



Wingspan Birds of Prey Trust
CONSERVATION ACTION
STRATEGIC WORK PROGRAMME
2013



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1. Introduction

>> Over recent decades our understanding of New Zealand's birds of prey, the threats they face and how to support them has improved considerably. Wingspan has been at the heart of these advances for over 20 years, driving and facilitating key research areas and leading the way in the development and improvement of conservation management techniques. With this ever increasing knowledge base, Wingspan is now in a position to develop and begin implementing the strategic conservation actions, that once fully fledged, will enable the trust to work on the landscape scales required to achieve its goal of restoring birds of prey into our daily lives and securing their long term future.

This strategy and planning document has been developed to guide the implementation of Wingspan's Conservation Action Programme. It aims to prioritise the work needed to achieve Wingspan's goal and ensure that conservation outputs are maximised within the constraints of limited resources. In so doing it provides the tools necessary to make strategic decisions about the conservation of New Zealand's birds of prey and guides how these actions should be prioritised relative to one another.

Figure 1. The structure and components of Wingspan's Conservation Action Programme and how it fits with the other two strategic programmes



Three components, research, active management and advocacy combine to make up Wingspan's Conservation Action Programme (Fig. 1). As much as it is important to support our threatened species Wingspan also believes that it is important to ensure common species remain common. As a result, this Conservation Action Programme aims to take a holistic approach to the management of birds of prey and the ecosystems they are an integral part of. We want to help encourage New Zealand's birds of prey back into all the varied landscapes that make up modern day New Zealand,

ensuring they persist not only in our protected conservation estates, but on our farms, in our back-gardens and in our cities.

1.1 Wingspans Goal

Wingspans goal is to restore New Zealand's birds of prey into our daily lives and secure their long term future through practical research based conservation action and education.

1.2 Document Structure

This document is split into two main parts. Part One starts by outlining a strategic approach to the conservation of our birds of prey, while Part Two outlines the specific actions required to conserve each of these species. As such, the document starts by detailing the overarching strategic approach that Wingspan will employ to develop and guide its conservation activities into the future such that birds of prey are restored into our daily lives. In Part Two this approach is then used to develop action plans for our highest priority species, the New Zealand falcon, and summary plans for all other species. An extensive review of our current state of knowledge on New Zealand falcon relevant to conservation planning is included in Appendix One.

This stepwise structure aims to ensure the transparent and efficient use of limited resources, while also making sure that Wingspans conservation activities translate into tangible benefits on the ground.

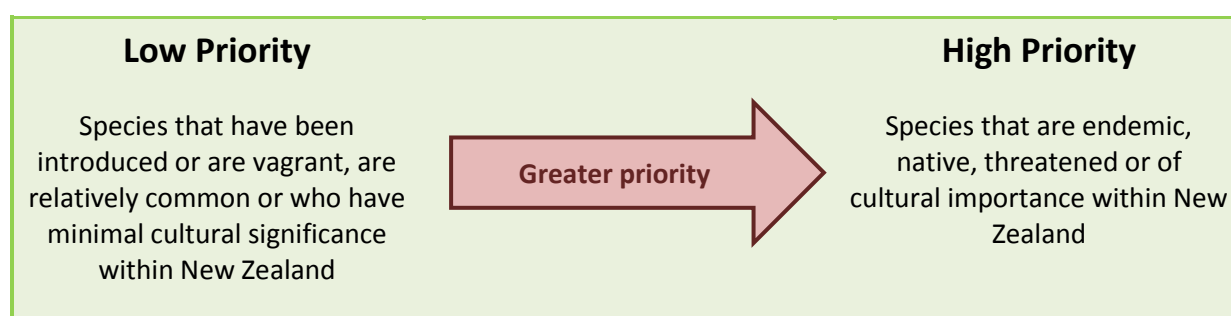
2. Part One: Wingspans Overarching Strategic Approach

>> Wingspans strategic approach to conservation management follows a three stage framework:

- | | |
|---------------------|--|
| Stage One: | Describes how Wingspan decides which species will receive the greatest resources and the most urgent action |
| Stage Two: | Outlines how Wingspan prioritises the geographic areas where action will occur |
| Stage Three: | Provides guidance on how each restoration programme will progress over time in order to reach Wingspans overarching goal |

2.1 Stage One – species prioritisation

The following criteria are used to guide the prioritisation of work on different species:



Using these criteria it is clear that activities that aim to support and expand New Zealand falcon populations are of the highest priority, implementing activities to support Morepork are of medium priority, and that a relatively low priority should be placed on work to support Swamp harrier, Barn owl & Little owl populations. Work on vagrants is not recommended under these criteria.

2.2 Stage Two – identifying where to work

Using our knowledge of where populations occurred historically, where they exist now and where they could potentially exist in the future, three land management classes are established in Stage Two:

1. Baseline population distribution,
2. Potential population distribution, and
3. Low potential areas.

These three land classifications are defined as:

2.2.1 Baseline Population Distribution

For management purposes, where a species breeds (at that moment in time) is considered the **baseline population distribution**. Within this, populations that are stable or increasing are considered the **core population distribution** of the species. Activities aimed at ensuring the core of each species remains stable should be the greatest priority for each species (i.e. should take priority over expanding the population into the potential population distribution). For the large part this will

not involve active hands on management of birds in these areas, rather activities will focus on education and advocacy work to reduce the threats facing populations in these areas, including working with partners and supporting the activities of other organisations that manage large areas of land that support birds of prey (e.g. forestry companies, the Animal Health Board, local government and the Department of Conservation and their partners).

Where a species is identified as being in decline, but they remain in relatively high numbers, this is considered the **declining population distribution** and specific advocacy activities aimed at addressing the cause of decline in these areas should be the focus of management actions in these areas.

Because detailed knowledge on the local population status of each of New Zealand's birds of prey is generally lacking, or at best poorly understood, it is largely not possible to distinguish the core from the declining population distribution of a species. Until this information is available the core and declining population distribution should be lumped and activities focussed on advocacy and education to support populations throughout the baseline.

SUMMARY

The baseline population distribution includes the area where a species currently breeds, and populations are stable, increasing or are in decline (but *relatively* high numbers remain). Within the baseline population distribution activities will be focussed on education and advocating for action to improve conditions and reduce limiting factors, rather than hands-on intensive conservation action.

2.2.2 Potential Population Distribution

Areas where a species is known to have occurred historically and suitable conditions for breeding remain (or could be provided), but where a species is currently absent (or only occur in very small numbers) are considered the **potential population distribution**. More hands-on practical conservation activities to restore populations should be undertaken in the potential population distribution, e.g. the hack-releasing of birds to restore very small or extinct populations. Although activities to restore birds into the potential population distribution may be more intensive, these activities should be viewed as a lower priority to the maintenance of the baseline population distribution – especially if the baseline begins to decline. Advocacy activities suitable to reduce threats will also be a vital component of any conservation action undertaken within the potential population distribution.

Areas identified as the potential population distribution should be loosely ranked in terms of priority. These ranks should be based on a combination of the distance to the nearest baseline population (the further away the greater the priority), the practical ability of Wingspan to manage any limiting factors and on the resources available within Wingspan at that time. In effect this means that Wingspan will implement activities to restore and support small or extinct populations in areas furthest away from healthy population's dependant on the resources available at that time.

The potential population distribution includes novel habitats if the species is known to have occurred in the wider region historically and if it is deemed that a self-sustaining population of the species can be established in the area without intensive on-going intervention.

SUMMARY

The potential population distribution includes areas that contain suitable conditions for breeding but where a species is currently absent or occurs in very low numbers. Within the potential population distribution activities should be focussed on hands-on conservation action supplemented with targeted advocacy activities.

2.2.3 Low potential Areas

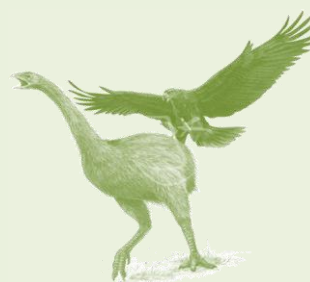
Areas that are identified as marginal or not containing suitable conditions for breeding (at that moment in time), where risk cannot be managed or suitable conditions can only be provided with intensive on-going intervention, or where a species did not occur historically, are defined as **low potential areas**.

The focus activity in low potential areas should be on research aimed at determining whether it is possible to manipulate conditions suitable to support breeding populations in this habitat (thus increasing the potential population distribution). Where research shows that conditions suitable for breeding cannot be provided Wingspan will not implement or advocate for any activities to support these species in these areas.

2.3 Stage Three – a phased approach to restoration

In line with Wingspan's goal to restore birds of prey into our daily lives, once each area has been classified in terms of whether it is part of the baseline, potential or a low potential area, Stage Three illustrates how populations of high priority species are expanded into the widest possible area (Fig. 2). In short, Stage Three describes how several overlapping and concurrent work streams move through a three phase process of restoration whereby the baseline is consolidated and expanded into potential and low potential areas until the optimum baseline area for that species is secured.

Hypothetical Example: Conservation of the Haast's Eagle



The following example illustrates how by applying different management techniques in the three different management areas (outlined in section 2.2), over time the baseline population is gradually expanded through the three broadly overlapping phases outlined in figure 2.

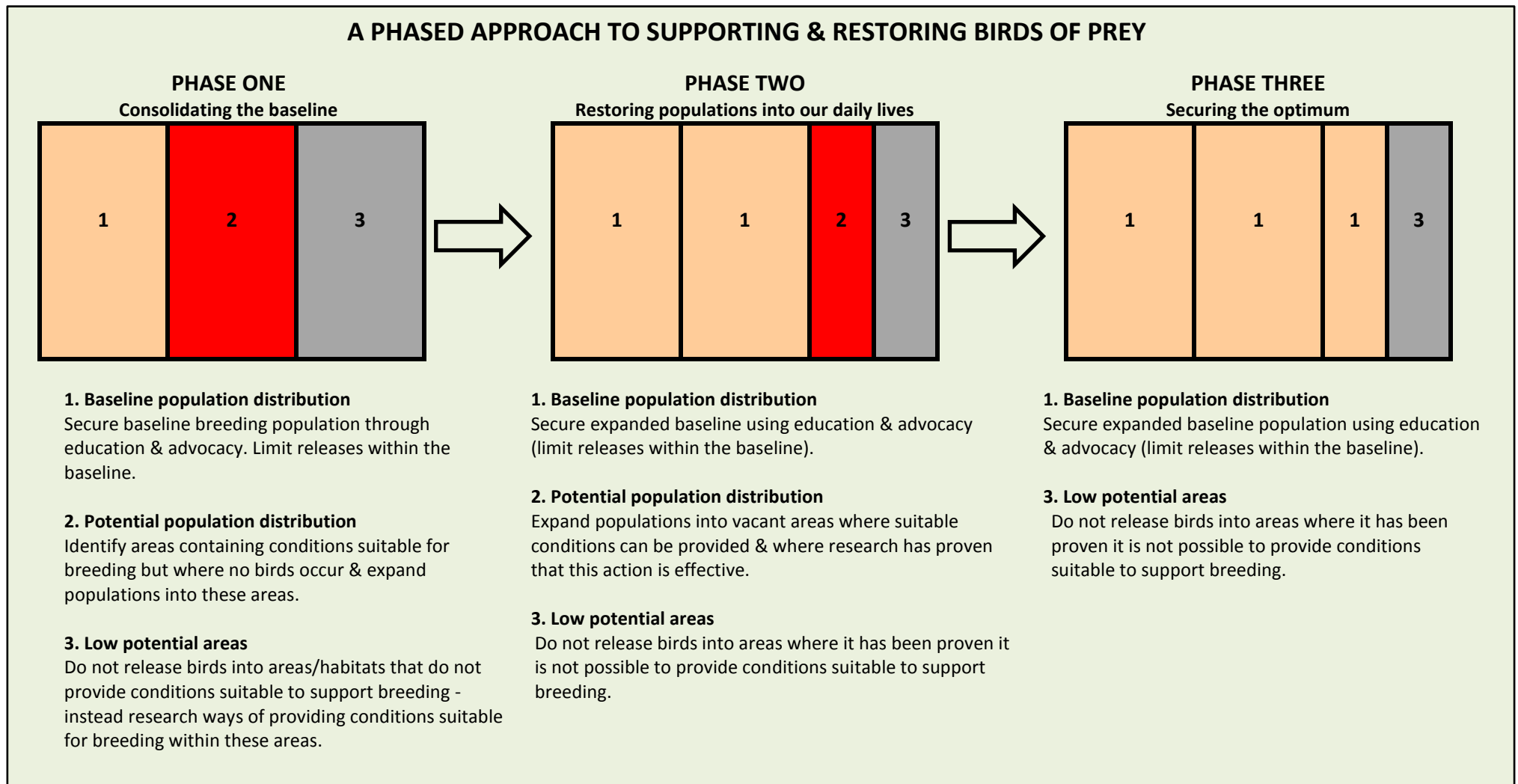
First imagine the Haast's eagle (*Harpagornis moorei*) is still alive and breeding in New Zealand. Next imagine that despite once breeding the length and breadth of New Zealand, the Haast's eagle now only remains breeding in the high country tussock lands of the South Island.

- The high country tussock lands of the South Island would represent the baseline population of Haast's eagle, thus advocacy action to support them in these areas would be a priority (for example this might include advocating for widespread control of exotic predators in high country tussock lands in the South Island).

Continued...

- The tussock lands in the Central Plateaux of the North Island would likely comprise suitable habitat where eagles no longer occur thus this area would be considered the potential population distribution. Work to restore breeding eagle populations into the Central Plateau (e.g. hack releases of captive reared chicks) would therefore be a priority.
- Once eagles were restored back into the Central North Island a new baseline population distribution would be described i.e. the Central North Island would be included in the baseline.
- Concurrent with advocacy in the baseline and restoration efforts to expand populations into the potential population distribution, research would be undertaken suitable to determine whether conditions could be modified to support eagle populations in habitats that were considered unsuitable for breeding eagles i.e. within low potential areas.
- If this research determined that suitable conditions for breeding eagles could be provided in for example farmland and forest habitats, but not in urban areas, farmland and forest habitats would now be included as part of the potential eagle population distribution and action to restore eagles into these habitats would also be initiated. As these populations became self-sustaining they would also become part of the baseline population.
- In this scenario urban habitats would remain low potential areas and action to restore eagle populations into these areas would not be undertaken unless future research illustrated that conditions could be modified to suit eagle breeding in this habitat.
- Thus, over time the baseline population distribution of Haast's eagle would increase into first the potential population distribution and then subsequently into some areas of the low potential as determined by research (Fig.2). In this way, over time the baseline population distribution is maximised such that a species is restored back into all areas of New Zealand that can support them.

Figure 2. Wingspan's phased approach to managing the restoration of birds of prey into our daily lives. 1. Baseline: ■ 2. Potential: ■ 3. Low potential: ■



3. Part Two: Wingspans Conservation Action Plans

>> Of the birds of prey found in New Zealand only the New Zealand falcon – Karearea is classed as a threatened species. As a result, a fully developed Action Plan has only been developed for the New Zealand falcon. However, in recognition that the range of some of the more common species is also in some cases restricted and that threats to populations are ever present, summary plans of action have also been developed for Morepork - Ruru, Swamp harrier – Kahu and Barn owl.

The action plans and summary plans outlined in the next section of this report have been developed in accordance with the three stage strategic approach outlined in Part One of this report. Each plan describes the actions that Wingspan will implement to conserve each species under the three main components of Wingspans Conservation Action Work Programme (Fig.1): Advocacy, Research & Active Management. Each plan finishes by time lining key targets so that Wingspan can evaluate and measure its success and modify future activities accordingly. These key targets should be reviewed every five years. Supporting information on falcons, including the evidence of their historical distribution, what action has been implemented to support falcons in the past and how successful these actions have been is included in appendix one & two.

4. New Zealand falcon - Karearea

SUMMARY

The New Zealand falcon – Karearea (*Falco novaeseelandiae*) is a threatened species that is listed as Nationally Vulnerable / Endangered under the New Zealand threat classification system due to its unnaturally small population size. Multifarious threats to falcon populations have resulted in a retraction of range that requires action if populations are to be restored and the threat of extinction addressed. This action can be split into three broad and overlapping work streams: active management, advocacy and research. Active management should concentrate on expanding the baseline falcon population into areas of suitable habitat where they no longer occur by releasing falcons from a network of release sites in Northland, Auckland, North Waikato, Coromandel, the Wairarapa coast, Banks Peninsula and Stewart Island. Advocacy activities should focus on improving conditions for falcons by promoting the implementation of best-practices and policies that reduce limiting factors and hence improve falcon survival (with a particular focus on ensuring the baseline population does not retract). Research effort should be directed into improving the effectiveness of advocacy activities, investigating how to expand populations into novel habitats and on monitoring success.

4.1 Introduction

The New Zealand falcon – Karearea (*Falco novaeseelandiae*) is New Zealand's only endemic diurnal bird of prey. Under the New Zealand threat classification it is also considered a threatened species (Miskelly et al. 2008). Consequently, the New Zealand falcon sits at the top of Wingspan's priority list for conservation action.

This plan details the activities that Wingspan will undertake to conserve and restore the New Zealand falcon back into our daily lives. This is the first time that a structured plan of action has been established for New Zealand falcon. As a result, rather than placing unrealistic timeframes around each activity, timeframes are only provided for the actions that make up the initial setup phase of this plan. Consequently, it is recommended that this plan be reviewed in five years' time (in 2018), with a view to developing a more detailed time line of actions once the resources and partnerships necessary to undertake the work are established. Further, because this plan is the first of its type it aims to set the stage for future work by providing a detailed review of previous work and the current state of knowledge on this species (Appendix One and Two).

Wingspan recognises that working with others is vital to the successful conservation of New Zealand falcons. Therefore, the detail of the areas that Wingspan proposes to engage and enable others in the conservation of falcons is included as a key component of this plan.

By employing the structured and strategic decision process outlined in part one of this report to inform a robust plan of action for New Zealand falcon, Wingspan aims to ensure that limited resources will be allocated efficiently and conservation benefits optimised.

4.2 Empowering people

In order for relatively small conservation organisations like Wingspan to achieve the lofty goals of a national species restoration programme collaboration must be wholeheartedly embraced. This includes freely sharing expertise on the best-practice necessary to undertake key elements of the conservation action programme. It also requires Wingspan to seek and establish meaningful partnerships with organisations, individuals and iwi that can enable activities that the trust does not have the skills, influence or capacity to achieve internally, or in isolation. In some cases, formal partnerships may not be appropriate but Wingspan may choose to provide support (e.g. through advocacy activities) in acknowledgement that an organisation undertakes activities that are crucial to the successful restoration of the falcon population.

4.3 Planning for Recovery

This section provides both long and short-term guidance for Wingspan on how best to support the conservation of the New Zealand falcon and reach its goal of restoring falcons into our daily lives. This advice is based on the background review of the literature provided in appendix one and two and on the guiding strategy outlined in Part One of this document.

4.3.1 Where Wingspan will Work

To put the current falcon population distribution in context it is first necessary to identify the historical range of the species. The literature summarised in appendix one, combined with historical vegetation maps (Fig.s 3a & 4a), indicates that at the time of European arrival New Zealand falcons would have been breeding throughout New Zealand and on many of its offshore islands.

To establish the current falcon distribution, survey data collated by Wingspan and reported in other recent literature (Lawrence 2002, Robertson et al. 2004, Bell & Lawrence 2009) was compared with maps describing the distribution of habitat types in which we know falcons usually breed (Fig.s 3b & 4b). Although maps describing habitat can be considered relatively accurate, because of the limitations inherent in surveying for a low density and often cryptic species, a degree of subjective judgement was required to develop the maps describing the current falcon distribution. To reduce this subjectivity it was assumed that, within areas of suitable falcon breeding habitat, increasing human population density would result in increasing confidence in the survey results and vice versa (Table 1).

Using the criteria set out in section 2.2 this approximation of the current falcon distribution was classified into the baseline and potential population distribution (Fig.s 3c and 4c). Because we are currently in Phase One of our phased approach to restoring birds of prey (Fig. 2) all areas containing habitat types that falcons do not usually favour for breeding are considered 'low potential' areas. As such, some areas that are currently classified as low potential areas may be reclassified in Phase Two as part of the potential population distribution dependant on the outcomes of research in these areas.

Table 1. Criteria for assessing which land management class each area of suitable falcon breeding habitat falls into.

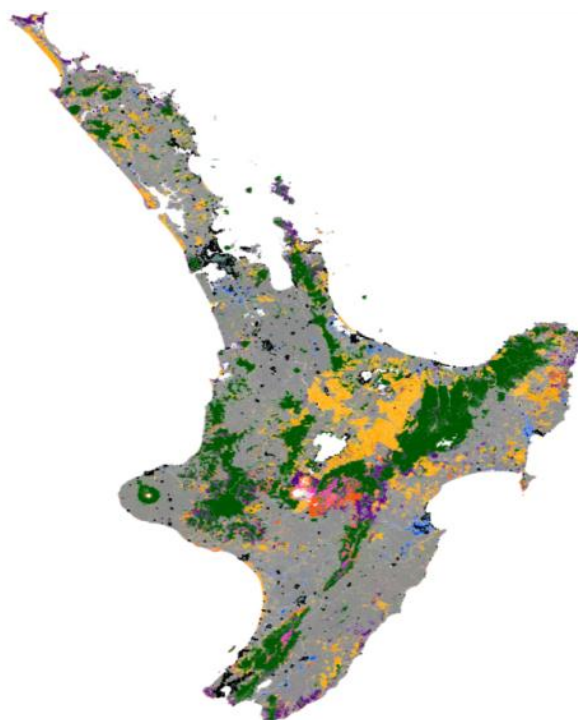
Density of falcon sightings	Breeding records	Human population density	Land Management Class
Moderate to High	Confirmed	Low to High	Baseline
Low	Confirmed	Low	Baseline
Low	Suspected	Low	Baseline
Low-Zero	No Records	Low	Potential
Low	Suspected or No Records	Moderate to High	Potential

Figure 3. Distribution of suitable New Zealand falcon breeding habitat in the North Island before the arrival of humans (approximate), at the current time and the baseline and potential distribution of breeding falcons in the North Island of New Zealand (based on the current distribution of suitable breeding habitat and the known distribution of the species). Habitat distributions based on Land Cover Data Base vs. 3 (LCDB3).

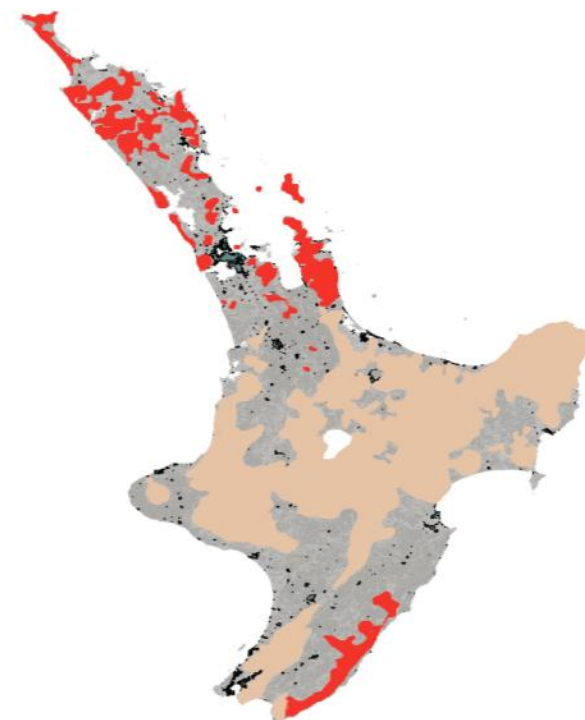
a. Pre-human



b. Today



c. Baseline & Potential (as of 2013)



Habitats suitable for New Zealand falcon breeding (without management): **Green:** Indigenous forest; **Yellow:** Exotic forest; **Purple:** Exotic & Native scrub; **Orange:** Low producing grass or tussocklands; **Pink:** Alpine shrub/herbfields; **Habitats not suitable for New Zealand falcon breeding without management:** **Grey:** high producing exotic grasslands & wetlands; **Black:** Urban areas; **Blue:** Vineyards, orchards & crops; **White:** Permanent snow or water.

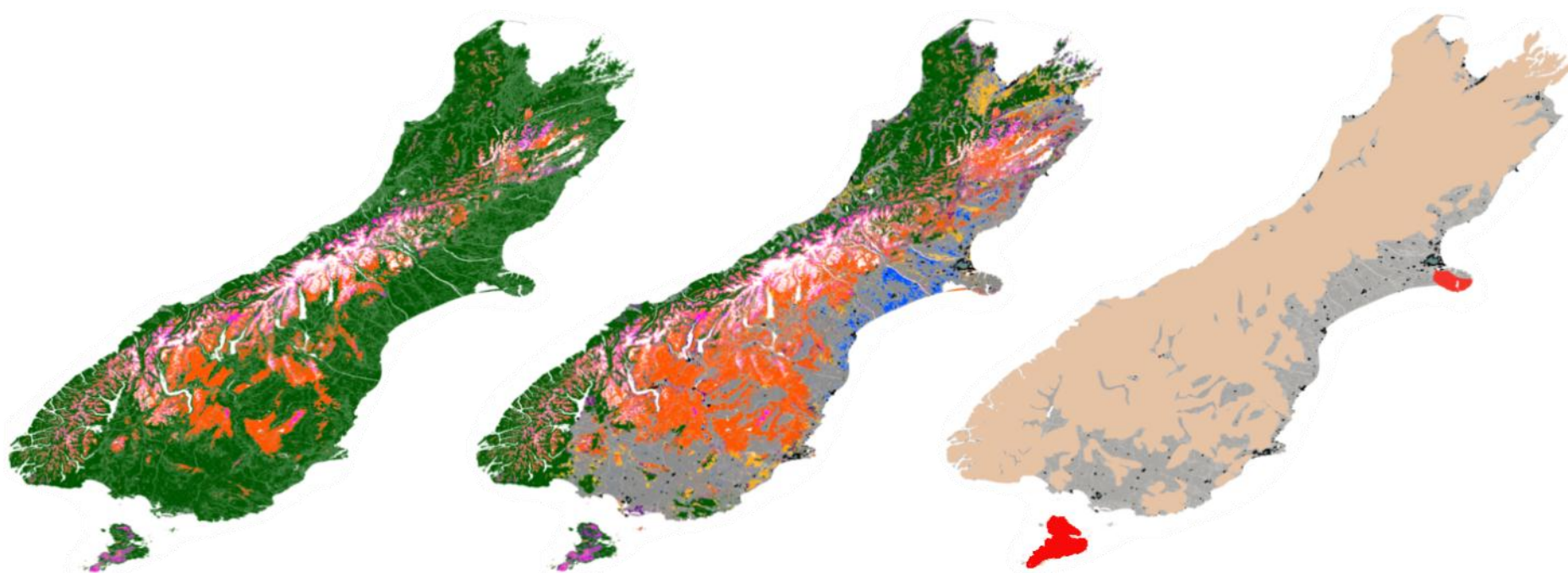
Tan: Baseline falcon population distribution
Red: Potential falcon population distribution
Grey: Low potential areas – not currently suitable for falcon breeding

Figure 4. Distribution of suitable New Zealand falcon breeding habitat in the South Island before the arrival of humans (approximate), at the current time and the baseline and potential distribution of breeding falcons in the North Island of New Zealand (based on the current distribution of suitable breeding habitat and the known distribution of the species). Habitat distributions based on Land Cover Data Base vs. 3 (LCDB3).

a. Pre-human

b. Today

c. Baseline & Potential (as of 2013)



Habitats suitable for New Zealand falcon breeding (without management): **Green:** Indigenous forest; **Yellow:** Exotic forest; **Purple:** Exotic & Native scrub; **Orange:** Low producing grass or tussocklands; **Pink:** Alpine shrub/herbfields; **Habitats not suitable for New Zealand falcon breeding without management:** **Grey:** high producing exotic grasslands & wetlands; **Black:** Urban areas; **Blue:** Vineyards, orchards & crops; **White:** Permanent snow or water.

Tan: Baseline falcon population distribution
Red: Potential falcon population distribution
Grey: Low potential areas – not currently suitable for falcon breeding

These maps illustrate that the New Zealand falcon population is reasonably well spread over both the North and South Islands of New Zealand. However, despite this, breeding falcons are absent from large areas of New Zealand, including the Northland and Auckland regions, the Northern Waikato, the Coromandel Peninsula, Banks Peninsula and Stewart Island. Despite some dispersing juveniles having been recorded in some of these areas they do not appear to be immigrating in sufficient numbers to establish breeding populations, thus releases appear necessary if restoration is the goal. Although it seems likely that a lack of breeding falcons on the South Wairarapa coast is due to a low human population making reports less likely, further investigations are required to confirm this thus for the time being this area is not included within the baseline population distribution. These maps also illustrate that large areas of New Zealand are devoid of conditions suitable for falcon breeding, especially in the North Island, thus research into how to provide suitable conditions for breeding within novel habitats will also be very important.

4.3.2 Plan of Action

A. ACTIVE MANAGEMENT

LONG-TERM AIM

To establish sustainable populations of falcons in Northland, Auckland, North Waikato, Coromandel, the Wairarapa coast, Banks Peninsula and Stewart Island

METHOD

Wingspan aims to hack-release falcon chicks into Northland, Auckland, North Waikato, Coromandel, the Wairarapa coast, Banks Peninsula and Stewart Island until New Zealand falcon populations are self-sustaining in these areas i.e. breeding pairs have been established in each region and their chicks have successfully fledged chicks

TASKS

- Develop partnerships with organisations, individuals and iwi that are able to support the release of falcons in Northland, Auckland, North Waikato, Coromandel, the Wairarapa coast, Banks Peninsula and Stewart Island
- Empower partners to release falcons by providing technical and field expertise
- In collaboration with partners establish hack-release sites suitable to release falcons at multiple sites in each region: Northland, Auckland, North Waikato, Coromandel, the Wairarapa coast, Banks Peninsula and Stewart Island
- Develop and maintain a captive management programme to support conservation activities

KEY TARGETS TO REACH BY 2018

1. Best-practice hack-release techniques for New Zealand falcon have been described and are freely available
2. Wingspan has developed, follows and freely promotes best-practice captive management techniques
3. The partnerships and resources necessary to run at least one hack-release site in Northland and Banks Peninsula have been secured
4. Falcons have been released from at least one hack-release site in Northland and Banks Peninsula
5. Monitoring suitable to establish survival until first breeding has been established at each release site

6. Permission to translocate wild chicks from pine forests in the Central North Island for release elsewhere has been thoroughly investigated

B. ADVOCACY

LONG-TERM AIM

To promote land management practices and activities suitable to support falcon breeding and survival

METHOD

Wingspan will advocate for activities that reduce threats to falcons, and land management practices that support falcon breeding and survival by promoting these activities to land managers and policy makers

TASKS

- Collaborate with organisations that work with species that share the same threats and who have common advocacy goals
- Promote land management practices that support falcon breeding and survival in indigenous forest and scrub, exotic forests, tussocklands and roughly grazed hill country pasture
- Support action to reduce threats to falcon breeding and survival
- Where research shows risk can be managed, advocate for action to support falcon populations in low potential areas (e.g. urban habitats and intensively farmed landscapes)

KEY TARGETS TO REACH BY 2018

7. The plantation forestry industry has implemented industry wide best-practice operating procedures suitable to reduce the impact of land preparation and harvesting operations on nesting falcons
8. Wingspan has described best-practice methods to reduce the impact of electrocution on falcons and has developed a plan to encourage the implementation of this best-practice by the industry
9. Wingspan has developed a pest management strategy to guide its support of pest control methods

C. RESEARCH

LONG-TERM AIM

To provide the information necessary to support the conservation of New Zealand falcon populations

METHOD

Wingspan will foster and support post-graduate research into areas that support the conservation of falcons. Where knowledge gaps occur that are fundamental to conservation management but cannot be filled by research Wingspan will aim to collaborate with others to implement suitable studies internally

TASKS

- Foster and support post-graduate research by collaborating with staff within the ecology and resource management departments at Universities around New Zealand
- Investigate the factors limiting the survival of hack-released falcons
- Monitor population trends by implementing appropriate longitudinal studies of bush, eastern & southern falcon populations (e.g. establish long-term monitoring programmes of falcons breeding within the baseline falcon distribution of one bush, eastern and southern falcon population)
- Determine land management practices that support falcon breeding and survival in indigenous forest and scrub, exotic forests, tussocklands and roughly grazed hill country pasture
- Define the factors that limit falcons breeding in low potential areas and establish whether these factors can be managed without on-going intervention

KEY TARGETS TO REACH BY 2018

- 10. Continue to encourage research into suitable areas and support students by providing expertise
- 11. Confirm the Wairarapa coast is part of the baseline falcon population
- 12. Monitor the survival of a sample of hack-released falcons until first breeding

5 Morepork - Ruru

5.1 Background Information

5.1.1 Species description

The Morepork (*Ninox novaeseelandiae novaeseelandiae*) is a small dark-brown owl with a compact appearance. Striking yellow to yellowish-green eyes set into two facial disks either side of a small sharply hooked bill. Spotted sparsely on back, breast variably streaked cream and brown through to rufous. Widely distributed throughout the native and exotic forests of New Zealand. Uncommon in the drier eastern regions of the South Island, especially south of Christchurch. Found in more open areas where suitable patches of vegetation remain including within some urban parks and gardens but absent from many urban centres. Occasionally found in scrub and orchards.

5.1.2 Conservation status

Not Threatened (Miskelly et al. 2008)

5.1.3 Threats

Although Morepork are able to survive in a variety of novel and modified habitats, their vulnerability to predation by a wide variety of introduced mammalian predators probably limits their numbers throughout their range. Preliminary results from monitoring being undertaken by DOC in the Eglington Valley and Waitutu suggests poor breeding success and a male biased population resulting from adult females being predated on the nest (Pryde et al. 2011). Similarly, research by DOC on the West Coast illustrates that chicks are highly vulnerable to predation by stoats while in the nest cavity (Jason Malham & Ruth Cole pers. comm. 2013).

Habitat modification and degradation likely impact Morepork numbers on two levels; reducing the amount of food available, and limiting the number of nest cavities suitable for nesting. Although Morepork often nest on the ground it seems likely that they are less prone to predation when nesting off the ground in cavities. Habitats that lack suitable nest cavities or opportunities to nest off the ground and also have high numbers of predators are therefore unlikely to contain healthy breeding populations of Morepork (e.g. urban areas with no large trees).

Morepork are prone to being stuck by cars when hunting alongside roads at night.

5.2 Action to Date

Considering the impact that introduced mammals have on Morepork breeding success and survival, the most widespread support of Morepork populations currently occurs through the control of introduced mammalian predators (e.g. cats and mustelids) and browsers (e.g. goats and deer) over large areas. Nevertheless, because Morepork can be prone to secondary poisoning e.g. by Brodifacoum (Stephenson et al. 1999), monitoring is required to ensure populations are not being negatively impacted by the large-scale application of some toxins. To this end DOC is currently monitoring Morepork populations before and after the aerial application of 1080 in the Eglington Valley, Waitutu (Moir Pryde pers. comm. 2012) and on the West Coast (Jason Malham & Ruth Cole pers. comm. 2013).

Other recent research includes a range of studies into Morepork ecology on Ponui Island (e.g. Denny 2009) and investigations into urban Morepork living in Hamilton City (Morgan & Styche 2012).

Although there has been limited direct action to support Morepork populations, captive breeding and release techniques have been established e.g. by Wingspan and during releases of Morepork onto Norfolk Island (Olsen 1996). Injured Morepork have been rehabilitated and released nationwide by numerous rehab centres and individuals.

5.3 Future Action

Future action by Wingspan to support Morepork populations should focus on advocating for the control of introduced mammals over large areas using control techniques that do not negatively impact Morepork populations. Because it appears that Morepork are nest site limited (as well as predator limited) in some habitats researching ways to restore populations into these habitats by providing artificial nest sites should also be at the heart of future work. Due to a general lack of knowledge on the population biology of Morepork in New Zealand Wingspan should also foster general research on this species by encouraging and supporting post-graduate student research.

KEY TARGETS TO REACH BY 2018

1. Techniques for encouraging Morepork to breed in nest boxes by hack-releasing captive reared Morepork from nest boxes in a periurban environment (with a view to establishing similar releases in urban gardens at a later date) have been trialled
2. Wingspan continues to encourage and support post-graduate research on the population biology of Morepork
3. Wingspan has developed a pest management strategy to guide its support of pest control methods

6 Swamp harrier - Kahu

6.1 Background Information

6.1.1 Species description

Swamp harriers (*Circus approximans*) are a large, tawny brown, long-legged bird of prey with sizeable taloned feet, prominent facial disks and a strongly hooked bill. They are most often seen feeding on carrion on the side of the road, or lazily quartering over farmland with wings set in a characteristic shallow V-shape. The Swamp harrier is common throughout most of New Zealand including the coastal fringe, estuaries, wetlands, pine forest, farmland and high-country areas. They are generally less abundant over large tracts of forest and in urban areas.

6.1.2 Conservation status

Not Threatened (Miskelly et al. 2008)

6.1.3 Threats

Due to the widespread clearance of forest and the introduction of mammal prey creating favourable conditions for harriers, populations have most likely increased since human arrival. Swamp harriers can currently be legally controlled if they are impacting threatened species management programmes or livestock. As a result, large numbers of harriers are shot and trapped all over New Zealand every year by DOC, poultry farmers, game wardens and duck hunters. The effectiveness of this control and its impact on harrier populations is however poorly understood.

Large numbers of harriers are also killed as a result of road collisions and there is a significant possibility of secondary poisoning due to their scavenging feeding behaviour.

6.2 Action to Date

Rehabilitation and release of injured harriers. Limited research on the species in New Zealand. Most significant research on harriers by Baker-Gabb (1982)

6.3 Future Action

Research and advocacy should be the main focus of Wingspans actions to support harriers as arguably no direct conservation action is required to support this relatively common species. Research to determine the need for the lethal control of harriers is however urgently required. Whether the control of harrier numbers is effective as a means of reducing predation on threatened species is sadly lacking as is any evidence to show that controlling harriers is a successful method of reducing impacts to livestock. Further, such persecution is likely to be detrimental to New Zealand falcon populations as yet further generations come to view birds of prey as pests that need controlling.

KEY TARGETS TO REACH BY 2018

1. Support post-graduate research into the efficacy of harrier control as a threatened species and livestock management tool

7 Barn owl

7.1 Background Information

7.1.1 Species description

The Barn owl (*Tyto alba delicatula*) is a strikingly beautiful medium sized, pale owl with a distinctive white, heart shaped face. White below with some dark spots and long pale, feathered legs. Upper surface orangey buff and grey delicately marked with white spots. In New Zealand, although sparsely recorded throughout the country since the 1940's, they were not recorded breeding until 2008 when a pair was found breeding in Kaitaia. Although they are currently considered a coloniser (and therefore native), recent evidence of captive bred cage escapees near Auckland during the 1990's and the fact that the species is known to disperse widely, makes it difficult to confirm the origin of the pair established near Kaitaia.

7.1.2 Conservation status

Not Threatened – Coloniser (Miskelly et al. 2008)

7.1.3 Threats

Whether the Barn owl population will expand in number or distribution in New Zealand is currently hard to predict. Overseas they rely on boom / bust cycles of small rodents to fuel highly productive breeding years. In New Zealand they appear to be mostly feeding on mice, rats and small birds. Whether these food items are sufficient to sustain and expand a population is unknown and whether other factors such as nest site availability will prove limiting is yet to be discovered.

7.2 Action to Date

Several artificial nest boxes suitable for Barn owl roosting and breeding have been erected by Wingspan around and in the wider landscape surrounding the current breeding pair in a hope that these will be used by some of the fledging young. Monitoring to date has indicated very limited use of these boxes.

7.3 Future Action

Due to the unknown provenance of Barn owls in New Zealand action to actively support the expansion of the Barn owl population beyond what has already been done is not recommended. Research to determine whether Barn owls arrived here naturally or are the result of captive releases should therefore be the first priority. Once this has been achieved the appropriateness of different management options should be reviewed.

KEY TARGETS TO REACH BY 2018

1. Whether the Barn owls breeding in Kaitaia arrived here naturally or are the result of captive releases has been determined

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9 Appendices

9.1 Appendix One: Review of Background Literature – New Zealand falcon

9.1.1 Species Description

The New Zealand falcon is a magpie-sized raptor that is endemic to New Zealand. Adults have a sharply hooked bill, striking yellow fleshy parts, a streaked cream breast, brown back and rufous under-parts. It is considered a single variable species with three forms that overlap in geographical range but are broadly distinguished by ecological and morphological differences (bush, eastern & southern) (Fox 1977). Whether these forms hold true genetically is currently under investigation (L. Olley & N. Fox pers. comm. 2013). Small passerines make up the greatest proportion of the diet, but larger birds such as pheasant, and mammals including rabbit and hare, can also contribute a significant amount to the diet (Fox 1977, Barea et al 1999, Seaton et al. 2008, Hyde & Worthy 2010, Kross et al. 2013). Insects are also commonly eaten, especially by young birds. Nest site choice is variable, including sites that are located within the epiphytes of large emergent trees, on rocky ledges or in simple scrapes on the ground (Fox 1977). Nests are generally located $\frac{3}{4}$ the way up a slope and afford a prominent view of the area (Seaton pers. obs.). They breed in a wide variety of habitats from the coast to above the tree line, including in native podocarp and beech forest, tussocklands, roughly grazed hill country and pine forest (Fox 1977, Barea 1995, Stewart & Hyde 2004). They will also breed in more intensively farmed areas, but only where suitable bush fragments remain (Seaton pers. obs.). Recently, they have also been reported successfully breeding in a periurban environment (Wingspan 2013). However, as a rule they are almost entirely absent as breeders from most urban and intensively farmed agricultural landscapes (Lawrence 2002, Robertson et al. 2004, Bell & Lawrence 2009).

9.1.2 Changes in the distribution of falcons: Pre-human to present day

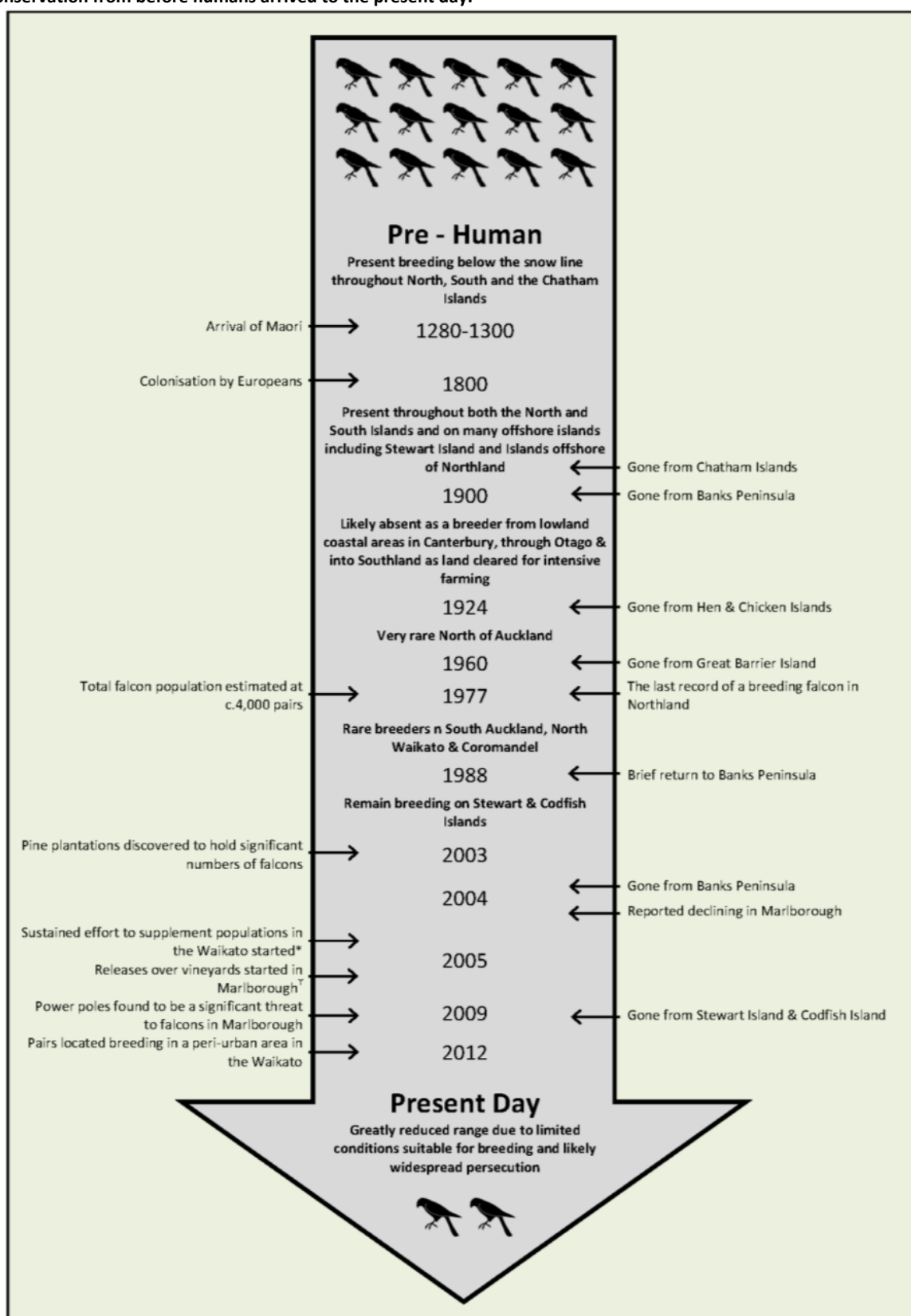
There can be no doubt that since the arrival of humans some 800 years ago (Wilmshurst et al. 2008) the population size and distribution of New Zealand falcons has greatly reduced. Before Polynesians arrived, falcons appear to have bred below the snow line throughout both main Islands and on many, if not all of New Zealand's major offshore islands (Oliver 1955), including the Chatham Islands (Scarlett 1955, Dawson 1957). Although it is not clear how bush clearance by early Maori and the introduction of Kioie affected the distribution of falcons', it seems likely that falcons still occupied most of New Zealand when early European settlers arrived. The following is a description of how the distribution of New Zealand falcons has changed since the European colonisation of New Zealand in the late 18th century (Fig. 5).

Some of the first specimens of New Zealand falcons procured by Europeans were collected in the Bay of Islands in 1824 and 1840 (Oliver 1955). Despite a lack of documented breeding records from Northland, these specimens, along with Oliver's (1955) assertion that "North of Auckland [falcons] have not been reported for more than 20 years", strongly suggest that falcons bred in the Auckland and Northland regions at the time of European arrival. Confirmed breeding records from the Hen and Chicken, Little Barrier and Great Barrier Islands (Oliver 1955) also show that falcons used to breed far further north than they do today. Equally, falcons were known to breed on the Chatham Islands, on Stewart Island and on the Auckland Islands in the mid 1800's, illustrating that falcons remained very widely distributed at this time (Marchant & Higgins 1993).

After 1888 no further signs of falcon breeding were reported from the Chatham Islands suggesting they became extinct there soon after this time (Marchant & Higgins 1993). Indeed, by the early 1900's it appears that the geographic range of the New Zealand falcon had retracted from large areas, including the Northland and Auckland regions (Oliver 1955). The last reports of breeding falcons from the Hen and Chicken Islands were in 1924 (Marchant & Higgins 1993) and by the 1960's falcons were no longer breeding on Great Barrier Island (Fox 1977). Despite Fox (1977) noting a pair of falcons breeding in Northland in the 1970's, they have not been reported there since (Lawrence 2002, Robertson et al. 2004, Bell & Lawrence 2009) indicating that they are extinct in Northland today. Similarly, falcons were reported in low numbers or absent in the Auckland region, northern Waikato and Coromandel in the 1970's (Fox 1977) and more recent surveys suggests that this remains the case (Lawrence 2002, Robertson et al. 2004, Bell & Lawrence 2009). Although populations of falcons remained on Stewart Island and Codfish Island in the mid-1950's (Oliver 1955), by the 1970's falcons were notably absent from much of the east coast of the South Island through Canterbury, Otago and Southland (Fox 1977). Indeed, falcons have only been recorded breeding on the Banks Peninsula very sporadically since the 1900's (Marchant & Higgins 1993), and they appear to be absent as breeders there today (Lawrence 2002, Robertson et al. 2004, Bell & Lawrence 2009).

Although the longitudinal studies necessary to conclusively determine population trends are lacking for falcons, indications that falcons may be declining in Marlborough (Gaze & Hutzler 2004) and the recently documented extinction of falcons on Stewart Island in 2009 (Harper 2009) are suggestive of a continued decline and an on-going retraction in range. Despite this, recent reports suggesting falcon breeding activity in the Auckland region (A. Schanzer pers. comm. 2012) coupled with research illustrating that falcons can breed in some highly modified and novel habitats (Stewart & Hyde 2004, Seaton et al. 2011, Wingspan 2013), gives hope that with the appropriate management of threats this threatened species could be recovered to large areas of its former range, and into a range of novel environments.

Figure 5. Changes in the distribution of New Zealand falcon and the timing of significant events relevant to their conservation from before humans arrived to the present day.



* By Wingspan, in partnership with the Kakepuku Mountain Restoration Trust

[†] Started by Falcons for Grapes & International Wildlife Consultants Ltd. Continued by the Marlborough Falcon Conservation Trust

9.1.3 Conservation Status

The New Zealand falcon, *Falco novaeseelandiae*, is classified under the New Zealand threat classification system as a threatened species (Miskelly et al. 2008)

Under the New Zealand threat classification system the three forms of the New Zealand falcon are classified separately as:

Bush form: Vulnerable (1000-5000 mature individuals – unnatural, stable. Data poor)

Eastern form: Vulnerable (1000-5000 mature individuals – unnatural, stable. Data poor)

Southern form: Nationally endangered (250-1000 mature individuals – unnatural, stable. Data poor)

Note:

These threat classifications are largely based on the population estimates made by Fox in the 1970's (Fox 1977). With advances in statistical modelling, improved knowledge of falcon ecology and more detailed land-cover maps it is likely that more accurate population estimates could be determined today. However, despite these advances the practical difficulties in collating the information on which models would be based remain and will always limit the accuracy of any population size estimate. Similarly, difficulties associated with population monitoring make it hard to determine which way falcon populations are trending. Nevertheless, an improved population size estimate combined with more information on population trends (e.g. collected via a number of localised monitoring programmes designed to inform more widespread trends), would lead to a more accurate assessment of the conservation status of this species, and an improved ability to prioritise any management actions required to support them.

9.1.4 Threats

Historically, the widespread clearance of native vegetation is likely to have been the single greatest factor in the decline of the New Zealand falcon population. Conversely, although habitat loss remains a significant threat in some areas (e.g. as pine forests are replaced with dairy farms), it is the direct and indirect effects of introduced mammals that likely pose the greatest threat to falcon populations today. Cats and mustelids have been documented predating both adults and chicks; while pigs, hedgehogs and possums will feed on eggs and chicks in the nest (Thomas 2008, Seaton et al. 2009, Kross 2013). In a forested habitat, the impact of predators on breeding success appears to be lower when nests are raised off the ground (Lawrence 2002). However, the effects of mustelids, a major predator of tree nesting species such as Kaka (Moorhouse et al. 2003), is likely to remain high wherever falcons nest. Further, regardless of where a nest is located, the combined impact of browsing mammals on vegetation cover, and predators on prey survival, reduces prey abundance which may limit the number of falcons that can survive in any one area.

Other threats include persecution and electrocution. The impact that persecution has had on falcon numbers in New Zealand should not be underestimated. Historically, it was commonplace for birds of prey to be shot on sight in the belief that they were vermin that needed controlling (e.g. to protect livestock & releases of exotic birds). Sadly, this attitude is still prevalent today and it is highly likely that deliberate shooting continues to have a significant impact on the ability of falcons to recolonize urban, periurban and even rural areas (Oliver 1955, Turbott 1967, Fox 1977, Heather & Robertson 1996). Added to this, in areas where high densities of un-insulated low-voltage power lines occur in relatively open habitats, it has been shown that electrocution can have a significant impact on falcon survival, particularly of juvenile females (Fox & Wynn 2010, Seaton et al 2011).

Finally, although it is unclear what impact disease (e.g. avian malaria) has had on falcon populations, there is certainly the potential for disease to have an impact on falcon numbers in the future, especially in light of a changing New Zealand climate and the latitudinal shift in vector species that could occur as a result.

9.2 Appendix Two: Conservation Work to Date

– New Zealand falcon

To move forward and plan for the future it is first necessary to understand what work has been undertaken in the past, what successes were achieved, where we failed and what needs to change to improve success. Below is a review of the conservation work undertaken to date split into the three components of the conservation action strategic work programme: Active Management, Advocacy and Research.

9.2.1 Active Management

The two activities that have been employed to date directly support falcon populations are 1. releases of captive reared falcons and, 2. the control of the introduced mammal pests that impact their breeding success and survival.

Restoration, Rehabilitation and Release

Since 1999 there have been several programmes established by Wingspan and other organisations to release captive reared falcons into the wild (Table 2). In an effort to offset the losses caused by human persecution, injured falcons have been also been rehabilitated and released nationwide by numerous rehab centres and individuals.

Table 2. Hack-release programmes established to supplement and restore populations of New Zealand falcon.

Programme	Conservation Successes	Limitations of Programme
Where: Paradise Valley Road, Rotorua When: 1999 to 2004 Who: Wingspan Birds of Prey Trust	<ul style="list-style-type: none"> - First to hack-release this species for conservation - Captive reared and released 13 falcons - Hack-release methods refined - Successfully established wild breeding pair onsite 	<ul style="list-style-type: none"> - Limited resources restricted the ability to monitor survival to first breeding thus limiting the assessment of success - A lack of detailed knowledge on the status of the falcon population in the area made it difficult to establish the benefits beyond supplementing the local population - Conflicts with captive and display birds made further releases untenable at this location
Where: Pahiatua Track, Palmerston North When: 2004 - 2008 Who: Massey University in collaboration with The Raptor Association of NZ. