Best practice techniques for the translocation of whiteheads (popokatea, *Mohoua albicilla*)

Ralph Powlesland and Kevin Parker

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Cover: Whitehead, Tiritiri Matangi Island. *Photo: Martin Sanders.*

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Ralph Powlesland[1] and Kevin Parker[2]

[1] 606 Manaroa Road, Manaroa, RD 2, Picton, New Zealand
powles1@attglobal.net

[2] Parker Conservation, Auckland, New Zealand
parkerconservation.co.nz

Abstract

This document outlines best practice techniques for the translocation of whiteheads (popokatea, *Mohoua albicilla*). It contains methods pertaining to the translocation process, from selecting the most appropriate time for translocation, and capturing, processing, housing, husbandry and transporting birds, through to post-release monitoring. It is intended that this information will help to increase the success of future translocations of whiteheads.

Keywords: whitehead, popokatea, *Mohoua albicilla*, translocation, best practice, New Zealand

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1. Introduction

The first translocation of whiteheads (popokatea, *Mohoua albicilla*) occurred in 1989. Since then, there have been at least 12 transfers, including multiple transfers to some sites to ensure that suitable numbers were released to increase the likelihood that a population would establish. Sites to which whiteheads have been translocated include the Hunua Ranges, Cascade Kauri Park, Tawharanui Open Sanctuary, and Tiritiri Matangi, Motuora, Rangitoto, Motutapu and Motuihe Islands (Auckland region); Cape Sanctuary (Cape Kidnappers); Maungatautari (Waikato region); and Zealandia (formerly known as Karori Wildlife Sanctuary) and Mana Island (Wellington region). Most of these sites now contain breeding populations of whiteheads, demonstrating that this species is highly amenable to the process of translocation and the establishment of new populations on predator-free islands and in isolated forest patches on the mainland where pest control is carried out (Miskelly & Powlesland 2013). However, the success of translocations to large blocks of forest in which whiteheads are able to disperse widely and where the surrounding forest away from the release site contains unmanaged mammalian predator populations (such as Cascade Kauri Park in the Waitakere Ranges and in the Hunua Ranges) has yet to be demonstrated.

The information presented in this document has been compiled from reports on four translocations of whiteheads that were carried out between 2001 and 2012 (Lovegrove 2003, 2008; Empson 2004; Asquith 2011), with additional information on the translocation of whiteheads to a variety of sites provided by K. Parker (pers. obs.). This document is one of a series of reports outlining best practice techniques for the translocation[1] of New Zealand bird species. It is intended that it will be used as an advisory document for people planning the translocation of whiteheads and/or assessing translocation proposals.

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

Confidentiality of information in this document

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

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

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

2. Animal welfare requirements

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

When handling wildlife, the animal welfare provisions of the Animal Welfare Act 1999 and its welfare codes[2] (e.g. Transport within New Zealand) must be met. Note that this best practice guideline has been produced to improve the likely success of translocations of whiteheads, 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.

3. Transfer team

While it is possible for a team that includes people with little or no experience of translocations to carry out a transfer, it is vital that the team also contains sufficient people with the necessary skills, such as capturing (mist net extraction skills—not only for the target species but also for non-target species, such as bellbirds (korimako, *Anthornis melanura*)), handling, measuring and banding, disease screening (if necessary), captive husbandry, transfer, release, and post-release monitoring. If there is a need to capture and transfer a large number (30+) of whiteheads over a few days, at least two catching teams will usually be needed, each with two to three people (including at least one experienced bird handler and preferably two, because it is not unusual to have a family group of four or more whiteheads in the net at one time). It is also important to remember that at least one member of the team will need to carry birds between the capture and processing sites, and there should be an experienced 'mist netter' at the capture site at all times. To process the birds, a processing team consisting of two to three people (including an experienced processing person to take measurements, band, etc. and someone to record data) is recommended. A captive team of one to two people is needed to look after birds that are being held in boxes or temporary aviaries.

4. Time of year for transfer

The capture and translocation of whiteheads is best attempted during the non-breeding season and once juveniles have reached sufficient foraging proficiency that there is a high likelihood of them being able to fend for themselves should they become separated from their parents during the transfer process. In whiteheads, egg laying occurs during September–December (Heather & Robertson 2005), and so late fledglings are likely to be reasonably self-sufficient by March, even though they have been observed receiving food from adults up to nine months after leaving the nest (Heather & Robertson 2005). Therefore, March–August are appropriate months for translocating whiteheads. Of ten translocations that have previously been carried out, one occurred in March, one in April, four in May, one in June, two in August and one in September.

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

5. Number of transfers

In many translocations of birds (saddlebacks (tīeke, *Philesturnus carunculatus*), robins (toutouwai, *Petroica* spp.), hihi (stitchbird, *Notiomystis cincta*)) and other animals, the survival of individuals is typically higher following the first transfer than any subsequent transfers, and this is also true for whiteheads. There was found to be a marked difference in the proportion of whiteheads that settled in Zealandia after the 2001 transfer (60%) compared with the 2002 translocation (17%) (Empson 2004), and the survival and establishment of whiteheads on Tiritiri Matangi Island was better following the first translocation than the second (75% v. 43% of 40 birds in each transfer) (Armstrong et al. 1994). There may be several reasons for this, including the proportion and age of juveniles being transferred, the presence at the release site of conspecifics (i.e. other birds of the same species) from an earlier release, better survival and greater dispersal. However, this does suggest that there is probably merit in planning to carry out a single large translocation of whiteheads (if sufficient can be captured), rather than transferring the same number of birds over two or more translocations (Empson 2004). An exception to this would be where birds are being translocated to a large block of forest where dispersal beyond a managed area is likely to be a problem.

