Best practice techniques for the translocation of North Island robins (*Petroica longipes*), South Island robins (*P. australis australis*) and Stewart Island robins (*P. a. rakiura*)

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Cover: South Island robin (*Petroica australis australis*). *Photo: Herb Christophers.*

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Abstract

This document details best practice techniques for the translocation of North Island robins (*Petroica longipes*), South Island robins (*P. australis australis*) and Stewart Island robins (*P. a. rakiura*). It contains methods pertaining to the translocation process, from selecting the most appropriate site and time 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 robins.

Keywords: North Island robin, *Petroica longipes*, South Island robin, *Petroica australis australis*, Stewart Island robin, *Petroica australis rakiura*, translocation, best practice, New Zealand

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1. Introduction

The information presented in this document has been compiled from reports on 15 translocations of North Island (NI) robins (*Petroica longipes*), South Island (SI) robins (*P. australis australis*) and Stewart Island robins (*P. a. rakiura*) that were carried out between 2002 and 2011. 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 that it will be used as an advisory document for people planning the translocation of robins and/or assessing translocation proposals.

The described methods are based on well-established techniques that have been tested and found to be successful in past translocations. Therefore, they are recommended as current best practice techniques for translocations of these three species of robins. Where there is no single best way of doing something, a range of techniques are described and, in these instances, the individual preference of the team that is translocating the robins comes into play. It is also important to note that the behaviour and reaction of birds to capture and translocation can vary between locations, seasons and years. Therefore, a good translocation practitioner will always closely monitor the birds in their immediate care and respond to their needs accordingly.

Further details on the background and expertise of the experts who contributed to this report are available in Appendix 1.

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 is shared with people carrying out translocations and research 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 translocations of robins, 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 DOC as the managed movement of live plants or animals (taonga) 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. Suitability of a release site for establishing a robin population

There are two important phases in establishing a self-sustaining robin population: the establishment phase and the growth phase.

The initial post-release establishment phase determines the number of birds that establish territories at the release site and become part of the breeding population during the first breeding season. Elizabeth Parlato (2010) analysed the results of NI robin reintroductions to 16 sites on the New Zealand mainland and Great Barrier Island (Aotea), where predator control had taken place. She reported that:

- Site connectivity to surrounding forested areas had a significant influence on the proportion of released birds known to establish, with more-connected sites associated with a lower proportion of birds establishing.
- A lower proportion of robins known to establish was also associated with the presence of rats at release sites, smaller release site areas, the absence of mammalian predators at the source site, and lower levels of effort put into searching for the robins post-release.
- Variables considered that had no significant effect on the number of birds that established were founder group size, presence of mustelids at the release site, time from release to the start of the first breeding season, and vegetation type (pine/native forest) at the source site.

The second establishment phase is an ongoing phase that determines the growth of the population. Parlato & Armstrong (2012) found that growth of reintroduced robin populations was affected by rat (*Rattus* spp.) tracking rates as well as the landscape surrounding reserves. They cautioned that managers need to be aware that sites may be marginal for robin populations if they are on peninsulas (where dispersing juveniles might be channelled out along forest edges), or are well-connected to forest or scrub habitat outside the reserve, regardless of the intensity of predator control.

Therefore, it can be concluded that assuming adequate predator control is in place, the factor that has the greatest effect on the successful establishment of robins at a site seems to be the site's connectivity to other suitable habitat and the opportunity this provides for the robins to disperse beyond the release site. Although a number of pairs may establish within a release site, the juveniles produced by these pairs can be lost as they disperse to other areas, resulting in the population failing to grow.

4. Composition of transfer group

Both adult and juvenile robins have been successfully translocated in the past. However, there has been dispersal out of the intended area by both age classes.

When territorial adult robins are transferred, some individuals may attempt to return to their territories, even if this means flying over the sea (Oppel & Beaven 2002). Juveniles go through a dispersal phase in late summer/autumn and often continue to disperse following release. Therefore, adults and juveniles may have an equal likelihood of establishing at the release site following translocation.

In addition, although territorial adults may be easier to train for capture because they can be found repeatedly in the same areas, juveniles may be easier to catch because they are more naïve.

Consequently, there is no specific recommendation on whether to transfer adults or juveniles and, in reality, transfer groups are likely to consist of a mixture of age groups because it can be difficult to distinguish between birds of different ages. There is also no advantage in transferring established pairs and releasing them together, as translocation typically breaks pair bonds. The most important thing is to release an even sex ratio, where possible.

When aiming to catch an even sex ratio, it is important to note that juvenile male robins look like females. Therefore, an even sex ratio is more likely to result if there is a focus on catching juvenile-looking birds, because this will lead to either juveniles or grey-plumaged females being caught, avoiding the fairly conspicuous, dark-plumaged males (refer to section 7—'Sexing robins').

5. Time of year for transfer

The months March through to May are a good time for translocating robins. During these months there are still lots of juveniles around (i.e. prior to the high winter mortality rates) and they are still relatively naïve and easy to catch, meaning that the target number of birds is more likely to be captured. Furthermore, natural food supplies are abundant, the days are long and the weather is generally good, making catching easier and, presumably, making the transition for translocated birds a little easier, i.e. by not being released in cold, wet conditions with short day length. At this time of year, the birds are no longer breeding and territorial bonds also tend to be at their lowest.

