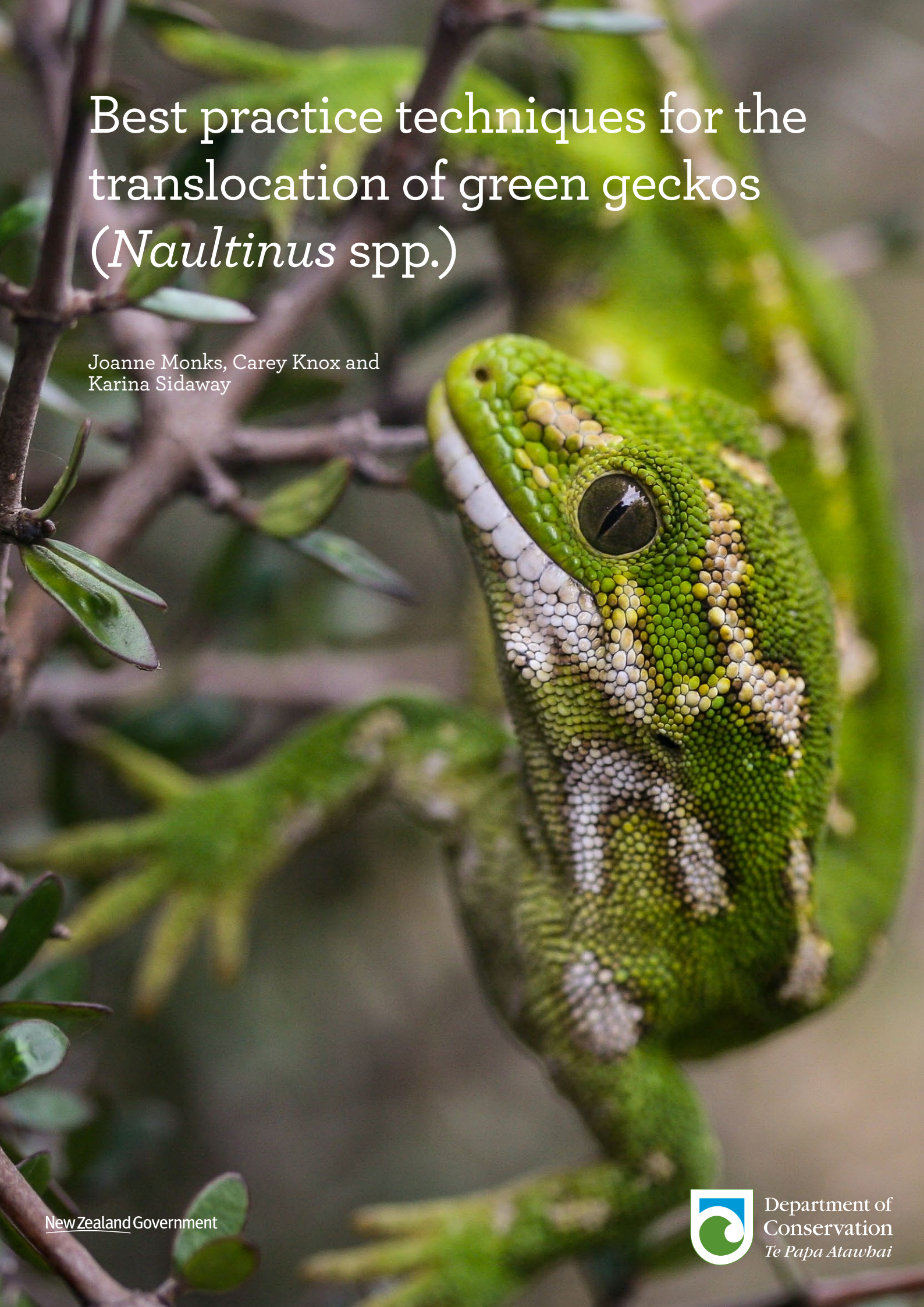
Best practice techniques for the translocation of green geckos (*Naultinus* spp.)