6. Composition of transfer group

Both adult and juvenile whiteheads have been successfully translocated in the past (Lovegrove 2003, 2008; Empson 2004), and birds from both age groups have become established. Empson (2004) found that a smaller proportion of juveniles than adults became established following two translocations to Zealandia in 2001 and 2002 (43% and 12% vs. 65% and 31%, respectively). However, although this suggests that the success of translocations may be increased by transferring only adults, there are good reasons for including juveniles in transfers—for example, juveniles may be more adaptable to new habitat types and foods, less likely to exhibit homing behaviour, and often make up a significant proportion of whiteheads that are caught (20–56% of four transfers; Lovegrove 2003, 2008; Empson 2004). It is also of note that juveniles have been found to gain weight whilst held in captivity, whereas adults tend to experience no change or a decline in weight (K. Parker, pers. obs). Since weight may have an impact on whitehead survival during the first few days following their release, it would be useful to carry out further monitoring of the survival of birds weighed just prior to release.

It is important to aim for an even sex ratio in the released birds.

7. Sexing whiteheads

7.1 Appearance

Male whiteheads typically have almost pure white heads and underparts, and pale brown upperparts (Fig. 1A). Females are similarly coloured but have brown crowns and napes (Fig. 1B) (Heather & Robertson 2005; Igic et al. 2010). Males are larger and heavier than females.

Figure 1. A. Male and B. female whiteheads. *Photos: J. Heaphy, DOC*.

7.2 Measurements

Although there is some overlap in measurements between male and female whiteheads, most birds can be sexed using a combination of wing and weight measurements (Robertson et al. 1983; Empson 2004; Igic et al. 2010).

In general, male and female whiteheads have the following measurements:

Wing length male—mean = 71.5 mm (range: 67–77 mm); female—mean = 66 mm (range: 62–70 mm)

Weight: Male—mean = 18.5 g (range: 16–21 g); female—mean = 14.5 g (range: 12–19.5 g)

There may be some variation in average whitehead measurements between populations, however (e.g. Tiritiri Matangi Island vs. Hauturu/Little Barrier Island; K. Parker, unpubl data). Therefore, it is important that wing length be plotted against weight while processing whiteheads at each site in order to have a progressive tally of the numbers of each sex. Such a plot will show a clear separation between the sexes and help with classifying the birds in the overlap area (see Igic et al. 2010: Fig. 2).

7.3 DNA sexing

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

Blood samples can be useful for looking at a range of genetic and health issues—where this is required (Fig. 2). However, feather sampling is probably 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.

Figure 2. A blood sample being taken from a wing vein of a whitehead. *Photo: S. Morrison (Nature Conservancy, California)*.

Although feather plucking is more painful for the bird than blood sampling, it requires much less skill and is very low risk to the bird. Furthermore, the formation of a haematoma as a result of blood sampling is probably painful for the bird and blood sampling can occasionally compromise a bird's survival (K. McInnes, DOC, pers. comm. 2012). Therefore, feather plucking is recommended as a general field technique for cases where blood is not otherwise required. Blood quill feathers can often be found on the thighs of a bird, thus reducing the number of feathers required to collect a reliable sample.

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

8. Ageing whiteheads

Juvenile whiteheads look much like adult females. Juvenile females in their first winter can be distinguished from adult females by their fleshy rictal flanges[3] and pale grey, rather than dark grey, legs (Empson 2004; Heather & Robertson 2005). However, since a few males look like females (Igic et al. 2010), a detailed study into the use of the morphology of the rictal flanges for distinguishing between juvenile and adult females is probably required to determine its accuracy.

9. Capture

It is recommended that separate teams of people are used to catch, process and look after the birds (refer to section 3—Transfer team).

Mist nets (mesh size 30 mm) have been successfully used to capture whiteheads. Whiteheads can be attracted to the nets using playbacks of whitehead calls and song, which should ideally be recorded at the capture site so that the dialect is similar. The song should be played through speakers that are placed on both sides of a net. The speakers can be connected through a switch that allows the sound to be switched from one side to the other to attract the birds through the net area (i.e. by playing through one speaker to attract birds to that side of the net, and even almost down to the speaker itself, and then drawing them into the net by switching play to the other side). If this is not possible, one speaker can be placed centrally beneath the net, although it may be useful to camouflage the speaker and cord. Also note that 'over-playing' the calls can overexpose the birds to a point where they are no longer responsive.

Between 10 and 12 mist net sites were operated by the Zealandia team when capturing whiteheads on Kapiti Island, which resulted in 1–22 birds being caught per day (Empson 2004). By contrast, in March 2007 on Tiritiri Matangi Island (where there is a higher density of whiteheads), 22 mist nets were set at 18 different sites, resulting in 52 whiteheads being caught over two days of catching (10 hours in total) (Lovegrove 2008).

In 2011, it was found that the preferred catching sites on Tiritiri Matangi Island were in low-canopy vegetation, particularly along the tracks and ridges. If it is really windy, it is also worth trying low sets with short nets in tight bush patches. If nothing is caught after 1 hour, it is recommended that the net be moved (i.e. do not persist with a site for too long; K. Parker, pers. obs.).

10. Transfer to base for 'processing'

Catching and processing teams need to maintain close contact. If the processing team becomes overwhelmed with birds, the catching team should slow down (by closing some nets) or stop catching altogether until the processing team has caught up. If the birds are to be put in a temporary aviary after processing, catching should be stopped each day while there is still sufficient time for processing the birds and getting them into the aviary while it is still light (e.g. 4 pm in winter).

[3] Rictus (noun)—in ornithology, the gape of the bill; the cleft between the upper and the lower mandible when the mouth is open. Definition from Century Dictionary and Cyclopedia: www.wordnik.com/words/rictus (viewed 10 January 2013).

Cloth bags can be used to transport whiteheads short distances from the capture location to a central site or 'base', where people are set up to measure, band, examine and disease-screen the birds. Whiteheads should not be carried in bags for longer than 30 minutes or across difficult terrain where there is a risk of the carrier falling—birds have occasionally been injured or killed this way. There must be only one bird per bag, and the carrier must have one hand free while walking to help avoid falls that could crush the bird. Any birds that are injured or killed during a translocation should be documented, so that the process can be reviewed and translocation methods modified accordingly.

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

Each cloth bag should be labelled with the capture time, catcher/team name, location, and gender of bird, if known.

11. Processing the birds

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

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

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

When using colour band combinations, the metal band must be placed below the colour bands on the leg. This is considered best practice because metal bands are heavier than colour bands. Therefore they may increase band wear on colour bands if the metal is placed above the colour band (due to the bands constantly running up and down the legs as the birds move 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 using its toes (G. Taylor, pers. comm. 2012). Refer to the DOC banding manual (Melville 2011) for further information about banding (banding permit holders will have a copy).

A thorough disease risk assessment should have been carried out as part of the translocation proposal (following the requirements of DOC's disease risk assessment tool (hereafter referred to as DRAT) and associated disease management workbook[4]. Often this will result in a series of

[4] This is a requirement of DOC's Wildlife Health Standard Operating Procedure.

screening tests being required. A physical examination to detect signs of ill health and provide a general assessment of physical condition needs to be undertaken for all birds as part of processing. In all cases, the types of screening and diseases of concern should be specified and thorough notes taken. This is important not only when a parasite or disease has been found but also when it has not—failure to record both presence and absence makes summaries pointless and provides no opportunity for building knowledge to inform future translocations (Sutherland et al. 2010). Furthermore, there should be a clear statement about what will happen if parasites or diseases are detected. In many cases, this may simply result in re-release of the individual at the capture site; however, in other instances it may result in treatment before re-release or translocation. These decisions can often be developed through discussion with veterinary specialists using the DRAT process, or through consultation at the time of reviewing the screening results. If the latter approach is taken, always ensure either that the translocation team includes a specialist (vet) or that one is available for contact (particularly outside business hours).

In the past, screening of whiteheads has been important for identifying parasites and disease. For example, 4 of 37 whiteheads caught on Kapiti Island in 2002 had swellings, two of which were subsequently diagnosed as avian pox infections (Fig. 3); therefore, these birds were released back into the wild on Kapiti Island (Empson 2004). No bacterial infections (*Salmonella* or *Yersinia*) or blood parasites (e.g. *Plasmodium* spp.) were detected in birds screened on Tiritiri Matangi Island in 2004, nor in approximately 100 birds translocated from Tiritiri Matangi Island in 2008 or in 60 birds translocated from Hauturu/Little Barrier Island in 2009 (K. Parker, pers. obs.). Coccidia oocysts were found in 10 of 43 birds tested from Tiritiri Matangi Island in 2007, and hippoboscid flies (louse flies) were noted on four birds; however, no external lesions or injuries were seen on any of these birds (Lovegrove 2008). Of 22 whiteheads from Whirinaki that were tested in 2011 and 2012, none had bacterial infections (*Salmonella* or *Yersinia*), ectoparasites, abnormal swellings or injuries, but five tested positive for avian malaria (*Plasmodium elongatum*—which is found throughout New Zealand and does not generally cause mortality), two had *Coccidia* oocysts, and one had *Strongyle* oocysts (J. Heaphy, pers. comm. 2013).

Once processed, birds should be placed in temporary aviaries (refer to section 12—Temporary housing in aviaries) or transfer boxes (refer to section 15—Transfer box design).

Figure 3. Possible foot papilloma on a hihi (stitchbird, *Notiomystis cincta*). *Photo: J. Ewen, Zoological Society of London.*

12. Temporary housing in aviaries

With appropriate care, whiteheads awaiting transfer from the source site or being housed at the release site have been held for up to 15 days in a temporary aviary (Empson 2004). It may be necessary to hold whiteheads in an aviary for a few days while enough birds are captured for the translocation, especially when catching large numbers of birds, or when the source or release site is in a remote location. Prior to using an aviary, it is important that it is checked for any holes/gaps that a bird might squeeze through.

For the two transfers from Kapiti Island, no deaths occurred among the captive birds in 2001 transfer, but two died in 2002 (Empson 2004). The latter were juveniles, and may have had insufficient foraging skills to survive in the aviary without parents. Such rare mortality does happen even when experienced people are looking after the birds and should always be recorded. By contrast, none of 45 whiteheads held captive for 5–6 nights before release at Tawharanui Open Sanctuary died in captivity (Lovegrove 2008) and there were no deaths among the whiteheads translocated to Motuora in 2008, nor among those translocated to Maungatautari in 2009. Two deaths did occur during the translocations to Rangitoto/Motutapu/Motuihe Islands, however, due to morepork (ruru, *Ninox novaeseelandiae*) harassment (K. Parker, pers. obs.).

There has been much individual variation in weight changes recorded for whiteheads being held in captivity—some lose weight, some stay the same and others gain weight. For example, 19 of the whiteheads transferred from Tiritiri Matangi Island to Tawharanui Open Sanctuary gained weight (increases ranged from 0.5 to 4.5 g), four maintained their weight and 22 lost weight (with losses ranging from 0.5 to 5.0 g). There may be a unique dynamic in an aviary that determines weight gain/loss. In a translocation of birds from Hauturu/Little Barrier Island to three islands in the Hauraki Gulf, birds were held in four aviaries that were placed alongside each other. In three of the aviaries, birds generally gained weight; however, in the fourth they generally lost weight, despite all the aviaries being managed identically. Therefore, it may be that individual bird(s) played a role in this one aviary, somehow disturbing feeding activities. It is unlikely that this type of random dynamic could be managed and all birds were considered fit for translocation. However, severe weight loss in captivity may be indicative of an underlying disease, and so any individuals experiencing this should not be translocated (Ewen et al. 2012).

Several different types of aviaries have been used successfully in the past. On Kapiti Island, whiteheads were held in a large aviary consisting of three flights, each of which was c. 3 m × 3 m × 2.5 m high (Empson 2004). Each flight had a weatherproof dark end, with an iron roof and walls made of plywood or black polythene over wire-netting, and a light end that had netting walls and a roof that were lined on the inside with shade cloth and through which rain could enter. The walls between the flights were constructed of plywood and doors at the dark end enabled access into each flight. Live shrubs were left in situ or transplanted into the light end. Each flight contained several perches, leafy branches to provide cover and had leaf litter spread on the ground. Feeders for whiteheads were hung from the roof approximately 1.2 m off the ground, and were sited next to perches and vegetation.

On Hauturu/Little Barrier Island, small temporary aviaries that were c. 2.5 m × 1.5 m × 2 m high (12 birds per flight) and portable tunnel house aviaries (Fig. 4) that were c. 4.5 m × 2 m × 2 m high (up to 30 birds per aviary), were used (K. Parker, pers. obs.). Both types of aviaries proved suitable for housing whiteheads.

There are some disadvantages to using an aviary that is only partially roofed, however. Inevitably, a few birds will roost in an unroofed section, meaning that they will get very wet if it rains at night. Furthermore, the contents of food dishes will need to be replaced after rain and the aviary floor can get quite dirty or compacted.

Figure 4. Portable tunnel house aviaries used to house whiteheads on Hauturu/Little Barrier Island. *Photo: S. Morrison.*

On Tiritiri Matangi Island, 45 whiteheads were held in a large aviary having a single flight (Lovegrove 2008). White shade cloth lined the inside of the wire-netting roof and walls to minimise any injuries resulting from birds flying into the netting. In addition to the usual wooden perches, fresh branches of karamū (*Coprosma macrocarpa*) were secured in the aviary to provide concealed perches. A layer of leaf litter was spread over the floor of the aviary and two water dishes were placed on the litter. Foods were provided cafeteria style (Fig. 5) in individual containers (tuna tins) secured side by side along lengths of timber (100 × 25 mm) that were situated by perches. This enabled a whole set of food containers to be replaced in one go so that the time people spent in the aviary when replenishing food was kept to a minimum. When using this set up, there should be at least two feeding stations per aviary—ideally with one cafeteria at each end of the structure (positioned so there are no perches above to avoid birds defecating into them), a planter tray with mealworms at each end and a planter tray with water at each end. The cafeterias should be spaced some distance apart to prevent any aggressive birds from dominating all food at both cafeterias (Fig. 6).

Figure 5A and 5B. Cafeteria-style set up that has been used to provide foods to captive whiteheads in temporary aviaries on Tiritiri Matangi Island. *Photos: S. Morrison*.

During the entire captive period, the birds must be treated with the utmost care and consideration to help reduce their stress levels. They need to be kept in a quiet environment—loud noises and activity nearby will scare them, so make sure that people do not have loud conversations, slam doors or make other loud noises around the captured birds. If at all possible, aviaries should be sited well away from people's accommodation, and public access around them should be minimised or prevented.

Figure 6. Temporary tunnel aviary showing the various foods provided for whiteheads—two cafeterias, a dish with mealworms, a dish with water and items of fruit attached to vegetation. *Photo: K. Parker*.

Aviaries should be sited such that they are neither in constant breeze nor full sun—some screening vegetation may be needed to provide shelter from the wind and sun. Any likely local problems must also be considered. For example, on Hauturu/Little Barrier Island there was a morepork that visited the aviaries every night. The people carrying out the translocation were not aware of this on the first night there were birds in the aviary, but later suspected that it caused the death of two birds by repeatedly hitting the sides of the aviary. They tried to scare the morepork away using various methods but it was extremely persistent. They eventually found that covering the aviaries with vegetation prevented the morepork from hitting the sides and disturbing the roosting birds (K. Parker, pers. obs.). Similarly, at Maungataniwha, a falcon (kārearea, *Falco novaeseelandiae*) kept harassing whiteheads in a temporary aviary, resulting in the death of two birds—the rest were quickly transferred to Cape Sanctuary (T. Ward-Smith, Cape Sanctuary Manager, pers. comm. 2012).

12.1 Capture in the aviary on transfer day

The following method was used to capture whiteheads in the aviary during seven translocations in 2011 (e.g. the transfer of whiteheads from Tiritiri Matangi Island to Ark in the Park (Cascade Kauri Park, Waitakere Ranges); K. Parker, pers. obs.:

- On the day of catching and transfer, give the birds at least one hour of undisturbed daylight to feed.
- Have the transfer boxes well prepared in advance (refer to section 15—Transfer box design).
- Select a team of about six people—take care when choosing the people and make sure that they are very careful in the aviary. Birds sometimes go to ground so everyone needs to **watch** where they put their feet!
- Enter the aviary and starting at the end closest to the door, carefully remove all of the vegetation from the aviary, preferably in two steps (i.e. into an annex and then outside the aviary). The removal of vegetation will need to be done in stages and people should be kept at one end so that the birds can flee to the other—especially when the aviary door is open. Assign somebody by the door when it is open to 'guard' the air space.
- When all the vegetation has been removed, get all six people into the aviary. Two people will work with hand nets at one end of the aviary—taking a wall each and working together (Fig. 7). Their role is to catch the birds against the walls with the nets using a controlled swing—swinging too hard will injure or kill a bird. The other four people should wait behind the catchers with black bags at the ready.
- Place birds into the bags, and then tie them up and hang them somewhere safe, e.g. a piece of wood with nails in it can be hung up in the aviary and used for this purpose (Fig. 8).