Winter translocations are more difficult because the population density of robins is generally lower, and the days are short and cold with changeable weather, which can be hard on both the birds and the catching teams.

If juveniles are specifically being targeted, transfers could occur earlier, i.e. in January/February, at which time juveniles can sometimes be distinguished from adults by their new wing feathers (adults will have worn feathers and some will be in moult). However, if translocations are being carried out from January to March, time must first be spent observing the birds to ensure that juveniles that are still being fed by their parents are not caught.

6. Transfer team

Having experienced bird handlers, bird banders, catchers and translocaters throughout the operation is vital for any translocation. If there is a need to transfer a large number (40+) of robins over a few days, three or four catching teams will generally be needed, each with two to three people (including at least one experienced bird handler). An experienced processing person with an assistant (not essential but extremely helpful if the catch rate is high) and one to three extra people (runners, etc.) are also needed.

7. Sexing robins

Robins can be sexed in the field to a reasonable degree of accuracy using a combination of the methods described in detail below, which include observing their appearance and behaviour, and taking tarsus and wing chord measurements.

It can be difficult to sex individual robins using measurements alone because there is some overlap between males and females. However, it is possible to estimate the sex ratio of an entire translocation group with reasonable accuracy—although it is important to be aware of possible regional differences in measurements.

It is also important to accept that even a skilled bird bander/measurer is going to make mistakes, i.e. the sex ratio might be skewed, generally towards males. However, no matter what time of year the translocation occurs, there should always be a reasonable number of birds that are correctly sexed. Post-release monitoring and/or DNA sexing will reveal how many have been correctly identified, and as long as there are a reasonable number of females, any slight bias in sex ratio should not cause any issues.

7.1 Appearance

Male SI and Stewart Island robins usually have darker plumage than females and have a fairly clean line across the breast (Heaphy 2003), which contrasts with the typically indistinct line in females. Juvenile males look like females at fledging and then develop the 'male' plumage as they mature. Although this is thought to occur in time for their first breeding season, plumage maturation has not been studied in this species, so there are no guarantees that 1-year-old males will have the obvious male plumage.

Male NI robins have darker plumage on their back and upper breast than females (Armstrong 2001). However, males do not acquire their dark 'male' plumage until after their first breeding season, 12–16 months after fledging (Armstrong 2001)—up until that time they are indistinguishable from adult females. It is therefore important not to assume that birds that 'look female' are in fact female, as these will also include young and juvenile males. Consequently, catching an equal number of 'male-looking' and 'female-looking' birds will result in the transfer group being male-biased.

Juveniles that have left their natal territory may be recognised by their pointed rectrices (the strong tail feathers that direct flight), and the usually yellow/orange colour on their feet and around their gape; however, these features are indicators only, as they disappear over time (Armstrong 2001) and vary among individuals.

7.2 Behaviour

Males are usually first to approach any clapping or taped call, as they are more inquisitive than females. By contrast, females tend to have more reserved behaviour (Heaphy 2003), although there are frequent exceptions to this rule and some females are highly territorial.

If two birds are attracted to the observer at the same time, this can make sex determination easier. The two birds are likely to be a pair if they tolerate each other and do not show too much aggression to each other (there may still be some chasing, but this is not usually as aggressive as between two unpaired birds). The male is also quite often a little darker grey than the female, although this can be reversed when an older female is paired with a first-year male.

It is easiest to sex robins by observing their behaviour during the pre-nesting period in spring (around August), as males will be courtship feeding females (Heaphy 2003). However, it is important not to catch and transfer birds once the breeding season has begun, as this will disrupt their nesting.

Although the sex of adult robins can be determined fairly quickly from their behaviour during the breeding season, it is difficult to sex most birds during autumn when the majority of translocations are carried out.

7.3 Measurements

Tarsus measurements provide a reasonable indicator of sex in juvenile robins regardless of time of year, because the tarsi have reached full size by the time the birds fledge (Armstrong 2001). By contrast, wing chord measurements are useful for adult birds but quite unreliable for juveniles, i.e. juvenile males as sexed by tarsus length can have a female-sized wing chord. A combination of both measurements can be used to increase accuracy.

The tarsus measurement that is normally used is the 'tarsus length with foot' measurement, which involves bending the foot downwards, and holding one end of the calliper against the notch on the upper end of the tarsometatarsus, and the other end against the folded foot (Armstrong 2001), with the callipers parallel to the bird's tarsus (Fig. 1). Wing chord measurements involve holding the wrist joint of the bird against the butt of a wing ruler and measuring to the tip of the longest feather. It is generally recommended that people use the flattened straightened wing chord (Melville 2011).

Figure 1. Taking the tarsus measurement. *Photo: N. Priddle.*

7.3.1 North Island robins

North Island robins can be sexed with about 80% accuracy based on tarsus length alone (Armstrong 2001). It is important that the measurements are taken consistently and correctly, however, as inexperienced measurers tend to overestimate tarsus length.

