution, although birds may well find holes that are not otherwise apparent.

Figure 15. Wooden nest box used at Cape Sanctuary. *Photo: Vince Waanders.*

Nest boxes are usually made of timber, which must be non-tanalised, as the birds can chew the inside of the nest box. One option (currently being trialled by Cape Sanctuary) is to use thermally treated pine, supplied by Tunnicliffes[9]. Thermal treatment dries the timber so it lasts longer than it would otherwise.

The size of the nest boxes used has been variable and there have not been any trials to determine which size or model is preferred by the birds. The design used at Cape Sanctuary (pictured in Fig. 15) is 250 mm wide × 400 mm high, with a 70 mm entrance hole.

The nest box can have brackets fixed to the back, to make it easier to attach it to a tree (note horizontal brackets on the back of the nest box in Fig. 15). These brackets could also be fixed vertically on the centre back of the box, if it is to be attached to smaller tree that is not wide enough for the horizontal bracket arrangement.

[9] Website: http://www.tunnicliffes.co.nz/contact/contact.htm

Nest boxes must be lined with untreated wood chips, or rotten wood. When preparing their nest chambers, female kākāriki spend a lot of time chewing up rotting wood to provide a base into which they dig quite a sizeable depression.

Nest box placement: Staff at Zealandia have found that red-crowned parakeets seem to prefer to nest in sites that have good cover and are relatively hidden, rather than in open view. Nests are often near water seeps.

At sites where kākā (*Nestor meridionalis*) are already established, kākā may damage the kākāriki nest boxes. To combat this problem, staff at Zealandia are trialling a polyethelene pipe nest box design (Fig. 16), which has a 60 mm entrance hole, and is lined with untreated timber and a thick layer of woodchips. The wooden panels attached to the inside of the pipe provide the nesting bird with a ladder down into the nest, and supply chewing material which can be incorporated into the nest floor. These inserts can be replaced as necessary. The lid is removable for access to the chicks and for cleaning.

When using plastic-type nest boxes it is **essential that they are checked regularly and cleaned out when necessary**, to prevent chick welfare issues such as:

- Chicks ending up sitting on smooth plastic and getting splayed legs
- Chicks being raised in dirty conditions, because plastic-based nest boxes do not have the self-cleaning/fallowing properties of natural nest sites and they will often have condensation issues.

If they cannot be checked and maintained regularly, this design of nest box must not be used.

The nest box shown in Fig. 16 is designed to be easily removed and cleaned after a clutch of chicks has fledged. A single bolt is screwed into the tree and the box is hung on this. The floor of the box is inset about 5 cm so that a smaller screw can be passed through the plastic and directly into the tree at the bottom. The bolt and the single screw are usually enough to keep the box firm and prevent it wobbling. A block of wood is attached to the back of the box, to keep the upper back of the box out from the tree about 30–40 mm. This prevents the roof touching the trunk, allowing it to be removed easily so that chicks can be accessed for banding, and helps prevent any water seeping down the trunk and into the box.

With only two attachment points, the box is easily removed for cleaning. The bottom screw is unscrewed, and the box is lifted off the bolt. The roof lifts off, three screws securing the floor can be removed and the floor knocked out. The inside wooden panels, each held by two screws, can be removed. All parts can then be scrubbed with water, washed with Trigene, rinsed and air dried before re-use.

