National Kiwi Translocation Guidelines 2021

Developed by the Kiwi Recovery Group

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Background

Translocations, which are defined as the human-mediated movement of living organisms from one area with release in another, are covered by the International Union for Conservation of Nature (IUCN) Reintroduction Guidelines (IUCN 2013). These guidelines state that a translocation must be intended to yield a measurable conservation benefit at the levels of a population, species or ecosystem, and not only provide benefit to translocated individuals.

For kiwi, translocations have taken place for the genetic management of isolated populations, and the restoration or rapid increase of kiwi numbers at sites where natural re-population would be impossible, difficult or likely to lead to genetic issues in a severely bottle-necked population. Translocations are a critical component of other kiwi recovery tools, such as Operation Nest Egg and kōhanga kiwi. Successful translocations of kiwi are those which are well planned and in context with other translocations and regional taxon plans.

The current Kiwi Recovery Plan identifies the need to develop national kiwi translocation guidelines to ensure that translocations are successfully used to achieve kiwi recovery aims (Germano et al. 2019).

Purpose of these guidelines

This document provides a framework that allows for a consistent approach to decision-makers for assessing the value of a proposed translocation. It helps local Districts and decision-makers have clarity on what considerations are needed to increase the chances of a successful translocation.

It includes principles and criteria to help strategic translocation planning at a regional level.

It is not a document intended for being the guidelines for community groups, as it can be communicated in a more effective way. There is work underway (in 2021) to develop a dedicated community guideline resource.

We acknowledge that as we continue to learn about what works and what doesn't, these guidelines may change to reflect new information and ensure it remains fit-for-purpose.

Note that as per DOC's Translocation SOP, all translocations should seek the view of the relevant Recovery Group. The Kiwi Recovery Group can therefore provide further guidance as part of that process.

National kiwi recovery context

The Kiwi Recovery Plan has been framed around some key principles that underpin the strategy. Within the translocation context:

Whaipainga pūnaha hauropi—Maximisation of ecosystem benefits

Kiwi recovery will, wherever possible, focus on gaining maximum benefits for the wider ecosystem (predator control).

Whakaoranga kaha—Strong recovery

Survival alone is not enough; all kiwi species will grow by at least 5% per annum.

Nohoanga tūturu—*In situ* management

Kiwi will be managed within their natural range or, if outside this range, with the overall aim of restoring them to their natural range in the wild.

Kanorau mātai iranga–Genetic diversity

The genetic diversity and distribution of each species or evolutionary significant unit will be maintained or enhanced as much as is feasible.

Oranga kararehe—Animal welfare

The welfare of the birds will be a primary consideration in all aspects of kiwi recovery.

Kaitiakitanga—Guardianship

Collectively, work will be undertaken to protect the environment, knowledge and resources required to reverse the decline of kiwi populations.

Considering the above, *in situ* management through predator control is considered the most effective way to achieve kiwi population recovery. The priority remains with managing/protecting existing population strongholds, with translocation, kōhanga and ONE viewed as support mechanisms. Translocations have been successfully used in this context.

What does translocation success look like?

There is ongoing scientific debate around how translocation success should be defined and measured. Translocations have different milestones, often overlapping. Success can be measured from transfer, initial survival of released birds, evidence of reproduction and population growth.

This is how we think of success:

Re-introduction

Short-term (Transfer/Survival/Reproduction): Approximately 40 founders[1] survive to contribute offspring to the new population. The founders have a close-to-even sex ratio. They are not known to be closely related to each other. Risks affecting mortality are clearly identified and are being managed.

[1]The number of 40 founders is based on modelling undertaken by Weiser et al. 2013 to achieve 90% retention of rare alleles. Although the model does allow some loss of founders from death or dispersal, the aim should be to have 40 founders breeding to maximise genetic diversity. Fewer breeders will mean lower diversity, although the translocation itself may be considered a success. Supplementation should be planned for.

Medium-term (Population growth): After ten years a population has established and is found to be increasing through call counts or dog survey as an indication that recruitment is greater than adult loss. New genetic diversity has been introduced at a rate of 1 new founder every 2 years (Weiser et. al 2013). Ideally a growth rate of at least 5%[2] is achieved. Where there is close-order monitoring, survival rate of at least 94% (Kaplan-Meier) for adults is needed to ensure a lifespan of approximately 17 years (just over half of what you would normally expect), which is needed to have confidence in population growth.