Joanne Monks, Carey Knox and Karina Sidaway



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A permit from the Department of Conservation is required to handle or move any native lizard.

Cover: Jewelled gecko (*Naultinus* sp.). *Photo: Carey Knox.*

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Abstract

This document details best practice techniques for the translocation of green geckos (*Naultinus* spp.). Specifically, it contains methods pertaining to temporary 'penning' to restrict dispersal of translocated geckos, with the aim of habituating animals to the release site so they will establish a breeding population. It is intended that this information will help to increase the success of future translocations of green geckos. **Penning prior to release is recommended as current best practice for translocated green geckos**, unless the habitat is isolated enough to restrict initial dispersal or penning would significantly increase the poaching risk.

Keywords: green gecko, *Naultinus*, dispersal, translocation, hard release, penning, soft release

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1. Introduction

Translocations[1] are an important tool used to conserve endangered species that face threats such as habitat degradation, predation and changing climates (Seddon et al. 2014). Success rates for herpetofauna translocations are relatively low (at approximately 40%) compared with other taxonomic groups (Germano & Bishop 2009). However, some of the apparent failures may reflect insufficient post-release monitoring or difficulties associated with monitoring cryptic species, rather than an actual failure to establish (Germano & Bishop 2009). The success of translocations depends on several factors, including ensuring that sufficient translocated individuals remain in the release area to enable a breeding population to establish (Ebrahimi & Bull 2014; Knox & Monks 2014).

The information presented in this document has been compiled from studies which evaluated the utility of penning green geckos (*Naultinus* species) to limit post-translocation dispersal (Knox & Monks 2014; Knox et al. 2017; Scott 2016). These studies identified that penning significantly reduces post-translocation dispersal of jewelled geckos, *Naultinus gemmeus* (Knox & Monks 2014; Knox et al. 2017), and the same trend is suggested for elegant geckos, *Naultinus elegans*, but data were insufficient to be conclusive for this species (Scott 2016). Therefore, the potential advantages of penning (which also includes increased ease of monitoring) may outweigh the disadvantages (e.g. cost) for green gecko translocations and may be applicable to other herpetofauna taxa.

This document focusses on penning (refer to section 2 for nomenclature), one of many considerations that must be addressed when planning a translocation, and therefore should be used in conjunction with the Department of Conservation's translocation procedures and guidelines (http://www.doc.govt.nz/get-involved/run-a-project/translocation/). It is intended that this document will be used as an advisory resource for people planning the translocation of green geckos and/or assessing translocation proposals, and the information provided in it may also be appropriate for other herpetofauna translocations.

Further details on the background and expertise of the authors of this report are available in Appendix 1.

Confidentiality of information in this document:

- 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.
- 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 Policy 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. Nomenclature

Release strategies in animal translocations are often categorised as being 'hard' or 'soft'. However, these terms can sometimes be misleading. 'Soft release' was originally used to describe procedures aimed at easing the transition of animals to the release site (such as provision of food, water and/or shelter to reduce starvation or predation; e.g. Wanless et al. 2002; Hardman & Moro 2006); whereas 'hard release' refered to the release of animals without measures aimed at assisting their transition to living at the new location. However, some researchers have associated soft release exclusively with temporary confinement of animals in enclosures ('penning'), irrespective of whether it is hypothesised to aid their transition to the new place (e.g. Treglia 2010). This leads to confusion as to whether a release which uses a pen or aviary, but does not include any other assistance (e.g. supplementary food or nest boxes), should be termed a 'hard' or 'soft' release. To avoid this confusion, this document uses the explicit terms 'penning' or 'penned release' to describe a release strategy involving temporary confinement of animals in an enclosure to restrict their initial dispersal, but does not involve provision of food, water and/or shelter.

3. Animal welfare requirements

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 green geckos, and thus promotes a high level of care of the lizards and a consideration of general animal welfare. However, it does not attempt to address each of the minimum standards listed in welfare codes and does not address all translocation considerations.