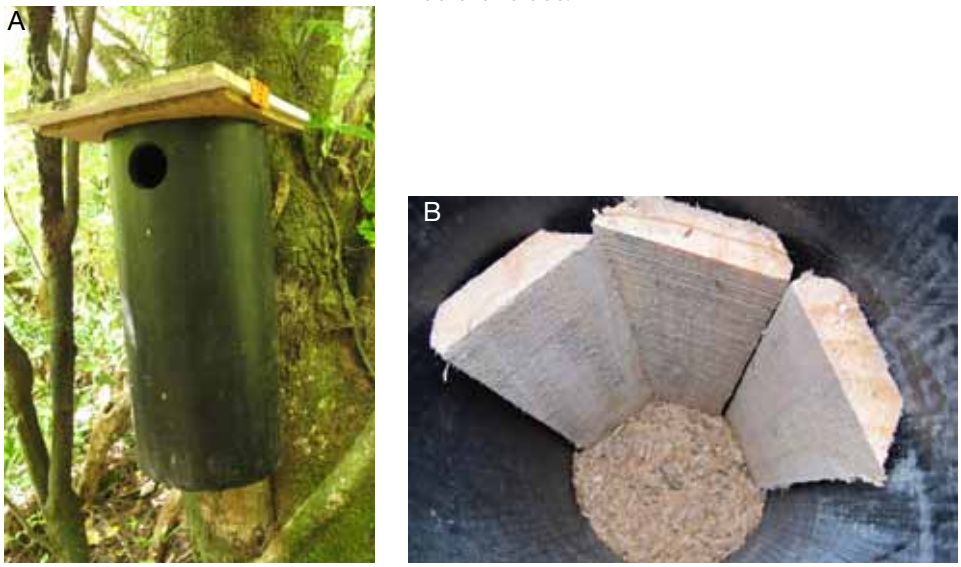

Figure 16. A—Pipe nest box used at Zealandia, B—Wood lining and floor chips in pipe nest box.
Photos: Richard Gray.

Predator proofing: At sites that are not predator-free, measures to predator-proof the nest box need to be considered. This could be done using a polyethelene pipe design such as that described above, with smooth surfaces and a lid that has a large enough overhang over the nest entrance hole to prevent access by predators (17 cm for stoats (*Mustela erminea*)). Alternatively, the tree that the nest box is attached to could be predator proofed, by fixing a smooth metal band to the trunk below the nest box (and above, if necessary). Predator-proofing is easier to achieve on stand-alone trees that have a single straight trunk.

16.3 Sound anchoring

Sound anchoring (where pre-recorded kākāriki calls are played from speakers at the release site) has been tried at Zealandia and Boundary Stream. At this stage results are inconclusive.

At Zealandia, speakers were set up at feed stations at the pre-release aviary, as well as further away from the aviary. Kākāriki released in 2010 were heard responding to broadcast chatter as they visited the release site, but it was not clear whether the broadcasts were attracting the birds to the site. What did become clear was that while there were birds still held in the pre-release aviary, the birds that had been released earlier responded to their continual chatter. This suggests there may be value in continuing to investigate the use of recorded sound, both as an anchor and to signal the presence of supplementary feed stations.

17. Post-release monitoring

17.1 Purpose

Post-release monitoring informs future management of translocated populations and can help to answer questions such as (Parker et al. 2013):

- Will the reintroduction be successful?
- Is management needed and/or sufficient?
- Will supplementary translocations be needed?
- Is genetic diversity sufficient (e.g. have enough founder birds survived)?
- Do the translocation techniques need to be refined?
- Does release site selection need to be refined?

Monitoring must also relate back to the operational targets in each translocation proposal. The design of post-release monitoring needs to match the questions the monitoring is trying to answer and the subsequent intended use of the data.

The need for monitoring is related to uncertainties about the translocation. For example, monitoring is likely to be most valuable if there is uncertainty about whether the habitat at the release site is too connected to adjacent unmanaged habitat, if densities of introduced predators or potential competitors are too high at the release site, or habitat suitability is otherwise unclear. By contrast, if kākāriki are reintroduced to an isolated area of apparently excellent habitat with no introduced predators, post-release monitoring may be far less intensive.

Post-release monitoring can be used to determine why translocations have failed (Fig. 17), whether a different management approach would prevent failure if the species was translocated to the same site again and, if not, the feasibility of future translocations. For example, if monitoring shows that only males are present, there may be an issue with predators; or if pairs are present and breeding but all the juveniles have disappeared, there is likely to be a problem with the recruitment of juveniles.

On the other hand, successful translocations provide useful information for similar projects in the future.