Long-term (Viable population): After 30 years the population is still growing if it has not reached carrying capacity, and genetic diversity is high.

Supplementation

Short-term: High survival rate and retention of new birds into the population.

Medium-term: Birds have settled within the protected area and are known through initial monitoring to be successfully contributing offspring to the population. The population is growing, ideally at 5% per annum or higher.

Long-term: After 30 years the population is still growing if it has not reached carrying capacity, and genetic diversity is high.

Goal

Where translocations are undertaken, it can be shown that they have supported the following kiwi recovery objectives:

- To grow all kiwi species/taxa by 2% per annum
- To restore kiwi to their former range
- Maintain genetic diversity

and that they are consistent with relevant taxon or species plans.

Translocation principles for kiwi

Whaipainga pūnaha hauropi—Maximisation of ecosystem/conservation benefits

Any proposed species translocation should be justified by identifying a conservation benefit and weighing those benefits against risks/cost. Part of the consideration may include whether alternative actions are appropriate and/or more cost effective e.g. kiwi are likely to disperse to the site naturally within the next two to three years. Would investing in increasing predator control to link with other sites result in kiwi establishing too?

When considering supplementation, consider how many birds are present already, and whether supplementation is needed to achieve the outcomes, or with adequate management the population can recover naturally. If supplementation occurs, only release enough birds to reach half the

[2] Whangarei and Moehau Kiwi Sanctuaries relied on trapping as their main protection, with intermittent 1080 operations. Whangarei was modelled to be growing at 8.6% per annum, and Moehau at 11.3% growth per annum (Robertson & deMonchy 2012), demonstrating what can be achieved once the population is established. Whangarei Kiwi Sanctuary was subject to dogs impacting the sub-adult/adult birds (as a proxy to ferret impact in ferret prone areas), reducing survival rate to 92.5%. However, productivity in Northland is much higher than seen in other areas of the country, thereby offsetting the reduced adult survival rate. Aiming for a moderate 5% annual growth rate can take into account areas where adult losses may occur, and offsets losses in unmanaged kiwi populations to achieve a 2% growth at a regional level.

estimate carrying capacity for the site (refer to Appendix 2), keeping in mind genetic principles (not swamping local genes). This guideline is to ensure we do not over-populate a site.

When planning for translocations at a taxon level, prioritise completing unfinished translocations over starting new ones.

Any source population should be able to sustain removal of individuals, except in the case of an emergency or rescue removal (IUCN 2013).

Whakaoranga kaha—Strong recovery

The release site needs to ensure birds won't just survive there, they need to thrive long-term to add to kiwi recovery. This includes consideration about size, connectivity and surrounding landscape.

Prioritise translocations to sites where greatest population gains can be made.

Nohoanga tūturu—In situ management

Transfer birds only within historical distribution of a species/taxon as outlined in the KRP, unless it is critical for the conservation of the species e.g. LSK on offshore islands outside of their range.

Kanorau mātai iranga–Genetic diversity

Genetic diversity must be maintained or improved for new and old introductions.

New introductions must not negatively affect existing diversity and genetic structure of existing taxa, therefore do not move birds between different taxa.

Avoid translocating birds across the extreme range of a taxon e.g. in the eastern region between the Ruahine and Whakatane

Translocations can be a useful tool to increase genetic diversity in small, isolated populations. However, do not flood the genetic representation of small, remnant populations with new genes. This will be context dependent, and require specific advice on how to minimise this risk.

Avoid using populations that have already gone through a bottleneck (e.g. established from a previous translocation) as a sole source site for new translocations – additional source sites will be required. We acknowledge for some species/taxa this may no longer be possible e.g. LSK, rowi and Haast tokoeka.

Oranga kararehe—Animal welfare

Welfare of birds must be a primary consideration. Every effort should be made to reduce stress or suffering throughout the translocation, from catching, transfer, release to ensuring that the habitat gives kiwi the ability to thrive.

Where a high degree of uncertainty remains or it is not possible to assess reliably that a conservation introduction presents low risks, it should not proceed, and alternative conservation solutions should be sought (IUCN 2013).

Kaitiakitanga—Guardianship

All translocations must involve tangata whenua as partners in kiwi recovery.