Figure 7. Capture of whiteheads in a temporary aviary. *Photo: S. Morrison.*

- The last two to three birds will be the hardest to catch—therefore, those waiting behind the catchers may need to gently coax these birds up to the 'catching' end of the aviary.
- Once you have finished, count all the bags to make sure that all the birds have been caught. If any are missing, conduct a very careful search of the leaf litter.
- Weigh each bird and check the metal number and colour bands against the data sheet—sort out the best system for doing this smoothly without tripping over each other and do it in the aviary in case a bird escapes.
- Stick a piece of duct tape to the top of each translocation box and record each bird's bands as it is put into the box. If using hard translocation boxes (two compartments per box), place five birds in each compartment; if using pet boxes, place three in each box.

Important note: This entire process needs to be done quickly but calmly as it is very stressful for the birds and the people.

Figure 8. Bags holding captured whiteheads in a temporary aviary prior to being processed and placed into transfer boxes. *Photo: S. Morrison.*

Findings from the transfer of whiteheads to Tawharanui Open Sanctuary (Lovegrove 2008) suggest that there is no need to ensure that members of each flock or family group are kept together while in aviaries or transfer boxes. This has also been supported by the findings of Armstrong (1995) and Armstrong & Craig (1995).

13. Feeding

Ideally, the aviary should be entered three to four times on the first day to make sure that there is sufficient food; however, subsequently twice a day should be sufficient. Food changes should be predictable and involve minimal novelty for the birds, i.e. same times, and same people and number of people. Time spent in the aviary should also be minimised (one trip to collect and replace food containers rather than multiple in/out trips). For a discussion of stress and translocation practices, see Parker et al. (2012).

Water should be supplied ad libitum so that birds can drink and bathe while in the aviary. Planter dishes that are c. 300–400 mm wide and 20–40 mm deep are ideal, filled with water to a depth of 15–20 mm. The addition of a rock, part of which gently slopes into the water, will help birds to access the water for bathing and drinking.

Captive whiteheads will take a wide range of foods, from both natural and commercial sources, although live invertebrates should make up the bulk of the food provided. Mealworms are the cheapest and easiest to provide, and whiteheads feed on them readily, typically consuming about 45 per bird per day. Wax moth larvae are also readily eaten by whiteheads, but they need to be removed from their cases before being provided. It is a good idea to scatter the larvae through vegetation so that the birds can glean them (K. Parker, pers. obs.)—wax moth larvae quickly crawl out of dishes and hide.

On Kapiti Island, captive whiteheads were provided with rotten logs containing grubs. Other foods comprised mealworms, wax moth larvae, defrosted wasp larvae, maggots, saddleback cake (see Appendices 2 & 3), liquids (jam/honey mix, water), and fresh fruit (Empson 2004). In addition, they were given fresh branches of flowering and/or fruiting native plants each day. Similarly, the captive birds on Tiritiri Matangi Island were provided with mealworms, wax moth larvae, fly maggots and thawed wasp pupae (and readily ate all except the latter), as well as jam and saddleback cake (which was readily eaten, especially when moistened with jam or honey water), and orange halves and soaked raisins (taken in small amounts). Mealworms were supplied in a shallow layer of bran in several 250-mm-diameter plant pot bases on the aviary floor and some forest litter was spread over the aviary floor each day. Details for the preparation of the jam mix and saddleback cake are available in Lovegrove (2008). The whiteheads also readily fed from branches of fruiting native species (māhoe (*Melicytus ramiflorus*), karamū (*Coprosma macrocarpa*), karo (*Pittosporum crassifolium*), pōhuehue (*Muehlenbeckia complexa*)) that were supplied daily.

If native fruits are not readily available, commercially available small fruits (such as grapes, blueberries, raspberries and/or strawberries, ideally fresh and washed) could be tried; fresh apples, oranges and pears cut into cubes and distributed throughout the aviary have also been readily eaten by whiteheads (K. Parker, pers. obs.).

Complan (a nutritional food supplement) has been provided to whiteheads, but since it is a dairy-based product it is no longer advocated. The concern with dairy products is based on whether or not the birds have the ability to digest lactose. Complan has been widely used in aviculture as a component of homemade lorikeet and honeyeater diets for many years with good success in both survival and reproduction in captivity. This suggests that lactose is digestible by most species, but empirical evidence is lacking. Therefore, whilst Complan can be used safely, for

an insectivorous passerine such as the whitehead, the recommendation is to use Wombaroo insectivore mix or Wombaroo honeyeaters food in preference, as these are better aligned to the wild diets of birds in terms of nutritional content and fatty acid ratios (Brett Gartrell pers. comm., Wildbase, IVABS, Massey University).

Appendices 2 & 3 contain a feeding protocol for birds held in temporary aviaries, along with an example of food requirements and recipes. This information is based on experience from seven translocations that KP was either involved in or had an advisory role for.

14. Whitehead husbandry

Always ensure that there is at least one person on the team who is dedicated to looking after the captive whiteheads and their food supply (i.e. once the first birds are caught this person stops being part of the capture team and is not given any other jobs to do).

It is important to check that none of the birds are being regularly harassed by others and that all are feeding. However, it is recognised that this may be difficult to achieve, particularly when an aviary contains 30–40 birds. Having several branches with many twigs and leaves in the aviary helps to provide ample perches and some cover for submissive individuals to hide in. Similarly, vegetation should be placed in transfer boxes to provide refuges in which subordinate birds can hide and to make it harder for dominant birds to chase others around. This recommendation came from the translocation of whiteheads from Tiritiri Matangi Island to Tawharanui Open Sanctuary (Lovegrove 2008), during which one group of five birds did not settle while being held overnight in a box at Tawharanui; consequently, four exhausted birds were removed to individual cotton bags for the rest of the night—and all survived.

15. Transfer box design

With appropriate care, whiteheads have been held overnight in a transfer boxes (Lovegrove 2008). It is preferable to use wooden boxes with shade cloth and netting on one side rather than cardboard boxes for this purpose, as they provide better ventilation and light.

Figure 9. A cardboard cat box prepared for a whitehead transfer, with a ventilation strip inserted and a door cut into the side. *Photo: J. Ewen*.

