Manaaki Whenua
Landcare Research

Nelson Wildlife Halo Operational Plan review

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Nelson Wildlife Halo Operational Plan review

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Summary

Project and Client

- Spillover of native biodiversity from the Brook Waimarama Sanctuary is expected to increase into surrounding areas as native birds respond to the eradication of introduced mammals in the sanctuary in 2017. To complement and capitalise on biodiversity gains from the sanctuary, Nelson City Council is developing the Nelson Halo project to increase native bird abundance and distribution in the wider Nelson landscape. Nelson City Council contracted Manaaki Whenua – Landcare Research to review The Nelson Wildlife Halo Operational Plan.

Objective

- To review Nelson Wildlife Halo: Operational Plan (Harper 2018) and other relevant aspects of Nelson Halo planning.

Methods

- *The Nelson Wildlife Halo: Operational Plan* (Harper 2018) was reviewed for consistency with current understanding of the outcomes and challenges of similar projects elsewhere in New Zealand.

Discussion

- The goals and objectives of Nelson Halo could be adjusted to refer to 'ecological integrity' and 'ecologically significant changes' as practical bases for proceeding
- Plans to increase habitat and connectivity through planting need to consider the large variation in the (generally poorly known) gap-crossing ability of forest birds
- The Nelson Halo operational area could be expanded to achieve more complete environmental representation and ensure year-round food supply is available for seasonally mobile birds
- It is inevitable that birds will disperse from Brook Waimarama Sanctuary, as it is contiguous with native forest outside the fence. It is unlikely that some highly sensitive species that may be reintroduced to the sanctuary can be protected from mammalian predation outside the fence, but ensuring effective pest control is undertaken when and where sensitive species begin attempting to breed outside the fence will increase the chance of them establishing there
- The current distribution of birds in the Nelson Halo area is likely to include refuges from predation and habitat loss and will not necessarily reflect habitat 'quality'
- It may not be possible to maintain pests at constantly low levels and depending on the species of interest and restoration goals this may not be necessary. Alternative pest control regimes could be considered, such as focussing on the bird breeding season and possibly undertaking pulsed pest control
- The use of pest control tools should follow best practice to maximise effectiveness, ensure the humane treatment of target animals, and avoid non-target bycatch

- Standard monitoring methods should be used to monitor outcomes at treatment and comparable non-treatment sites, and detailed protocols for each monitoring method should be strictly followed

Recommendations

- Place the Nelson Halo goal in the context of ecological integrity
- Set residual abundance targets for mammalian predators (e.g. 5% tracking rate for ship rats and possums during the main forest bird nesting period) rather than a change in relative abundance, and use these as performance indicators (rather than control effort)
- Emphasise the need to follow best practice in the use of pest control tools to ensure the humane treatment of target animals and to avoid non-target bycatch
- Initiate predator control at sites where and when there is evidence of attempted breeding of focal bird species such as kākā, unless the wish is to protect vulnerable species like tīeke, while feeding and roosting.
- Include outcome monitoring at non-treatment sites that are comparable with treatment areas
- Continue to use 5-minute bird counts for bird monitoring undertaken in November
- Monitor ship rats and possums July–September, at the beginning of the main bird breeding season.

1 Introduction

Nelson Halo is a project initiated by Nelson City Council, coordinating and undertaking pest control in an area surrounding the Brook Waimarama Sanctuary, as part of the Nelson Nature programme. The Nelson Nature programme is a collaboration between Nelson City Council, the Department of Conservation, private landowners, and community groups undertaking pest plant and animal control. This work contributes to the goal of the Nelson Biodiversity Strategy – to create a biologically rich and sustainable future for Nelson through aligned action on biodiversity (Nelson Biodiversity Forum 2018) – and to meet responsibilities for maintaining indigenous biological diversity under the Resource Management Act 1991.

Vulnerable, endemic forest bird species have declined on the New Zealand mainland for centuries and these declines continue today (Innes et al. 2010; Walker et al. 2017). Predation by introduced mammals is the primary cause of contemporary declines and limitation of New Zealand forest birds in large tracts of native forest, and interacts with food competition, habitat area, genetics, and other factors (Innes et al. 2010; Parliamentary Commissioner for the Environment 2017). In areas where forests are fragmented by urban or agricultural development, control of mammalian predators and management to increase the area of, and connectivity between, fragmented patches of vegetation are likely to help forest bird populations (Ruffell & Didham 2017; Walker et al. 2017).