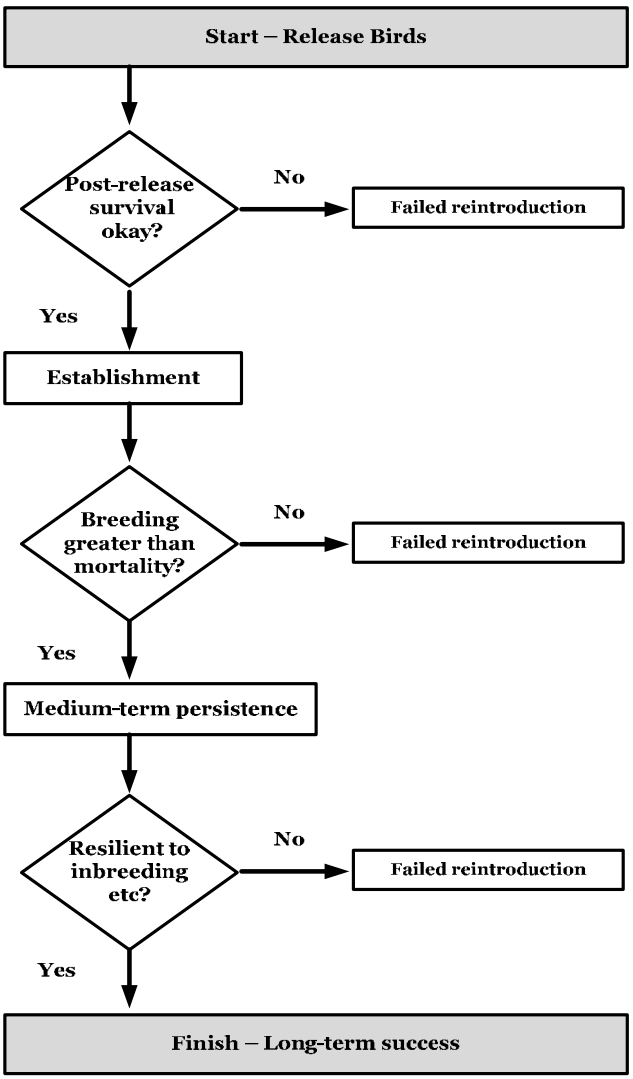

Figure 17. Determining the success or failure of a translocation (Parker et al. 2013).

17.2 Recommended monitoring

Translocation project teams have reported different experiences of the ease or otherwise of monitoring kākāriki. Teams translocating kākāriki to islands have tended to find monitoring relatively easy when using experienced teams, while at mainland sites the birds are often difficult to monitor as they can be highly secretive post-release. Their short legs and canopy-dwelling nature can make reading their colour bands difficult. Monitoring at release sites where the canopy is very high will be more difficult than at sites where the canopy is lower (e.g. regenerating forest). For these reasons it can sometimes be difficult to estimate the survival rate of translocated kākāriki, or determine causes of translocation failure.

For help designing a monitoring programme appropriate to a translocation, advice can be sought from DOC District Office staff. Information is also available in the monitoring toolbox on the DOC website: http://doc.govt.nz/getting-involved/run-a-project/our-procedures-and-sops/biodiversity-inventory-and-monitoring/birds/.

Ideally, a monitoring programme would include:

- Searching for kākāriki in areas of suitable habitat within the release site, to find out how many birds are known to have survived the transfer.

- Surveying for kākāriki after the first expected breeding season at the release site, by searching known habitat or using a monitoring technique such as line transect counts[10] to identify whether there are any unbanded birds present. The proportion of banded birds to unbanded birds must be calculated to find out whether the released birds have established and bred.
- Continued monitoring of the proportion of unbanded birds to banded birds over time (e.g. annually) to determine whether the population is well established and self-sustaining in the long term.

Monitoring methods can include walking transects and stopping at regular intervals to playback kākāriki calls, and listening for responses. Playback is a very useful tool during monitoring. It often enables the person monitoring to call a bird in close enough for its band combination to be seen.

In addition, some band re-sighting could be achieved by monitoring for kākāriki at feeding sites (i.e. if millet is provided at the release site post-release), and checking artificial nest boxes during the breeding season (if installed).