Males and females can be distinguished as follows:

- Based on data from Tiritiri Matangi, robins with a tarsus length of ≤ 35.6 mm are likely to be female, while robins with a tarsus length of > 35.6 mm are likely to be male, although there is some overlap (Armstrong 2001).
- Robins with wing chord measurements of ≤ 87 mm are more likely to be adult females, while those with wing chords > 87 mm are more likely to be adult males, although again there is some overlap (Armstrong 2001), particularly between juvenile males and adult females.

Recent data from a study at Bennydale also suggest that NI robins inhabiting mature pine plantations are, on average, larger, heavier and have longer tarsus measurements than birds inhabiting native forest (N. McArthur, unpubl. data 2005).

7.3.2 South Island robins

Based on measurements from 111 robins in the Dunedin area (D. Hegg & I. Jamieson, unpubl. data 2011), the following equations can be used to sex SI robins using tarsus and weight measurements:

$x = -70.8398 + (0.5088 \times \text{tarsus}) + (1.4230 \times \text{weight})$

$P(\text{male}) = e^x/(1+e^x)$

- If $P > 0.5$ the bird is likely to be male, whereas if $P < 0.5$ the bird is likely to be female[3]
- Tarsus length is measured in centimetres and weight is measured in grams, i.e. multiply the tarsus by 0.5088 and weight by 1.4230 before adding them together, then add it to –70.8398.
- This method is expected to achieve an accuracy of about 85%. It is worth noting, however, that the accuracy of the method will depend on the measurer, with the best results being achieved if all tarsus measurements are taken by the same person, for whom the method should be calibrated.

If tarsus measurements alone are used to sex SI robins, a cut-off value of 37.5 mm (males have longer tarsi) could be used; the expected accuracy of this method is 70%–80% (D. Hegg & I. Jamieson, unpubl. data 2011).

7.3.3 Stewart Island robins

The sexing analysis for SI robins has not yet been carried out for Stewart Island robins, because in the past they have been sexed either by their behaviour as adults or by DNA sexing. The body sizes of SI and Stewart Island robins differ, so the cut-off value of 37.5 mm used for SI robins does not apply, and there is no equivalent cut-off measure available for Stewart Island robins.

The best advice currently for sexing Stewart Island robins by measurement is to try using the equations above for sexing SI robins based on tarsus and weight measurements. All of the measurements must be taken by one person.

[3] To get the probability (P) of the bird being male, take the base of the natural logarithm (e), which is approximately 2.718281, and raise it to the power of x (for most hand calculators, you can enter x and then press function key e^x). Then divide this value by $(1 + e^x)$.

7.3.4 Limitations

As explained above, sexing robins using the measurement method has its limitations (i.e. measurer variability and accuracy, overlap between the sexes). For these reasons, it can be useful to take samples for DNA sexing, although this does not provide immediate information and increases the cost of the project.

7.4 DNA sexing

DNA sexing has a high level of accuracy and can be carried out using blood or feather samples. It usually takes at least a week to obtain the results.

Blood samples can be useful for looking at a range of genetic and health issues—where this is required. However, feather sampling requires less skill and is the most commonly used method for gender assignment. The quill tip of the feather (where it contacts the skin) is the most important section of the feather, meaning that the feather must be plucked, not cut. Feathers that have been cut, or samples that consist only of down are unlikely to yield DNA.

Information on how to obtain feather samples can be found in DOC's avian blood/feather and reptilian tissue sampling standard operating procedure (SOP 2010), copies of which can be obtained from a local DOC office.

8. Capture

It is fairly easy to capture robins when they have been pre-conditioned to accept food such as mealworms. It is useful to pre-feed the robins as much as possible if they need to be captured quickly on transfer day; however, it is also possible to catch robins with little or no pre-feeding. Females are often harder to find, so pre-conditioning provides an opportunity to get the more reluctant females used to coming for mealworms.

Robins can be 'trained' to approach for mealworms by making a noise (such as clapping) when feeding them, so that they learn to associate the noise with receiving food from a person. When feeding robins, it is helpful to clear an area of leaf litter and use that area for feeding, as this makes the mealworms easier to see and the robins soon learn that a newly cleared patch often heralds delicious mealworms. Clearing litter can also be effective for attracting robins in the first instance, as they naturally associate this with food. (Note: The cleared patch does not necessarily have to be in the same place each time 'training' occurs.) Robins can also learn to take mealworms from alongside a trap, so that come capture day they are already used to feeding next to the traps.

Recorded robin calls (specific to the target species) can be useful for capture or monitoring (Heaphy 2003). However, recorded calls typically attract males and often result in those males responding with territorial behaviour (singing high in trees), at which point they are impossible to train. Consequently, recorded calls tend to be more useful for monitoring than capture, although they could be useful when mist nets are being used to catch birds (refer to section 8.2—'Other capture tools'). It is usually more effective to move through the forest fairly quietly whilst looking for robins, as this means that the robins are more likely to be trainable and the transfer group will have an even sex ratio.

The presence of a male at a catching site can sometimes make catching females or juveniles difficult, because males are the dominant birds and will chase others away from the mealworm lure. Therefore, if other target robins are present and are being excluded from the trap, catching the male first may make it easier to catch the other birds—if the male is not one of the targets for transfer, it can then be released where it was caught (within 30 minutes).

8.1 Clap traps

Robins are usually captured using clap traps with mealworm lures.

Clap trapping is usually safe, but anyone using this technique must first be trained on safe use of the traps by an experienced trapper, as robins can be killed in these traps. Because it can be quite easy to catch robins, people (especially those with limited bird handling experience) often become very confident very quickly—and this is when birds start to be injured or killed. Catchers must be very patient and careful.

8.1.1 Setting up the clap trap

Before attempting to catch a robin, make sure that the traps have been tested and are working well. They should spring quickly when triggered, so that the bird does not see the net coming in time to fly out. Do not use any clap traps that have a complete square of metal edging, as this increases the risk of injury to the bird. Clap traps should have a light-weight, three-sided metal frame with a string top edge (see Fig. 2).

Clear an area in front of the net so that mealworms will be clearly visible to the bird. Making a leaf litter buffer around the bars of the trap (see Fig. 2) is also recommended, so that the edges of the net will lie flat when it is triggered. This helps to prevent the robin's escape once the net has come down over it, especially if the ground is uneven—it is worth the 1 minute it takes to build, because a bird that escapes is generally very much harder to catch second time around. To prepare the buffer, trigger the trap and then make a buffer of leaf litter that is 10–15 cm wide and approximately 10 cm high, and which sits just under the perimeter of the sides, top and bottom of the net.

Once the trap has been positioned appropriately, pull the net back and set it with the mealworm in place. Some operators recommend tying the mealworm down using fishing line (Heaphy 2003), or using a pin or small stick to secure the mealworm to the spot, so that the robin has to pause inside the trap to tug at the mealworm. An easier option is to pinch the head of the mealworm to kill it. Either way, it is important that the mealworm does not move away from the correct position at the base of the trap (see arrow in Fig. 3). Mealworms can be placed on a fresh leaf so that they really stand out to the robin.

Figure 2. Tony Woodruff setting up a clap trap to catch a robin. *Photo: A. Coffey*.

Figure 3. Clap trap set to catch a robin. The arrow shows the location at which the robin needs to feed to be caught safely. *Photo: R. Powlesland.*

8.1.2 When to trigger the trap

Robins can only be captured safely if they are feeding calmly from the very base of the trap, in the centre (see arrow in Fig. 3). Birds that dart in and grab the mealworm cannot be captured. It is therefore necessary to wait until the robin is relaxed with the set up. Once the robin is feeding calmly, the trap can be triggered just as the robin is reaching for the mealworm in the correct location. It is then necessary to move quickly to pin the robin down before it has time to work out how to get out from under the net. It is best to pin **around** the robin with both hands rather than putting your hand directly on the bird (Fig. 4).

Figure 4. Taking a robin out of a clap trap net. *Photo: A. Coffey*.

Some robins will be wary and difficult to catch. Suggestions for clap trapping particularly wary birds include:

- Set and bait the trap, and let the robin get used to feeding from it in its own time (while you watch, do not leave the trap set and unattended). Repeat the process until the robin is feeding calmly from the base of the trap.
- Move the trap to a less-open site. Robins seem to be more confident when they have a bit of undergrowth to retreat into and plenty of raised perches around, so setting a trap up next to a fallen log or on the edge of a dense patch of understorey vegetation often helps.
- Shift the trap in the direction of where you think the bird's core territory is, as robins tend to be less confident near the edges of their territories. Robins often seem to centre territories around gullies, so try to catch robins in the bottom of gullies rather than up on adjacent ridges.

8.2 Other capture tools

Hand nets have been used successfully to capture adult robins on South Island inshore islands (Willans 2002a, b, 2008), using mealworms to lure them close, as well as on Tiritiri Matangi Island, where the robins are very familiar with people. However, hand nets are more likely to be successful with more naïve fledglings or juveniles, and thus are routinely used to capture young birds at many sites.

Mist nets have also been used successfully in combination with clap traps to target pairs (Ward-Smith & Stephenson 2008). During the Cape Sanctuary translocation, mist nets were particularly useful for catching the female of a pair, as females are sometimes harder to entice into a clap trap than males, even with lots of pre-feeding. Using a combination of both techniques usually resulted in the pair being caught. In some cases, nets were set up close to clap traps so that birds were captured when approaching the clap trapping site, whilst other birds were caught by setting mist nets and throwing mealworms onto the ground on the back side of the net, so that birds were captured when they tried to fly down to the mealworm (Ward-Smith & Stephenson 2008).

Drop traps (with mealworms for bait) have also been used to catch robins. A drop trap is a five-sided wire frame that has mesh covering the sides and top, and a flap on one side to enable easy retrieval of the captured robin. The trap is propped up on one side with a stick that is attached to some nylon fishing line, which is pulled to drop the trap down over the bird. The mealworm must be placed in the correct position (as for the clap trap), near the base of the trap where one side of the frame is sitting on the ground. The stick is pulled away just as the robin is in position well inside the trap, looking down to pick up the mealworm. There is potentially less risk of injuring a bird using this method (as the trap simply falls down rather than having the forced spring closure of a clap trap), but again it is essential that people have adequate training from someone experienced in using this technique. Robins that escape capture will be very difficult to catch next time.

8.3 Following capture

Once it is captured, the bird must be transferred immediately to a black cloth bag, which, if necessary, can then be hung (securely) in a tree in a quiet, shady place for up to 30 minutes while other birds are being caught at the site. Note that bags with birds in them must never be put on the ground—only kept in the hand or hung on a tree.

