Best practice techniques for the translocation of North Island kōkako (*Callaeas wilsoni*)

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Cover: North Island kōkako female sitting on nest with two chicks, Coromandel Range, January 1979. *Photo: Dick Veitch*

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Abstract

This document details best practice techniques for the translocation of North Island kōkako (*Callaeas wilsoni*). 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 kōkako.

Keywords: kōkako, *Callaeas wilsoni*, translocation, best practice, New Zealand

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1. Introduction

The information presented in this document is based on information from the Kōkako Management Folder (Flux & Innes 2001b) which was last reviewed in 2009 (Haxton et al. 2009), and experience gained during North Island kōkako (*Callaeas wilsoni*) translocations during the past 18 years. This document is one of a series outlining best practice techniques for the translocation[1] of New Zealand bird species. It is intended as a resource for people planning kōkako translocations and 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 further kōkako translocations. It is 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.

Anyone considering establishing a population of kokako should first contact their local Department of Conservation (DOC) office and the Kōkako Recovery Group to discuss their proposal and seek feedback on its feasibility before commencing further detailed planning.

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 should be sent to the Technical Advisor—Systems Improvement, Terrestrial Ecosystems Unit, Science and Capability Group, DOC (co-ordinator 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 must 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 lead the translocation project, 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 kokako, 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. Priority of the translocation

The Kōkako Recovery Group currently prioritises the in–situ management of relict kōkako populations ahead of any translocations to establish populations at new sites. Kōkako translocations may be considered, based on the priorities set out in the Kōkako Recovery Plan (currently available in draft form but under review) (Flux et al. 2012) and the document 'National priorities for North Island kōkako—ensuring long term persistence of the species' (Thurley et al. 2014). Current priorities for translocations may include completing reintroduction projects already underway, or managing the genetic diversity of existing populations by supplementation. This means that there may be delays before birds can be made available for translocation to new sites.

4. Source population

A key issue that the Kōkako Recovery Group must consider for new translocation proposals is the availability of birds from source populations. A balance must be struck between maintaining the genetic health and growth-rate of existing populations, and harvesting them to create new populations. At present, the Kōkako Recovery Group considers it more important to increase current kōkako populations until they are clearly robust enough to sustain harvest of kōkako, before further birds can be removed to establish new populations elsewhere.

For translocation proposals that it endorses, the Kōkako Recovery Group will advise on the most appropriate source populations and number of founding birds required for the translocation. Harvest rates from relict populations will now be carefully managed to prevent possible loss of genetic diversity.

Genetic management is also an important part of the decision about the most appropriate source population. The Recovery Group is currently working with Otago University to determine how best to manage isolated subpopulations of kokako to minimise inbreeding and allele loss. Where possible, developing connectivity ('ecological corridors') between existing populations is likely to form an increasing part of the genetic management of kōkako populations.

5. Suitability of a release site for establishing a kōkako population

The Kōkako Recovery Group has a list of prioritised sites for future releases, and will consider any additional release sites on a case-by-case basis. It is important that new proposals to establish kōkako populations are discussed with the Kōkako Recovery Group at an early stage, to determine their feasibility and relative priority before significant planning resources are invested.

5.1 Habitat

Choosing a good release site for kokako is not as straightforward as it might be for some other species, as viable kōkako populations require large and diverse forest habitat areas. They are typically found in tall, diverse native forest, usually with a healthy shrub-hardwood understory below a canopy of tawa (*Beilschmiedia tawa*) or taraire (*Beilschmiedia taraire*) and with emergent podocarps or kauri (*Agathis australis*) (Innes et al. 2006; Flux et al. 2012). Kōkako defend large

territories of 4–20 ha, usually located in dissected terrain and containing a great variety of vegetation types and plant species (Innes & Flux 1999). Spring-fruiting plants appear to be highly important, as they provide a large portion of nestling diet. Pigeonwood (*Hedycarya arborea*) formed over 70% of chick diet at Mapara and Kapiti (Ian Flux pers. comm.); *Coprosma* spp., mapou (*Myrsine australis*), bush-lawyer (*Rubus cissoides*) are other species that are regularly fed to nestlings.

The precise habitat requirements of kokako are complex and although well studied, aspects remain poorly understood—this is highlighted by the situation on Kapiti Island (2000 ha), where the vegetation composition and structure appear ideal, yet the translocated kōkako population has a history of very slow population growth, suggesting the habitat is in some way sub-optimal, despite the island's considerable size and pest free status. Any area being considered as a potential release site for kōkako requires a thorough site assessment by an experienced kōkako specialist to determine the suitability of the habitat and whether it provides the variety of fruiting species kōkako need. To date, no translocated kokako population has achieved the population growth rates observed in relict populations at sites in the central North Island and several have struggled to persist. Kōkako experts are consequently carefully assessing the risks and value of future translocations.

Note that at some sites where kōkako were originally present (but have since disappeared from), browsing animals such as goats, possums and deer may have had a significant impact on the range of plant species required by the birds. Even if control of these pests is well established and successful, the habitat may already have lost soil fertility and botanical diversity and may take many decades to recover sufficiently for kōkako to thrive.

Successfully establishing a kōkako population may also be linked to the topography and overall extent of their new habitat. Newly translocated kōkako have often moved uphill to ridgetops, or have moved out beyond managed areas where forests are continuous. It may be difficult to establish kōkako in sites where the uphill movement of birds may lead them out of the pest-managed area, or where similar habitat extends well beyond a pest-managed area.

5.2 Habitat size

Populations of kōkako existing in small blocks of forest or on small islands are likely to suffer prolonged genetic bottlenecks, which may limit their long-term genetic fitness. Release sites should contain at least 2000 ha of contiguous suitable habitat, with at least 1000 ha managed (i.e. pest-controlled) at the time of release and with plans in place to increase the extent of the pest-managed area to achieve total kōkako populations in excess of 500 pairs. Alternatively, release sites may be considered if they are situated strategically between existing managed kōkako populations and the eventual aim is to link them and to improve connectivity and mixing of populations (and hence, genetic material). Over time it is desirable that isolated kōkako populations are, where possible, linked by 'habitat corridors' created to allow birds to move between existing populations and to link in other reserves containing suitable habitat. All such 'corridors' must involve detailed consultation with landowners and other stakeholders and may present opportunities for local communities to become involved with an exciting new development in kōkako management. A theoretical example might be a project to link populations in the 1400 ha Mapara area with those in nearby Pureora Forest. This would involve perhaps 2 km of native planting and the possibility of including an outlying 2000 ha DOC reserve near Benneydale.

5.3 Pest animal control

All kōkako release sites must have an effective pest animal control and monitoring programme in place. Effectiveness must be demonstrated using established national protocols for monitoring of possums (*Trichosurus vulpecula*) (NPCA 2011) and other small mammalian predators (Gillies & Williams 2013). The desired target for post-pest control indices (Flux et al. 2012) is:

- 1% trap catch for possums
- 1% tracking index for ship rats (*Rattus rattus*)

Post-pest control indices of < 5% for possums and ship rats are acceptable, but greater than 5% for either species means an operational failure (Innes et al. 1999; Flux & Innes 2001b).

These targets are based on pest animal poison operations undertaken during August to October, so that ship rat populations are lowest at the time of kōkako breeding from November onwards (Innes et al. 1999; Flux & Innes 2001b). Where pests are managed year-round, < 5% ship-rat tracking must be maintained throughout the kōkako breeding season.

Successfully meeting pest control targets is vital during the initial years of population establishment, as it maximises the chances of the translocated birds surviving and contributing to successive generations. This not only enables rapid initial population growth, but maximises the genetic health of the establishing population (Flux et al. 2012; Weiser 2014).

To date, no research has been conducted to enable an equivalent recommendation to be derived for stoats (*Mustella ermina*). Stoats are known to prey on kōkako (particularly on nesting females during years with no pest-mammal control). Some stoat control may be useful, but what scale or intensity of stoat control would be necessary to benefit kōkako survival has not yet been established.

6. Composition of transfer group

Both adults and independent juveniles may be captured for translocation, although with current capture techniques few juvenile or sub-adult birds are caught (generally only territorial birds are attracted to the pre-recorded kōkako song played at capture (mist net) sites). Juveniles may be recognised by their small pink/lilac wattles and browner plumage.

In general, the age of captured kōkako cannot be determined. If catching birds at a site where some kōkako banding has taken place, what to do with any banded individuals caught should be discussed with local DOC managers; in most cases it will be best for them to be released at the capture site, as they will be older birds. If any captured bird is unexpectedly wearing a leg band, details should be recorded and site managers consulted as to its age and the desirability of it being transferred.

The sex ratio of the transfer group taken from each source site should be approximately even. Ideally, kōkako should be sexed on the day they are captured so that excess birds can be promptly released at their capture site if an uneven sex ratio is caught (refer to section 13.2 Sexing kōkako). If 20 birds are to be taken from a site, a minimum ratio of 7:13 of either gender is acceptable.

A minimum of 40 to 60 birds (Weiser 2014) should be transferred to establish a new population; how many are required will depend on the size (or carrying capacity) of a site and the quality of its habitat (and therefore the potential growth rate of the transferred population). A translocation of this number might take several seasons of catching to complete; for example, the Secretary Island and Ark in the Park projects both took 2 years to catch and translocate the 27 birds released at each site.

While it is not appropriate for initial transfers to establish a new population, transfer of eggs or chicks may be an option in future for sites with an existing kokako population that requires **supplementation** to improve genetic diversity. Chicks that can be fostered by pairs at a release site may be more easily integrated into a new population than translocated adults, because they learn the local kōkako dialect as they are raised by their foster parents. Egg swaps have been carried out between kōkako populations on Tiritiri Matangi Island and the Hunua Ranges to reduce inbreeding of the small population on the Island. However, it must be remembered that more transferred individuals will be required if eggs or chicks are translocated, as their survival and recruitment rate will be lower than that of adults.

NB: Local dialect is an important part of kōkako pairing behaviour. Previous translocation projects have found that when birds from several different regions are translocated to a release site, individuals will generally only pair with others from their home region. The population starts to integrate only once offspring are produced, as they learn the new dialect evolving at the site and can communicate with each other and therefore pair.

7. Time of year to transfer kōkako

The capture of kōkako for translocation should usually be undertaken from **1 April to 30 September**, which is during the non-breeding season.

If catching kokako in April, some monitoring is needed before catching commences to ensure that no late nests are underway. In addition, captures should also be delayed if many birds in a population are in heavy moult, as this is a high energy demand/high stress period for the birds and their survival chances may be reduced if they are transferred at this time.

The kōkako breeding season is normally from October to March, although this varies with latitude and from season to season.

People considering translocations should be aware that the responsiveness of birds to pre-recorded kōkako song (essential for capture) can be variable and unpredictable; however, kōkako often become more territorial and therefore responsive during the month leading up to breeding. The Kōkako Recovery Group may consider extending the catching period into October and early November on a case-by-case basis, depending on what is known about previous laying dates at specific sites, and subject to the following conditions:

- Kōkako at planned catching locations are observed by experienced kōkako observers the day before catching, including at least one continuous follow of 35 minutes or more, to confirm that females are not ready to lay eggs or that any breeding pairs are not already incubating eggs.
- Catching sites are abandoned when, during the follow to determine breeding status, females hide, are furtive, unresponsive to playback or spend 50% or more of the follow time inactive or roosting quietly.
- All capture attempts are halted at any territory where a female does not move consistently with her mate at the net site, or the female ceases to respond to playback within 15 minutes.
- If any female that is caught has an obviously swollen abdomen (egg bearing), she must be released immediately at the capture site and all capture attempts halted at that location.

Local weather conditions should also be taken into consideration when planning the timing of a transfer, as fine, calm conditions are needed for mist-netting. Winter translocations can be difficult because the days are short and the weather can be cold and changeable, which can be hard on both the birds and the catching teams.

8. Budget planning

Kōkako translocations are often very expensive, because capturing kōkako is difficult, takes a lot of time, and requires a high level of specialist training, skill and experience. Often, several expeditions over 2–3 years are needed to catch the target number of birds to complete a translocation.

For example:

- Two teams were involved in four catching trips to catch and transfer 20 kōkako from Te Urewera Mainland Island to Whirinaki Forest Park in 2010. This resulted in four separate transfers of birds, from late August to early October 2010. (King 2010).
- To transfer 27 kōkako from three North Island sites to Secretary Island, five transfers were carried out in 2008 and 2009. At Kaharoa, 8 birds were caught over 16 days of catching attempts (two trips); at Mapara, 12 birds were caught over 13 days (two trips); at Rotoehu, 10 birds were caught over 10 days (one trip). In total, 30 birds were caught over 39 days (three birds could not be transferred). (Willans & Wickes 2010).
- For the translocation of kōkako from Rotoehu and Kaharoa Forests to Otanewainuku Forest, 10 birds were caught during three catching trips from mid August to mid September 2010 (OKT 2011).

Extra time should be allowed as unfavourable weather conditions are likely to reduce the number of catching days available.

Table 1 provides an example of the costs that might be involved in a kōkako translocation. It is based on estimated costs for a team of seven people (including three paid specialists and four volunteers), working for 60 days to catch and translocate 40 kōkako. Any chartered boat costs or flights for staff would be additional. Post-release monitoring (beyond the first month post-release) would be ongoing and is also not included. The cost guidelines are indicative only. Real costs can vary significantly depending on the locations of the source populations and release site, weather, and responsiveness of birds.

Table 1. Example of a budget for a kōkako translocation.

ITEM DETAIL	$ PER UNIT	NO. UNITS	TOTAL COST ($)	COMMENTS
Lead kōkako capture contractor	50.00	500	25,000	500 hours @ $50 per hour.
2nd kōkako capture contractor	25.00	500	12,500	500 hours @ $25 per hour.
Kōkako husbandry specialist	25.00	500	12,500	500 hours @ $25 per hour.
Flights for team	600.00	4	2,400	
4 volunteers	0.00	2000	0.00	
Food for team	105.00	60	6,300.00	$15 per person per day, 7 people for 60 days.
Accommodation for team	100.00	60	6,000.00	
Kokako food	600.00	1	600.00	
Kōkako food dishes & husbandry equipment	200.00	1	200.00	
Kōkako holding aviary (tent)	1,000.00	1	1,000.00	
Dividers for tent aviary	1,000.00	1	1,000.00	
2nd tent borrowed from Kōkako Recovery Group	0.00	1	0.00	
Kōkako tent sterilisation	200.00	1	200.00	
Kōkako disease testing	80.00	40	3,200.00	
DNA feather sexing	30.00	40	1,200.00	

Continued of next page

Table 1 continued

ITEM DETAIL	$ PER UNIT	NO. UNITS	TOTAL COST ($)	COMMENTS
Courier fees and phone bills	1,000.00	1	1,000.00	For disease screening, feathers for sexing, tent, catching gear, transfer boxes.
Kōkako transmitters & harnesses (if recommended)	270.00	20 (1 sex)	5,400.00	
Kōkako bands	120.00	1	120.00	
Kōkako transfer boxes	0.00	10	0.00	Borrowed from other projects (e.g. Kaharoa Kokako Trust).
Batteries	100.00	1	100.00	For torches, sound equipment, GPS.
Other field equipment and repairs	600.00	1	600.00	
Mist nets 10 × 12 m 5 × 9 m	100.00	15	1,500.00	(The Kōkako Recovery Group may have nets available to borrow.)
Equipment for mist-net site set up	1,700.00	1	1,700.00	String, lead sinkers and carabiners, machetes/loppers to clear sites.
Recording and playback equipment	500.00	1	500.00	Some equipment borrowed. (The Kōkako Recovery Group may have equipment to lend.)
Bird transfer costs (helicopter/ other transfers)	750.00	4	3,000.00	
Koha for powhiri at kōkako release	500.00	1	500.00	
Kōkako monitoring contractor—post release	25.00	250	6,250.00	Immediate post-release monitoring (approx. 1 month).
Sound anchoring equipment (if recommended)	590.00	4	2,360.00	Could be borrowed from other projects.
***Indicative total**			**95,130.00**	

* This total may vary widely due to weather conditions and kokako responsiveness as well as operational details.

9. Transfer team

There are few people adequately experienced with kōkako capture; so it can be difficult to find people with the right skill-sets who are available at the desired catching time.

The **optimum** number of people for a kōkako transfer team is seven:

- Two catching teams with three people each—to operate two net sites; and
- One person experienced with captive management of kōkako—dedicated to managing the birds held in temporary captivity.

Each catching team must have a **minimum** of either two people experienced with mist-netting kōkako, or one experienced person with two assistants (who may be trained on the job), to safely and efficiently operate a mist-net site. Within each catching team there must be one experienced kokako catcher/handler/bander (endorsed by the Kōkako Recovery Group and with a permit) and another person experienced in general bird handling and mist-netting.

At least one person in the transfer team must have experience with captive kōkako husbandry and, ideally, specific experience with captive holding of kōkako during translocations. Depending on the site and ease of access, this person could potentially be involved in initial early morning catching trips; however, once the first birds are caught, looking after the captive kōkako would become this person's priority. This will mean that they have less time to be part of the catching team and, as more birds are captured, the care and monitoring of the captive birds may become a full-time job.

The leader of the team needs to be someone who is comfortable deciding how to deal with stressed or injured birds and how to care for them, regardless of other pressures such as time deadlines, media expectations, protocol needs, etc.

Catching kōkako is a difficult and complicated process requiring specialist training. Careful setting and adjusting of nets is required and this can only be taught through practical demonstration. It is recommended that a high portion of the team is skilled at mist-netting and bird handling. Anyone on the team without mist-netting experience should receive training[3] prior to the translocation, if possible.

10. Specialist advice

Capture teams should always have a wildlife veterinarian on call who will be available during the period of the catching trip to give advice and, if necessary, deal with stressed or injured kōkako.

The Kōkako Recovery Group is the other main source of specialist advice. Details of Kōkako Recovery Group members involved in recent kokako translocations who can be contacted for further advice are provided in Appendix 1.

11. Capture

Most translocations involve capture of territorial adults using mist-nets. Mist-nets (Fig. 1) are hoisted into gaps in the forest canopy and kōkako are lured into them using pre-recorded kōkako song.

11.1 Mist net size

Figure 1. Mist net set to catch North Island kōkako, Mapara. *Photo: Greg Sherley (DOC image library)*.

The appropriate mist net mesh size for catching kōkako is 60 mm (stretched diagonally). This equates to a square size of 40 × 40 mm.

Mist nets must be 110 denier/2 ply nylon.

Mist nets are available from the DOC banding office[4], or from suppliers in other countries; a current New Zealand banding permit is required to purchase them (Melville 2011). Refer to Appendix 6 of the Bird Bander's Manual (Melville 2011) for a list of mist net suppliers.

Mist nets from Ecotone (Poland) are recommended by Tertia Thurley. Contact the Kōkako Recovery Group for advice about sourcing appropriate mist net and catching equipment.

Kōkako mist nets come in 9 m or 12 m lengths. Having both lengths on hand provides more flexibility to set up nets at a range of catching sites. Two sets of 12 m nets (3–5 nets per set) and one set of 9 m nets (3–5 nets per set) is sufficient.

Before use, each net must be checked for holes, and any that are found must be repaired (see Appendix 2 for instructions on how to repair a mist-net). Nets must also be checked to ensure that pocket depth is set correctly at approximately one third of the total bay height.

[3] 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.

[4] DOC banding office, email: bandingoffice@doc.govt.nz Phone: 04 471 3248

11.2 Pre-capture preparations

Locating pairs, recording local calls (for subsequent play-back) and identifying as many capture sites as possible before the planned catching expedition will increase the likelihood that the target number of birds will be caught within the desired timeframe. Engaging staff with local knowledge of the area and the kōkako population is also extremely valuable. In general, a new site is created for each pair of birds to be targeted and sometimes more than one site may have to be constructed in a pair's territory to ensure success.

Early identification and preparation of capture sites is important so that once the first birds are captured, ongoing catching is not hindered by the need to search for and locate further pairs and suitable mist-net rig sites (Willans & Wickes 2010).

Mist net sites should be fairly accessible, i.e. a drive or a walk of no more than one hour.

Selection of mist net sites will depend on the site characteristics and the skills of the team. Essentially, a suitable site will have tall trees at either end (where the 'top-rope' will lie), lower trees at the sides (where birds will launch from) and will be located toward the centre of a kōkako territory. A site requiring minimal removal of vegetation is preferred, but a gap of at least 2 m either side of the net is required and some high-pruning is often needed. Tree-climbing skills are required in the mist-netting team.

11.3 Setting up a mist net rig

Appendix 3 provides a list of the equipment required to set up a mist net.

1. Choose a suitable mist net site within the known territory of a kōkako pair. The net site must have tall trees at either end that a 'top line' can be strung between. Good height is required to elevate the mist net to a suitable height to capture the birds. It is often beneficial if the net can be set higher than vegetation on either side of the net.
2. Using a sling-shot, fire a sinker that is attached to braided or nylon fishing line wound on a fishing reel over the chosen end tree (Fig. 2a: direction A→B). Tie the end of the 'top line' to the fishing line and retrieve it (Fig. 2a: direction B→A). The braided line might have to be tied to a lighter cord (Fig. 2a: B→A) and then followed in reverse by the top line (Fig. 2a: A→B). Repeat the process for the other end tree chosen, so there is a top line over each tree (Fig. 2b). The order and direction in which this is done can vary depending on where in each end tree the top rope needs to emerge from.
3. Once both ends of the top line are retrieved, tie the 2 ends together with a strong, undo-able knot. A double fisherman's knot is sufficient. When tying two different thicknesses use a sheet bend knot. Keep the centre of the top line on the ground (Fig. 2b).
4. Connect a large carabiner to the top line at one end with a butterfly or clove hitch, which can be removed later when the mist-net rig is being taken down. Cut a length of cord equal to the length of the net being used. It is useful if this dyed a bright colour and kept on a separate spool or winding board for future measuring of other mist net rigs. Use this cord to measure the distance between the carabiners; i.e. hold one end at the attached carabiner, with a second person pulling the measuring cord along the top line (the top line must be very taut). Then attach the second carabiner at the end of the length of cord.
5. Run guide ropes (endless) through the carabiners. These will be made into loops used to haul up the attached mist-net. Make sure that both ends of these are tied to something on the ground; otherwise they will fall out of the carabiners when the top line is pulled up.
6. Haul up the top rope and adjust to the correct net position by pulling either end in the direction required. Once the carabiners are in the correct position, tighten the top line ends until the top line is very taut, and tie off the top line rope ends.

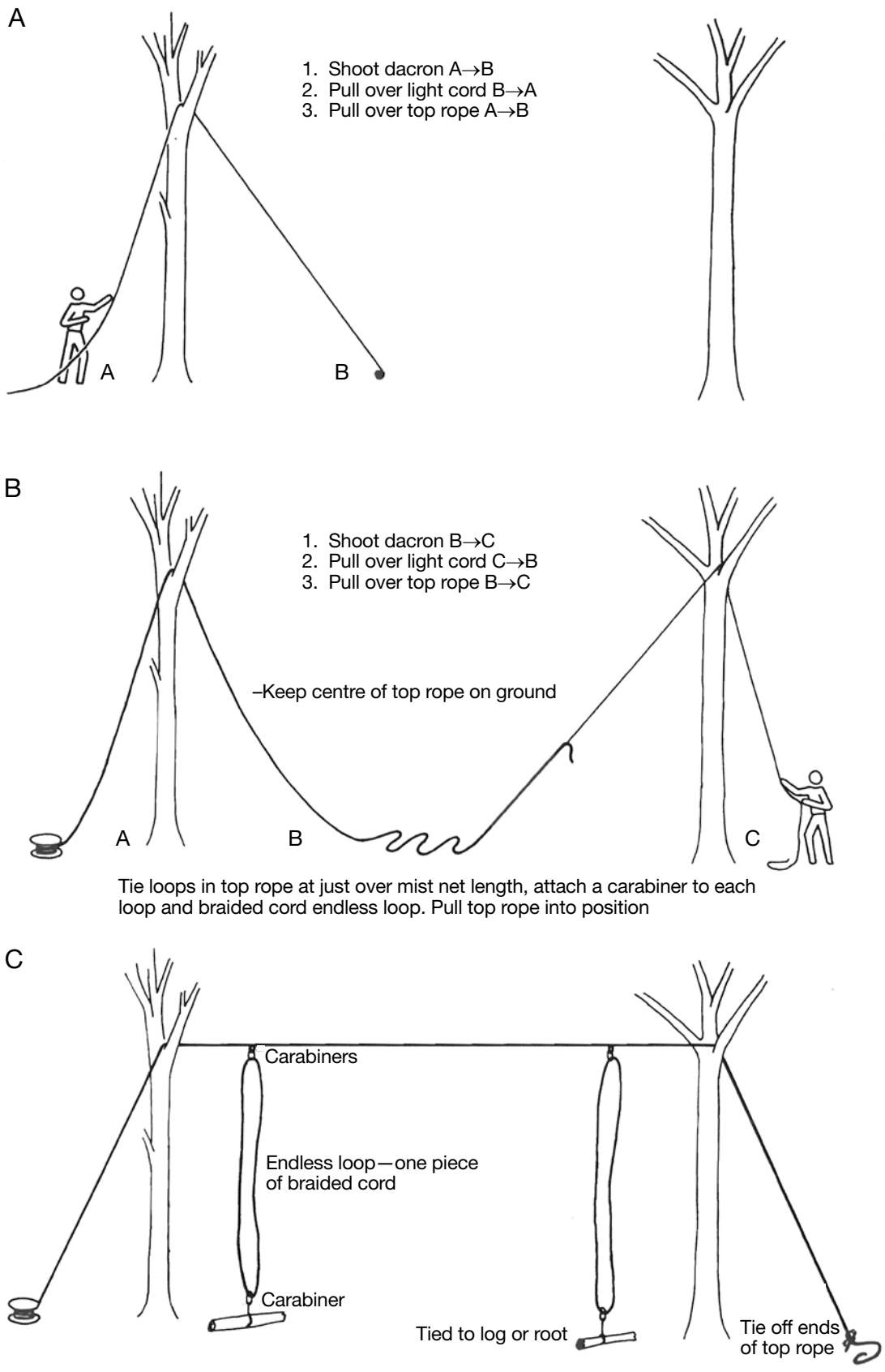


Figure 2. Stages in erecting a mist net rig. Top to bottom—2a, 2b, 2c (from Dilks et al. 1995).

7. Where each of the guide ropes touch the ground, place a large heavy object (e.g. log) and tie a string or rope loop to it. Attach a carabiner to this loop at a comfortable operating height (about 1 m), and clip the carabiner onto the guide rope (Fig. 2c).
8. Tie the guide rope ends together using a figure of eight or bowline knot, to form an endless loop. Adjust/tighten the guide rope so it pulls the top line down a little and is taut. When tying the guide rope ends together, aim to create a taut loop. Tension the rope, tie with half hitches and tie off slack using the half hitch loop and tail from the figure of eight or bowline that was used. The guide rope can now be formed into a taut loop, which acts as a pulley and runs free through the connected carabiners.
9. Run a zigzag cord across the site, between the guide ropes, to catch the net when it is lowered and keep it free of debris from the forest floor. This 'zigzag' should be about hip/waist height.

11.4 Attaching a mist net

Mist nets are usually stacked three to six nets high on a mist-net rig.

1. To attach the mist-net onto the rig, attach the top plastic shower curtain ring of the net to the guide rope loop, just above the join in the loop (Fig. 3). Ensure it is securely attached so it cannot slip down.
2. Take hold of the guide rope and, taking care not to let it go, remove the carabiner anchoring it to the ground. The curtain rings of the mist-net will have a string through them—tie this onto the bottom of the guide rope. Then slide the curtain rings of the net onto the guide rope making sure the rings follow the correct order as they are threaded onto the guide rope (Fig. 4).

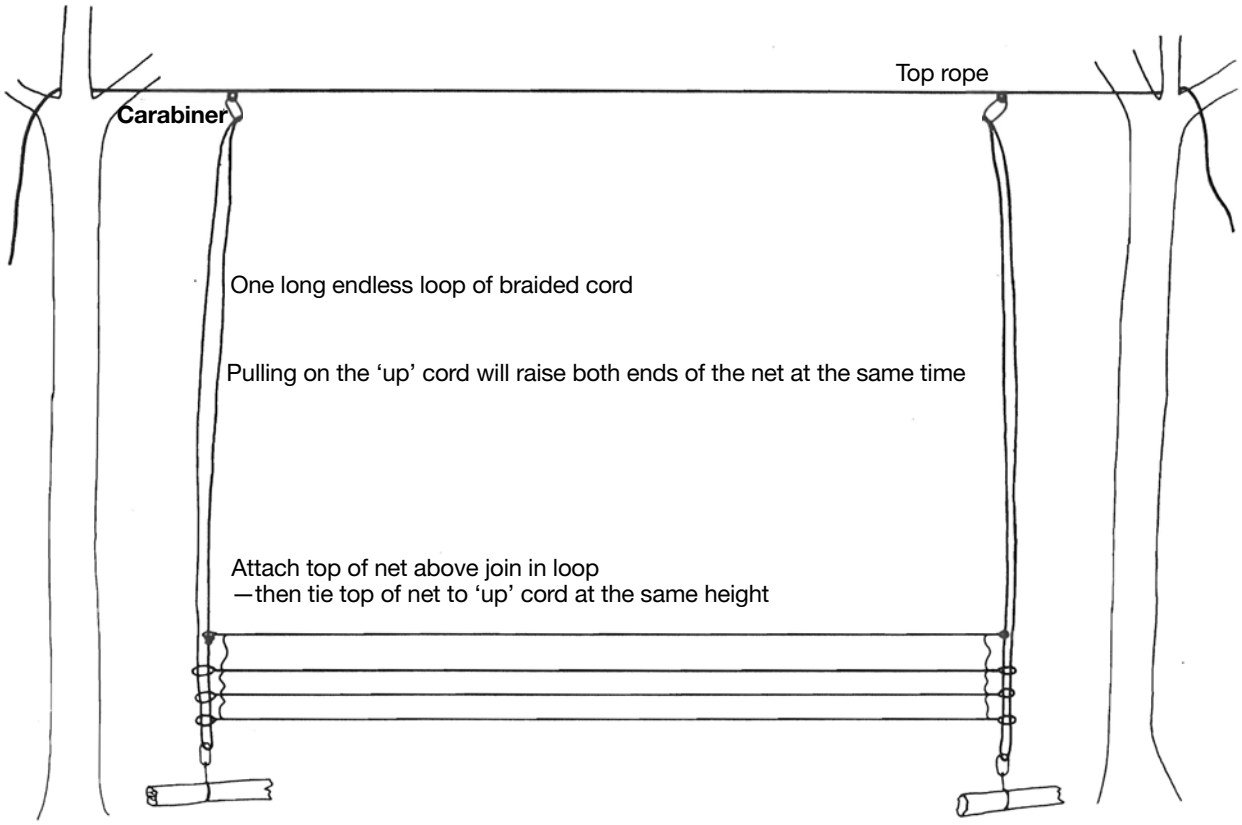


Figure 3. Attaching the mist net to the rig (from Dilks et al. 1995).

