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MANAAKI WHENUA

Potential bird-related research in the Cape-to-City Project, Hawke's Bay

Potential bird-related research in the Cape-to-City Project, Hawkes Bay

John Innes, Neil Fitzgerald

Landcare Research

Prepared for:

Hawke's Bay Regional Council

159 Dalton Street
Private Bag 6006
Napier 4142

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Landcare Research, Gate 10 Silverdale Road, University of Waikato Campus, Private Bag 3127, Hamilton 3240, New Zealand, Ph +64 7 859 3700, Fax +64 7 859 3701, www.landcareresearch.co.nz

Reviewed by:	Approved for release by:
Corinne Watts Scientist Landcare Research	Fiona Carswell Portfolio Leader – Enhancing Biodiversity Landcare Research

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Contents

1 Background

World-wide, there is limited knowledge about bird movements, including natal dispersal (the distance from where a bird fledges to where it first breeds) and breeding dispersal (subsequent movements by breeding adults), although these processes are acknowledged to be critical components of population viability (Baillie et al. 2000). Recent renewed interest in studying these and other kinds of dispersal, including in New Zealand (NZ), has come from studies of habitat fragmentation, and the increasing focus of management on smallish (<2000 ha) sanctuaries.

Curiously, more is known about post-translocation dispersal in NZ than natal dispersal, because post-release monitoring of translocated birds can be mandated by the NZ Department of Conservation (DOC) approval process, and because there is strong interest in where translocated individual birds go. However, in the long term, colonisation of regional landscapes is achieved more by natal dispersal, the study of which demands that nests are first found and juveniles marked with affordable, scientifically robust and ethical study tools.

2 Research issues

Natal dispersal distances of kereru, pāteke, kākā, and tomtit are largely unknown, distances for bellbirds, tui, and red-crowned kākāriki need further study, and natal dispersal of falcons outside exotic forests is unknown or unpublished (scientific names of birds and mammals are in Appendix 1). Present studies suggest large variability in this behaviour, so replication in different habitats would be valuable.

Natal dispersal of any NZ bird species is poorly understood. For example, what is the relationship between mean and maximum distances, and what factors drive dispersal timing and outcomes? Is dispersal prompted by rising population density (being at carrying capacity), as bellbird movement from Hauturu suggests?

There are three possible research avenues of habitat planting that may be useful:

a) Value of planting CONNECTING vegetation for birds to move through. For some small forest birds (robin, whitehead, saddleback, rifleman), gaps as small as 100 m can easily be bridged by planting fast-growing exotics as lines or stepping stones.

b) Value of planting native or exotic trees as plantations or other production crops to INCREASE THE HABITAT AREA of small native vegetation remnants.

c) Value of planting native or exotic FOOD TREES in residential properties or for soil conservation roles or plant-based industry (e.g. mānuka honey) around the Cape-to-City (C2C) footprint that could be exploited by mobile species, particularly bellbird, tui, and kereru.

These avenues are not necessarily separate. For example, experimental riparian planting could fulfil all three roles.

Managers designing planting to aid bird connectivity require better knowledge of gap sizes that different bird species will cross. This demands following individual birds in detail, probably with radio transmitters.

Little is known in detail about relationships between residual abundances of key pests and vital rates (birth, death) of nearly all NZ birds, and yet this interaction will grow or limit populations in the long term. North Island robin is an exception that has had substantial work by Doug Armstrong and his students (e.g. Armstrong et al. 2006). Determining nesting success and subsequent mortality under different pest control regimes with residual abundances of key pests measured with best practice SOP techniques is required. Population outcomes depend on nett outcomes of births, deaths, emigration, and immigration. In NZ and C2C, these outcomes are largely dependent on pest control and habitat connectedness.

3 Research methods for monitoring bird movements

Presence/absence of a bird can be explored by basic observational surveys, perhaps using playback and/or acoustic recorders. The main techniques for determining movement of individual birds are leg-banding and other marking, VHF radio transmitters, satellite tags, PIT tags, and genetic studies (if individual genetic markers are available). Song analysis has been used to trace origins of bellbirds (Brunton et al. 2008). Long-term outcomes of dispersal are now routinely addressed by genetic studies of widely spaced populations (e.g. Baillie et al. 2014).

Bird banding may be ethically better than transmitter attachment because bands weigh much less than transmitters. Also, bands can last much longer than transmitters, which may be scientifically useful but perhaps ethically costly for the bird. On very small birds, they remain the only tool for certain questions. However, re-sighting rates are generally poor (and recently declining in UK, Robinson et al. 2009) and population-level conclusions require huge samples of banded birds, frequently achieved over many years (e.g. Paradis et al. 1998). Although movements of individual birds can be deciphered by banding (e.g. Parker et al. 2004), distinguishing between death and emigration is usually unachievable because in both cases the birds simply disappear.

VHF radio transmitters are necessary for some questions about bird movements. Compared with bird bands, they are financially and ethically expensive, and short-lived if small, but can reveal routes taken by moving birds and can distinguish mortality from emigration. Satellite tags are expensive and still too big for small birds (current SIRTRACK minimum satellite tag is 3.5 g which is adequate for birds heavier than 120 g), and perhaps necessary for, e.g. kereru that can fly 100 km or more (Powlesland et al. 2011). PIT tags are small and unobtrusive but need to be read at very small ranges, so suit birds that will use feeders (Rickett 2010) or nest boxes. Key properties of bird-tracking technologies are compared by Fiedler (2009) and Bridge et al. (2011). Strengths and limitations of direct (banding, radio-tracking) and indirect (or ‘intrinsic’, e.g. genetic markers, trace elements, and stable isotope ratios) bird markers are discussed by Coiffat et al. (2009) and Griesser et al. (2014).

4 Possible future C2C studies

There are many valuable bird studies possible in the C2C footprint. Topics include post-translocation, natal and breeding dispersal movements, the role of vegetation corridors, and vital rates of populations in relation to measured residual pest abundance in and outside Cape Sanctuary and other managed sites. Prioritising these should be discussed among key stakeholders in a medium- to long-term (10 years) framework. Regular systematic counts of birds and indices of pest mammal abundance using best practice SOPs across the C2C footprint will be critical to monitor the most important ongoing changes over many years.

Possible additional bird or bird-related studies are:

1. Determine movements of kereru, tui, and bellbirds in the C2C footprint by banding and radio-tracking. These mobile, relatively common taxa are the most likely birds to first show evidence to landowners and residents that pest control is effective. They will visit urban and rural gardens, particularly to established plantings of food trees. Nationally, there is more known about seasonal movements of these species than others but they do represent the biggest possibility for interaction with people. However, natal dispersal movements of juveniles of all three are almost entirely unknown. Residents and citizen science could be used to increase re-sightings of banded birds, but we suggest trained observers would be more effective. Study design can target movements from sites of particular interest, e.g. band all juvenile birds in Cape Sanctuary with a certain colour, and use alternative colours for other key breeding sites.
2. Follow fates of individuals that are translocated, using radio transmitters; then undertake population monitoring and measure natal dispersal using banding and more transmitters as populations establish. This could focus on robins, tomtits and kiwi on the Maraetotara Plateau, or selected species in Cape Sanctuary. Detecting dispersing individuals could be enhanced by employing trained surveyors who use playback to increase detection. Correspondence with researchers such as Dr Isabel Castro, Massey University, Palmerston North, and Dr Graeme Elliott, DOC, Nelson, who are elsewhere testing acoustic recorders is advised. Techniques for searching the resultant digital data to find signature bird calls will slowly improve.
3. Given the paucity of forest and shrubland habitat in C2C, it is highly likely that many forest birds (kākā, tomtit, rifleman, whitehead, saddleback, robin) will be vegetation-limited, even if mammal pests can be nearly eradicated. Planting to increase habitat area and to improve connectivity for these species should be undertaken in an experimental way at key sites, probably a) radiating from Cape Sanctuary, via pine forests to Havelock North, and b) on the Maraetotara Plateau including Mohi Bush, and the bird responses should be monitored. Gap-crossing by birds can be studied experimentally here or elsewhere (Creegan & Osborne 2005) to methodically improve the effectiveness of planting.
4. All current NZ bird banding office data (administered by DOC) should be examined for multiple sightings of bird species of interest to C2C. This may reveal natal and breeding dispersal distances that are currently unknown.

5. Threatened or declining endemic bird species that may suit the dominant C2C vegetation (sparse forests and shrublands in a pasture-dominated landscape) but are sensitive to the predators being controlled in C2C include falcon, kiwi, pāteke, pipit, weka, and whio. Research that focuses on restoration of any of these taxa would be valuable.

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The Infographic on 'Restoring birds in Cape-to-City'

Background

Hawke's Bay Regional Council requested a '3-4 page guide in booklet format that describes eight species of interest within the Cape-to-City region with respect to recolonization factors (behaviour, natal dispersal distances, habitat requirements, use of landscapes and corridors, sources of mortality and spill-over effects noted at other sanctuaries)'. We searched published and unpublished literature and consulted species experts to derive best available knowledge and measures of the natal dispersal, post-translocation dispersal, breeding dispersal and habitat gap-crossing ability of 14 bird species that are relevant to the Cape-to-City project. We also contacted managers of sanctuaries in New Zealand and asked them about their experiences of birds travelling from inside sanctuaries to the surrounding mostly unprotected landscape. From these and other data, and our broader experience of species recovery in New Zealand, we selected key points that will guide landscape management for birds and displayed them in Infographic form.

Page 1 (Restoring birds in Cape-to-City) makes the point that to be sustainable in the long term, bird populations need to be genetically robust, which requires in turn that they are large. New populations should not be started if there are too few (<40) or genetically inappropriate (e.g. highly inbred) founding individuals; if the final population size cannot be large (500+), and if population growth rates are likely to be low. Achieving high population growth rates in New Zealand is dependant primarily on having effective predator control, but also on having adequate areas with suitable vegetation, environments and food supply. If habitat areas are fragmented, as is the case with forest and shrubland birds in Hawke's Bay, then large populations may be best achieved by linking the remaining fragments together by new planting. Alternatively, other species such as pipits that are at home in pastures may be good candidates for restoration in the predominant farming landscape. This page reminds readers of end-goals that should be achieved in the long term.

Page 2 (Bird mobility and vulnerability) shows bird natal dispersal distances plotted against gap-crossing ability, where known. All birds are classified also by predation-vulnerability. Generally, few of these movement data are well verified with large sample sizes and scientific publication; further studies of the same species at other sites may yield different outcomes. However, the graphic shows some clear separations between those taxa that can range widely over pastoral landscapes (e.g. bellbird, falcon, tui, kereru, pāteke, kākā) and those that are forest-bound (e.g. rifleman, whitehead, saddleback, robin).

We predict many surprises in the future about the broad habitats native birds could survive in if mammal predators were absent, and there are many species (e.g. South Island takahe, whio) for which their present habitat use is perhaps primarily a predation refuge rather than truly preferred habitat. The graphic also shows that maximum known natal dispersal distances can be much larger than mean distances for a taxon. Factors determining these differences are poorly understood.

Page 3 (What do Cape-to-City birds need?) shows current knowledge of key predators of the 14 birds we have focused on, plus one or two other key management actions that will help each species. Key predators are presented in a Sankey diagram in which the width of the lines is proportional to the importance of the predator species for each bird. One consequence of this is that the total importance of each mammal predator to all 14 birds is related to the size of the aggregated lines by each mammal's name on the left hand side of the diagram. We derived initial line thicknesses by ranking predators in order of declining importance for each bird (1, 2, 3, etc.), then applying (1/rank) x 10 to calculate line thickness. In this way, the first (most important) predator has a line thickness of (1/1 x 10) = 10; the second predator has a line thickness of (1/2) x 10 = 5; the third is (1/3) x 10 = 3 and so on. The thickness of aggregated lines (all predators) on the right hand side of the Sankey diagram is then made the same for each bird so that thicknesses derived as above are scaled to accommodate this. For example, the two predators of rifleman (in order of declining importance, ship rat and stoat) together have the same width as the five predators of NZ dotterel (again in order, cat, hedgehog, Norway rat, stoat, and black-backed gull).

At first glance, stoats and ship rats are key predators, but ship rats primarily damage small-to-medium sized, tree-nesting forest and shrubland birds, whereas stoats affect most birds in most habitats. Predators are also generally very 'replaceable' in New Zealand. That is, if you kill all ship rats and possums, then harriers may take more tui. Many of the predators are generalists and they may respond both behaviourally and numerically to the removal of other predator species.

The kinds of 'other management' selected on the right hand side of page 3 were derived partly from Infographic page 2 data and partly from other literature. Species with poor gap-crossing abilities identified on page 2 clearly need planted corridors between existing habitat fragments to establish and maintain viable large populations, while mobile frugivores that have high gap-crossing ability can access planted food resources in widespread gardens and plantations. Kākā eat sap and take insects from mature trees and damage the trees in the process, and have annoyed Wellington residents with this behaviour (Charles 2012). We therefore suggest that publicity about this will be required if kākā become widespread in Hawke's Bay. Pet and farm dogs can be significant threats to brown kiwi, weka, and other large flightless birds; falcons may attack domestic hens and poultry, while NZ dotterels nesting on beaches require protection against disturbance from humans and their dogs. These are ways in which Hawke's Bay residents will have to change their behaviour to accommodate the birds that Cape-to-City aspires to increase.

Page 4 (Pest-free Cape-to-City 2050) captures the vision that if mammal predators are absent, then native birds could live in surprising places. The presence of the falcon reinforces that the vision is not to end predation per se, but to make predation (and herbivory and other ecological processes) dominated by indigenous and not exotic taxa. Page 4 also reveals that bicycle design has not changed in the next 34 years, and cyclists still have to wear helmets.

Data and statements in the Infographic were derived from species-based texts in the Handbook of Australia, New Zealand and Antarctic Birds (HANZAB), the website NZ Birds Online *http://nzbirdsonline.org.nz/*, plus the following literature and people:

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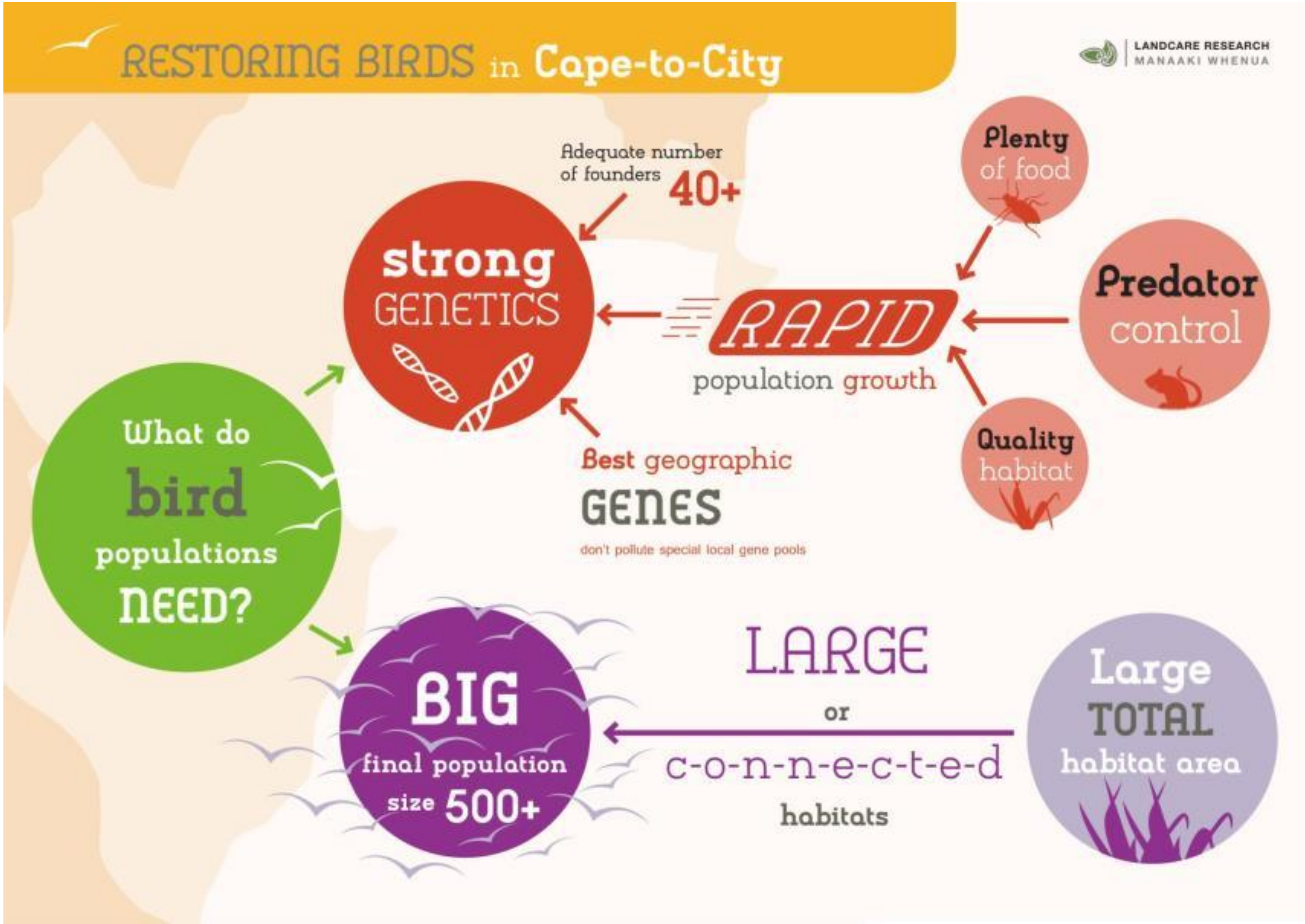
Appendix 1 – Scientific names of birds and mammals used in the text and following Infographic, ordered alphabetically by common name

Common name	Scientific name
Bellbird	*Anthornis melanura*
Black-backed gull	*Larus dominicanus*
Kākā	*Nestor meridionalis*
Kereru	*Hemiphaga novaeseelandiae*
New Zealand dotterel	*Charadrius obscurus*
New Zealand falcon	*Falco novaeseelandiae*
New Zealand pipit	*Anthus novaeseelandiae*
North Island brown kiwi	*Apteryx mantelli*
North Island robin	*Petroica longipes*
North Island tomtit	*Petroica macrocephala*
North Island weka	*Gallirallus australis*
Pāteke	*Anas chlorotis*
Red-crowned kākāriki	*Cyanoramphus novaezelandiae*
Rifleman	*Acanthisitta chloris*
Saddleback	*Philesturnus rufusater*
South Island takahe	*Porphyrio hochstetteri*
Tui	*Prosthemadera novaeseelandiae*
Whio	*Hymenolaimus malacorhynchos*
Whitehead	Mohoua albicilla
Cat	*Felis catus*
Ferret	*Mustela putorius*
Hedgehog	*Erinaceus europaeus*
Norway rat	*Rattus norvegicus*
Ship rat	*Rattus rattus*
Stoat	*Mustela erminea*


RESTORING BIRDS in Cape-to-City
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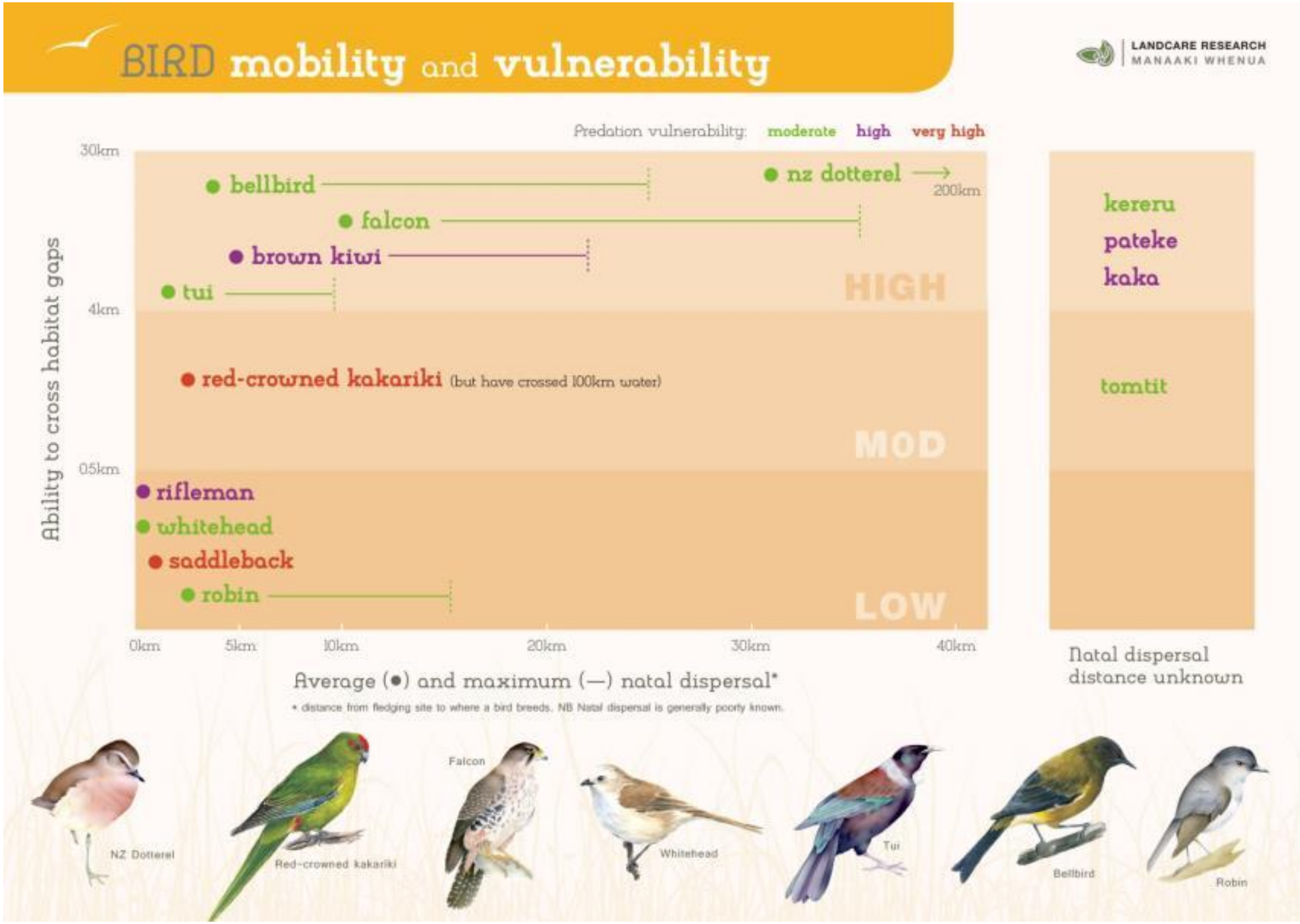
MANAAKI WHENUA
What do bird populations NEED?
strong GENETICS
Adequate number of founders 40+
Best geographic GENES
don't pollute special local gene pools
RAPID population growth
Plenty of food
Predator control
Quality habitat
BIG final population size 500+
LARGE or c-o-n-n-e-c-t-e-d habitats
Large TOTAL habitat area


BIRD mobility and vulnerability
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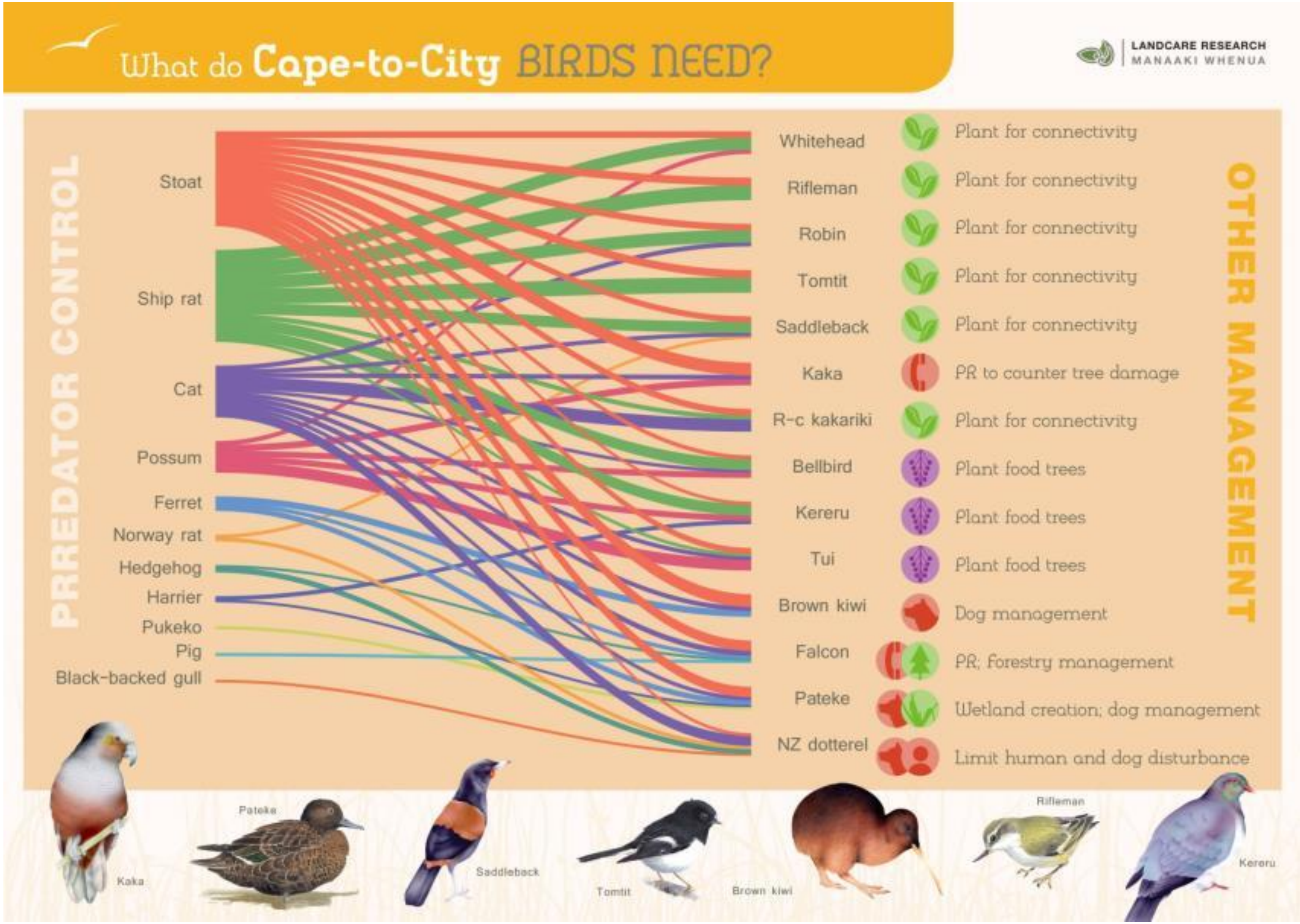
MANAAKI WHENUA
Predation vulnerability: moderate high very high
30km
4km
0.5km
Ability to cross habitat gaps
bellbird
nz dotterel
200km
falcon
brown kiwi
tui
HIGH
red-crowned kakariki (but have crossed 100km water)
MOD
rifleman
whitehead
saddleback
robin
LOW
0km
5km
10km
20km
30km
40km
Average (●) and maximum (—) natal dispersal*
* distance from fledging site to where a bird breeds. NB Natal dispersal is generally poorly known.
kereru
pateke
kaka
tomtit
Natal dispersal distance unknown
NZ Dotterel
Red-crowned kakariki
Falcon
Whitehead
Tui
Bellbird
Robin


What do Cape-to-City BIRDS NEED?
LANDCARE RESEARCH
MANAAKI WHENUA
PREDATOR CONTROL
Stoat
Ship rat
Cat
Possum
Ferret
Norway rat
Hedgehog
Harrier
Pukeko
Pig
Black-backed gull
Whitehead
Rifleman
Robin
Tomtit
Saddleback
Kaka
R-c kakariki
Bellbird
Kereru
Tui
Brown kiwi
Falcon
Pateke
NZ dotterel
Plant for connectivity
Plant for connectivity
Plant for connectivity
Plant for connectivity
Plant for connectivity
PR to counter tree damage
Plant for connectivity
Plant food trees
Plant food trees
Plant food trees
Dog management
PR; forestry management
Wetland creation; dog management
Limit human and dog disturbance
OTHER MANAGEMENT
Kaka
Pateke
Saddleback
Tomtit
Brown kiwi
Rifleman
Kereru

PEST-FREE Cape-to-City 2050

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John Innes, Neil Fitzgerald, Landcare Research, Hamilton, New Zealand. Email: John Innes at innesj@landcareresearch.co.nz

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