In the absence of mammalian predation, indigenous birds generally increase within pest-fenced sanctuaries through the recovery of resident bird populations and the reintroduction and natural recolonization of other birds that were previously locally extinct (Fitzgerald & Innes 2014; Tanentzap & Lloyd 2017; Bombaci et al. 2018; Miskelly 2018). There is also considerable anecdotal evidence of biodiversity benefits (such as increases in indigenous birds) emanating from pest-fenced sanctuaries into the wider landscape. Empirical evidence of biodiversity 'spillover' like this is also beginning to emerge (Tanentzap & Lloyd 2017). Consequently, there is increasing interest in protecting and enhancing the biodiversity gains that spill over from fenced sanctuaries into the wider landscape, e.g. the Cape to City project in Hawke's Bay, and several initiatives near Zealandia, Wellington.

At present, there are only 14 ring- or peninsula-fenced wildlife sanctuaries greater than 25 ha in New Zealand, and few of these are near major urban areas, so the Brook Waimarama Sanctuary offers a rare opportunity for Nelson to capitalise on biodiversity gains from the sanctuary in an urban setting. This report reviews *The Nelson Wildlife halo: Operational Plan* (Harper 2018), which was commissioned by Nelson City Council to guide the establishment of native species recovery protocols and infrastructure as part of the management of Nelson Halo.

2 Background

The Brook Waimarama Sanctuary is 690 ha of native forest encircled with a pest-resistant fence. The sanctuary is less than 5 km south of the centre of Nelson and is contiguous with a large area of indigenous forest. Eradication of all introduced mammalian predators within the sanctuary was completed in June 2018. The Brook Waimarama Sanctuary is one of several community-led pest-control and restoration initiatives in the Nelson District, and Nelson City Council is working to coordinate and support such work.

3 Objective

To review and advise on plans for the Nelson Halo project outlined in *The Nelson Wildlife Halo: Operational Plan* (Harper 2018) and other relevant aspects of Nelson Halo planning.

4 Methods

The key document describing the current strategy to achieving the goals of the Nelson Halo is *The Nelson Wildlife Halo: Operational Plan* (Harper 2018; hereafter Operational Plan). A draft of this document was reviewed for consistency with current understanding of the outcomes and challenges of similar projects elsewhere in New Zealand.

5 Discussion

To be successful, the Nelson Halo project will need to contend with many, variable, often poorly known, social and ecological issues. The draft Operational Plan does a good job of addressing these issues, and significant improvement in native biodiversity can be expected from the implementation of the recommended management actions. Section 7 of the Operation Plan gives excellent background information on current control measures and the importance of residual pest monitoring rather than trap captures which deserves to be highlighted earlier in the document. In this report, I make some suggestions on adjustments or alternatives to parts of the Operational Plan. However, having worked predominantly in the North Island, my knowledge of ecology particular to Nelson is inevitably less than Harper's, who may have specific reasons of which I am not aware for positions taken on certain issues discussed in the Operational Plan.

The term "halo" has often been used in New Zealand in relation to movements, typically of birds, from areas of relatively low predation pressure into the surrounding habitat matrix. It is commonly used where pest control and habitat enhancement are undertaken in an area surrounding a pest-free (or nearly so) sanctuary. This is the situation at Brook Waimarama/Nelson Halo, but it is worth noting that the term is also used in slightly different contexts so there may be potential for misinterpretation. For example, Glen et al. (2013) define a 'halo effect' as an area where the impacts of invasive species are reduced beyond, as well as within, a treatment area. Another variation is the Hamilton Halo project (one of the

longest running halo projects), which is based on the concept of protecting birds from nest predation in a 'halo' of native forest fragments in a ring around Hamilton. Hamilton Halo has successfully restored tūī (*Prosthemadera novaeseelandiae*) to urban Hamilton using this approach (Fitzgerald et al. 2017). Despite conceptual and spatial differences in the use of the term, the common objective of biodiversity halo projects in New Zealand is to enhance the movement of native biodiversity across landscapes beyond core areas of the most intensive effort.

Comments on specific sections of the Operational Plan are given below. Some concepts are discussed in multiple sections in the Operational Plan but are generally discussed only once here.

5.1 "Goals and objectives"

The stated goal of Nelson Halo is reasonable – "To increase the long-term abundance and diversity of native birds within the Nelson City boundaries". However, it could valuably be deeper/broader and follow DOC acceptance of 'ecological integrity' (Lee et al. 2005) as the main underlying framework for guiding Halo restoration and monitoring. Key elements are:

- *indigenous dominance* – key ecological processes such as herbivory, predation, pollination, and decomposition are shaped primarily by indigenous species
- *species occupancy* – species that naturally occurred at a site are present at a relevant spatial scale (for rare or missing taxa, this may require active management, including translocation)
- *environmental representation* – an indigenous biota occurs across regional environmental gradients derived from climate, soils and geology (abiotic aspects of ecosystems).

The ecological integrity framework allows for the inclusion of non-avian taxa (e.g. reptiles and plants) in Nelson Halo projects and acknowledges the fact that some predation – if done by native predators such as New Zealand falcon (*Falco novaeseelandiae*) and weka (*Gallirallus australis*) – is desirable. The importance of natural predation is often overlooked, as evidenced by references to "lack of predation" in the Operational Plan, which would be more accurately described as a lack of *mammalian* predation.

The stated objectives refer to "statistically significant" changes in the abundance of native birds and invasive mammals. Statistical significance alone has little importance if it does not relate meaningfully to biologically or ecologically significant change, so it should be tempered with an understanding of these. Small changes in abundance can be statistically significant and ecologically irrelevant, and ecologically important changes – such as the presence of previously absent species – can be missed by statistical tests. A "statistically significant increase in the abundance of native birds" in Nelson (objective 1) may be challenged by the uneven response of native birds to release from mammalian predation. Some common native species such as silvereye (*Zosterops lateralis*), grey warbler (*Gerygone igata*), and New Zealand Fantail (*Rhipidura fuliginosa*) declined following pest eradication at Maungatautari and Zealandia, likely due to increased competition (Fitzgerald & Innes 2014; Miskelly 2018). Common native birds may similarly *decline* within Brook Waimarama

Sanctuary and this may also occur in other Nelson Halo areas if predator control there is effective.

A "statistically significant reduction in abundance of invasive mammalian predator numbers" (Objective 3) may fail to recover native species if the residual abundance of the pest species is still too high. The relationship between pest abundance and conservation outcomes can be described by density-impact functions (Norbury et al. 2015). For example, the response of some birds might be 'proportionate', such that any level of pest control results in some benefit, while other birds may be highly vulnerable and see little benefit unless key pests fall below a certain threshold. The form of density-impact functions is unknown for most New Zealand birds. In the absence of this information, a common approach is to set targets for residual ship rat (*Rattus rattus*) and possum (*Trichosurus vulpecula*) abundance at <5% using standard indexing methods (tracking tunnels and residual trap catch respectively, or comparable indices such as chew-track-cards; Sweetapple & Nugent 2011). These targets are derived from research on few, highly vulnerable species, such as North Island kokako (*Callaeas wilsoni*; Innes et al. 1999). Other birds are more, or less, vulnerable, so pest control targets should be driven by the restoration goals. These residual abundance targets are recommended in the discussion document *The Nelson Halo: "Bringing kaka to the suburbs"* (Harper 2017), and are mentioned as targets for individual sites, but are not included in the overall objectives of the Operational Plan.

Objective four of the Operational Plan is to increase habitat through planting. Analysis of habitat gaps and plant phenology in relation to the bird species of interest is needed to inform if and where these issues could be most effectively addressed. There is remarkably little reliable information on nearly all bird species' movements in New Zealand, although the ability of New Zealand birds to cross undesirable habitat gaps clearly varies greatly (Burge et al. 2017) and is distinct from dispersal distances through continuous habitat. Bird dispersal in the Nelson Halo is likely to be limited by gap-crossing ability, not distance from a source population, as dispersal distances (through favourable habitat) for most forest birds are likely to be greater than the entire Nelson Halo area.

5.2 "Operational Area"

It is not clear from the figures and text in the Operational Plan if the Nelson Halo operational area includes the Brook Waimarama Sanctuary or is exclusively the area that surrounds it. The Brook Waimarama Sanctuary is mapped within the 'Core' area, but it is not listed as one of the 'Core' sites. This should be clarified.

The operational area does not include any urban areas. The number of communities with 'predator-free' aspirations around New Zealand is increasing. Nelson Halo should consider encouraging coordinated backyard predator trapping to engage residents and enhance native biodiversity there.

The operational area is described on a basis of providing safe *breeding* habitat for native birds dispersing from Brook Waimarama Sanctuary. This is a reasonable initial plan because breeding is a time of increased predation vulnerability and a key limiting factor for many native forest birds (Innes et al. 2010). However, some species (e.g. tīeke; *Philesturnus* spp., and kiwi; *Apteryx* spp.) are highly vulnerable to some predators throughout the year, and for

many others once nest predation has been mitigated other limiting factors such as food supply are likely to become important. Improving food supply is now being explored at other similar projects, such as Hamilton Halo (Innes & Fitzgerald 2018). Maximising environmental representation (e.g. LENZ environments and across altitude gradients) and plant species occupancy in protected areas will help to increase year-round food supply, but this may require expanding the proposed operational area.

5.3 "Current and future wildlife values"

The Operational Plan states that birds that are likely to be reintroduced to Brook Waimarama Sanctuary "will probably disperse once they have reached large breeding populations". In fact, they *will* disperse out of the sanctuary, and this will happen well before a large breeding population has established there, particularly through post-release and natal dispersal, as well as adult dispersal and seasonal movement. These processes need to be considered in reintroduction and restoration planning (Richardson et al. 2015).

The Operational Plan recommends that predator control be implemented once more than 0.5 kākā (*Nestor meridionalis*) are counted per 5-minute bird count. The rationale for this is not clear, and a mean of 0.5 per 5-minute count is high. At Maungatautari, the mean number of kākā per 5-minute bird count is less than 0.1, 10 years after their reintroduction there (Manaaki Whenua – Landcare Research unpublished data). It is more important to protect establishing populations when they are small, so a better cue to initiate pest control would be evidence of any breeding attempt, such as presence during the breeding season.

5.4 "Management actions"

The Operational Plan suggests "firstly securing and enhancing the highest quality areas for native birds", with additional sites to provide additional habitat for birds dispersing from those 'seed' sites – essentially a halo within the Halo. However, the "high quality" sites may represent refuges from predation and habitat loss for many of the species present there, rather than preferred habitat. Protecting extant populations at these sites should still be a priority, but the absence of birds at other sites may not reflect their potential importance for native bird restoration.

It is noted that "cats have a particular impact on native birds that spend time on the ground or lower understory". In addition to the examples given, some birds, such as kākā and tūī are vulnerable to cats for a period after fledging when they are often found on or near ground. Cats also prey on native reptiles and invertebrates, and this should be included when considering cat management.

The targets given for pest control at each site suggest maintaining rat (presumably ship rat) and possum abundance below target levels throughout the year. The reason for year-round control is not clear in the Operational Plan but should relate to the desired biodiversity outcomes and may be more sustainable. Although more pest control can be expected to result in greater native biodiversity gains, alternative control regimes may be enough to achieve the desired outcomes. Year-round control may reduce plant browse (which will increase bird food supply) but will be much more difficult to achieve than focusing on

protecting nesting birds only. Failure to achieve unrealistic and unnecessary goals may can be demoralising for volunteers. Forest bird nesting seasons vary between species, but control between August–January would protect the main breeding period of most forest birds. For the most sensitive birds, such as tīeke, it is likely to be impossible to maintain pests at low enough abundance with currently available tools, so areas outside Brook Waimarama Sanctuary will inevitably be sinks for birds dispersing into unfenced areas.

An alternative to annual pest control is to use a pulsed regime, where control is carried out some years but not others. This allows resources to be spread over more sites. Hamilton Halo successfully recovered tūī to Hamilton using 3 years 'on' followed by 2 years 'off'. A pulsed regime is a cost–benefit trade-off that assumes the gains from the years when control is 'on' outweigh the 'off' years and is dependent on the desired biodiversity outcome. A pulsed regime could be further refined by focussing control (or more intensive control) of eruptive pests, such as ship rats and stoats, on mast years, or if the birds of interest are irregular breeders (e.g. New Zealand pigeon; *Hemiphaga novaeseelandiae*), years when they attempt to breed. There is also likely to be some biodiversity gains from trapping only of possums and stoats in the large Maitai and Roding catchments if ship rat abundance is naturally low outside of beach mast events. Trapping in these areas would also help to reduce the reinvasion risk at Brook Waimarama Sanctuary.

The Operational Plan recommends lower intensity rat control below 500 m altitude at Marsden Valley than in the mature forest above this. Ship rat abundance is likely to be higher in the lower altitude forest, so more intensive control will be required there, rather than less.

The Operational Plan largely recommends the use of traps to control rats at most sites. This may prove difficult and the use of toxins may need to be included as an option.

There is no specific guidance in the Operational Plan on potential bycatch in traps. All traps should be set following best practice to exclude non-target species such as weka, kea (*Nestor notabilis*) and kākā if they are likely to be present in the control areas. Additionally, all traps should be NAWAC approved for humaneness.

Outcome monitoring

The relationship between management effort and biodiversity outcomes is sometimes indirect and variable, so it is important to monitor outcomes, not the effort that goes in to controlling pests. The number of pest animals remaining alive is important, not the number killed. Killing animals without clear evidence of positive benefit for native biodiversity could be considered unethical, and this could be detrimental to community trapping initiatives such as those at Nelson Halo sites.

If possible, outcome monitoring should be undertaken in comparable non-treatment areas as well as the areas receiving pest control. Although this increases monitoring work, it allows for effects other than the management actions to be accounted for.

Birds

Five-minute bird counts have been undertaken at some Halo sites annually in November between 2015 and 2017. These provide valuable baseline data against which future changes

can be measured. The Operational Plan follows McArthur and Ray (2017) in recommending future counts be undertaken in September. However, counts from different months are not comparable (Hartley 2012), so changing timing of the counts would mean discarding the baseline data. The timing of bird counts is less important than consistency, and 5-minute bird counts are often undertaken in November in other studies (e.g. Smith & Westbrooke 2004, Fitzgerald & Innes 2014, Fitzgerald et al. 2017). Furthermore, in September some species (such as tūī) may still be in non-breeding groups at abundant food sources away from breeding areas. Baseline bird counts were undertaken annually. While annual sampling is good, this could be reduced to 2–5 yearly if it is necessary to reduce the cost of this work to incorporate monitoring of new treatment or non-treatment sites.

During each of the 2015–2017 surveys, birds were counted on four different occasions at each of 62 stations. If possible, increasing the sample size from 62 to 100–200 would increase the power to identify changes in the bird indices. The increased cost of counting more stations could be offset by reducing the number of times each station is counted in each survey year as this pseudoreplication will be less valuable. If new count stations are established, these should be along lines traversing areas that are as representative of the Operational Area as possible. The same count stations should be used in each survey, including the existing 62 stations, to maintain a repeated measures sample design.

Predators

It is crucial that consistent monitoring methods are used, and if the data is to be compared with other studies, standard protocols should be strictly applied – e.g. Gillies and Williams (2013) for rodents and mustelids. In the long-term, using standard residual abundance indices and adaptive management will also help to establish guidelines for restoration if they are not already known.

Rodent tracking tunnels should be set on random lines, stratified by major vegetation types or altitude zones if applicable, rather than subjectively favouring some areas over others (e.g. not selecting "denser forest, not open ridgelines").

Camera traps are an emerging tool for simultaneously monitoring multiple species, and Craig Gillies (DOC) is currently preparing standard protocols for their use and analysis. The use of cameras is mentioned for cat monitoring at Grampians but no detail of the monitoring design is given. Once protocols are established, camera traps will provide a useful monitoring tool, particularly for species that are currently difficult to monitor such as stoats and cats. It may be worthwhile contacting Craig to see if there is a case yet to use cameras in a meaningful way.

Pest monitoring should be undertaken around July, immediately prior to pest control at the start of the bird breeding season (to identify whether pest control is required), and at the beginning of the nesting season (August–September) to ensure residual abundance targets are met. It may be necessary to repeat rat monitoring approximately three months later to ensure their relative abundance has increased beyond the target level but monitoring outside of the bird breeding season is unnecessary, unless the aim is to protect highly vulnerable birds such as tīeke, or other biodiversity such as lizards or plant regeneration. Possums increase more slowly than rats, so once residual abundance targets have been met monitoring may not be necessary until the following bird breeding season.

Vegetation

It is difficult to quantify changes in vegetation from photo points, and unless the vegetation is highly degraded it may not be possible to see much change in photographs. If vegetation monitoring is required, 20×20 m permanent plots (Hurst & Allen 2007) are an established method.

6 Recommendations

- Place the Nelson Halo goal in the context of ecological integrity
- Set residual abundance targets for mammalian predators (e.g. 5% tracking rate for ship rats and possums during the main forest bird nesting period) rather than a change in relative abundance, and use these as performance indicators (rather than control effort)
- Emphasise the need to follow best practice in the use of pest control tools to ensure the humane treatment of target animals and to avoid non-target bycatch
- Initiate predator control at sites where and when there is evidence of attempted breeding of focal bird species such as kākā, unless the wish is to protect vulnerable species like tīeke, while feeding and roosting.
- Include outcome monitoring at non-treatment sites that are comparable with treatment areas
- Continue bird monitoring using 5-minute bird counts undertaken in November
- Monitor ship rats and possums July–September, at the beginning of the main bird breeding season

7 Acknowledgements

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