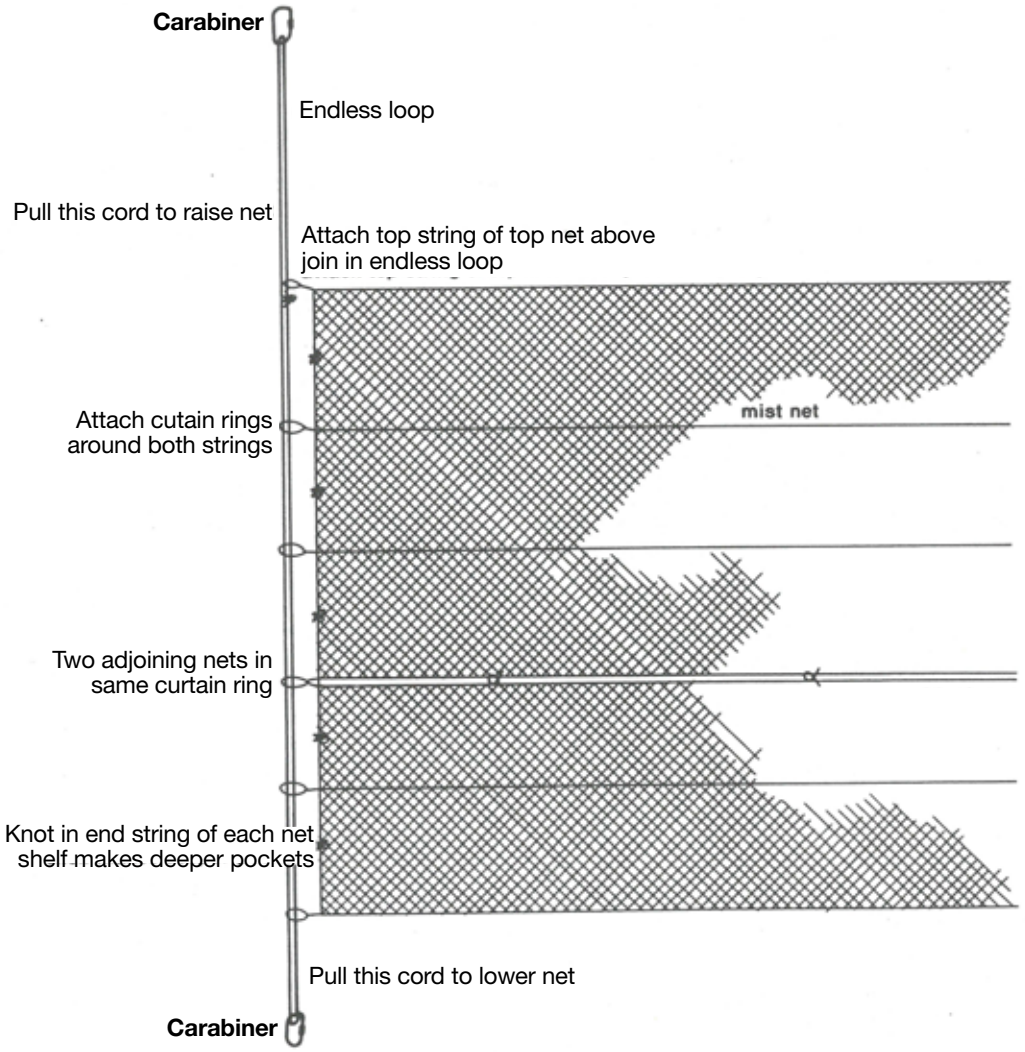


Figure 4. Detail of mist net attachment to end loops (from Dilks et al. 1995).

3. Once the net is on the guide rope, re-connect the guide rope to the carabiner (ensuring there are no twists in the rope) and remove the string that was used to slide the net on.
4. Take the top string of the net and unfurl the reminder of the net while walking towards the other guide rope. Ensure that the net is completely untwisted before attaching it to the other guide rope. Repeat the process in points 1–3.
5. With a person at each end, raise the mist-net evenly (using the guide ropes) to the full height.

To take the mist-net down, reverse the process described above. Always furl the net after use and ensure the top string of the net is marked with a different knot or coloured tape so it is easily identified.

If a mist-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), to prevent the accidental entanglement of birds. 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, DOC, pers. comm. 2013).

When the rig is not in use, the guide ropes (and sometimes the top-rope) should be loosened to prevent wear on the rope, but ensure that the guide ropes are secured within reach.

11.5 Operating the mist net site

Active mist-nets must be attended and **watched at all times**. It is significantly easier to remove a trapped bird if you observe the direction it entered the net, and the pocket it flew into. Mist net sites for kokako must be attended by **at least two people**, as it takes two people to lower the net quickly and evenly. These two people should be stationed next to the guide ropes so they can lower the net immediately when a bird is caught. It is strongly recommended that a third person is available to operate the sound equipment and handle captured birds as the net is lowered.

At **every mist net set** there must be at least one person experienced at, and comfortable with, removing kōkako and other birds from mist nets. Before catching attempts commence, the two people operating the mist net rig should practice lowering the net quickly a few times to ensure smooth and even operation. If the net is lowered unevenly (i.e. with one side much higher than the other) it can put additional strain on (or twist) the captured bird's body.

The pre-recorded kōkako song used to lure the birds to the net should include current song recorded at the site that year. It is important to obtain a variety of recordings (song, contact calls, mews, etc.) prior to starting captures. The sound equipment used must be capable of recording and playback in the field.

Do not use mist nets in conditions where the birds will get wet if caught, and avoid mist-netting in conditions where the net will get wet, or when windy conditions and/or sun on the net will make the net visible to the birds.

11.6 Removing kōkako from the net

Disentangling kōkako from a mist net requires skill and great care. Hands-on training and close supervision by an experienced operator is required before anyone may handle kōkako. Refer to section 13.1—Handling.

Ensure someone on the team is allocated the role of timekeeper and scribe. They should record the time the bird is captured in the net and how long it takes to disentangle it, using the kōkako capture and processing record sheet in Appendix 4.

As the net is lowered and nears the ground, one person should watch closely to identify which pocket of the net the bird is in and should be ready to gently restrain the bird, with its wings folded against its body to help prevent further entanglement. Usually, if the bird's belly and vent is clear this is an indication that the correct pocket has been identified. It is generally preferable for two people to disentangle a kōkako; one person taking a lead role and the other assisting as the bird is held gently but securely by its upper legs and is methodically removed from the net.

The net is usually removed from around the bird's feet and legs first, then the tail, wings and body, and lastly the head. Special care is required when removing any mesh from around the bird's wattles or tongue, as threads pulled tight around these can cause significant injuries.

Cutting the net to remove a bird is an absolutely last resort, and should never be undertaken just to save time. If there is a need to cut the net, be careful to cut it to avoid creating extensive damage to the net and without harming the bird. Choose carefully which strands are cut; ideally, it should be just one snip because every strand will need to be accounted for, otherwise a thread might remain wrapped around the bird's body unseen under all its feathers.

If several bird species are caught in the net at once, free the kōkako first. Remember to release non-target species in a direction well away from the nets.

Once a bird is captured, it should be transferred immediately to a dark cotton draw-string catch bag (at least 30 cm × 30 cm) which, if necessary (e.g. if there is a second bird in the net or capture of another bird seems imminent), can then be hung securely in a tree in a quiet shady place for

up to 20 minutes while other birds are being caught at the site. Always ensure that the drawstring is tied securely around the gathered material at the top of the bag to prevent the bird escaping. If a bird can get its head through a hole its body will generally follow and it will be extremely hard to catch this bird again. Note that bags with birds in them must never be put on the ground—only kept in the hand or hung on a tree. **Do not keep a bird in a catch bag for longer than 20 minutes**—kōkako must never be held in this way for prolonged periods.

Weigh the bird and catch bag and check the bird's body condition[5] and vitality. **Only kōkako in good condition should be transferred**; any birds appearing to be in heavy moult, lacking energy/alertness, in poor condition, or below 190 g in weight must be released at the site of their capture as soon as possible (Willans & Wickes 2010). Birds transferred in poor condition have a lower chance of survival.

After the bird has been weighed, it should be offered food from the hand; a soft, high-energy fruit such as banana is appropriate. During this first handling, solid rather than liquid food should be offered to reduce the risk of inhalation when the birds are overly stressed. Then the bird must be placed in a wooden transfer box (if walking distance is short; i.e. box is not too heavy) or a cardboard/coreflute pet carry box. Birds must be kept in a cool place at all times.

Once the first bird is captured at a net site, it may be held in a carry box for up to 30 minutes while attempts are made to catch further birds. However, to reduce stress on the bird, someone should be available to take the bird to base for processing immediately, so that it is not waiting at the site where it can hear other birds calling.

Usually, once the capture site is abandoned (because, for example, further birds are not likely to be caught within an acceptable time), the team returns to base with the birds and catching is finished for the day.

12. Transfer to base for 'processing'

Kōkako must be transported from the capture site to base and the temporary holding aviary in a well ventilated and secure pet carry box or wooden transfer box lined with paper and leaf litter, and soft edible vegetation (e.g. young leaves of karamū (*Coprosma robusta*), kanono (*Coprosma grandifolia*), puka (*Griselinia lucida*), hound's tongue (*Microsorum pustulatum*) or hanging spleenwort (*Asplenium flaccidum*)) if available. Corflute pet carry boxes[6] are recommended because they are waterproof and can be disinfected and re-used.

The captured kōkako should be manually carried from mist-net sites to the holding aviary and base camp in preference to using quad bikes, because quad bike rides are too bumpy and noisy. Mist net sites should be chosen on the basis that they are accessible—normally a drive or a walk of no more than one hour. Try to avoid excess noise—minimise vegetation brushing on carry boxes, as this will create extra noise for the birds.

[5] Body condition in birds is generally assessed by feeling muscle mass over the keel bone—it varies between species, but generally the keel bone should not feel sharp.

[6] Available from veterinarians and pet shops.

13. Processing the birds

Weight and brief condition assessment will have been recorded on each bird's capture, but full processing (measuring, banding, disease screening, etc.) is usually done at a secure site away from the catching site, often near or within the temporary holding aviary (refer to section 14—Temporary housing).

Processing should be carried out immediately on arrival at the aviary, to reduce total handling time and the number of capture and handling events (and therefore stress on the birds). Note that there may be the occasional exception with overly-stressed birds where processing has to be abandoned and finished at a later time (e.g. on the day of transfer).

Two people are required for all kōkako handling procedures; it is safer and easier for one person to hold the bird whilst another does the banding, measuring, attaching transmitter, etc.

Good organisation of equipment and planning the order of tasks is essential to reduce handling time, which should take less than 30 minutes.

Good record keeping is essential. Describe each bird's response to the handling process, how long it took, and ensure all banding and measurement data is recorded in the kōkako capture and processing record sheet in Appendix 4. This enables easy comparisons of how long processing took and the behaviour of each individual; this information can be very important if things go wrong.

13.1 Handling

Kōkako can be difficult to handle because they bite and have long sharp claws which can inflict pain and be difficult to extract. They also have long legs which can be damaged if handled incorrectly. Hands-on training and close supervision is required before anyone may handle kōkako.

People who have not handled kōkako before may do so only:

- Under direct supervision by an experienced and approved handler;
- After the correct handling technique has been demonstrated to them; and
- If they have previously handled other bird species of a similar size.

At this stage of the process, all kōkako handling should be in an enclosed space (tent or room) so that if the bird escapes it can be quickly recaptured.

Two people are needed to place a kōkako in (or retrieve it from) a box: one person opens the box and guards/covers the opening, while the other takes the bird out.

Kōkako should always be held with two hands—firmly but gently—to avoid muscle damage. One hand holds the upper legs (near the bird's body, leaving the lower legs free) between the thumb and middle fingers, with the index finger between the legs. The other hand is placed over the back and wings (to prevent flapping), with the index and middle finger on either side of the head to help prevent the bird biting.

Usually it is not necessary to cover the head of a bird while it is being handled. However, if it is required to help calm a bird, a hand or a light-weight piece of fabric can be lightly placed over the head.

No team member should smoke in the vicinity of the bird. Rapid or noisy movements around kōkako must also be avoided. The handler in particular must be prepared to be bitten and have claws pierce fingers/hands; the instant reaction to withdraw a pierced hand rapidly might injure the bird.

When planning to handle kōkako, a small variety of soft fruits (banana, berry fruit, stone fruit) should be available close to hand. Kōkako will readily feed in the hand and this may help to calm and distract them during handling. Birds that will not take fruit may be offered jam water in a bowl, although be aware that with liquids there is a higher risk of inhalation, especially if the bird is stressed and has a high respiratory rate. Liquids should only be offered to birds that appear calm. Attempts should be made to train kōkako to recognise this type of food and food trays, by offering food from the trays that will be used to present the food in the aviary. If the bird will not take food directly from the tray, offer the food by hand with the tray close and visible.

Kōkako should be handled and released as quickly as possible without rushing (it is important to handle the bird calmly), with the aim of releasing the bird within 30 minutes. Monitor the bird's reaction carefully throughout capture/handling and be willing to stop if the bird shows a significant stress reaction.

Stress reactions that would be cause for concern include hyperactivity or very little activity (e.g. a very quiet bird that becomes limp), unusually aggressive behaviour, defecating more than the usual amount, sustained alarm calling and struggling, panting and gaping. Gaping is not usual and is a sign that the bird is very stressed. If a bird exhibits these signs, it may be necessary to stop processing and put it into the temporary holding aviary, and attempt to finish processing another day. The minimum processing required is banding and feather extraction for DNA sexing; if the bird is too stressed, the transmitter attachment and disease screening can be abandoned.

Kōkako that exhibit major stress reactions must be either released at their site of capture, or housed in the temporary aviary under close observation while they recover—this decision will be made by the experienced kōkako handler(s) on the team.

13.2 Sexing kōkako

Kōkako can be sexed to a reasonable degree of accuracy using weight and tarsus measurements. However, there are overlaps in measurements between the sexes, and size differences between populations. Fledged kōkako juveniles can also be sexed by measurements, as their legs are fully grown by the time they fledge, although they may not yet have reached the usual adult weight.

DNA sexing using feather samples offers a more reliable result, although it does not provide immediate information and increases the cost of the project. Observations of breeding behaviour also provide an indication of gender—usually males feed the females during courtship, while females carry out the majority of nest-building and all incubation. Post-release monitoring and/or DNA sexing will reveal how many have been correctly identified.

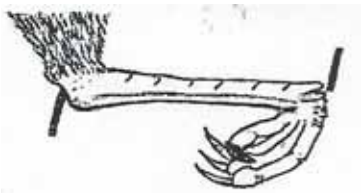
13.2.1 Sexing by measurement

The weight and tarsus length are the most important measurements needed to determine kōkako gender. Males are generally bigger than females; however, measurements can overlap, and vary between populations. Using a combination of tarsus (Figs 5 & 6), head (Fig. 7) and wing length (Figs 8 & 9) measurements will increase the accuracy of sexing estimates. Equations given in Flux & Innes (2001a) allow gender to be determined for over 90% of individuals.

Measurements of kōkako captured previously may have already been gathered for your local area and will help provide a guide to the size differences in the sexes for that area (refer Table 2). If there is no existing data for the area, it is useful to send the data you collect on your project to the Kōkako Recovery Group Leader for inclusion in this document, to improve the information available to others.