People involvement in kiwi recovery operations must be long-term and committed to protection of the new population and their habitat across generations.

Working together to realise synergies and opportunities is essential.

Situations Appropriate for Translocation

(as taken from the draft Northland translocation strategy)

The following indicative scenarios are considered appropriate circumstances for translocation of kiwi. At the time of writing this strategy (2020), situations appropriate for translocation are:

- To supplement existing kiwi populations to improve a population's genetic diversity;
- To boost a population to become viable, and take full advantage of an investment in trapping or other integrated, Best Practice predator control;
- To create crèche or kōhanga sites;
- To expand the current range of kiwi by returning them to managed areas where they have historically been present but are unable to recolonise through natural dispersal, or where natural dispersal is likely to take decades;
- Where deemed appropriate by DOC in consultation with tangata whenua and in special circumstances only, to salvage landlocked individuals, or in emergency situations to rescue kiwi where risk/threat profiles have changed
- When injured and rehabilitated kiwi come from an unsafe source site and require an appropriately secure release site.

Situations Inappropriate for Translocation

(as taken from the draft Northland translocation strategy)

Some situations do not align with current translocation guidelines. At the time of writing these guidelines (2020), situations inappropriate for translocation include:

- Into unmanaged release sites where predators are not adequately controlled, particularly ferrets and dogs;
- Into small or fragmented sites with no other suitable kiwi habitat nearby;
- Where other management tools would be more efficient and effective means of achieving broader biodiversity gains, e.g., integrated pest control along kiwi corridors;
- An agreement between groups where kiwi are sourced from one site for good conservation reasons, but only if kiwi (either offspring or other) should be returned to the original site as a proviso of the transfer. In other words, the transfer is more about people wanting to swap birds rather than ensuring the translocation is needed for kiwi recovery.
- Motivations such as attracting funding or public profile, or moving organisms to facilitate economic development are not regarded as for conservation purposes (IUCN 2013).
- When the primary motivation is to move kiwi out of an area to allow infrastructure, building or land development to occur;
- During forestry operations. Adult birds are able to move out of the way of forestry work and appear to adapt to establishing new territories in neighbouring areas.

- Where a genetically robust population is already present and population is growing at 2% or more through predator control – there may be other sites that have a higher need to for birds available for transfer.

How to increase translocation success

The priority is always around maintaining existing and viable populations, rather than allowing these to decline while we attempt new introductions. Translocations can however play a key role in achieving recovery goals.

Release site suitability

Habitat size

The effective habitat area will depend on the size, shape and isolation of individual patches if the habitat is fragmented. For some taxa, habitat quality and proximity/connectivity to other sites may be more important determinants of habitat suitability than habitat size (IUCN 2013). The shape of the site will also affect how effective predator control can be – long and narrow will have higher incursion rates than large and round.

We are now steering away from a minimum habitat size and assessing proposed sites based on their ability to support around 100 pairs long-term, including smaller sites where dispersal of non-translocated individuals in and out of the area connects the population as part of a larger area. See Appendix 2 for average expected territory sizes for different types of kiwi.

The size of the protected area should be large enough to allow for the safe movement of newly released birds. Natural dispersal of newly translocated kiwi into adjacent, unsafe areas can cause a translocation to fail.

Releases should rather be towards the centre of the protected area rather than the edges, maximising protection of kiwi and reducing the risk of kiwi dispersing directly out of the project area.

Supplementation

If a population is already present, the guidelines are to release birds until the estimated half carrying capacity has been reached. This means an estimate of the current number of birds present is needed. This is a rough estimate only, and the amount of effort that goes towards estimating the current number of birds does not need to be onerous.

As per Best Practice, at least 6 hours of listening at each site should reveal the presence of most (c. 90%) resident males and many (c. 70%) resident females within c. 500 m of the listening site, though the detection range will vary depending on the topography. Even then, it is possible that some kiwi may go undetected, especially where the listening site is at the edge of the home range of a local bird – counts do not need to continue night after night once you have detected that kiwi are present. Follow the Kiwi Best Practice Manual method described on pg52 onwards.

In large areas, it's not feasible to cover the entire area, and there will be a need to do some extrapolation. A minimum of 10 call count stations should be undertaken to get an estimate of number of kiwi, and then extrapolate across the whole area. Although kiwi densities are not uniform, this should be sufficient for a rough estimate.