4. Suitable habitat and stocking density

Translocation success is also influenced by the area of suitable habitat available at the release site and the numbers of individuals released. Wherever possible, the pen should be set up to encompass suitable, already well-established native habitats that are complex (rather than monoculture). Primary habitats for green geckos include dense, small-leaved *Coprosma* spp. shrubs (or other structurally similar divaricating shrubs), dense kānuka (*Kunzea* spp.), mānuka (*Leptospermum scoparium*), tōtara (*Podocarpus* spp.) and large tussocks. Native vines may also improve habitat by adding additional structural complexity and food sources. An already established habitat should be used; however, supplementary planting could be undertaken to enhance the habitat. If supplementary planting is done, it is preferable that plant species appropriate to the geographical area or region are used.

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

Ground-level refugia such as rock outcrops, dense low-growing shrubs and large tussocks help geckos tolerate climatic extremes (such as hard frosts or extreme heat). Supplementary refugia can be added if the release site lacks such habitat, and are particularly important if the release site is inland or at high altitude. Examples of supplementary refugia include deep loose rock piles, piles of scrub or slash and/or clumps of dense rank grass around the base of shrubs. Ensure the orientation of the pen provides sufficient sunny edges for basking.

The height of the vegetation is a consideration for post-release monitoring. Locating and monitoring green geckos (either by spotting individuals basking in sunlit foliage by day or via spotlighting at night) is easier in vegetation less than 3.5 m in height. A site sheltered from strong winds is preferable, so the wider environment should also be considered when deciding on the location of the release site.

Generally, the population density of geckos when released into a translocation site should be no greater than that of the source population. However, if the population density of the source population is low, the densities of the species at other sites can be used to inform the stocking rate. The size of the area penned will depend on the quality of the enclosed habitat, location, species translocated, and number of individuals, but should be large enough to easily support the number of geckos within (at least for a period of 4 months). It should be surrounded by additional suitable habitat to allow for gradual population expansion and growth after the pen is removed. Knox & Monks (2014) used a pen that was 10–15 m wide by 55–60 m long for a translocation of 42 geckos (24 adults), which equated to around 27 m^2 per adult gecko. In general, larger is probably better than smaller, but this needs to be weighed up against the cost of materials and time spent in constructing the pen. The population density of geckos within the pen will frequently be higher than that at the source site, as the reason for the translocation is often to establish the species at a safer location (e.g. because the source population is being affected by introduced predators and/or poachers, so its numbers may be less than the carrying capacity of the habitat). Ideally, introduced predators should either be absent, controlled or eradicated from the release area. It is also important to consider whether the species to be translocated is already present in the pen area or surroundings, as this will influence the number of geckos released (to ensure the overall density is not too high for the release site).

5. Construction of pens

The following information details the methodology for constructing temporary pens to limit post-translocation dispersal of green geckos. The following is a proven method for green geckos; however, other similar materials may also be suitable. More-expensive fencing designs are available in other countries, but it is unlikely that these are required here. If poaching is a concern, careful location of the release site and concealment through camouflage will be important considerations.

1. To construct the pen you will need a spade, plenty of warratahs (steel fence posts, also called T-, Y- and star posts), a roll of fencing wire, several rolls of heavy-duty waterproof tape (such as AG tape from CRT) and a roll of 1-m-wide black polythene (such as this: black polythene rolls)
2. Pen fences should be made of single- or double-layered heavy-duty polythene and, when completed, be at least 50 cm high, with a buried 'skirt' inside the pen that extends 15–20 cm towards the pen's centre. The skirt should be buried to at least 20 cm below ground level.
3. Clear an approximately 2-m-wide swath of ground around the selected pen area to ground level (so that there is approximately 1 m of cleared ground either side of the fence; however, if over-hanging trees are present, a greater distance may be required to prevent geckos

from jumping out of the pen). Trim back vegetation inside the pen area so that geckos will not be able to use it to launch themselves from.

4. Dig a trench around the interior perimeter of the proposed fence line approximately 40 cm wide and 20 cm deep. Keep the excavated soil inside the pen area so it can be used to backfill over the skirt once the fence is installed. Alternatively, if a trench cannot be dug around the fence perimeter, crusher dust (fine gravel capable of firming to a hard, concrete-like state with rain) can be used to cover the skirt and help secure the posts.
5. Hammer in warratahs at 2–3 m intervals around the entire fence perimeter just on the 'outside' of the trench.
6. String a length of fencing wire right around the pen perimeter through the holes in the warratahs at a height of about 45–50 cm above ground level and pull this wire as tight as possible. It may be better to use several lengths of wire around the top of the fence to ensure it is kept tight at a consistent 45–50 cm height.
7. Lay the roll of polythene in the trench and roll it out around the perimeter of the pen. Put the soil back into the trench on top of 30–40 cm of the polythene to hold it in place (this is the 'skirt' part of the polythene that extends horizontally below ground level to stop geckos burrowing out of the pen; Fig. 1).
8. Pull the remaining approx. 50 cm of the polythene sheet up and just over the top of the perimeter wire and tape it down firmly on the other side (do this around the entire pen). This should form a rigid vertical wall that the geckos cannot climb (see Fig. 2). Taping the polythene down over the wire securely will help ensure that the pen stays intact through strong winds and other extreme weather such as snowfall. If extreme weather is of particular concern, ensure that two layers of polythene are used and add an additional wire around the outside perimeter of the pen at about 25 cm above ground level to help keep the fence rigid in strong winds. Ideally, pens should be constructed with a single length of polythene, so that only one join is needed. Any joins should be taped neatly with polythene tape, trying to avoid creases that geckos could use to gain purchase on to climb out of the pen.