Modified cardboard cat boxes, each containing a perch, have been used to transfer whiteheads, with three birds being transported per box (K. Parker, pers. obs.). A small door should be cut in the side at floor level to allow a bird to be placed in the box while the lid is closed, and to access containers of food and water with minimal risk of the bird escaping (Figs. 9 & 10).

Whiteheads were transferred from Tiritiri Matangi Island to Tawharanui Open Sanctuary in wooden boxes (1050 × 350 × 350 mm high) that were divided into two compartments (450 × 350 × 350 mm high), with up to five birds per compartment (Lovegrove 2008) (Fig. 11). A wooden perch was placed in each compartment, and twiggy and leafy branches were also provided as additional perches for submissive individuals and to reduce the risk of injury if there were jolts during transit. It is essential that birds have suitable secure perches in the transfer boxes—ideally, natural branches that are 20–30 mm in diameter; commercial dowel is usually too smooth and is hard for birds to grip in the smaller gauges (< 20 mm).

Figure 10. A cardboard cat box prepared for a whitehead transfer, containing two perches, vegetation and mealworms. *Photo: J. Ewen*.

Wooden transfer boxes can be reused once they are washed, sprayed with Trigene and dried in the sun. Cardboard pet boxes can also be reused provided that a thorough wipe with a wet cloth can adequately remove dirt and faeces, and the box is then sprayed with Trigene.
If cardboard boxes are heavily soiled, they should be discarded.

16. Transport

There is no need to provide water in transfer boxes for trips of short duration (< 2 hours), as it will inevitably be spilt during transportation, wetting either the birds or the inside of the box. Instead, in previous translocations, two orange halves have been wired to the inside of transfer boxes to provide hydration, along with a little sugar (K. Parker, pers. obs.). If birds are to be held in boxes for longer than two hours, then water and food should be provided. However, water and any wet food (especially honey/jam mixes) should be removed just before the birds are transported. Mealworms and wax moth larvae have also been placed on the floors of boxes in case occupants want to feed during transfer.

Figure 11. Two wooden transfer boxes prepared for a whitehead transfer, containing perches, vegetation behind the perches and food. *Photo: S. Morrison.*

Throughout the transfer, the birds should be kept in the shade and out of draughts—small boxes heat up very quickly and birds can be unintentionally killed due to hyperthermia. A cool, stable place that is away from draughts is better than a warm place. Minimise noise and vibrations as much as possible. During transportation, place the boxes on mattresses or foam rubber (e.g. camping sleeping mats) to reduce vehicle bumps and vibrations, which can stress the birds. Ensure that the boxes are secure and stable, and that ventilation holes are not covered by neighbouring boxes or other objects.

17. Release

Whiteheads should be released in the morning or by early afternoon at the latest. An early morning release gives the birds plenty of daylight hours to find food and shelter before evening.

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

When the time comes to release the birds, ensure that the boxes are facing towards a clear, uninterrupted, suitable escape route, with the releasers, spectators and any photographers **behind** the boxes. It is not appropriate to release birds in the middle of a circle of people as this means there is nowhere safe for the birds to fly to, which would be very stressful for them. If any birds fly back into the crowd, tell people to remain still.

To release the birds, simply open the boxes and let them fly out in their own time. Never try to catch a bird in a transfer box—it is very stressful and risks injury to the bird. Although it is best to let the birds fly out when they are ready to depart, it is sometimes necessary to coax a bird out, especially if there is a lot of vegetation in the transfer box in which they can hide. Check the boxes very carefully after the birds have been released to make sure that all birds have left.

18. Post-release monitoring

18.1 Purpose

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

- Will the reintroduction be successful?
- Is management needed/sufficient?
- Will supplementary translocations be needed?
- Is genetic diversity sufficient?
- Do the translocation techniques need to be refined?
- Does release site selection need to be refined?

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

The need for monitoring is related to uncertainties about the translocation. Whiteheads have been successfully translocated to several islands and discreet mainland sites (peninsulas or isolated habitat remnants), whereas translocations to mainland sites within larger contiguous unprotected habitats have been much less successful (Parker et al. 2013). Therefore, monitoring is likely to be most valuable if there is uncertainty about whether the habitat at the release site is too connected to adjacent unmanaged habitat, densities of introduced predators are too high, or habitat suitability is otherwise unclear. By contrast, if whiteheads are reintroduced to an isolated area of apparently excellent habitat with no introduced predators, post-release monitoring will be a lower priority.

Post-release monitoring can be used to determine where translocations have failed (Fig. 12), whether a different management approach would prevent failure if the species was translocated to the same site again and, if not, the feasibility of future translocations. For example, if monitoring shows that only males are present, there may be an issue with predators; or if pairs are present and breeding but all the offspring have disappeared, there is likely to be a problem with the retention and/or recruitment of juveniles.