Dogs could be used if a group wanted to get a more exact estimate, but it is not a requirement for this exercise.

Food availability
A common tool for ensuring there is enough food available is undertaking soil samples and assessing invertebrate presence, abundance and diversity. Generally:

- Where kiwi are nearby and translocations are into present range of kiwi it is not required to do invertebrate assessments unless the soil type is significantly different from the surrounding areas.
- Where kiwi are absent but were abundant in the last 50 years invertebrate assessments are not required
- Where kiwi are to be translocated into areas they have not been present in historic times (~100 years) or had been in areas that have not had abundant densities, invertebrate sampling and habitat assessment is required.

This information will help guide whether there is a welfare risk to introduced kiwi to the site, or whether kiwi may be able to be successful there albeit at low densities.

There is a need to collate this information, so that we can develop better comparisons of what good or bad kiwi habitat looks like. Therefore all invert sample information should be sent to the Kiwi Recovery Group Leader.

Future habitat suitability
The occurrence and severity of episodic or unpredictable events that are extreme and adverse for the species should be assessed (IUCN 2013). This includes making sure that the climate at the destination site will be suitable for the foreseeable future and planning for any predicted changes. Any considered release site should include reassurance that its climate is predicted to remain suitable for kiwi for long enough to achieve the desired conservation benefit, acknowledging the uncertainties inherent in climate projections.

We know that drought events can have a significant impact on kiwi e.g. significant little spotted kiwi declines noted on Tiritiri Matangi and Red Mercury after a severe drought (Robertson et al. 2019a & b). This is modelled to increase in parts of New Zealand (Ministry for the Environment 2016). Drought frequency and intensity is projected to increase in magnitude in most areas of the country, except for Taranaki-Manawatu, West Coast and Southland. The strongest increases are observed over the northern and eastern North Island and along the eastern side of the Southern Alps, especially later in the century under the highest emissions scenario. Note that anecdotally, very few kiwi exists in areas that have less than 1200mm of rain annually (pers comm. H Robertson 2019).

Where it is already very dry it will be necessary to take this into account - translocations as a tool to establishing populations is a long-term commitment into the future.

The release site and essential habitat for kiwi should be secure from incompatible land-use change e.g. vegetation clearance, which could result in the translocation to fail, or threaten the population's viability long-term. Therefore, a conservation covenant or written agreement needs to be in place to ensure kiwi are protected long-term.

<u>Threat management</u>
There should be strong evidence that the threat(s) that caused any previous extinction or decline have been correctly identified and removed or sufficiently reduced (IUCN 2013). For kiwi, threats that <u>must</u> be managed include:

- Stoats
- Ferrets where known to be present
- Dogs where they are a major impact

Threats that may need to be considered depending on site are:

- Cats
- Rats, pigs and possums as competitors
- Habitat loss
- Vehicle strike
- Rabbits in the wider landscape which attract ferrets

Releasing kiwi near urban areas increases risk to kiwi from dogs and vehicle strikes. There are three parts to consider when thinking about dogs:

1. How to protect kiwi at the release site from dogs e.g. no dogs allowed, local dogs kept indoors or secured, kiwi avoidance training etc.
2. Response plan if a kiwi is found killed and how this will be managed
3. If an urban area is within 5km of release site, protect wandering kiwi from dogs outside of the release site e.g. strong social process with the wider community and evidence of support for keeping dogs controlled, kiwi avoidance training

Pest control programme based on best practice management of pests and predators must be implemented and monitored on site for at least three years before kiwi are released. Predator control plans and trap results should be reviewed by the Threats Advisory team to ensure that a site fulfils DOC Best Practice and incorporates the current understanding of effective management (particularly important where ferrets are present).

We acknowledge it is currently difficult to measure the efficacy of a pest control regime to protect kiwi using conventional indices such as tracking tunnels. The purpose of the three-year timeframe is to:

- Establish a measure of the longer-term commitment and sustainability of the group
- reduce the resident predator populations
- 'fine tune' the predator control work so that it is optimised for the site, in other words it gives groups time to work out the best and most practical trap checking/luring and toxin regime for their site

There may be consideration for reducing this timeframe if three-yearly 1080 is in place for the foreseeable future OR it can be clearly demonstrated that the significant predators of kiwi are at levels low enough that they will not impact on the establishment and persistence of the population.