Note that at sites where kōkako populations are increasing, the resulting population pressure may reduce kōkako territory size, which could have an impact on kōkako size measurements over decades (S. Wills, pers. obs.). Therefore, if possible, the most recent data should be obtained when sexing by measurement.

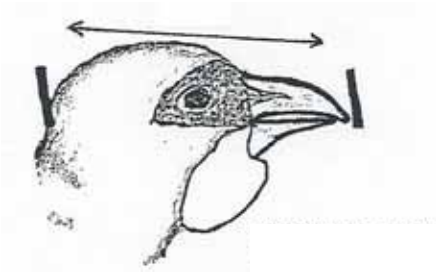
Measuring may only be carried out by people who have been shown by an experienced handler how to take each of the measurements.



Use calipers, from notch of upper joint to end of bone with foot turned down

Figure 5. Placement points for callipers when taking the tarsus measurement (Flux & Innes 2001b).

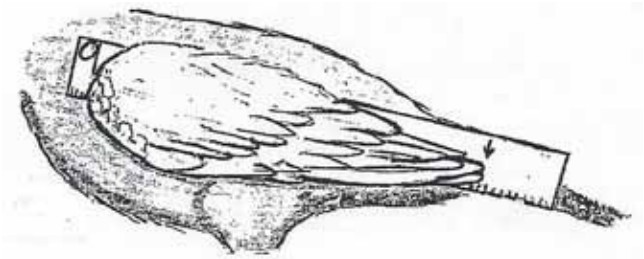
Figure 6. Taking the tarsus measurement of a kōkako chick. *Photo: Ian Flux (DOC image library).*



Use calipers, longest axis of head from back of skull to tip of bill. Ensure calipers are parallel to axis of skull

Figure 7. Placement points for callipers when taking the head and bill measurement (Flux & Innes 2001b).

Figure 8. Wing rule used to measure wing length. *Photo: www.avinet.com.*



Use ruler with end plate to butt against leading edge of wing. Flatten wing onto ruler with finger then release before reading to tip of primaries. Wing should lie naturally, do not straighten.

Figure 9. Placement of wing rule when taking the wing length measurement (Flux & Innes 2001b).

The tarsus measurement that is normally used is the 'tarsus length' measurement. This involves holding the leg with the tarsus at right angles to the tibia, bending the foot down-wards, and holding one end of the callipers against the notch on the rear of the upper end of the tarsometatarsus and the other end on the front of the leg in the notch formed between the tarsal bone and the articulation with the toes (Figs 5 & 6). The callipers are near parallel to the bird's tarsus on a front-rear diagonal. Repeat the measurement on the other leg if you have any doubts as to the bird's symmetry.

Table 2. Weight and tarsus measurements of kōkako at North Island sites, 1990–2011 (Flux & Innes 2001a; Wills unpubl. data 2014).

SITE (DATE)	SEX	N*	MEAN WEIGHT (g)	WEIGHT RANGE (g)	MEAN TARSUS (mm)	TARSUS RANGE (mm)
Kaharoa (2008–11)	Male Female	9 8	225.0 205.4	202–238 179–238	69.8 65.5	67.8–72.7 64.1–69.2
Mangatutu (2003–04)	Male Female	3 7	257.7 208.3	240–269 200–216	72.2 66.4	70.9–74.1 64.0–68.4
Mapara (1990–99)	Male Female	46 32	229.0 210.0	209–259 180–243	68.1 63.7	64.0–72.8 60.3–69.5
Mapara (2008–09)	Male Female	3 7	226.7 215.3	220–235 195–230	68.0 66.0	66.3–69.6 64.2 –69.0
Otamatuna (1993–99)	Male Female	13 9	254.2 236.2	238–278 226–242	71.1 67.2	68.0–75.0 65.0–68.5
Otamatuna (2007–09)	Male Female	13 11	247.6 216.4	206–266 200–235	70.6 63.3	66.0–73.0 63.3–69.0
Rotoehu (1990–99)	Male Female	17 14	235.0 231.0	Data not available	69.0 65.4	68.4–74.0 59.0–68.0
Rotoehu (2008–11)	Male Female	7 12	245.0 213.5	224–277 192–270	69.5 64.6	66.8–75.0 60.4–69.7

*N = number of birds measured. (Data is from DOCDM-1344793)

13.2.2 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.

Even if DNA sexing is not planned for your project, it can be useful to take feathers while the bird is being held for banding and measuring, in case they are needed at a later stage to verify sexing estimates or to further national knowledge of kokako genetics. Extra feathers should be fully labelled with collector, date, bird and site (GPS) details and provided to the Kōkako Recovery Group Leader.

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. Two to three contour feathers are usually sufficient; new (pin) feathers will yield better DNA samples.

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

13.3 Banding

In most situations translocated kōkako are given individual colour band combinations, to make it easier to monitor the survival of released birds and identify pair members and territory location. Birds receive a metal 'E' band and up to three colour bands (up to two bands per leg).

For further information and to order bands, contact the DOC banding office[7]. Note that **banding may only be carried out by approved (permitted) banding operators** (Banding Certification[8] Level 2 or 3) who have been:

- Shown how to band kōkako by an experienced, approved Level 3 certified bander; and
- Approved by the DOC kōkako banding permit holder. This is currently Sarah Wills (for contact details refer to Appendix 1).

Level 1 certified banders may band kōkako while under direct supervision only if they have previously gained experience with banding other similar-sized species with E bands (e.g. banded rail (*Moho pereru*), red-billed gull (*Larus novaehollandiae*), red-legged partridge (*Alectoris rufa*)).

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). Refer to Appendix 3 for a list of equipment required for banding kōkako.

Metal bands are considered permanent on kōkako and will provide life-long identification. However, plastic bands can rapidly wear on their insides and ends from continuous friction against the leg, and may last as little as 6 years. There have been problems in the past with thin plastic wrap-around bands (with up to 3 coils) becoming worn on the inside, resulting in a larger internal diameter; these can slip over a bird's foot. More durable colour bands are now used; however, **all plastic bands should be checked for wear every time a bird is handled, and replaced if required**.

13.3.1 Metal banding

Metal bands must be size 'E' stainless steel. They can be fitted using either large banding pliers (designed for bands E to O), or small standard pliers (Fig. 10). There have been cases in the past of kōkako legs being broken during banding with banding-pliers; this may occur where a bird kicks its leg into the plier jaw during band-closure. Some operators find small standard pliers a safer option; the band can be held at the distal end of the plier jaw and the bander's finger can then be held against the outside of the band—restraining the bird's leg (Fig. 11). In any case, it is essential that banding techniques for kōkako are taught by demonstration.

Figure 10. Standard pliers used for metal banding kokako. *Photo: Ian Flux*.

Figure 11. Finger held against outside of band during banding with standard pliers. *Photo: Ian Flux.*

[7] DOC banding office, email: bandingoffice@doc.govt.nz Phone: 04 471 3248

[8] 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 bander 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.

To fit a metal band to a bird:

1. Place the open band into the pliers, ensuring that it is exactly parallel to the plier jaws. Ensure that the band numbers are upright, so the numbers can be read when bird is perching in a normal and relaxed manner.
2. Then gently manoeuvre the bird's leg into the band and restrain the leg with your finger during band closure. Close band gently with a firm and even pressure.
3. Turn the band 90° (to bring the band opening against the jaw of the pliers) and close the last millimetre or two by rotating the band a few degrees in each direction and closing with a series of small crimps to either side of the band-opening. This method is only safe with standard pliers, and it will ensure that you cannot overlap the band on itself.
4. When finished, the edges of the band should firmly abut with no gap between them.
5. Record all banding details using the North Island kōkako banding and measurement record sheet in Appendix 4 and send copies to the Kōkako Recovery Group Leader and the DOC Banding Office.

NB: 'E' bands are the smallest band size in this thickness of stainless steel, and can be difficult to close fully. By applying the technique just described, the risk of crushing the bird's leg or having the band overlapped should be significantly reduced. Bands should be closed with one hand on the pliers, people with smaller hands may find E-bands difficult to work with.

13.3.2 Colour banding

Again, it is essential that kōkako colour banding techniques are taught by demonstration.

The metal band should be attached first. The metal band must always be positioned **below** the colour band on the leg. This is considered best practice because metal bands are heavier than colour bands, and so may increase 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).

Use a maximum of two bands (including the metal band) on each leg.

Colour bands are made from 8 mm wide strips of Darvic[9] PVC (0.75–1.0 mm thick) and have an internal diameter of 6.5 mm (equivalent to a closed 'E' band). The bands have an overlap of 1½–1¾ wraps. While bands do become brittle over time and break, there have not been any known injuries to kōkako caused by this type of colour band. Worn colour bands tend to break and drop off rather than becoming stuck over the joints or foot. See Appendix 5 for instructions on how to make colour bands.

To fit a colour band to a bird:

1. Roll the band inside out, open the end just wide enough to fit over the leg, then spiral the band back to its original shape around the leg. This requires care not to pinch the bird's leg in the band.
2. Hold and gently squeeze the band between the thumb and index finger to restore the original band shape.
3. Apply a tiny drop of Super Glue inside the outer end of the band, and hold it closed firmly for 20 seconds. This will ensure the band cannot unwind and slip off the leg. Wipe off any excess glue immediately, and roll the band around in your fingers while the glue dries to ensure the band does not stick to the bird's leg or bander's finger and cause injury.

[9] Darvic is no longer made, and has been replaced with an alternative material called Salbex (made by PAR Group, UK). Salbex has not yet been used for making colour bands for kokako; as at January 2014 it remains untested.

4. Check that the plastic band fits well: rotates freely on the leg and cannot slip over the bird's leg joints or the metal band. Check the Super Glue has dried and holds.
5. If applying a second colour band on a leg, put it on the leg spiralling in the opposite direction. This should reduce the risk of the bands slipping over each other.
6. Record all banding details using the North Island kōkako banding and measurement record sheet in Appendix 4 and send copies to the Kōkako Recovery Group Leader and the DOC Banding Office.

NB: Band combinations are applied and read from the bird's left leg first, then its right leg.

13.4 Disease testing

Disease testing fulfils several functions—improving our overall knowledge of kokako pathogens and parasites, ensuring the health of transferred birds (non-thrifty individuals may not survive transfers) and reducing the risk that novel and unwanted diseases are transferred to new sites. The results from each translocation are then used to help decide what testing is needed for future translocations. Cumulative results increase our certainty that diseases can be detected. Nevertheless it should be kept in mind that endemic parasites and diseases are part of the ecology of the species—many parasites are host-specific and may be rarer than the host.

The importance of disease testing will depend on the distance birds are being moved and the relative isolation of the receiving site. For example, if birds were to be moved between Mapara and Pureora (15 km) disease testing is less important than if birds were being transferred to an offshore island. There may also be some existing baseline disease information available for some populations that have an extensive disease testing history. People planning translocations should discuss the situation with the DOC veterinarian during development of the translocation proposal to assess the level of risk and therefore the importance of the disease testing. There might be situations where blood samples are not necessary. The need for disease management must also be weighed up against any risks to the animals caused by sampling and holding during testing.

Note that as population densities increase toward carrying capacity at source sites it is expected that the incidence of pathogens and parasites may also increase.

The following standard disease screening protocol is recommended (September 2014) by DOC veterinarian Kate McInnes. It has been designed so that there is minimum hold up to the translocation and birds are held for less than 10 days.

- Engage a local veterinarian to provide equipment, advice, review results and dispense any required treatments.
- Carry out the disease tests shown in Table 3. Test the birds in two or more batches, according to order of capture—this allows results from the first group to inform decisions for the second group.
- Group 1: Test all birds caught in the first three days of successful captures. Send the samples immediately to the laboratory. Because previous sampling has shown a low risk of infectious disease, birds do not have to be held captive until results are known. If all birds have passed a physical examination and weight check, they can be transferred. If any abnormalities are detected in a bird's physical exam or weight check, this should be discussed with a veterinarian, as it may indicate a health problem in the population.
- Group 2: Continue to catch birds and test those caught in the next three days of successful captures. Group 2 birds can be released before their test results are known, **only if** Group 1 results are normal **and** they have passed a physical examination and weight check. If the first set of testing indicated any problems in the population, take any required actions in the second group before release. Birds should be tested in groups as catching continues.

Table 3. Disease tests for kokako during translocation projects.

TEST	SAMPLE REQUIRED	EQUIPMENT	WHO CAN TAKE IT?	SAMPLE HANDLING	LABORATORY	ACTION REQUIRED
Compulsory tests						
Physical examination	n/a	n/a	Vet or experienced kōkako handler	n/a	n/a	Do not transfer animals with significant injuries, abnormalities or illness. Seek veterinary advice, instigate first aid if required.
Body weight	n/a	Scales, weigh bag, list of normal body weights	Experienced kōkako handler	n/a	n/a	Do not transfer birds that are under 190 g unless satisfied the bird is small but in good condition. Males should exceed 210 g and females should exceed 190 g.
Recommended tests to inform translocation outcomes and contribute to population and site-specific disease knowledge						
Blood parasite check	Blood smear	Sterile 25/26 gauge needles, alcohol swabs, capillary tubes, glass slides, slide transport box, gauze swabs	Person qualified to take blood from brachial vein. Refer to Sampling avian blood and feathers SOP	Air dry and store at room temperature	New Zealand Veterinary Pathology or Gribbles	High parasite results suggest some of the birds in this population are sick and are poor candidates for transfer. Release any affected birds back to capture site and seek advice from the veterinarian regarding continuation of the translocation, and any issues if birds have already been transferred.
White cell count (WCC)						Do not transfer if WCC >30. Either obtain a vet check and transfer if bird is otherwise normal or release back to capture site and seek advice from the veterinarian regarding continuation of the translocation, and any issues if birds have already been transferred.
Faecal egg count	Faecal sample from the bird, box or foliage, not from ground	Specimen pottle	No special skills required	Refrigerate and send to lab chilled within 48 hours	New Zealand Veterinary Pathology or Gribbles	Consult vet and treat for worms if count is high for any worm species, then transfer.
Faecal coccidia count						Consult vet and treat for coccidia if count is high, then transfer.
Salmonella and yersinia culture	Cloacal swab	Culture swab with transport medium	Experienced kōkako handler	Refrigerate and send to lab chilled within 48 hours	New Zealand Veterinary Pathology or Gribbles	Salmonella—the bird and its aviary mates cannot be transferred, release back to capture site and disinfect the aviary. Seek advice from the veterinarian regarding continuation of the translocation, and any issues if birds have already been transferred. Yersinia—actions depend on the species detected. *Yersinia psuedotuberculosis* and *Y. Enterocolitica*—consult with your veterinarian and the Recovery Group about treating all birds in the aviary with antibiotics (this may exceed the maximum holding time). *Yersinia frederiksenii* and *Y. Kristensii*—no treatment is required—continue with transfer if all else is normal.

- Preventative treatments for parasites, e.g. Baycox for coccidia, are **not** considered best practice. Drug treatments should only be considered in consultation with a veterinarian and if there is a specific problem (e.g. high parasite loadings).

Ensure that all samples are clearly labelled with the species name, individual birds' ID (e.g. band no. or colours) and the date of collection.

13.4.1 Physical examination

The general condition of a bird should be assessed as part of the disease testing process, and before a transmitter is fitted.

While another person holds the bird gently upright, check the bird from head to toe for any abnormalities that could affect its survival (e.g. major injuries, high ectoparasite loading). Also check the bird's condition by feeling along the keel and spine, to determine if the bones are prominent (i.e. bird is in poor condition), or difficult to locate due to the muscle or fat layers.

Decide whether the bird is fit and able to be transferred.