If captured birds are all brought to a central banding station, each cloth bag should be labelled with the capture time, catcher/team name and location, gender (if known), and any other useful comments (such as if the bird was one of a pair caught at one site) (Gilbert 2009). A guess at gender, based on the behaviour of the bird before it was caught, can be helpful to the team processing/sexing the birds (Heaphy 2003).

9. Transfer to base for 'processing'

Black cloth bags can be used to transport captured robins 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. Robins 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—robins have occasionally been injured or killed this way. There must be only one bird per bag, and the carrier must have one hand free while walking to help avoid falls that could crush the bird (Davies et al. 2010).

An alternative method was used by the team transferring robins from reserves in Dunedin to Orokonui Ecosanctuary (Hegg & Jamieson 2010). During the transfer from the capture location (in steep terrain) to the base, the birds were still carried in cloth bird bags, but these were protected by a sturdy cardboard box fitted inside a backpack. Up to five bird bags could fit inside a cardboard box, suspended from a perch at the top of the box. The bags need to be hung in such a way that they do not swing and bang into each other, and the sides of the box should be padded. Also, note that this technique should only be used during cool temperature conditions—otherwise birds may overheat in such confinement.

10. Processing the birds

Processing must be carried out in a dry, sheltered, quiet and shaded area such as indoors or under a tent fly. Tarpaulins would only be suitable in calm conditions, as they can be noisy in the wind.

All of the handling (banding, disease screening, etc.) should be done immediately after removing the robin from the cloth bag—repeat handling should be avoided. Never try to catch a bird in a transfer box—it is very stressful for the bird, risks injuring it and may result in the bird's escape.

Translocated robins are usually given individual colour band combinations, so that it is easier to monitor the survival, territory location and identity of pair members following release, and more detailed data can be obtained. If resident nestlings/juveniles are to be banded and monitored over several seasons, it may be helpful to use one colour with the metal band to specify a cohort, e.g. released birds, chicks of each season.

When using colour band combinations, the metal band must be placed below the colour bands on the leg. This is considered best practice because metal bands are heavier than colour bands, and so may increase band wear on colour bands if placed above them (due to the bands constantly running up and down the leg as the bird moves around). Also, if the colour band becomes brittle or opens slightly, the extra weight of the metal band may result in the colour band being pushed over the ankle joint, effectively preventing the bird from using its toes (G. Taylor, DOC, pers. comm. 2012). Refer to the Bird Bander's manual (Melville 2011) for further information about banding (banding permit holders should have a copy of the latest manual).

11. Temporary housing

It is often necessary to house robins temporarily while enough birds are captured for the translocation, especially when catching large numbers of birds, or when the source or release site is in a remote location.

During the entire captive 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—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 captured birds.

With appropriate care, robins awaiting transfer have been held without injury or mortality for up to five nights in modified cardboard pet carry boxes. Robins must be housed individually and the carry boxes should be modified as illustrated in Fig. 5, with the following features (Lovegrove 2008; Davies et al. 2010; Hegg & Jamieson 2010):

- **Gauze-covered ventilation holes** along one side **and a high, long, narrow window** on the other to provide enough light for the bird to see to feed. The window should be placed near the top of the box, above the bird's line of sight (so it does not see movement outside), and lined with a double layer of shade cloth to allow some light in but reduce visibility out.
- **Perch**—This can be nailed in place from the outside, or stuck through the cardboard on either side and secured on the outside with tape so that it does not rotate (Davies et al. 2010). The perch should be big enough for a robin to be able to wrap its toes most of the way around—approximately 1–2 cm in diameter (birds have to work harder to perch on smaller branches). Rough branches (i.e. textured for grip) should be used—avoid using clean dressed doweling as it provides no grip. There must be at least 150 mm between the perch and the top of the box to allow enough headroom for the bird.
- **Non-slip matting**[4] lining the floor—The box can be lined with a layer of newspaper or paper towels to absorb any moisture, with the non-slip matting placed on top. The matting should be stuck down with double-sided sticky tape to help prevent it from shifting or bunching up during transit. Alternatively, boxes lined with fresh leaf litter (atop a layer of newspaper) have been used; however, this is more likely to shift during transit. If leaf litter is used, it must be dry and free from mould—damp, mouldy leaf litter can harbour disease-causing pathogens. Keep the area for the food dishes clear of leaf litter and press the litter down to help keep it in place.
- **A small door** at the end of the box, for putting the bird in the box. Once the bird is in, the door should be secured shut and not opened again unless necessary to visually check the bird.
- **A small flap** at floor level at the end of the box away from the perch, through which water and food can be provided in small dishes. The ability to slide the dishes out of the box to check and replenish their contents rather than putting your hand into the box each time will cause fewer disturbances to the birds. It should be possible to secure the flap shut—tape can be used, with a layer of insulation tape on the other side so that you can open and close it repeatedly without tearing the cardboard box.
- **Top of each box taped shut**—If there is limited room for storage (or transport) the top of the box can be taped down so that it has a flat top for ease of stacking. One handle can be left without tape so that it can be folded upwards to use for carrying.
- **Individual robin identification information** written clearly on top of each box, along with a feeding timetable.

[4] Non-slip matting may be available from hardware or homeware stores.

- **Food and water dishes**—Small tuna tins (ensure they have no sharp edges and are clean), plastic jar lids and plastic Petri dishes have all been used. Porcelain ramekin bowls have also been used, secured in the box with cardboard edging. Ideally, the food dishes should be stable (unable to be moved or tipped over by the birds) and safe during transit. Avoid using dishes that are too large and therefore difficult to pull in and out of the box.

The carry boxes must be kept in a cool (but not draughty) and sheltered place, preferably indoors, and spaced to allow for good air circulation (Gilbert 2009). Note the movement of the sun through the day, as it may strike the boxes for a period of time.

It is best to destroy cardboard boxes after use, but grip matting can be cleaned, sterilised and reused.

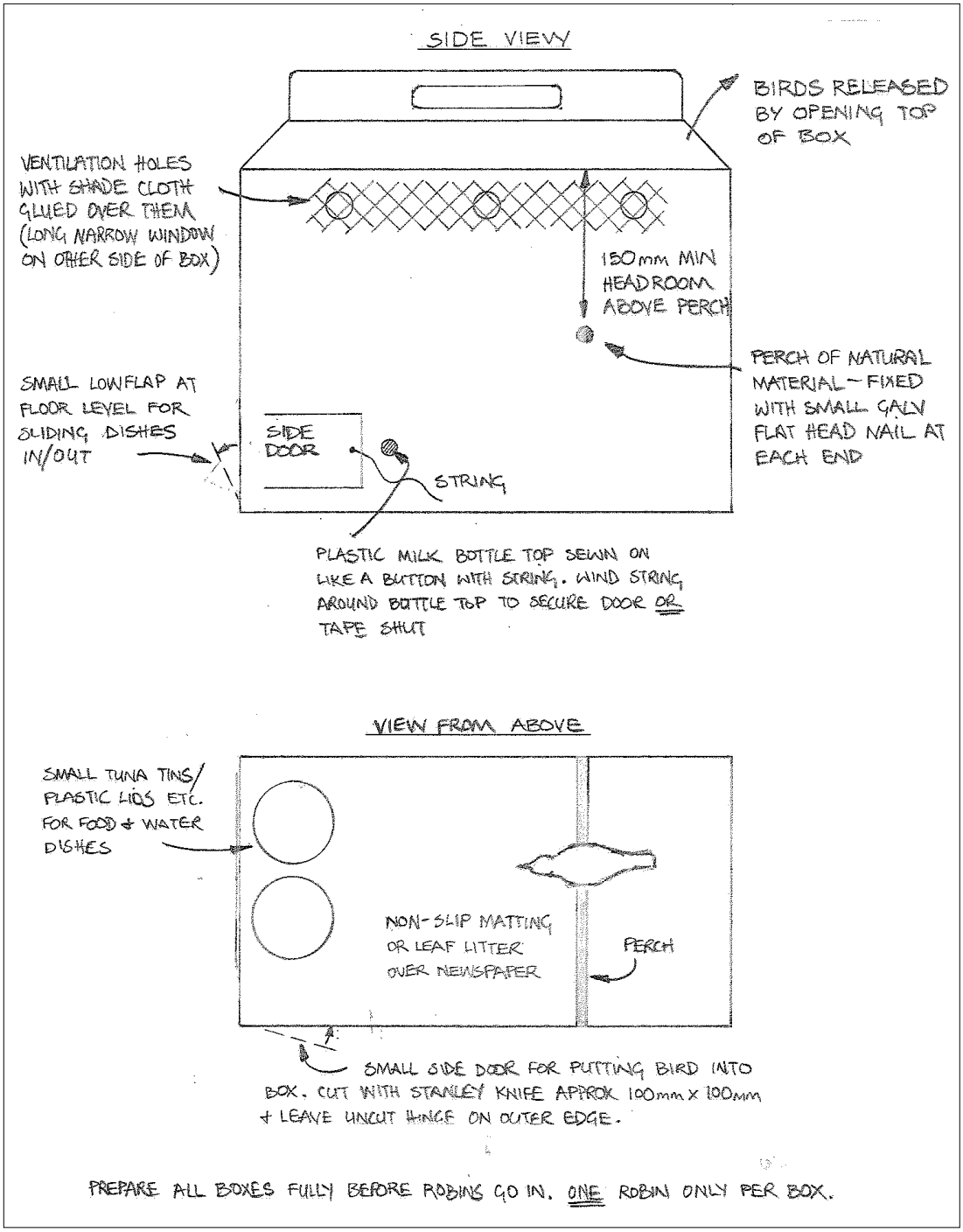

Figure 5. Temporary holding box design for robins—designed by Tim Lovegrove in 2005.

12. Feeding

Water and food should be checked at least three to four times per day and replenished ad libitum (Lovegrove 2008; Gilbert 2009). A small torch can be useful for checking the birds and the food and water in the boxes, taking care not to shine it directly on the birds or disturb them too much. Water and food dishes should be cleaned if they become soiled.

Robins should be fed live mealworms and wax moth larvae[5]. Ensure that the live food is of good quality and healthy by following the care instructions provided by the supplier, and do not use any insects that have died. Each bird will need approximately 100 mealworms and up to 30 wax moth larvae per day. However, it is important to note that sometimes the birds will eat more than expected, so over-ordering is the best approach. Any leftovers can be used for post-release monitoring.