Experienced bird monitoring people are needed, to enable kākāriki to be identified by their calls and colour bands. Even if all of the bands on a bird cannot be seen, observers should note whether or not they could see the bird was banded or unbanded, as the presence of unbanded birds indicates successful breeding.

At some sites, intensive monitoring may be impractical. An alternative to trying to monitor kākāriki post-release is to do a survey 1 year after release and annually therafter[10]. The results can then be compared year to year.

If kākāriki are going to establish at a release site, it is usually evident within approximately 2 years at a small predator-free island site, or 5 years at a mainland site.

17.3 Transmitters

If transmitters are being considered as a monitoring tool, advice should be sought from DOC District Office staff and others experienced in kākāriki translocations. Transmitters are expensive, but can be worthwhile for projects that are well resourced and have enough people to undertake this intensive level of post-release monitoring. Note that there is an energy cost to the birds that wear transmitters, so there must be strong justification for their use (e.g. if other monitoring methods have failed to establish causes of translocation failure).

Transmitters were used for post-release monitoring during translocations from Te Hauturu-o-toi / Little Barrier Island to Motuihe Island and Tāwharanui. At Zealandia, transmitters were used to help locate natural nest sites that would otherwise have not been found, and this enabled nest monitoring and banding of chicks.

At Zealandia, catch cages were set up at feeding sites where kākāriki are accustomed to feeding on the supplementary millet provided. Males only were captured, and transmitters attached to their tail feathers, allowing the birds to be monitored through the breeding season (with the transmitters subsequently falling off when the birds moulted their tail feathers).

The transmitters used were BD-2 transmitters (for red-crowned parakeets), weighing 1.9 g, with a battery life of 24 weeks. They were obtained from Holohil Systems Ltd[11].

At the time of writing, the following people can offer further advice about how to attach transmitters:

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[10] Bird monitoring techniques can be discussed with local DOC staff. Information is also available on the DOC website: http://doc.govt.nz/getting-involved/run-a-project/our-procedures-and-sops/biodiversity-inventory-and-monitoring/birds/

[11] Holohill Systems Ltd, Ontario, Canada. Website: www.holohill.com E-mail: info@holohill.com

- Conservation Team at Zealandia; contact: richard.gray@visitzealandia.com
- Luis Ortiz-Catedral, Massey University; email: L.Ortiz-Catedral@massey.ac.nz

Figure 18 shows a transmitter being attached with dental floss, while the bird is restrained in a bag. Subsequently, Super-glue is used to stick the floss to the feather shaft and the top of the transmitter.

Figure 18. Attaching a transmitter to kākāriki tail feathers.
Photo: Richard Gray.

18. Record keeping

It is important that good records are kept throughout the translocation process, so that methods can be assessed, lessons learnt, techniques refined and practices improved for future translocations. Knowledge sharing becomes even more important where multiple and often independent groups are translocating species.

The way in which methods and results are documented is also important. Standardisation of documentation allows factors that promote or inhibit translocation success to be evaluated, and leads us further towards evidence-based conservation. For example, while anecdotal accounts of bad weather affecting the result of a translocation may not be helpful, quantifiable information describing the weather conditions (e.g. 'a gale force southerly for 5 hours') will allow people to make a sound evaluation of whether this influenced the success of the project.

The aim should be to record everything that is done—especially if things are done slightly differently from how they were planned. Also, it is important that records are thorough, with all components of a procedure explicitly stated, so that it is possible to differentiate something that did not happen from something that did happen but simply was not written down. For example, when recording the presence of ectoparasitic mites on birds during health examinations, record 'seen' and 'not seen' for each bird, so that a summary of 'five birds had mites' is meaningful; this makes it clear that every bird was actually checked for mites and so the data indicate the true prevalence of mite infection (proportion of all birds with mites), rather than potentially reflecting haphazard observations where mites were recorded if they happened to be seen but may also have been present on other birds that were not searched (giving a false prevalence).