There will be periods where translocations have a higher risk of failing than others e.g. during beech masts events, or when rabbit numbers indicate that higher numbers of ferrets may be due. In these instances, ensure that the translocation is delayed until the high-risk has passed. Although such events will occur again, the initial few years when a population becomes established is the most crucial.

Note that although the minimum habitat size can vary, the predator control needs to protect the whole mosaic of possible habitat, including the unsuitable habitat in between the suitable habitat patches with sufficient buffers around.

Genetic diversity

Founder selection should aim to provide adequate genetic diversity. Based on genetic diversity considerations, the optimum number of founders the KRG recommends for translocation is 40 sub-adult/adult birds that are not known to be related, transferred over a short period – 2 to 3 years.

The ideal is to successfully add 1-2 additional unrelated founders every generation (10-20 years) to isolated populations to maintain its genetic diversity. The odds of translocation success increase with the number of individual birds released, but this needs to be balanced against impacts on source populations.

Where genetic issues are identified as being critical to the success of a translocation, monitoring should be used to assess genetic diversity in establishing populations or the effects of reinforcement or other management (IUCN 2013). This is particularly important for isolated or fenced populations where natural migration is unlikely. See the Monitoring section for more detail.

Animal welfare

To guard against injury or death of kiwi during capture, transportation or release; Best Practice should be followed at all times to ensure the welfare of the birds.

There is an expectation that groups have the right skill, or easy access to professional advice and handlers before the kiwi arrive.

An exit strategy should be an integral part of any translocation plan. Having a strategy in place allows an orderly and justifiable exit if the welfare of the birds are compromised either during the transfer itself, or evidence is suggesting that the translocation is failing.

Monitoring

Ultimately, we want to understand if the translocation is a success.

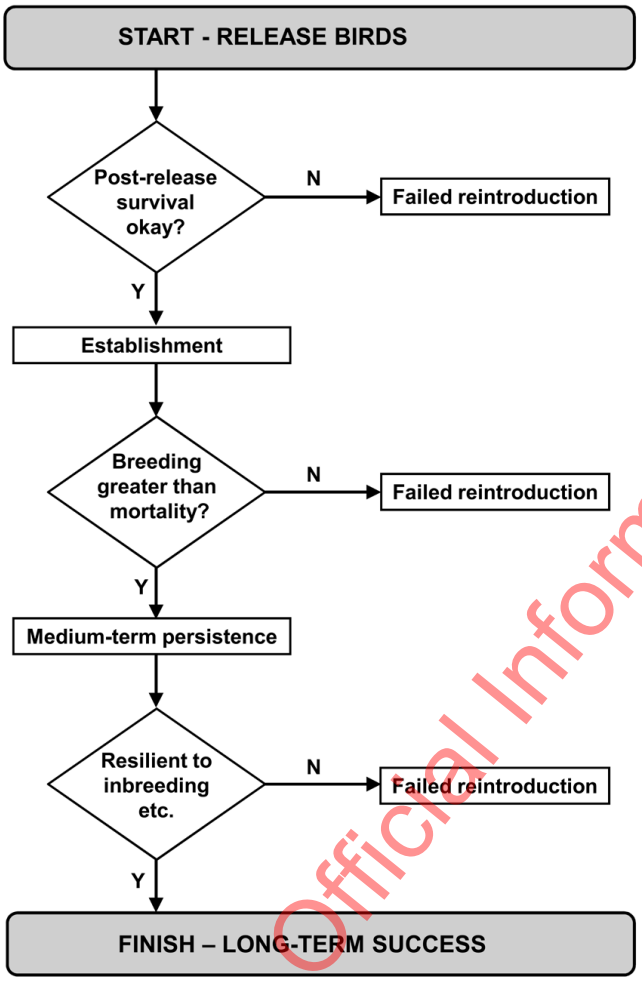

Figure 1: Possible short-, medium- and long-term outcomes following a translocation. Outcomes should be assessed against specific *a priori* criteria in determining what level of survival indicates a successful translocation (Parker *et al*. 2013).

Monitoring

1. Initial success and survival: This is particularly important for re-introduction sites where there is a risk factor identified that may result in failure e.g. trapping regime that differs from what is outlined in these guidelines. In all cases where ferrets are consistently known to be present, monitoring will be required because they have caused translocations to fail in the past, and we are still learning the best way to protect kiwi from ferrets.