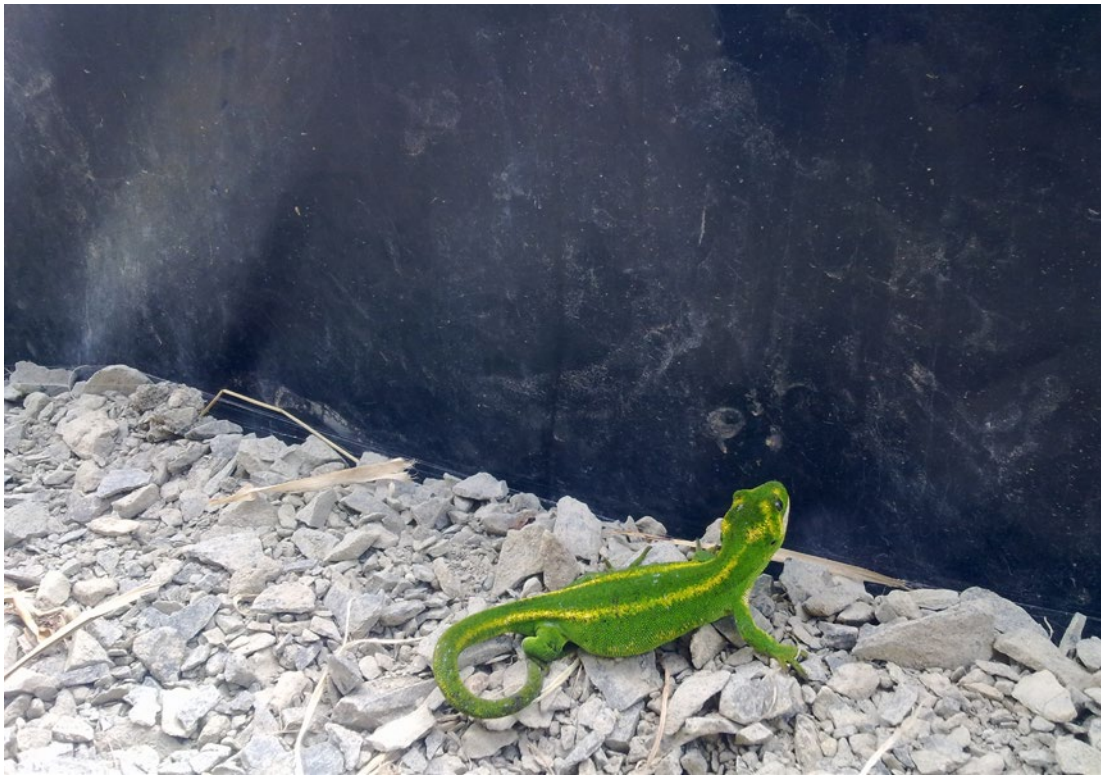

Figure 1. Jewelled gecko (*Naultinus gemmeus*) on back-filled soil over plastic skirt inside a pen. Note the polythene fence constructed without folds or other irregularities which could assist lizards to climb over it. *Photo: Carey Knox.*

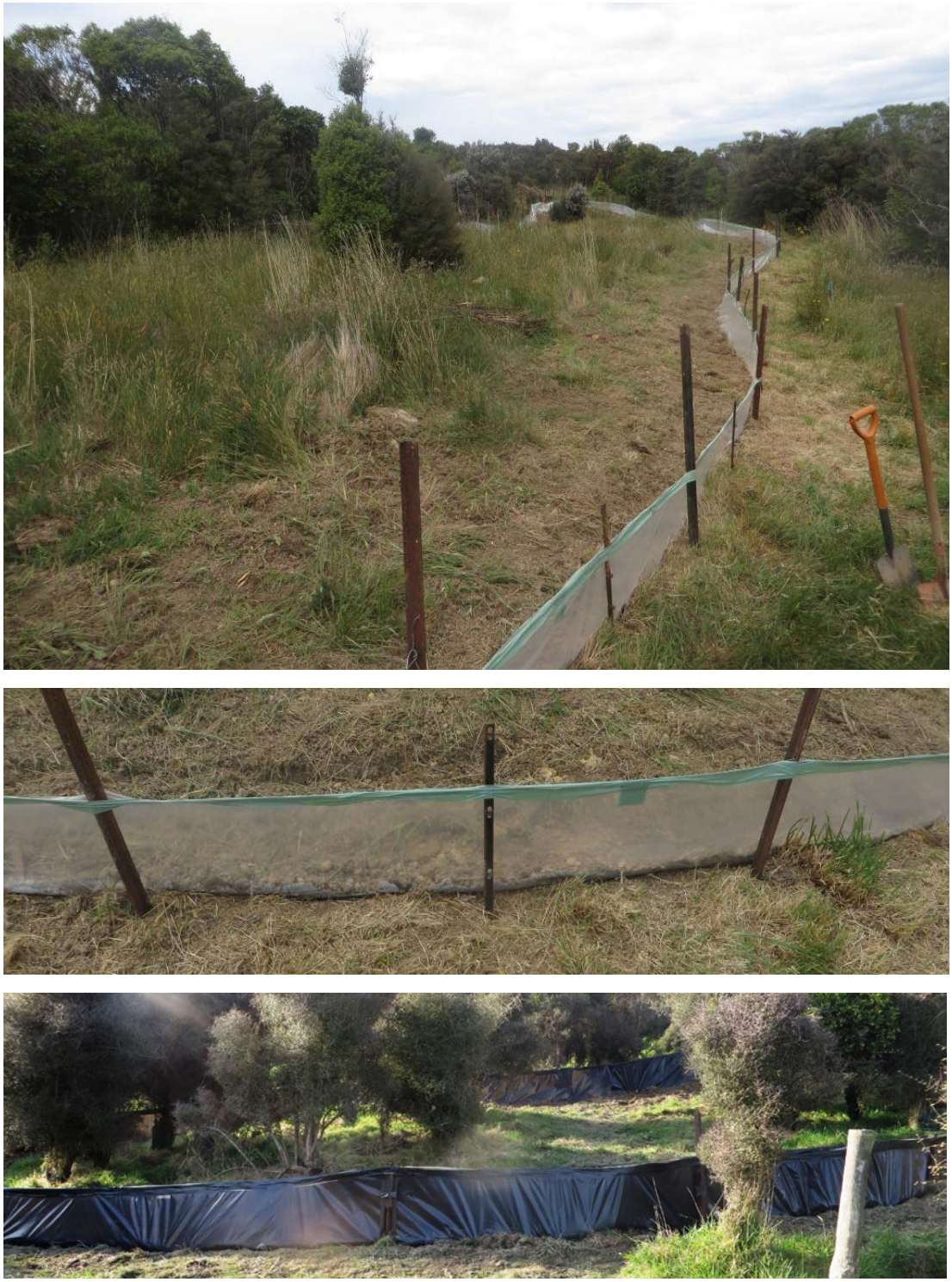

Figure 2. Examples of pens used for jewelled geckos (*Naultinus gemmeus*) or green skinks (*Oligosoma chloronoton*). *Photos: Carey Knox*.

9. Fill in the trench completely, pack down the soil and fill any holes in the ground that geckos could burrow into.
10. Carefully examine the entire fence looking for any weaknesses and fix them as best you can. Make sure geckos cannot get purchase on the warratahs or pieces of tape (you can lean the warratahs in towards the middle of the pen slightly so that the polythene drapes slightly away from them, or tape small pieces of foam to the warratahs to prevent them from forming a hard edge against the polythene).

11. Check on the structure of the fence regularly after translocation to ensure no defects appear and that it is holding up to the weather. Fix any defects with AG tape. Two-weekly or one-monthly checks should be sufficient and this could be tied in with the post-release monitoring schedule.
12. If poaching is a concern, camouflage will be required. Examples include using green polythene instead of black; using weedy scrub/slash (e.g. gorse) piled in front of the pen (but not close enough for geckos to use it as a means of escape) in any areas close to public access/tracks.

6. Length of time geckos need to be penned prior to release and seasonal timing of release

At the time of writing this document it was uncertain how long (both optimal and minimum times) geckos would need to be penned at release sites. However, Knox et al. (2017) found that mean dispersal distances of geckos were similar for individuals released after 4 months or 9 months. Until research demonstrates otherwise, geckos should be penned at their release sites for a minimum of 4 months, after which time the fence should be removed.

Although geckos generally move less during winter due to cooler temperatures, Knox et al. (2017) found that mean dispersal distances were not influenced by season. Their research shows that hard-released geckos dispersed significantly more than soft-released (penned) geckos during winter. Therefore, cooler temperatures should not be used as a reason to avoid using the penning technique during green gecko translocations.

7. Situations when penning may not be necessary or advised

Although penning is the best practice for release of translocated green geckos, there may be some situations where there is a natural barrier and penning is therefore not necessary. One such situation would be when the release site is onto a small island that is the correct size for the population density of the translocated geckos. Another situation would be when the release site is a discrete patch of suitable habitat surrounded by unsuitable habitat that the geckos are very unlikely to disperse through. Unsuitable habitat could include a substantial area of very short (pasture) grass or scree. In a study investigating microhabitat use by *Naultinus manukanus*, Hare et al. (2007) found areas of introduced pasture grasses were not used as habitat by this species and observations of jewelled geckos on Otago Peninsula also support this finding (Knox 2010). Geckos may disperse across pasture grasses or other suboptimal habitats, but usually only small distances (i.e. <50 m), and larger distances across pasture grass provide a strong deterrent to dispersal, most likely because of predation risk and the unattractiveness of the pasture as habitat.

Some green gecko species are in high demand by poachers. If release sites are visible to the public and cannot be adequately concealed (see section 4 (point 12) above) penning would not be advised.

When planning a translocation of green geckos in the absence of penning, well-supported justifications must be provided to explain this decision.

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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 herpetofauna translocation:

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