13.4.2 Blood sampling

Blood sampling of kokako may only be carried out by people approved by the Kōkako Recovery Group Leader. To gain approval to take blood samples, operators must have:

1. Read the Sampling avian blood and feathers, and reptilian tissue SOP (DOC 2010), copies of which can be obtained from a local DOC office
2. Observed sampling from a minimum of five kōkako by an experienced approved operator
3. Taken samples from a minimum of five kōkako under direct supervision of an experienced approved operator, who will supply a letter of recommendation to the Kōkako Recovery Group Leader

In kōkako, blood samples must only be taken from the brachial vein (wing), not the metatarsal vein (leg). Only a small quantity of blood is required to make blood smears for disease testing. In most situations 50 µl (one droplet) of blood is sufficient.

Method

1. Follow the guidelines in the Sampling avian blood and feathers, and reptilian tissue SOP.
2. Blood is collected from the brachial vein at the first joint of the wing. Swab the area with an alcohol swab to sterilise the skin and move feathers out of the way.
3. Make a tiny puncture in the vein with a 25 or 26 gauge hypodermic needle, and collect the blood into capillary tubes (1½ tubes is sufficient), by holding tubes on a downward angle from the blood droplet.
4. Apply a clean gauze swab to the wound and get the holder to hold it firmly in place with gentle pressure until the bleeding stops, or at least two full minutes. Do not just fold the wing back into place and expect the swab to do all the work.
5. Make at least two blood smear slides, aiming for a thin smear with a feathered edge.

13.5 Attaching transmitters

Attachment of radio-transmitters to kokako is a highly specialised procedure and must only be performed by experienced operators approved by the Kokako Recovery Group Leader. To gain approval to attach transmitters to kokako, operators must have:

- Read the following documents (available from DOC offices):

  –Planning bird radio-tracking and data-logging projects SOP. Department of Conservation, Wellington. DOCDM-708204 (DOC 2011a)

–Attaching radio and data-storage tags to birds: Harness mounts SOP. Department of Conservation, Wellington. DOCDM-708212 (DOC 2011b)

- Been shown how to attach a transmitter by an experienced approved operator
- Attached transmitters to a minimum of five kōkako under direct supervision of an experienced approved operator, who will supply a letter of recommendation to the Kōkako Recovery Group Leader

Transmitters used should be as light as possible. Those currently in use weigh less than 5 g, including the harness. Under no circumstances should the weight of the transmitter exceed 5% of the bird's body weight (i.e. 9.5 g for a small female). Transmitter specifications currently used are:

Max. weight:	4 g
Size:	30 × 13 × 6 mm; 3 mm internal diameter end tubes
Pulse:	Width 22 ms; rate 30 ppm
Antenna:	Plastic-coated whip; flexible 0.7 mm diameter wire
Battery life:	7–10 months

Refer to Appendix 6 for instructions on how to make a transmitter harness.

Method

1. Switch on the transmitter (usually by taking the magnet off) and check with a receiver that it is working and the signal is clear and sharp. Record the fine tuning.
2. Check the front loop of the harness (head hole) is approximately 50 mm long (i.e. the cord from the front end of the transmitter to the top of the weak link tube is 50 mm).
3. Pass both harness loops over the bird's head. Pull the wings forward through the rear loop, so that the rear loop lies behind the wing and the front loop lies in front of the wing, and the harness is positioned like a backpack. The top of the weak-link tube should sit slightly below where the clavicles meet.
4. Pull the mid point of the rear loop to draw the loop firmly (but not tight) around the bird. Preen both harness cords under the feathers, starting with the front loop, so it sits neatly against the skin.
5. Adjust the cords so that the harness will not be tight when the bird is active. When the transmitter is fitted, a pencil should fit snugly between the transmitter and the bird's back and the transmitter should be almost concealed beneath the feathers. The weak-link tube should lie along the bird's keel. The head loop must be loose enough to allow the bird to swallow large seeds but not so loose that the bird could get its bill caught under the loop. Make sure the transmitter is properly preened in and fitted before going to the next stage.
6. Raise the toggle 1–2 mm and, using synthetic thread, stitch, bind and stitch through both cords (at least 6 stitches securing the cords) as close as you can to the transmitter. Slip the plastic toggle down over the stitches. Do not crimp the cords with a small metal band, as this is known to cause injuries to kōkako.
7. A melting tool can be simply constructed using a ni-chrome wire filament attached to a handle with a button-switch and a small battery (others have used a gas soldering iron or cigarette lighter). Carefully melt the cord ends to fuse them together and prevent them fraying. (If a lighter is used to melt the cord, there is a risk of burning the bird's feathers; slip a bit of card below the transmitter before doing this to protect the bird.) The melting tool will trim back both the toggle and the harness cords and melt the plastics together—a smooth joint raised only about 3–4 mm off the transmitter is the desired result.
8. NB: An alternative technique is to tie and glue the cords above the transmitter using a reef knot and Super Glue. If using this method ensure that there is no possibility of the bird dislodging the knot. As no birds have been recaptured following the use of this technique, we cannot be sure that no skin/feather damage results; however, birds wearing these

harnesses that have been monitored for years afterwards have appeared not to have any injuries or difficulty with them.

9. If you are not satisfied that the transmitter/harness is fitted correctly, remove it and try again another day. The bird's welfare is always paramount.

14. Temporary housing

Catching enough kōkako for a transfer takes time, often several days or weeks. There have been occasions when the release site is not far from the source and birds can be captured, transferred and released on the same day (Puketi Forest Trust 2013). However, it is usually necessary to house kokako temporarily in an aviary at the source site while enough birds are captured for the transfer.

The Kōkako Recovery Group has a modified tent available for use as a temporary holding aviary (contact the Kōkako Recovery Group Leader). This is a converted family tent with three compartments separated by mesh screens.

Up to three birds (or three pairs if there is certainty they are indeed pairs) can be held in this tent for a maximum of 10 days. Usually more than one tent is needed for a transfer.

14.1 Tent aviary specifications

Tents used to house kokako must have the following features:

- Each compartment measures approximately 2 × 2 × 2 m
- Plenty of light inside
- Large window flaps for ventilation
- Quiet zips
- Large zipped doors into each compartment for easy access when furnishing
- Enclosed annex at entrance, to provide security against birds escaping when entering and exiting the tent

Willans & Wickes (2010) found the Sportiva Homestead made a suitable tent aviary when catching kokako for the Secretary Island transfer.

Contact the Kokako Recovery Group Leader for further advice about buying a tent and the required specifications.

14.2 Tent aviary positioning

The tent aviary should be positioned in a quiet, sheltered and shady spot, but ideally with sufficient light to encourage the birds to remain active and feeding. The tent aviary must be situated so that it will not overheat (i.e. always out of direct sunlight). For practical reasons it should be near the staff accommodation so it is easy to feed the birds and check on them regularly. Consider recent and planned activities in the area and what disturbance to birds may result. It is also important to consider whether animals such as feral pigs, dogs or stock are likely to have access to the aviary site.

Tent aviary positions at previously used capture sites were:

- Otamatuna—next to the hut, in the shade of the hut; Te Mapou hut: under the forest canopy near the hut.

- Mapara—across the river/bridge, 100 m along the track in a clearing in the bush.
- Waipapa—near the fire station (30 m behind it) in a clearing in the bush.
- Mangatutu (Pureora)—inside the garage of the accommodation building with the lights on and door open during the day. (Note: as garages are very dark at night, consider also leaving dim lighting on to provide enough light for birds to feed after sunset).

14.3 Tent aviary set up

Prepare the tent aviary by furnishing it with leaf litter and fresh vegetation to provide adequate humidity and food and hiding spaces for the birds. As much as possible should be set up before birds are captured (e.g. leaf litter, perches, logs), so the kōkako are not kept waiting in boxes while the aviary is furnished. Find the best sources for fresh browse vegetation in advance of the aviary set up and bird capture process.

The tent aviary should be set up as follows:

- Line the floor with a thick layer of fresh leaf litter from an adjacent local forest.
- Create hiding spaces with dense vegetation in one corner/along one wall on the darker side of each compartment. This should be vegetation that will last at least a week before wilting (i.e. it will not need replacing during the bird's stay in the tent).
- Place large amounts of fresh edible foliage and branches of fruiting/flowering browse species throughout each compartment at all heights. This is likely to be the main food the birds eat for the first few days, until they adapt to the artificial diet provided.
- Ensure there is vegetation screening the dividing walls of the compartments, so neighbouring birds cannot see each other.
- Large logs can be placed on the floor to help secure the vegetation upright.
- Create perching areas. Heavy branches and ponga logs can be erected to provide a sturdy perching structure (Willans & Wickes 2010).
- Place a shallow water dish on the floor near the door (not under a perch). Kōkako will use these for bathing as well as drinking. Large plastic pot-plant bases (e.g. 5 cm deep × 32 cm wide), or paint trays could be used. Stones may need to be placed in the dishes to keep them stable.
- Fix the food tray holder and Wombaroo/jam water holders at perch height, in a well-lit area near the door. Provide trays of the artificial diet, and bowls of jam-water and Wombaroo. Food trays/holders can be placed on high stumps amongst the vegetation, or wedged/tied into branches. It is better to place the food trays amongst the vegetation so the birds have some cover while they feed, rather than on the floor where food can quickly become soiled. Placement near the door makes it easier to replace the food without needing to go inside very far and potentially scare the birds.
- Secure the window flaps open. Windows must remain open during the day to keep the tent cool; during wet weather windows can be tied outwards to shield the interior from the rain. Windows should only be closed to keep out heavy rain at night.
- As the tent is unlikely to be completely predator-proof (a rat once chewed through the floor of a tent (Speed et al. 2007)), rat/stoat traps should be set up outside the tent and checked regularly.

14.4 Feeding

Provide as much natural food (i.e. a good variety of native browse vegetation/native fruits) in the tent aviary as possible, as this is what the kokako will recognise as food before they learn about the artificial diet. Birds can be expected to start eating the artificial diet (listed below) within a

couple of days. This can be helped along by mixing lots of their preferred native berry-fruit in with the chopped fruit and vegetables on the food tray.

Suitable browse species include:

- Ferns such as hounds-tongue, hanging spleenwort, shining spleenwort (*Asplenium lucidum*), hen and chicken fern (*Asplenium bulbiferum*)
- *Coprosma* spp.
- Māhoe (*Melicytus ramiflorus*)
- Puka
- Tree fuchsia (*Fuchsia excorticata*)
- Five-finger (*Pseudopanax arboreus*) and other *Pseudopanax* spp.
- Pate (*Schefflera digitata*)
- Pigeonwood (*Hedycarya arborea*) fruit (kōkako do not usually eat the leaf)
- Hangehange (*Geniostoma ligustrifolium*)

Kōkako particularly like mahoe leaves, pigeonwood fruit, and the fruit, flowers and young leaves of karamū and raurēkau/kanono.

In addition, the following supplementary diet of chopped fruit and vegetables must be offered daily to each pair of kōkako (halve amounts for birds held singly):

50 g corn kernels

25 g peas

1/8 apple

1/8 pear

1/8 banana

1/8 orange

1/4 carrot

2 grapes

2 silverbeet leaves

Generous quantities of greens such as dandelion, puha and milk thistle

100 ml Wombaroo Nectivore/jam mix (30 g Wombaroo + 18 g jam mixed with 100 ml cold water)

50 ml jam water (1 heaped teaspoon jam per cup water; or 1 cup per litre)

Wax moth larvae and/or locusts[10] (or use local insects such as stick-insects, small weta, huhu grubs, bag-moths)

Kōkako will readily eat stone fruit, berry fruit, kiwifruit and figs, so a selection of these should also be offered.

Note: All fruit and vegetables must be organic, or at least spray-free. Any fruit that is not organic or spray free must be peeled and cored. If possible, use an additive-free berry jam.

Refer to Appendix 3 for a list of equipment needed for feeding kōkako.

Two sets of food trays/bowls are needed so that each day used food dishes in the aviary are replaced with clean dishes, with minimum disturbance to the birds. Kōkako food trays and bowls must be scrubbed clean using hot water and dishwashing liquid daily, rinsed thoroughly with hot water and air dried. Water dishes must be cleaned out when the water becomes dirty, usually at least every second day.

[10] These are commercially available from Biosuppliers: http://biosuppliers.nz/. 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 with Biosuppliers well in advance of a translocation so they can ensure that they have an adequate supply.

Note that changing browse and replacing the food trays each day is disturbing for the birds. However, if it is done at the same times each day, it may be less stressful to 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 may experience higher stress hormone levels than birds that are fed at the same time each day.

In hot weather, the vegetation and tent should be sprayed frequently with fresh cold water to keep the atmosphere cool and moist. The stems of some of the vegetation can be placed in water to keep them fresh and prevent wilting (ensure the water containers are packed or filled with rocks so birds cannot fall in), but browse should also be replaced regularly as required.

14.5 Care of kokako during captivity

Kōkako must not be held in the tent aviary for more than 10 days.

Allow one bird per flight, unless they were caught as a pair. If there is any doubt that two birds are in fact a pair, their interactions in the aviary should be observed. Do not place two birds of the same sex in a flight; they are unlikely to be compatible. Juveniles may be held together, or two birds of the opposite sex, as long as they are closely observed for stress and aggressive behaviour.

Always ensure that there is one experienced person on the team who is dedicated solely to looking after the captive kōkako and collecting natural food for them (i.e. once the first birds are caught this person's primary job is to look after the captive birds and they may not have time to continue being part of the catching team).

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 very few, if any, visitors. Loud noises and activity nearby will scare them, so make sure that people move slowly and quietly, and do not smoke or have loud conversations, slam car doors or make other loud noises around the aviary. Ideally, just one or two persons should go near the aviary when it is necessary to put newly captured birds in, replenish food and water, or conduct observations.

Ensure that all birds are feeding well, particularly if they are to be held for some days.

14.5.1 Monitoring

Birds in the aviary can be observed by lying very still as far back as possible within the empty compartment. Kokako will usually cope quite well with this. Observers should check that the birds are feeding, moving around, and not fighting. If two birds are in one flight together, check that both birds are feeding. It is often possible to hear them eating. If observation from within the tent is not possible because the birds are reacting to your presence, try sitting outside, a short distance from the tent, with the outside door of the tent opened slightly to allow the inside to be viewed. If observations are still not possible, listen for signs of activity, feeding and vocalisations.

Normally, birds adapt quickly to life in the aviary and it is unusual for birds not to eat, although it has happened on rare occasions with some individuals that appeared overly stressed. It is very important to check the birds' consumption of both natural and artificial food at least once per day to determine how well each bird is feeding. Use the aviary record sheet in Appendix 4 to record food consumption. As a general guide, birds will drink jam water and eat native browse foods during their first day in the aviary, and begin consuming Wombaroo the next day. It is common for them to not eat much of the chopped artificial diet, and this is fine as long as they are consuming the jam water, Wombaroo and native foods.

The birds' behaviour and appearance should also be monitored; prolonged lack of activity and sitting fluffed up in the corner are the most obvious signs that all is not well. Pacing behaviour is also an indication of stress.

14.5.2 Dealing with stressed birds

If a bird appears to have not been feeding at all during their second day in the aviary (i.e. there is no sign of natural or artificial food consumed and little faecal matter), try offering some different natural food types. If by the beginning of day three in the aviary the bird is still not feeding, catch and weigh it, and attempt to feed it soft fruits from the hand and from a food tray. Fruit puree has been hand-fed to stressed birds with some success (Adams & Collen 2004). This is done by blending the artificial diet until it is runny, then dribbling it slowly and carefully into the bird's beak using a small syringe, ensuring the mouth is not overfilled and the bird swallows the food and doesn't inhale it. This way of feeding birds can help initiate food recognition and feeding response. If the bird still refuses food this is very unusual and cause for concern; advice must be sought urgently from others with kokako transfer experience and a veterinarian. All techniques used to manage birds must be documented in detail (Adams 2006).