   Monitoring a sample of ~20 birds in the first two to three years can give information about causes of mortality so that management can be adjusted, and help support the decision to continue to release birds. If a site has increased risk a cautious approach is recommended of releasing 10 birds with transmitters in the first year, and releasing a further 10 in the following year. If survival rates combined for the 20 birds after Year 2 meets the success criteria, more birds can be released. Plan for a third year of monitoring if any birds have been killed by predators or the results only just meets the success criteria. Any hands-on monitoring efforts for at least three years are encouraged even if things look to be going well.

   We acknowledge this does not provide a full picture of translocation success, as episodic events such as ferret incursions or a severe drought can impact the population after the first few years. If survival is lower than expected (less than 94%), adapting management and continuing to

monitor will be required. This includes supplementing the population to ensure close to 40 founders are maintained once the cause of the lower survival rate has been addressed.

Note that monitoring by transmitters may not be possible if large areas of mingimingi or *Muelhenbergia complexa* are present that could entangle transmitters; monitoring plans will be developed at such sites on a case by case basis.

2. Genetic diversity: Taking blood samples or pin feathers from the initial founders and ensuring the founders have been marked with either transponders or banding. This allows for a comparison every 10 years to make sure we're retaining diversity and the population is healthy and growing.

3. Long-term growth: a combination of call counts and dog surveys, moving towards a more hands-off approach to determine whether enough recruitment is occurring to offset any adult loss.

Reporting

There is an expectation that all translocations should be adequately documented, reported and listed in the translocation database (KRP action 10.1). This is usually a requirement under translocation permits, with an annual progress report to Permissions, the case manager and the local office, with a final report after the translocation has been completed.

Reports should include:

- Monitoring results;
- Any injuries or deaths (including the cause);
- Any reviews/changes to predator control relating to the deaths of kiwi
- Details of any transmitters not able to be recovered
- The location of the storage facility of any feathers collected and details of the genetic register; and
- Any implications for conservation management

It is the role of DOC translocation case managers to add the report to the translocation database.

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Appendix 1: Additional information

Best Practice guidelines

All translocation proposals will be assessed against Best Practice Manual (see Topic 8 in particular).

Invertebrate sampling

If invertebrate sampling is thought to be necessary (see guidelines), sampling should occur once in each season of the year to adjust for seasonal variation in food availability. Here is further information on how to undertake invertebrate sampling:
https://doccm.doc.govt.nz/wcc/faces/wccdoc?dDocName=DOC-6594651

Pest control

The level of pest control depends on geographical scale, geography and proximity to other predator control – a small peninsula is much more defendable than in areas surrounded by stoat and dog habitat. Doing 3-yearly 1080 in bait stations in a small area of forest is probably not going to be enough because the re-invasion of rodents and stoats will be very rapid, but if it is done as part of landscape-scale 10,000+ ha scale, then it has been shown to be enough for established population (Robertson et al. 2019). Therefore, in areas of 10,000ha or more, translocations into an area where there's only 1080 is likely to be sufficient. Although, when supplemented with trapping the recovery rate of the population will increase.

However, for a new population that needs to establish quickly, or it's an area less than 10,000ha in scale, Best Practice trapping (i.e. DOC200s at 1 trap/10ha density) with a minimum 5-year toxin (with secondary kill of stoats) is recommended. For kiwi, we have found that long-term stoat trapping has diminishing returns and so a strong recommendation is that for any trapping programme, a very short (single 1-2 week) pulse of 1080 (or other toxin with secondary poisoning effect) is done at least every 5 years to manage any untrappable stoats (Robertson et al. 2016). Note some toxins like pindone is not recommended/effective for secondary kill of stoats.

The trap network should also undergo regular quality assurance checks to make sure the traps are functioning at their best, and a record of an audit is expected before kiwi are released. The whole network should be audited at least every 3 years (or sections done annually) to ensure traps are catching and fix/move if needed. For island or predator-free sites, there needs to be a well-developed biosecurity and incursion plan.