Alongside good record keeping, reporting is also important, as this enables project managers to fully evaluate a translocation and its outcomes, and for people to learn from others' experiences and improve the chances that future translocations will be successful. DOC's reporting

instructions (Collen & Cromarty 2011a) include a reporting template, which shows all of the information that is required to produce an informative report. This document should be read in advance of a translocation, so that people carrying out a translocation are familiar with the standardised information that needs to be included in a transfer or monitoring report. In addition, record sheets that clearly list the data to be collected during a translocation should be prepared in advance, so that everyone involved in the translocation understands what information they need to record.

Translocation practitioners from various organisations have recently proposed a set of minimum requirements for documenting translocation planning, release methods, post-release monitoring and the writing of informative reports on project outcomes (Sutherland et al. 2010). These can be achieved by:

- Documenting the planned translocation (by completing DOC's translocation proposal form; Collen & Cromarty 2011b)
- Documenting release methods and conditions (using DOC's reporting instructions (Collen & Cromarty 2011a) as a guide)
- Documenting post-release monitoring (see section 17 Post-release monitoring)
- Providing reports on the translocation using DOC's reporting instructions (Collen & Cromarty 2011a).

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Appendix 1

Suggestions for setting-up a small, portable aviary for kākāriki

Richard Gray, Conservation Officer, Zealandia, Wellington

Prepared during translocation of yellow-crowned parakeets from Mana Island to Boundary Stream, September 2012.

Phase 1. Kānuka

Use kānuka (*Kunzea ericoides*), (long soft branches) to make bundles that will stand vertically from floor to ceiling in the four corners of the aviary. Using stiff-leaved and stiff, branchy vegetation such as mānuka (*Leptospermum scoparium*), tarata (*Pittosporum eugenoides*) and kōwhai (*Sophora* spp.) at these locations in the aviary hinders catching later in the transfer process.

The bundles need to have soft tips orientated to both the ceiling and the floor (i.e. half the soft ends face one way and the remainder the opposite way, with the bundle tied around the middle to hold it all together).

Bundles need to be loose and soft enough to allow birds to hide between the foliage and the aviary walls. When it comes time to re-catch the birds, this will allow the catcher to gently depress the foliage the birds are hiding in, reducing the birds' ability to move and making it easier to catch them.

Note: The vegetation dries out over the days the birds are in the aviary and so becomes more brittle. Even soft kānuka can be quite stiff by the time the birds need to be removed from the aviary. So it could be useful to have some short (400 mm) fresh bunches of soft kānuka that can be inserted in the corners as capture proceeds on the transfer day.

Some soft kānuka can be placed vertically along side walls. Again, it should be placed in a way that allows the soft leafy twigs to be depressed against the aviary side, trapping the bird for catching.

Once installation of kānuka (as described above) is complete, the centre of the aviary will still be empty of vegetation, with only the walls and, especially, the corners, vegetated. (Take special care with the ceiling and floor corners, as the birds tend to congregate in these areas.)

Once the kānuka phase is completed, some of the food can be introduced (millet sprays and seed bells). These can be tied to some of the kānuka or hooked onto side mesh/walls.

Phase 2. Other vegetation

Other vegetation (to reduce flying, for roost and perching sites, and for food (leaves, buds, flowers, fruit)) needs to be added once the walls and corners of the aviary have been lined with kānuka. This vegetation is placed vertically in the empty centre area of aviary (some may be in water containers to prolong freshness). Several pieces (branches) need to extend from floor to ceiling to provide supports for shorter lengths of food-source vegetation.

Again, the choice of plant used is important. As much as possible, soft-wooded, flexible vegetation (such as *Coprosma* spp.) should be selected. Remember that on the transfer day, the catcher will need to remove all of this Phase 2 vegetation before the birds are caught, and trying to extract stiff, woody, partially dried vegetation (such as mānuka) or long branches of pittosporum or kowhai from the aviary can be traumatic for both birds and personnel. Softer-stemmed, flexible vegetation is easier to manage and helps to keep difficulties with this part of the process to a minimum.