To give a rough idea of how many mealworms and wax moth larvae are needed for a translocation (note this can vary a great deal):

- 15 000 mealworms and 5000 wax moth larvae were used to feed 60 birds over the 5-day catching/holding period during the translocation to Moehau (Davies et al. 2010). It was found that 17 mealworms and 7 wax moth larvae per feed were not enough, so the number was increased to 30–35 mealworms per feed.
- 2000 mealworms were used during a transfer of robins to Adele Island (Golding 2009), where 30 birds were caught and housed overnight (for 24 hours). This included pre-feeding for three days before capture.

The live food can be provided in stable dishes that the robins cannot tip up (such as tuna tins or ramekins), and that the mealworms cannot climb out of and disappear from, so that it is easier to see how much has been eaten. If the live food is escaping or disappearing, it is important to keep the food topped up to maintain a ready food supply. Make sure there are always some live mealworms left at each top up. Wax moth larvae tend to move around a lot, so are best fed out in lower numbers.

Alternatively, mealworms can be dropped through the ventilation holes in the top of box (re-covering the holes with a flap of shade cloth/mesh afterwards). The robins see the insects drop down and then forage for them on the floor, rather than having to eat out of a dish. If using this method, take care to offer the food more frequently, i.e. roughly ten mealworms every hour. Since only a water dish is needed using this method, a smaller access flap can be cut into the box that is the same height as the dish and the dish can be wedged under the flap, sticking out just enough to be able to pull it out easily to refill.

It should be possible to get an idea of how well the birds are feeding by listening for them moving about in the boxes. Many successful translocations of robins have been reported where there were no problems getting the birds to feed; however, be alert to problems with birds not feeding and losing condition. The important thing is to ensure that plenty of live food and water is provided.

Note that changing and topping-up the food containers is disturbing for the birds. However, if it is done infrequently and on a predictable schedule, i.e. at the same times each day, it will be less stressful for them. Parker et al. (2012) found that the predictability of a stressor enables a bird to learn to differentiate between potentially life-threatening and benign situations. In this situation, birds that are fed on an irregular, unpredictable schedule will experience higher stress hormone levels than birds that are fed at the same time each day.

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[5] These are commercially available from Biosuppliers: www.biosuppliers.com. Biosuppliers can also provide information about how to look after the insects before they are fed to the birds. It is wise to place orders to Biosuppliers well in advance of a translocation so they can ensure that they have an adequate supply.

13. Care of robins during captivity

Always ensure that there is at least one person on the team who is dedicated to looking after the captive robins and their food supply (i.e. once the first birds are caught this person stops being part of the catching team and is not given any other jobs to do). During the Moehau translocation, feeding 60 robins during the 5-day holding period was a full-time job for one person (Davies et al. 2010). For transfers of more than 30 birds, there should ideally be two people dedicated to this task.

14. Transport

Robins can also be transported in the modified pet carry boxes described in section 11—'Temporary housing', with only one bird per box.

Water dishes must be removed before travel to avoid getting the bird and box wet. If birds are being translocated immediately from the capture site (i.e. released within a few hours of capture), they will not need water.

Throughout the transfer, the birds should be kept in the shade but away from draughts. Minimise noise and vibrations as much as possible (Gilbert 2009). If possible, when birds are being transported by road, the floor of the vehicle should be lined with mattresses or foam rubber (e.g. camping sleeping mats) to reduce bumps/impacts (Gilbert 2009; Hegg & Jamieson 2010). The boxes must be secured and stable, with the ventilation holes not covered by neighbouring boxes or other objects. Unless the weather is overcast, vehicle windows should have shades on them to ensure that the sun does not shine directly onto the boxes. Transporting birds at night may minimise stress due to the lower light levels, reduced traffic and travelling at a time when they are normally resting.

15. Release

Robins should be released during fine weather 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 and shelter before evening (Hegg & Jamieson 2010).

Releasing birds on the same day as capture works well for short-distance transfers; however, only do so if the birds can be released by mid-afternoon (2 p.m. at the latest during winter). Otherwise, for longer distance transfers, it is a standard procedure to keep the robins in their transfer boxes overnight with food and water, and release them the next morning.

When the time comes to release the birds, make sure that the boxes are 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 as this means there is nowhere safe for the birds to fly to, which would be very stressful for them.

To release the birds, simply open the boxes and let them fly out in their own time. Never try to catch a bird in a transfer box—it is very stressful and risks injury to the bird. Check the boxes very carefully after the birds have been released to make sure that all birds have left.

16. Post-release monitoring

16.1 Purpose

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

- Will the reintroduction be successful?
- Is management needed/sufficient?
- Will supplementary translocations be needed?
- Is genetic diversity sufficient?
- 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 the translocation proposal. The design of post-release monitoring needs to match the questions you are 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, densities of introduced predators are too high at the release site, or habitat suitability is otherwise unclear. By contrast, if robins are reintroduced to an isolated area of apparently excellent habitat with no introduced predators, post-release monitoring will be a lower priority.

Post-release monitoring can be used to determine where translocations have failed (Fig. 6), 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 offspring 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.