We recommend at least 12 trap checks a year, ideally 14, with higher frequency (~fortnightly) checks over spring/summer during the stoat juvenile dispersal period and lower frequency (~bi-monthly) checks from late autumn through winter. Each site might have different considerations however, for example if the area is 'ferret prone' then that will influence what lures to use and might mean high frequency traps checks will be required through to early autumn, if the site is small and has large numbers of (otherwise uncontrolled) non-target species (e.g. rats and/or hedgehogs) that might clog single-action or single-set traps then 12 checks a year may be insufficient.

Ferrets should be a key target in any site in the current range of ferrets, taking into account that ferrets are capable of penetrating well into forests, especially where there are roads, tracks, or grassy clearings that rabbits and hence ferrets might be attracted to. For ferrets, trap checks would need to increase during high-risk times e.g. September and February. In areas where ferrets are not currently known, consider surveillance to detect when ferrets may arrive.

Dog control plan

A dog control plan needs to be in place to minimise this threat where present and may include aversion training for hunting and working dogs. The safest option, especially for pet dogs, is to avoid any possible encounter by keeping them away from kiwi areas, or keeping kiwi away from dogs where practical (e.g. kiwi proof fence). Here is the dog management plan template: https://doccm.doc.govt.nz/wcc/wccproxy/d?dDocName=DOC-6049495

Appendix 2: Average territory sizes for brown kiwi to inform translocations

Taxon	Location	Territory size/pair	Source	Notes
Northland brown **Average 10ha***	Waitangi forest	3-5ha	Colbourne & Kleinpaste Notornis 1981	Banding study
	Rarewarewa/Hodges Bush	3-5ha	R Colbourne pers observation	Transmitters over 10 years 1990-2000
	Trounson	6ha	Colbourne & Digby 2016	
Coromandel brown **Average 20ha**	Kuaotunu	25-29ha	Pers. Comm	Maybe this is what carrying capacity looks like
	Port Charles	15.7ha	Colbourne & Digby 2016	
	Moehau	~50ha	Paddy 2021	
Eastern brown **Average 20ha**	Puketukutuku Peninsula	15ha	Project estimates	
	Whinray	10.6-24ha	Project estimates	
	Maungataniwha	15-20ha	Pers comm	

	Whakatane	11-15ha	Bridget Palmer, pers comms	
Western brown **Average 20ha**	Whanganui	20ha	Colbourne & Digby 2016	
	Tongariro Forest	30-90ha	Miles 1997	
	Pouiatoa	20ha	Pers comm	
	Aotuia	11-15ha	Don Ravine, pers comms	

Appendices 2: Using these guidelines for strategic planning of translocations at a regional scale

Within a regional/species plan, consider the Kiwi Recovery Plan goals and taxon/species-specific goals. Think strategically about how translocations can help achieve these goals – which translocations still need to be completed, where are priority source sites and priority release sites, supplementation vs. re-introductions. By doing so, we can use translocations pro-actively to achieve kiwi recovery rather than re-actively.

Habitat suitability
To make sure that kiwi will thrive at new sites, identify sites regionally that has the greatest chance of success:

- Size of the release site needs to be bigger rather than smaller. Sites which might hold 100 pairs in a good year or might disperse and connect with others introduces uncertainty and risk. Prioritise large areas where there is confidence that the site is large enough to hold enough kiwi and keep growing to become strongholds of at least 100 pairs
- Sites that are connected to others are better than isolated populations. Translocations could strategically fill in gaps between existing isolated populations

When assessing strategic direction for translocations regionally, identify sites where kiwi have disappeared within the last 50 years compared to 100 years ago. This will identify where sites may need a closer look to determine whether it is appropriate for kiwi to be returned.

Ensure there is a good understanding of where drought is already a risk and where it's modelled to become an increased risk, and consider prioritising areas that will continue to have higher rainfall.

Where release sites are not on PCL, is there a covenant or written agreement to ensure kiwi are protected long-term?

Predator control
Identify sites that already have effective predator control in place (see further information in appendices), coupled with evidence of good kiwi numbers, that can be used as priority source sites for future translocations and therefore a priority to continue to protect. Identify priority release sites for future investment. Consider previous guidelines around size, connectivity, land tenure and habitat suitability long-term.

Genetics
Note the key principles that there should be no movement of birds between different taxa and no translocations across the extreme range of a taxon.

Identify sites small, isolated sites where we may need to guard against inbreeding, including the previously introduced kiwi populations.

Take into consideration the genetic management principles developed by the KRG.