If a bird has lost more than 10% of its original capture weight during its time in captivity, observe it closely over the next day(s), and if there are concerns about its vitality or behaviour, seek specialist advice to help decide what to do and whether the bird should be transferred. Note that bird weights can naturally vary by several grams, depending on the time of day and whether the bird has just eaten or defecated a large amount. Initial capture weight may include a very full digestive tract if the bird has just fed. Also remember that **you may have added 6–8 g to the bird if you have fitted bands and a transmitter**. Rapid weight loss, however, may indicate the bird is ill, so be wary and consult with others if in doubt. If the bird has not been feeding for 2–3 days it is probably best to release it back at the capture site (where it will know its food sources and may have a better chance of survival).

14.6 Tent aviary hygiene

Before and after use, the tent aviary must be thoroughly cleaned and disinfected with an anti-viral disinfectant such as Virkon or Trigene, rinsed thoroughly with water and air dried for several days. In Auckland, the tent can be professionally treated at the Quarantine Treatment Centre[11] (all loose dirt/leaf litter must be removed first).

During a translocation project, the tent aviary should be cleaned out after each group of birds is transferred. This involves removing all the vegetation (except for the permanent perches) and leaf litter, and sweeping out and cleaning the floor with water.

If disease testing revealed parasites or other pathogens, clean the tent more thoroughly using a disinfectant.

During any cleaning, the tent must be checked for any holes, tears or any signs of wear, and repaired as soon as possible.

[11] Quarantine treatment Centre: 1/22 Andrew Baxter Drive, Airport Oaks, Auckland. Ph: 09 275 5589. http://www.biosecurity.govt.nz/regs/trans/treat/approved

15. Transfer preparations

15.1 Transfer box design

Wooden boxes are used to transport kokako from the source site to the release site.

A good transfer box has the following features:

- Dimensions: each compartment measures approximately 350 mm long × 300 mm wide × 250 mm high
- Ventilation—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.
- Padding—the internal walls and ceiling are lined with closed-cell foam to minimise external noise and prevent the bird injuring itself during transit.
- Sturdy wooden perch placed low inside the box, 20–25 mm in diameter.
- No holes big enough for a bird's beak 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.
- Stackable if being transported by helicopter, where space is limited. Baffles may need to be attached to prevent loss of ventilation.

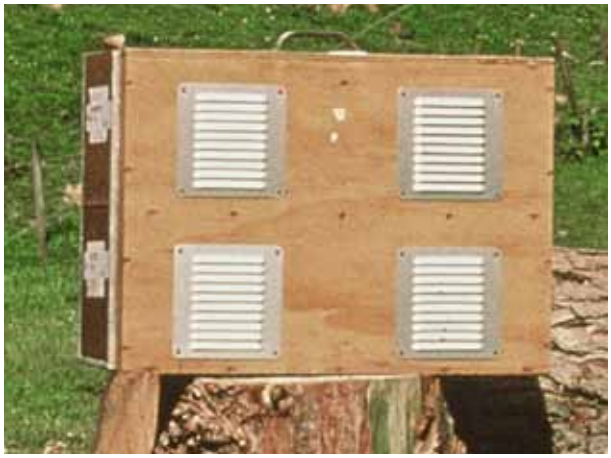


Figure 12. Kokako transfer box with four compartments. *Photo: Ian Flux (DOC image library).*

The Kaharoa Kokako Trust has eight wooden transfer boxes, each with two compartments (Fig. 12). Similar boxes may also be available for borrowing from the Mount Bruce National Wildlife Centre or the Maungatautari Ecological Island Trust (MEIT).

Prepare the boxes by lining them with non-slip matting (to give the birds grip) or newspaper, and adding a layer of moss or leaf litter. Add edible foliage/fruiting branchlets, to provide the kōkako with some distractions during its journey, and also to help keep the atmosphere moist (but not wet).

Kōkako transfer boxes should only be used to transfer kōkako, to avoid disease transfer between species.

Transfer boxes must be cleaned thoroughly with hot soapy water before and after use, disinfected with Trigene® or a similar anti-viral disinfectant, rinsed well with water and thoroughly air dried.

15.2 Catching the birds on transfer day

The process of catching kokako from the aviary and getting them into transfer boxes is very stressful for the birds and those catching them. This operation requires experienced kōkako catchers and handlers.

The timing of captures will depend on transport logistics. Ensure that the planned release is timed to allow the birds plenty of forage time at the destination before dusk. Always aim to have

the kōkako well fed and hydrated before transportation (e.g. transfer them after the morning feed, or if the transfer is overnight or early morning offer them plenty of fresh food the evening before). Catch the birds so that they can be put in the transfer boxes as close as possible to the departure time, one kōkako per compartment.

Remove all water bowls and food trays before catching starts. Some of the vegetation may also need to be removed to gain access to the birds. Use patience and care when catching birds in the aviary; no lunging tackles. Birds can be caught gently but firmly against the mesh, by hand or using a soft hand net. A good technique for catching the birds is to gently crawl around the flight with the door open into the empty compartment, with a second person waiting unseen outside ready to net the bird on the floor as it walks through the door.

Kōkako are quiet and fairly easy to catch if they are caught during the near-dark of the early morning; often they can be gently but deftly caught from their roost perch. Once a bird is captured, it must be weighed to check it hasn't lost more than 10% of its original capture weight. Birds that have lost this much weight may be ill and need medical attention; consider the bird's condition and vitality carefully—if you have any concerns, release it back into the aviary and seek advice from a veterinarian or kōkako translocation specialist.

Check that the bird's transmitter and bands are still sitting correctly and not causing injury, and offer the bird some soft fruit (or whatever food the individual has shown a preference for), before placing it into the transfer box. **Each box must house only one bird per compartment**. If the kōkako are to travel by air, check with the operator—you may need to turn transmitters off during transit.

Write the bird's identification details (band combination, transmitter frequency, name) on stickers affixed to each door of the transfer box. Secure the doors with screws or strong tape. If boxes are to be transported by a carrier, ensure they are clearly labelled 'Live animals'.

15.3 Information transfer

Ideally, the person who has been primarily responsible for the care of the kōkako in captivity should accompany the birds to the release site. Alternatively, the accompanying person should be someone from the catching team who has an understanding of the individual birds and any issues there may have been since they were captured. This is because it is important that birds are dealt with appropriately during transportation and release.

Individual records (in the form of processing and transfer record sheets in Appendix 4) must also accompany the birds from the source to release site, and be given to the receiving team so they are fully informed about each bird's history.

16. Transport requirements

Kōkako 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 and visitors to keep quiet around the birds and not smoke or make any other disturbance that will scare them.

Transfer boxes must always be handled gently and stowed in shade so that ventilation is unrestricted and the birds are kept cool. Stowing them in a quiet, dark place with minimum disturbance is ideal.

Transport time should be kept to a minimum (less than 8 hours), and aimed at ensuring that the birds arrive at the release site as early in the day as possible (refer to section 17—Release).

An experienced bird handler must always accompany the birds. They should carry with them extra food (banana, native fruits, etc.) and jam-water in case this is needed at any point in the journey.

Where the time birds will spend in the box exceeds 4 hours, a secure site needs to be arranged where the kōkako can be taken out during the journey and offered more food and liquids. If the transfer is carried out overnight, this will not be needed because the birds would not normally be feeding anyway.

Before the birds depart, ensure that all sections of the journey are planned for and that all transport operators have agreed to your timetable. Check the weather forecast for any air or sea travel sections. Have a contingency plan and carry details of contact people you might require en-route (local DOC staff, veterinarians, transport operators).

16.1 Mode of transport

Kōkako have been transported by many means of transport without problems.

Car

Vehicles must be kept cool during transportation to avoid heat stress. Full ventilation or air conditioning is essential for sunny or warm days. Do not transport boxes in the boot of a car, as not only is ventilation reduced, but also there is a risk of carbon monoxide poisoning.

Secure the transfer boxes with a seatbelt or other secure restraint to prevent them moving during the journey. Do not have the radio on loud and keep voices down. Keep sufficient windows open and ensure you have plenty of fuel for your planned journey. Never leave the birds unattended and avoid parking the vehicle in the sun. Travel in convoy with another vehicle or carry a cell-phone so that contact can be made in the event of any problems.

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.

Boat

Boat travel can often be delayed by bad weather. Always plan to have a helicopter back-up option, or be prepared to release birds back into the territories where they were caught if conditions deteriorate so much that transportation is not possible.

On boats, stow transfer boxes in a dry and well-ventilated area. If transfer boxes are being transported on deck, they can be placed with a tarpaulin over them to protect them from salt spray; however, they should only be placed outside on deck if the conditions are not hot and sunny. Transfer boxes stored below deck must be spaced out in a ventilated area.

Aeroplane

If birds are to be transported using air freight, refer to the Air New Zealand species transport guide (DOC 2014, available from DOC offices) for information about the agreement DOC has with Air NZ for transporting threatened species, and the flight booking process.

Staff should be present at the departure and arrival destinations and may ask airline staff to observe the loading and unloading of the boxes. Ask the airline handlers to load the birds last to avoid any possibility of their ventilation being restricted by other cargo.

Check that the birds will be in a quiet, pressure and temperature controlled, space and away from any other animals (dogs/cats) which may create disturbance and stress during the flight.

Check with the operator whether it is allowable for the birds to have live transmitters while in the aircraft. If live transmitters are not permitted, use transmitters that can be switched off as the birds are placed in the transfer boxes.

Helicopter

In helicopters, carry transfer boxes in the cabin to avoid excessive noise.

16.2 Arrival at release site

Ensure that an aviary or secure room is available at the destination in case any kōkako need to be kept under observation, or have experienced problems during the journey.

Some kind of welcome ceremony is usual. Often this involves the donating iwi (who may travel with the birds) gifting the birds to the local receiving iwi. Such ceremonies will vary considerably depending on the iwi involved but will often involve some speeches from senior members of each iwi and the singing of waiata. Be sure that all involved understand the importance of handling the bird boxes gently and quietly and the importance of releasing the birds as soon as possible. Ensure all parties communicate their plans and that everyone involved agrees on the timetable for releasing the birds at the optimum time for their health and welfare (refer below to section 17—Release).

17. Release

Once the kōkako arrive at the release site they can be released immediately. Housing kōkako in pre-release aviaries at release sites is not recommended because it is considered to place increased stress on the birds (King 2010) and has no apparent benefit (Molles et al. 2008).

Kōkako should be released during fine weather and as early as possible in the day. A release early in the day gives the birds plenty of daylight hours to find food and shelter before evening. Kōkako must be released **at least 4 hours before dusk**.

Decide on the specific release location in advance of the release, and plan where any spectators and photographers will be positioned—allowing the birds an easy and uninterrupted escape route to the canopy. Ask spectators not to use flash photography and to remain still and quiet. 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 escape to, which would be very stressful for them.

Confirm all birds are active prior to release. If the birds have been several hours in transit it may be appropriate to handle and feed the birds prior to release—giving an opportunity to check the birds' vitality and wellbeing—but balance this against the stress this extra handling may cause. Release the birds onto a sloping tree, which will allow them to bound up toward the canopy (i.e. do not release them directly onto the ground as it can leave them vulnerable). If transferring a pair, release them together.

If birds are handled, encourage them to feed on soft fruit or their preferred food. If birds are carrying radio-transmitters, check they are still well positioned and reactivate them if they were turned off for air travel. If a bird is being handled for advocacy and publicity reasons, choose one that is known to feed well in the hand and is in the best condition weight-wise.

Check the birds as you open each box. If any appear overly stressed or otherwise compromised (e.g. inactive, drooped wings), contact the consulting veterinarian or a kōkako translocation specialist for advice. The bird may need to be retained for medical care at a captive facility.

Ensure that local staff receiving the birds are given copies of all the birds' records.

18. Post release management

18.1 Acoustic anchoring

Sound or 'acoustic' anchoring (where pre-recorded kokako calls are played back from speakers at the release site) has been tried at a number of release sites where the area managed with pest control sits within a larger area of continuous forest (Speed et al. 2007; Molles et al. 2008; King 2010; OKT 2012). The theory behind acoustic anchoring is that released kōkako may remain close to acoustic devices and within the management area rather than dispersing.

Kōkako song, 'tooks' and 'mews' are recorded from pairs at the source site, to make a series of 'natural sounding' song tracks interspersed with periods of silence. Speakers are erected at the release site, 5–10 m high in trees along ridgelines. The recordings are played at dawn each morning for 7–10 days after the birds are released (or longer in some projects).

Results so far have shown that birds are known to approach the speakers and respond to them (Molles et al. 2008), and pairs have established territories adjacent or within hearing range of the anchor systems (OKT 2012). Similar results occurred with NI robins (Bradley et al. 2011). To date, however, there is no conclusive evidence that acoustic anchoring retains more kokako at a site than would be the case with an "unanchored" release, therefore the Kōkako Recovery Group does not specifically recommend the technique.

Acoustic anchoring should be seen as experimental and **discussed fully with the Kōkako Recovery Group before being considered** as part of a translocation. Unless the method is robustly tested using a 'control' (non-anchored release), knowledge about the efficacy of this technique is unlikely to be increased. Further testing of the method may be appropriate as a university research topic.

18.2 Pest control

If some of the translocated kōkako establish territories outside the management area (i.e. outside the area of current pest control), the pest control programme may need to be altered to include these areas. This must be considered during the planning phase of the translocation, as it will increase the cost of the project.

19. Post-release monitoring

19.1 Purpose

Post release monitoring informs future management of translocated populations and can help to answer questions such as:

- How many translocated individuals survive?
- How many kōkako disperse from the area?
- Where and when are pair-territories established?
- What proportion of nesting attempts succeed?
- At what rate does the population grow?

These, in turn, inform a further set of questions (Parker et al. 2013):

- Will the reintroduction be successful?
- Is pest-management 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?

The need for monitoring is related to the risks and uncertainties around a particular translocation. Short-term risks may relate to habitat suitability, local predator communities (including native species) and possibilities of the birds leaving the managed area. The long-term success of the translocation will depend on its genetic robustness and this, in turn, relates directly to the number of translocated individuals that survive and the speed with which the population grows. Particular projects may lend themselves to addressing questions of national importance and may be suitable for an external researcher to become involved.

Post-release monitoring is essential if your group wishes to understand the ecological mechanisms affecting your kōkako population—good management is adaptive, your monitoring results will inform future decision making.

Post-release monitoring can be used to determine why translocations have failed (Fig. 13), whether a different management approach would prevent failure if the species was translocated to the site again and, if not, the feasibility of future translocations. On the other hand, successful translocations provide useful information for similar projects in the future.