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

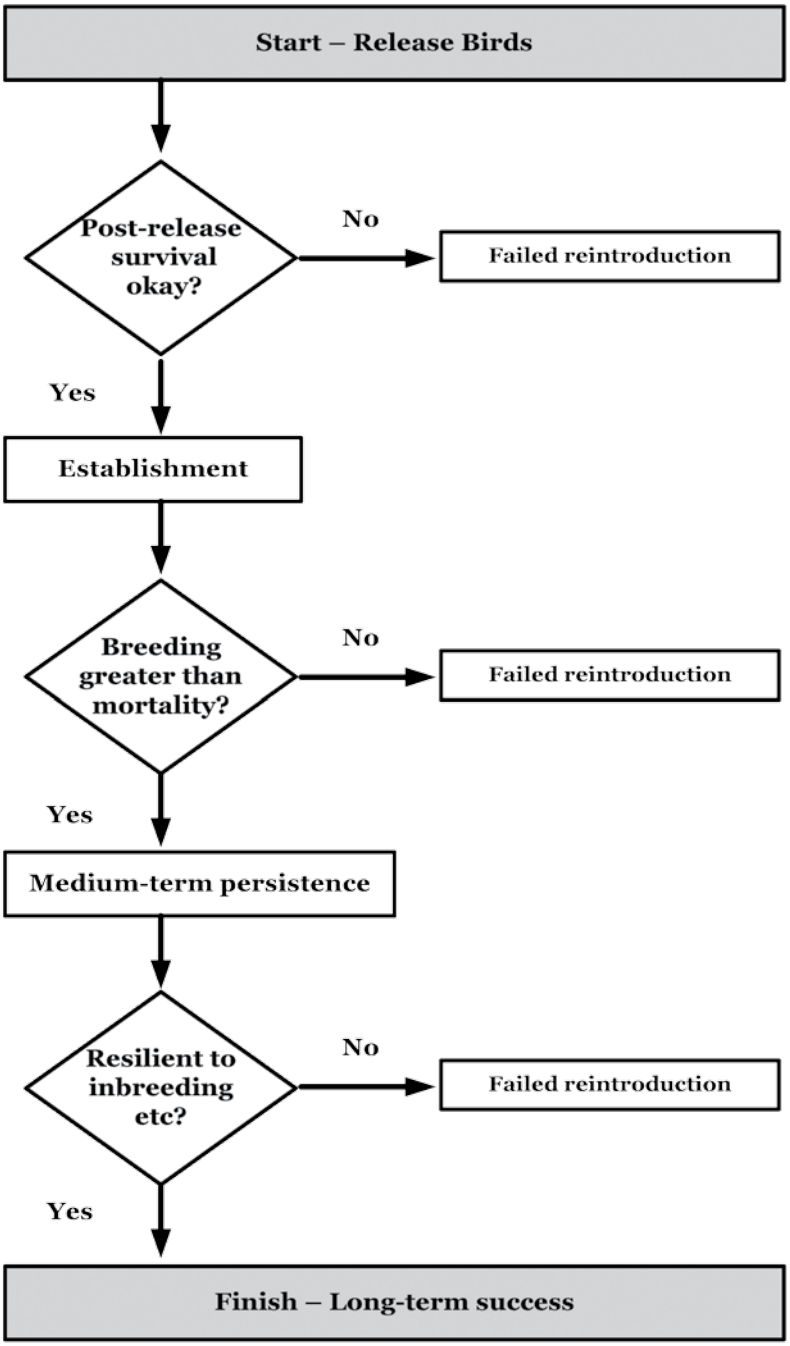

Figure 12. Determining the success or failure of a translocation (Parker et al. 2013).

18.2 Recommended monitoring

To enable suitable monitoring, released whiteheads should be individually marked (colour banded), and the same search method needs to be used consistently (e.g. search points, lines or routes). Also, search effort (time spent surveying) and timing (weekly, monthly, quarterly, pre- and post-breeding surveys) must be consistent (Parker et al. 2013). Trained observers will be required and their records need to be interpretable, as different people may be analysing the records. Ideally, monitoring records should be entered into a computer spreadsheet and at least two copies saved at different locations to prevent accidental loss.

Most whitehead translocations in recent years have followed similar monitoring regimes that have involved:

- Searching suitable habitat within the release area for the presence of released individually identifiable (colour-banded) birds (to estimate post-release survival)
- Mapping territories when pairs form (to determine post-release survival, breeding rate and recruitment)
- Monitoring nesting activities and outcomes (to determine recruitment, breeding rate and breeding success)

Post-release monitoring of this species is not easy because whiteheads tend to spend a lot of time high in the canopy and are quite active, making it difficult to read band combinations. Lure tapes can be used to attract birds for counting and reading band combinations if used infrequently. However, sound anchoring (the playing of whitehead calls and song through speakers set up in the forest where the birds are being released) did not encourage whiteheads to remain in close proximity to the speakers at Tawharanui Open Sanctuary.

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

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

19. Record keeping

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

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

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

Alongside good record keeping, reporting is also important, as this enables project managers to fully evaluate a translocation and its outcomes, and others to learn from your experience and improve the chances that future translocations will be successful. DOC's reporting instructions (Collen & Cromarty 2011a) include a reporting template, which shows all of the information that is required to produce an informative report. This document should be read in advance of the translocation, so that you are familiar with the standardised information that needs to be included in a transfer or monitoring report. In addition, record sheets that clearly list the data to be collected during the translocation should be prepared in advance, so that everyone involved in the translocation understands what information they need to record.

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

- Documenting the planned translocation (by completing DOC's translocation proposal form; Collen & Cromarty 2011b)
- Documenting release methods and conditions (using DOC's reporting instructions (Collen & Cromarty 2011a) as a guide)
- Documenting post-release monitoring (see section 18—'Post-release monitoring')
- Providing reports on the translocation using DOC's reporting instructions (Collen & Cromarty 2011a).

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Appendix 1

Details of report contributors

This document was contributed to and reviewed by the following experts with extensive experience in whitehead translocation:

Ralph Powlesland (author)—Honorary Research Associate of the Department of Conservation; former DOC scientist

Kevin Parker (author)—Conservation Scientist, Parker Conservation; member of HIHI Conservation.com and member of Motuora Restoration Society Inc.[5, 6]

Pam Cromarty—Formerly Technical Advisor Systems Improvement, and coordinator of the translocation process, National Office, DOC, Wellington[7]

John Ewen—Research Fellow, Institute of Zoology, Zoological Society of London, United Kingdom; coordinator of HIHI Conservation.com; co-chair Hihi Recovery Group[8]

Sandra Jack—Community Relations Ranger, DOC; formerly project manager for Ark in the Park, Auckland[9]

Tamsin Ward-Smith—Cape Sanctuary Manager, Cape Kidnappers, Hawke's Bay[10]

[5] For more information, refer to www.hihiconservation.com (viewed 1 April 2014)

[6] For more information, refer to www.motuora.org.nz (viewed 1 April 2014)

[7] For more information, refer to www.doc.govt.nz (viewed 1 April 2014).