If woody vegetation must be used because of its food value, then branches must be kept slim and short (i.e. maximum length 500 mm) for easy removal. They can be attached to the more flexible coprosma or kānuka verticals in the central area.

While adding this vegetation, more millet and seed bells can be added in the central area of the aviary. (Note: Millet stapled to the ceiling did not appear to be touched by the birds.)

Phase 3: Horizontally placed vegetation

Any material installed horizontally for use as perches must be smooth, clean lengths that can be easily withdrawn without hooking on other vegetation and shaking the vegetation throughout the aviary as they are removed. Flax flower stalks without the flowers or seed heads are ideal.

Observations during capture of birds in aviary (21 September 2012)

During the capture process, birds placed in the aviary tended to congregate at the far end (furthest from the entrance door). This was not surprising, due to the presence of people at the opposite (door) end! It did mean that to get to the birds a lot of vegetation had to be removed, which resulted in a large open space in the door section of the aviary around which the birds could fly when pursued. They tended to alight on the shade cloth-covered mesh sides and then duck back into cover. This wasn't a critical problem, as the flight distance was very short. However, having kānuka at the sides (see Phase 1 above) would reduce this.

Unlike the larger Kapiti aviary, where the red-crowned parakeets favoured the bright corners near the ceiling during capture, the yellow-crowned parakeets in this transfer congregated in the darkest corners and where vegetation was thickest. They tended to seek out the tight dense cover in which to hide.

All birds were caught by hand between vegetation and the ply wall or shade cloth. A high proportion of the birds were caught in the corners, both at ceiling and ground level.

Foods sampled

It did not appear that much millet had been eaten. Food on the lightest/brightest side of the aviary (the side nearest the building wall, where reflected light increased the illumination) was consumed the most. During lulls in the capture period, a few kākāriki ate seed on one of the bells and on the ground.

Appendix 2

This document was contributed to by experts with experience in kākāriki translocation:

Rose Collen (compiled this information)—Translocation specialist and contractor to the Department of Conservation (DOC)

Bill Cash—Biodiversity Assets Ranger, Sounds Area Office, DOC

Lynn Adams—Technical Advisor Fauna, National Office, DOC

Luis Ortiz-Catedral—Head of Restoration Ecology Group, Charles Darwin Foundation/Durrell Wildlife Conservation Trust; Massey University

Matu Booth—Zealandia Conservation Officer, Karori, Wellington

Richard Gray—Zealandia Conservation Officer, Karori, Wellington

Denise Fastier—Biodiversity Ranger, Ahuriri/Napier Office, DOC

Kahori Nakagawa—Cape Sanctuary Co-Manager, Cape Kidnappers, Hawke's Bay

Tamsin Ward-Smith—Cape Sanctuary Co-Manager, Cape Kidnappers, Hawke's Bay

It was reviewed by experts with kākāriki translocation experience, or with translocation process experience:

Terry Greene—Science Advice Monitoring, Science & Capability Christchurch, DOC

Andrew Grant—Technical Advisor Ecology, Science & Capability Christchurch, DOC

Raewyn Empson—Zealandia Conservation Manager, Karori, Wellington

Judy Gilbert—Manager, Windy Hill Rosalie Bay Catchment Trust, Great Barrier Island

Ralph Powlesland—Honorary Research Associate of DOC; former DOC scientist

The following people have been involved in recent kākāriki translocations and can be contacted for advice and further information about the methods described in this best practice:

Denise Fastier (Biodiversity Ranger, Ahuriri/Napier Office, DOC)

Ph: 06 8344842 Email: dfastier@doc.govt.nz

Tamsin Ward-Smith (Cape Sanctuary Co-manager)

Ph: 06 8750308 Mob: 027 2273543 Email: tamsin@capesanctuary.co.nz

Kahori Nakagawa (Cape Sanctuary Co-manager)

Mob: 0274355369 Email: kahori@capesanctuary.co.nz

Luis Ortiz-Catedral (Massey University)

Ph: 09 4140800 ext. 41192 Email: l.ortiz-catedral@massey.ac.nz