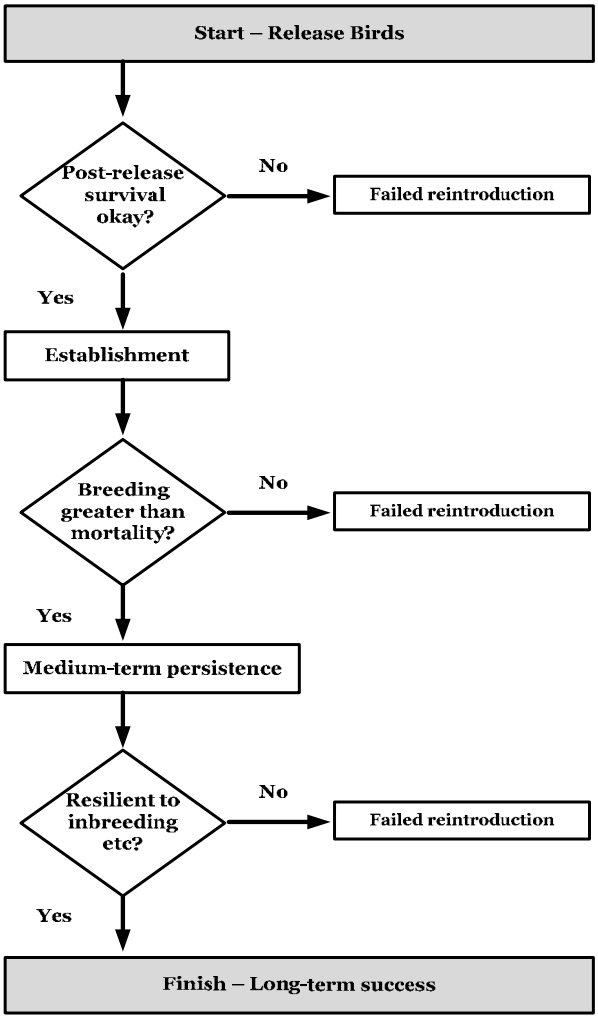


Figure 13. Determining the success or failure of a translocation (Parker et al. 2013).

Translocated kōkako populations may, depending on survival and recruitment (growth) rates, need further supplementation within 5–10 years of the initial translocation. Populations arising from too few founders may suffer loss of genetic variability, due to bottleneck effects (Flux et al. 2012). Any perceived need for supplementation should be discussed with the Kōkako Recovery Group, and detailed monitoring results will help inform their recommendations.

19.2 Recommended monitoring

The Kōkako Recovery Group can help you develop a monitoring regime to benefit both your site and to improve national knowledge of kokako translocations.

The draft Kōkako Recovery Plan (2012–2017) recommends the following standards for post-translocation monitoring:

1. Post-release monitoring is recommended (possibly using radio-transmitters). This will help managers identify where individuals and pairs form territories. Managers may need to modify pest-managed areas as a result. Identification of individuals (by colour-bands or transmitter) will help build a picture of establishment (i.e. who are the founders).
2. Annual territorial-adult population census (with identification of banded/un-banded individuals) until the population reaches 25 pairs.
3. Annual monitoring of the breeding success of at least 5 breeding pairs, until the population reaches 25 pairs, is recommended to assess population growth rate and identify any site management problems early on.
4. For populations of 25 to 50 pairs within areas that are pest-managed to the required standard: population census every 4 years.
5. For populations of 25 to 50 pairs within areas that are not pest-managed: annual population census in case significant predation by stoats occurs.
6. Once the population is established with 50 pairs or more, estimate population size using a best practise sampling approach, at a frequency advised by the Kōkako Recovery Group.

The population census is a count of territorial adults by November 1 each year, done by walk-through survey using the specific method detailed below.

Walk-through surveys begin at dawn and proceed along pre-planned routes (usually prominent ridges in hilly terrain) that traverse the site until early afternoon, listening for kōkako song and playing pre-recorded calls approximately every 200 m. Once birds are located, they are followed until their territory can be distinguished from those of their neighbours. This method determines the number and location of most territories present, and whether these are occupied by pairs or single birds. For further information about the types of kōkako surveys and the methods, refer to the Kōkako Management Folder (Flux & Innes 2001b).

To achieve the required level of monitoring, all released kōkako must be banded with a metal band and unique colour band combination.

While attachment of transmitters to all birds is not specifically recommended, it can be difficult to monitor the birds initially without transmitters. If it is important to know the survival rate of the translocated birds, transmitters on at least one gender may be considered. Fitting transmitters to females also aids monitoring of breeding success—seek advice from the Kōkako Recovery Group. Note that there is an energy cost to the birds that wear transmitters, along with risk of entanglement in vegetation, interference in body insulation, or restriction imposed by a harness; so there must always be strong justification and clear reasons for using them.

Skilled and experienced kōkako monitoring personnel are needed for the annual census and breeding season monitoring, and to train others to do the work. It is essential that people new to kokako monitoring are trained by experienced people, because kōkako monitoring is difficult and a lot of time can be wasted if people are unaware of the correct techniques.

19.3 Radio tracking

Guidelines for radio-tracking techniques can be found in DOC's Field skills online course:

http://doc.govt.nz/get-involved/training/online-courses/field-skills-online-course/

http://intranet/upload/training-courses/field-skills/index.html

19.3.1 Transmitter frequencies

When choosing the radio frequencies for the transmitters, check with any other telemetry users in the area to avoid selecting radio frequencies that are already in use.

Before buying transmitters, test all the frequencies available in your area, checking there is no distracting radio-frequency interference. Seek advice from the electronics laboratory, Science & Capability, National Office, DOC. Transmitters operating on adjacent channels are acceptable if they are distant from one another, but if your study has fewer than 45 birds, aim for either even- or odd-numbered channels on a TR4 receiver to avoid frequencies being too close together. If the release site is close to an urban area, go through the channels and note down those that pick up interference; do not get transmitters in those channels.

Store and carry transmitters separately so that they cannot be turned on accidentally. This is easily done by placing them in appropriately shaped holes cut into a piece of foam rubber that fits inside a plastic lunchbox. All stored transmitters should be checked periodically to ensure that none are switched on, as this would reduce the battery life.

20. 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. This way a summary of 'five birds had mites' is meaningful; this makes it clear that every bird was actually checked for mites, so the data indicate the actual prevalence of mites (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 the 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 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 19—Post-release monitoring)
- Providing reports on the translocation using DOC's reporting instructions (Collen & Cromarty 2011a).

Contractors are often used for catching kokako during translocations. It is the project manager's responsibility to ensure a report on the translocation is completed and submitted, and to ensure the contractors and their catching teams record adequate information.

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Appendix 1

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Appendix 2

How to repair a mist-net

Equipment needed:

- 1 spool of black cotton thread (heavy weight)—100% cotton is best because it is easier to knot than nylon or blends
- 1 needle large enough to hold comfortably and thread easily.
- 1 pair of sharp scissors—ideally nail or surgical scissors
- Coloured flagging tape for marking holes

1. While the net is still set up (e.g. at a catching site), examine it using the sky as a background to locate any holes. Mark all the holes to be fixed by tying flagging tape loosely next to the hole. Some people prefer to mend the nets whilst still hung.
2. Set up the net in an area that has good light and plenty of room to move the net around. Take out one end of the net leaving the horizontal support line loops still tied. If the first hole is far from the end, carefully put that end of the net in a second holding bag.
3. Spread out the net with the hole open. Test all weak-looking points around the hole (such as those circled in Fig. A2.1) by pulling firmly on them. If some strands of the net have been chewed, consider them broken. With the scissors, snip out all loose ends in the centre of the hole (such as those in the larger circle of Fig. A2.1), leaving only tie-on ends no longer than one square of the mesh. It is far easier and stronger to mend the whole area than to try to incorporate fragments of net.
4. The most common type of hole is shown in Fig. A2.2. Select a 'T' break at either A or C for your starting point. Most, but not quite all, holes have one or more such 'T's'. Wrap the threaded needle around the net once on either side of the 'T' as shown in Fig. A2.2. Knot the thread to itself twice, then knot the thread twice again, this time to the broken end of the 'T'. Firm all knots with fingernail tension.
5. Now draw the thread to the next point, B in Fig. A2.3, which in this case is an 'open corner'. Wrap the needle around the corner three times, for there is often nothing to tie it to and, also, you will be changing directions for the next side. Draw the thread to the approximate size of the mesh and carry the thread back over itself, then bring the needle under the thread and up through the loop that is formed, as shown in Fig. A2.4.
6. Pull the thread through the loop. If you see that the net square is going to be too big or too small, insert the needle tip into the closing knot to adjust the length of the side, guiding the knot closed with the needle. Finish the mend in Fig. A2.4 by again twice wrapping the needle around the 'T' at C, then knotting the thread twice with the broken stub and to itself. Knot it a third time to itself if the stub is too short for knotting.
7. Carefully trim off the thread and net stub ends to about 1–2 mm long, as you mend.
8. In the case of a hole like that shown in Fig. A2.5, four separate threads are needed. The first two in one direction, A and B, form a 'ladder'.
9. The third and fourth threads, C and D, are knotted as they cross threads A and B of the 'ladder' by triple wrapping and knotting as described for point B in Fig. A2.4. The first two threads of the 'ladder' should be left a little bit longer than the normal span, as knotting takes up a small amount of thread.
10. General tips: never tie a single knot, always tie two—and tension them firmly. Mend small holes around the perimeter of a big one first. When mending large holes, avoid long empty expanses, as it is sometimes difficult to judge where and how long the next point of connection should be. If you do make a connection error, snip it out. Don't run double threads along one side of a square.

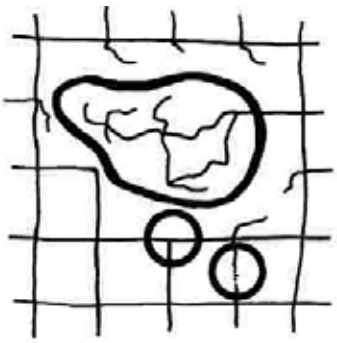


Fig. A2.1

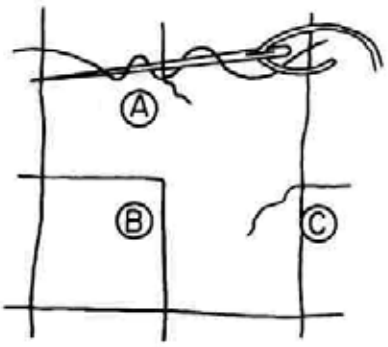


Fig. A2.2

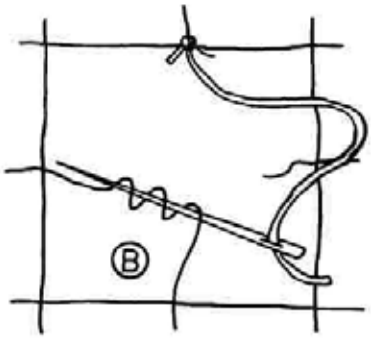


Fig. A2.3

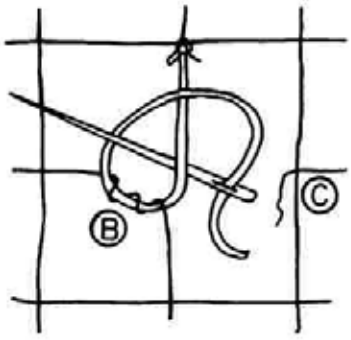


Fig. A2.4

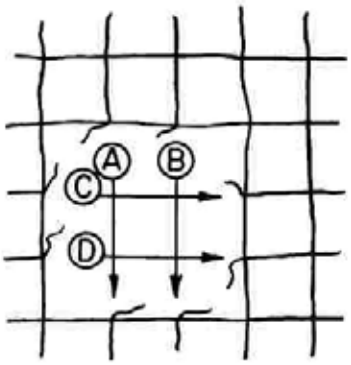


Fig. A2.5

Appendix 3

Equipment lists

A3.1 Mist-netting equipment

Personal safety

Compass, GPS and maps of the area

First-aid kit

Personal locator beacon and radio/cell-phone

Warm clothing/rain gear

Snacks and water

Safety glasses (2)

Helmets (2)

Cutting net sites

Machete

Pruning saw

Secateurs/forestry loppers

Chainsaw (if available with trained personnel)

Climbing equipment (and trained personnel)

Setting up mist-net rig

Flagging tape

Sinkers (a reasonable number of varying sizes; typically 1–4 oz)

Sling shot (plus spare rubber)

Knife

Mist net measuring ropes (9 m and 12 m)

Carabiners (4 per net site)

Top line rope (about 100 m of strong 4 mm cord)

Guide ropes (endless ropes) (length: 2 times the height of the vegetation)

Rope to make net cradle (zigzag)

Spare cords/ropes (to tie back branches or attach to 'shaker trees', etc.)

Fishing line reel and draw cord for shooting top-lines

Mist-netting (per catch team)

Kokako mist-nets (5 × 9 m and 10 × 12 m)

Speakers × 2 (plus hand speaker)

Long cables for speakers

Flip switch for speakers

Sound system (e.g. minidisc or digital recorder/player)

Amplifier

Spare batteries and playback equipment (in case of electrical failure)

Microphone and recording equipment

A3.2 Kōkako handling/processing equipment

Bird handling

Dark cotton catch bags with drawstring—one per bird

Holding/transport boxes—one per bird

Soft fruits (banana, berry fruit, stone fruit), jam water for feeding birds

Banding and measuring kit

Metal 'E' bands—Stainless steel or 'monal' (Latter is easier to close)

Colour bands and list of combinations to use

Banding pliers / pliers

Right-angle circlip pliers—very high quality, with points fine enough to open bands without putting pressure on the bird's leg

Small sharp scissors (e.g. surgical)

Super Glue (liquid not gel)

Wing-measuring ruler

150 mm Vernier callipers—to measure tarsus

Pesola (or similar) scales (300 g & 500 g)

Banding and measurement record sheets—one per bird (Appendix 4)

Pencil/pen

A3.3 Kōkako feeding equipment

Food trays

Food bowls (flat-bottomed) for serving Wombaroo and jam water. Consider red colour for high visibility.

Water dishes (e.g. large plastic pot-plant bases (e.g. 5 cm deep × 32 cm wide), or paint trays)

Sharp knife

Chopping board

Scales and spare batteries

Measuring cup

Dish brush (use only for kokako dishes, do not use for human dishes)

Dishwashing liquid

Wash bucket

Dish drying rack

Antibacterial soap (for washing hands)

Appendix 4

Translocation record sheets

A4.1 Record of capture attempts

Please send a copy of this sheet to the Kōkako Recovery Group Leader

Date	Location	Total time spent	No. kokako caught	No. kokako seen at site	Comments
XX/YY/2XXX	Plantings @ bottom. Planting TK, Central Block	5 hrs	0	1	Failed to catch a bird but worth trying again at this site.

A4.2 Kōkako capture and processing record sheet

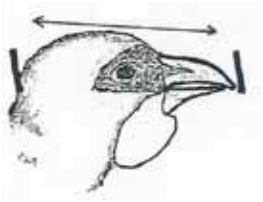
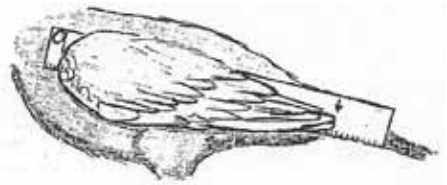
Please send a copy of this sheet to the Kokako Recovery Group Leader

Bird name:	**Sex:**	**Bands:**	**TX:**

CAPTURE

Capture date:	**Weather:**	
Capture team (names):		
Location (Name of forest or management area):		**Site no:**
Grid ref.	**Easting: E**	**Northing: N**
Status of bird: Pair ☐ Single ☐ Juvenile ☐ Unknown ☐		**Mate caught:** Yes ☐ No ☐ Mate's bands:
Time captured:	**Total time in net:**	
Transported to aviary in: Box ☐ Bag ☐ **Transported by:** Foot ☐ Vehicle ☐	**Time released into aviary:**	
Comments (e.g. if very tangled in net, injuries, behaviour, stress levels, food offered/taken):		

BANDING & MEASUREMENTS

Date:	**Bander:**	**Holder:**
Metal band no:	**Colour combination:**	
Tarsometatarsus (mm): 	**Head + bill (mm):** 	**Wing length (mm):** 
Time handling started:	**Total time to band/measure:**	
Comments (e.g. behaviour, stress levels, food offered/taken):		

Continued on next page

Kokako capture and processing record continued from previous page:

Bird name:	**Sex:**	**Bands:**	**TX:**

TRANSMITTER ATTACHMENT

Date:	**TX frequency:**	**Fine tuning:**	**TX working OK?** ☐
Attached by:	**Holder:**	**TX + harness weight (g):**	
Attached: At capture site ☐ At aviary site ☐		**Harness type:**	
Time handling started:		**Total time to fit transmitters:**	
Comments (e.g. behaviour, stress levels, food offered/taken):			

DISEASE TESTS

Date:	**Samples taken by:**	**Holder:**
Time handling started:	**Total time to take samples:**	

Samples taken:

Cloacal swab: ☐ Faeces: ☐ Feathers: ☐ Blood: ☐

Tests required:

Total plasma protein: ☐ Salmonella: ☐ Haematocrit: ☐

Yersinia: ☐ Blood count: ☐ Haemoparasite: ☐

Salmonella/Yersinia: ☐ Smear only: ☐ Total protein: ☐

Faecal egg count and coccidia: ☐

Avian haematology (Hct, Hb, MCHC, fibrinogen and screen for parasites) blood and smear: ☐

Results sent to:

Recovery Group Leader (for central file)

Email:..... ☐

Name: Kate McInnes, DOC vet/Wildlife Health Coordinator (for National Wildlife Health Database)

Email: kmcinnes@doc.govt.nz..... ☐

Comments (e.g. any difficulty collecting blood, stress):

A4.3 Aviary record sheet

Complete one record sheet per flight of birds.

Bird name(s):	Sex:	Bands:	Location in tent (flight no.):

Date:	Feed time:	Weight and description of food IN:	Weight and description of food OUT:	Describe what/how much foliage/browse appears to have been eaten:	Comments (behaviour of bird, etc.)

A4.4 Kōkako transfer and release record sheet

Bird name:	Sex:	Bands:	TX:
Bird weight @ capture (g): (refer to capture/processing form)		Bird weight @ transfer (g):	
Number of days in aviary:			

TRANSFER DETAILS

Date/time departed aviary site:	Date/time arrived at release site:
Main transport used: Person accompanying bird:	Times fed during transfer: Food offered:
Total time bird in box: Food offered at time of release:	Release site: Weather conditions at release:
General observations (e.g. behaviour during/after release):	

Appendix 5

How to make kōkako colour bands

1. Cut 'Darvic' plastic into strips 51 mm long and 8 mm wide.
2. Snip all four corners off. Using sand paper, lightly sand the ends and sides of the band so there are no sharp edges that could cut into a bird's leg.
3. Heat a pan of water on the stove to a simmer. Place the mould into the hot water. The mould should have three different sized holes: 10 mm, 10.5 mm and 11 mm.
4. Drop the band into the hot water; just long enough to make the plastic soft and pliable. Take hold of one end of the band with a pair of tweezers (taxidermist tweezers are ideal), and remove it from the water. Wrap the band around the tweezers so it forms a spiral/circle.
5. Using the tweezers, place the band into the appropriate hole in the mould. Most 'Darvic' colours are placed into the 10.5 mm holes, but some colours (usually the blue and orange) are slightly thicker and must be placed in the larger 11 mm mould to keep the internal diameter at 6.5 mm (equivalent to the 'E' band).
6. Once the band has been placed into the mould, use the tweezers to push the internal part of the coil out against the mould, so there are no gaps in the coil where it overlaps. Ensure that the edge of the band is flat and smooth (i.e. the coil overlaps evenly and has not spiralled).
7. Place the whole mould into cold water to set the plastic hard.
8. Leave for several seconds then gently push the band out of the mould with the tweezers.
9. Check the condition of the band: the ends lie flat against the coil, the wrap is even and has no gaps (i.e. the coil meets surface to surface), the side edges are flat (not spiralled) and the internal diameter is 6.5 mm. If the band is not in perfect shape return it to the hot water and repeat the process, as a substandard band must never be used on a bird.

Appendix 6

How to make kōkako transmitter harnesses

All photos in this section by Jane Haxton.

Equipment needed (Fig. A6.1):

- Soft polypropylene braided cord diameter 2.0–2.5 mm (e.g. Waproo / Footcom NZ / Tana shoe laces) (100 cm per harness). Do not use cotton (which may shrink) or nylon/polyester which may abrade the skin.
- Scissors
- Needle and polypropylene/polyester thread
- Weak link cotton with breaking strain of 750 g (e.g. 'Mettler' quilting cotton)
- Ruler
- Lighter
- Plastic tubing: 5 mm external diameter; ≥3 mm internal diameter (from Mitre 10)
- Plastic tubing: 3 mm external diameter; 2.2 mm internal diameter (from DOC Banding Office or scientific supplies agency)
- Vivid marker pen
- Pen/pencil
- Super Glue (liquid)
- Transmitters
- TR4 receiver

Figure A6.1. Equipment for making kōkako transmitter harnesses.

1. Remove the core from inside the cord. Cut two lengths, one long enough to pass around the bird's neck (30 cm), and one long enough to pass around the body behind the wings (45 cm).
2. Seal the ends of the cord with the lighter flame, making a pointed tip so it is easier to poke the cord through the transmitter attachment holes. This seal will also stop the laces fraying.

3. Fit the 30 cm cord (neck) to the front attachment tube of the transmitter and the 45 cm cord (body) to the rear attachment tube of the transmitter. Both ends of each cord are passed through the attachment tube in opposing directions to form loops at either end of the transmitter (Fig. A6.2, arrow indicates the body loop). A needle and thread can help to pull the second end of the cord through. When threading the cord through, ensure the cord does not become twisted.

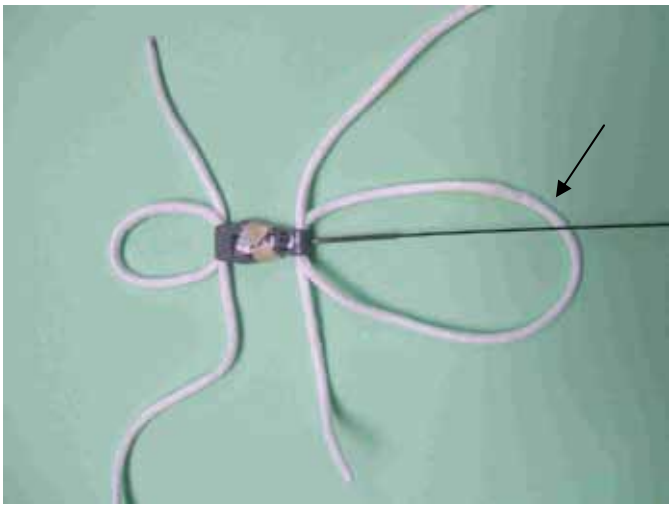


Figure A6.2. Loops formed at either end of the transmitter.

4. Melt out and smooth the pointed tips from the cord ends to obtain a neat smooth finish.

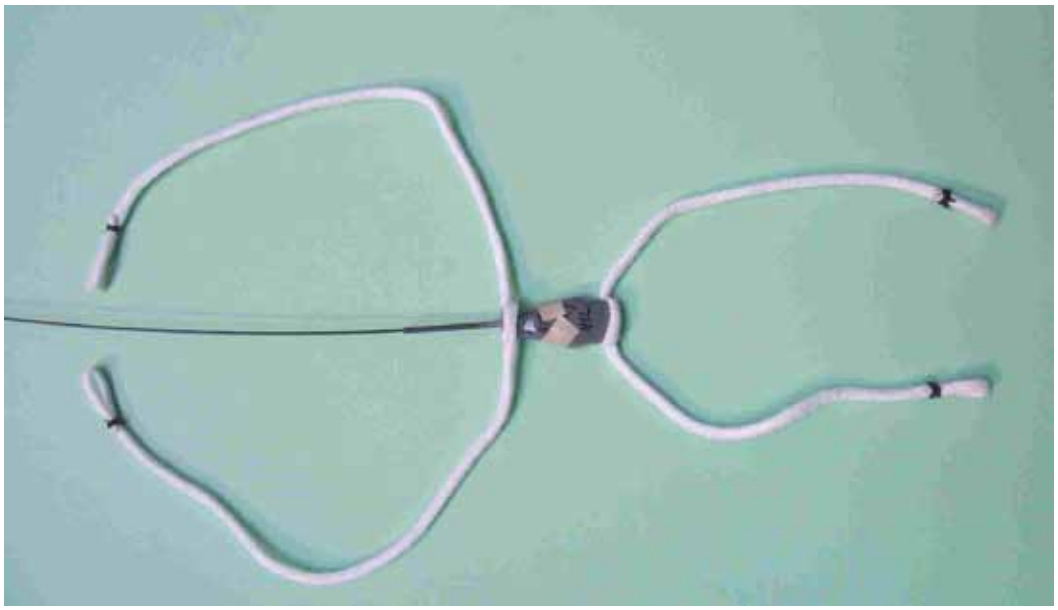


Figure A6.3. Eyelets at the end of each cord.

5. Form eyelets (small loops) at the end of each cord (Fig. A6.3) by turning the end 1.5 cm back on itself and stitching/binding it firmly and neatly with synthetic thread (not cotton). Imagine how the loops will sit against the bird's body, and stitch so the joins face outwards.
6. To enclose the weak-link thread, take two short lengths of soft plastic tubing. They should fit neatly inside one another; the outer tube with 5 mm external and 3 mm internal diameter,

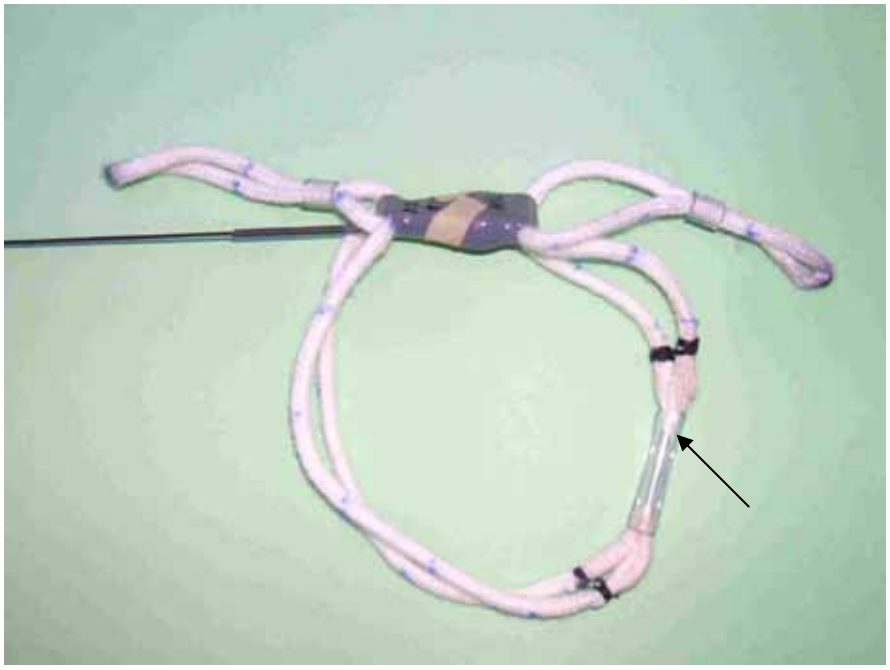


Figure A6.4. The completed harness. Arrow indicates the cord eyelets within the outer tube.

and the inner tube of 3 mm external and 2.2 mm internal diameter. The outer tubing selected should neatly accommodate the two cord eyelets (Fig. A6.4). Cut the outer tube to 20 mm. Cut the internal tube to 10 mm.

7. Slide the two tubes together. They should be flush at one end.
8. Using cotton thread of the required breaking strain, feed the cotton through the inner plastic tube (from the flush end), then through the two eyelets on the front cords and back through the inner tube.
9. Ease the two eyelets into the end of the outer plastic tube until they rest against the inner tube. The inner and outer tubes should still be flush at the other end. Once both eyelets have been squeezed into the tubing make sure the 'weak link' is not twisted.
10. Loop the cotton through the remaining two eyelets (on the rear cords) and draw the thread tight, edging the two front cord eyelets into the tube as much as possible.
11. Knot the ends of the thread securely at the accessible (flush) end of the inner tube. If the thread loop breaks, all four ends should fall free.
12. Feed the remaining two eyelets into the tube, while pushing the inner tube gently until it is centred within the outer tube. The eyelets already inside the tubing can be slowly worked outwards while the other eyelets are pushed in. The entire loop of weak-link cotton should be inside the inner plastic tubing, to protect it from abrasion (Figs. A6.4 & A6.5).
13. Take the mid-point of each cord and pull until each harness loop is centred. Mark every 2 cm along the cord, marking the middle with a different colour. These marks should line up, this is important for fitting the transmitter to the bird.
14. Push the mid-point of each cord through a neatly fitting toggle of plastic tubing. These toggles should be 2–3 mm long, cut from the 5 mm tubing.
15. Pre-size (and mark) the head hole to 50 mm in length, i.e. the cord from the front end of the transmitter to the top of the weak link tube is 50 mm. This may need minor adjustment when fitting.
16. When fitting constantly check that the mid-point remains centred as you gradually preen in and evenly tighten the harness.

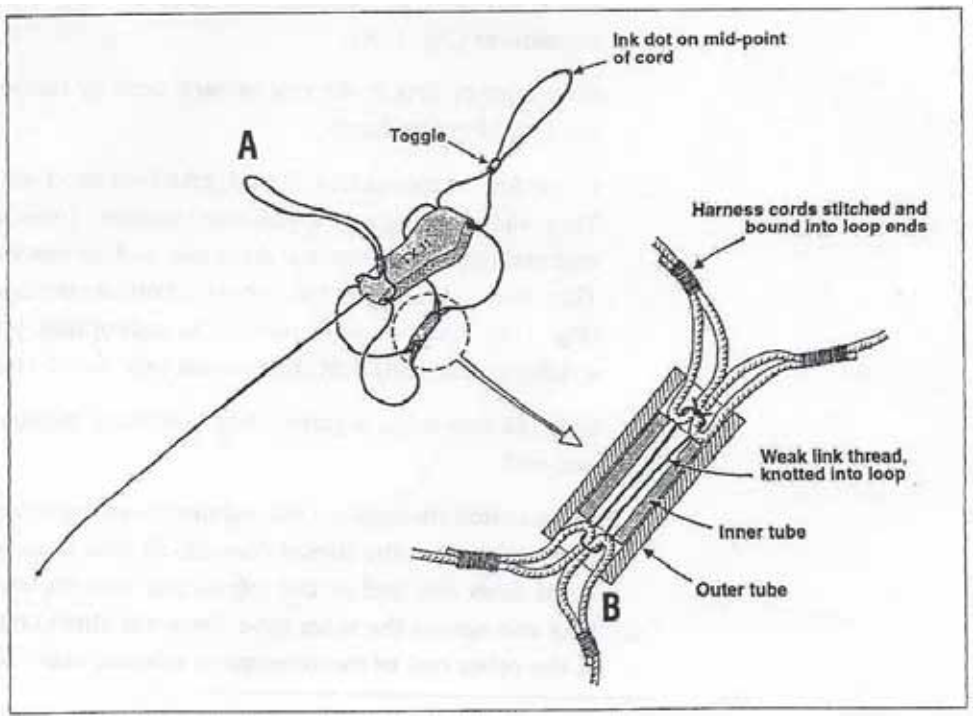


Figure A6.5. A: Loop formed at either end of transmitter. B: Cord eyelets fit within outer tube. (Flux & Innes 2001b).