[8] For more information, refer to www.zsl.org/science/ioz-staff-students/ewen,1091,AR.html (viewed 1 April 2014).

[9] For more information, refer to www.arkinthepark.org.nz/about_ark_in_the_park/contact_us (viewed 1 April 2014).

[10] For more information, refer to www.haumoana.com/pages/capesanctuary.html (viewed 1 April 2014).

Appendix 2

Feeding protocol for whiteheads being held in temporary aviaries

- Check the aviaries three to four times per day for the first 1–2 days to make sure the birds are being provided with sufficient food; subsequently, twice per day should suffice:
  - Morning feed at approximately 0930 hours
  - Afternoon feed at approximately 1530 hours
- There must be food in the aviaries at all times.
- Prepare all of the food beforehand (see Table A2.1 for food suggestions for each aviary).
- Liquid foods can be mixed in large jugs and refrigerated until required (see Appendix 3 for recipes).
- Fruit should be washed and quartered—but do not cut until just prior to feed outs.
- Wax moth larvae need to be pulled out of their cases prior to feeding out. Do not store them in small, tightly sealed containers as they quickly suffocate. They will begin to move straight away in the aviary, but the birds will find them.
- Mealworms tend to stay put in the dishes—a sieve is useful for separating them from the bran.
- All liquid food, fresh fruit and water baths should be replaced once or twice a day, depending on levels of consumption and weather. Fill the food dishes almost to the brim so that the birds can see their contents—remember, they have never seen a food dish before!
- Place all food for feed outs into buckets and carry a water bottle for the water baths. Extra buckets might be required for the dirty food dishes and old fruit.
- Keep time and people in the aviaries to an absolute minimum—each feed out should only require one person to enter and exit an aviary once.
- Enter the aviary and place all the dirty food dishes, food and fruit into buckets.
- Clean the water baths and replace the water.
- Place fresh food into the cafeterias and distribute fresh fruit evenly throughout the aviaries (secure the fruit onto vegetation by spiking it onto branches—do not leave it sitting on the cafeteria boards as it will get dirty or will quickly be knocked to the ground).
- Arrange any fresh natural fruits into secure positions that are accessible to the birds.
- Add a bag of fresh leaf litter each day, along with fern fronds, etc. as fresh forage.
- Quickly scan the aviary floor and the birds themselves, checking for any that are fluffed up, immobile or have an unkempt appearance—note the bands of these birds.
- Clean all the dirty dishes in hot soapy water and then submerse into a Napisan solution to soak. Dishes must be rinsed with fresh water after being removed from the Napisan solution.

Do not enter aviaries in between feed outs unless it is absolutely necessary and keep all other disturbance to a minimum. Many people will want to look at the birds in the aviaries, but this disturbance is unnecessary and only unsettles the birds. If people are particularly interested in seeing the birds in the aviaries, then get them to help you with the feed outs—and all the dishes afterwards!

Table A2.1. Example of the food requirements for aviaries/feed outs for whiteheads. This protocol has been used for flights containing 12–50 birds. The tin sizes and number of invertebrates vary depending on how many birds are being held.

LOCATION/AVIARY	FOOD PROVIDED AT EACH FEED OUT
Each big aviary on Tiritiri Matangi Island	• Jam mix × 2 (one in each cafeteria) • Vegetable puree × 2 (one in each cafeteria) • Fruit cake with either jam mix or honey water poured over the top × 2 (one in each cafeteria) • Invertebrates (mealworms and wax moth larvae) × 4 (two in each cafeteria) • Two planter trays with mealworms in them (preferably secured in an easy to access spot above the ground) • Water dishes for drinking and bathing × 2 • 1–2 each of a selection of fruit, e.g. apples, oranges, pears, grapes (washed and quartered or cubed, spiked on branches) • Natural fruit, if available • Fresh leaf litter and fern fronds (once per day) • Wombaroo if available (not essential for whiteheads but worth a try if you have it) × 2 (one in each cafeteria)

Appendix 3

Recipes for whitehead foods

Adapted by Kevin Parker from Empson & Booth (2007).

Jam and honey mix

Mix ¼ cup berry jam and ¼ cup honey with hot water until dissolved.

Add ½ tbsp 'Pronutro original' cereal[11] and ½ tbsp bee pollen and mix until dissolved.

Add cold water to make 500mL mix.

Pureed fruit and vegetable mix (from Pukaha/Mt Bruce)

Blend the following ripe fruit and vegetable ingredients to make a runny puree:

- ½ carrot, ⅓ apple, ⅓ pear, ¼ orange, ⅓ banana, 10 grapes, 500 g corn kernels, 50 g peas

This mix can be divided into daily portions using ice cube trays and stored in the freezer until required.

It should be very liquid when fed out, so add sugar water or the 'jam and honey mix' to the puree until it is of a sloppy consistency.

Fruit cake / saddleback cake (from Lovegrove & Veitch 1994)

Cream 200 g butter and 1 cup sugar

Add 3 eggs and beat

Add:

- 2½ cups of flour
- 2½ tsp baking powder
- 1 cup sultanas pre-soaked in boiling water

Stir well and spread into a greased baking dish / large cake tin lined with baking paper or patty pans.

Bake for 30 minutes in a moderate oven (reduce time if using patty tins).

Makes an approximately 1 kg cake.

Cut into small portions when cool.

Pour 'jam and honey mix' or sugar water over the top before feeding out.

Wombaroo lorikeet & honeyeater food (bird food for nectarivores[12])

Dissolve ½ cup Wombaroo in ½ cup warm water.

Mix until dissolved and add cold water to make up to 500 mL.

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