16.2 Recommended monitoring

Recommendations around monitoring are currently under review; however, the information presented in this section is the most up-to-date advice that is available at the time of writing. During recent translocations, robins have been banded with individual colour band combinations to enable monitoring of survival, territory location and breeding success. Most of these robin translocations have followed similar monitoring regimes that have involved:

- Searching suitable habitat within the release area for the presence of released birds (to estimate post-release survival)
- Mapping territories when pairs form (to determine post-release survival, recruitment and breeding rate)
- Monitoring nesting activities and outcomes (to determine recruitment and breeding success)
- Banding fledglings (to determine breeding rate, recruitment of juveniles and short-term success)

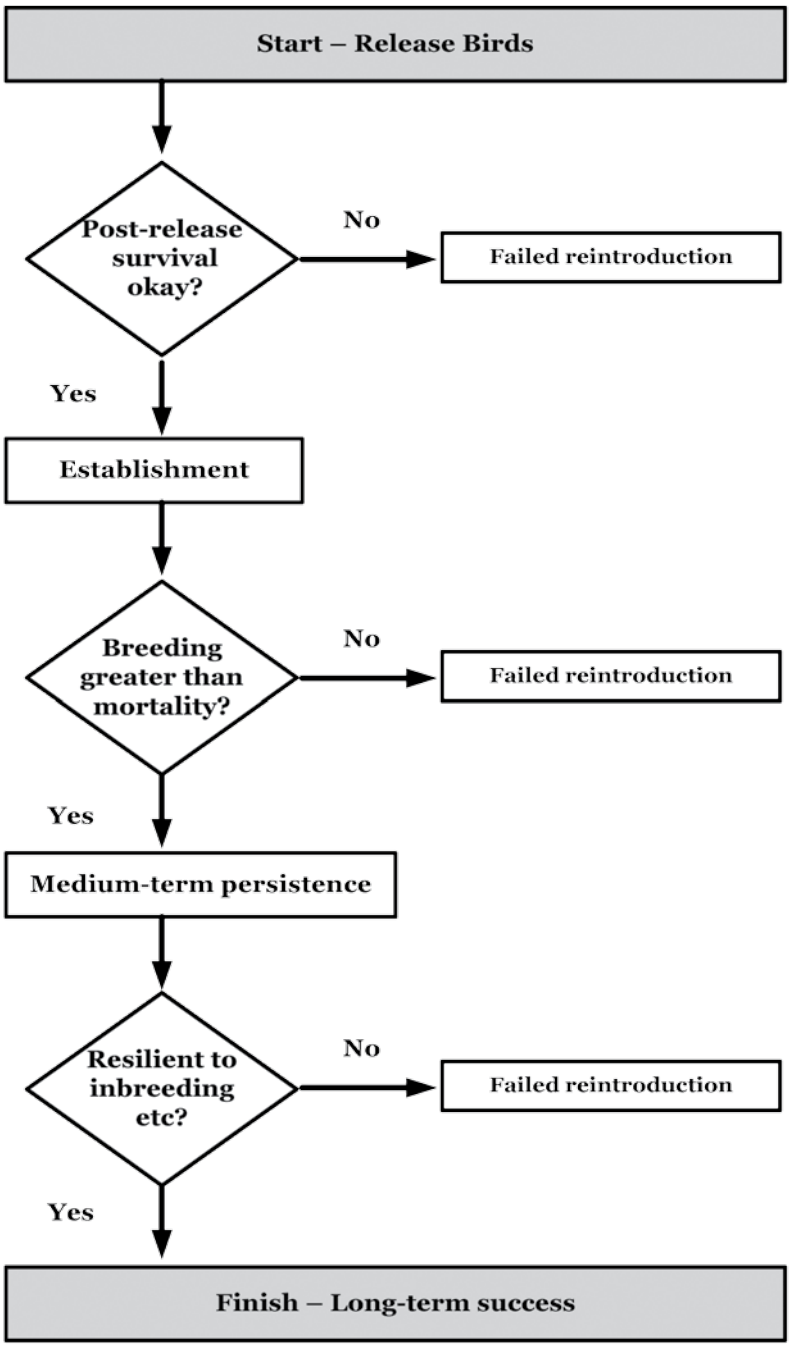

Figure 6. Determining the success or failure of a translocation (Parker et al. 2013).

Following initial monitoring of the newly released robins, breeding season monitoring should continue for a number of years until it is known whether robins have established at the site and are persisting in the long term, which indicates that the translocation has been successful.

A high level of commitment to monitoring is especially important for translocations to sites with a fair degree of uncertainty (e.g. small, edgy, questionable habitat—refer to section 3—Suitability of a release site for establishing a robin population). Where possible, population size should be estimated at such sites through distance sampling, site occupancy or the re-sighting of individually marked birds (Parker et al. 2013). Less-intensive monitoring, such as annual surveys for breeding pairs, might be acceptable for translocations with a higher expectation of success, such as those to mammalian-free islands that contain excellent habitat.

17. 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.

You should aim 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 others to learn from your experience 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 the translocation, so that you 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 the 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 16—'Post-release monitoring')
- Providing reports on the translocation using DOC's reporting instructions (Collen & Cromarty 2011a).

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Appendix 1

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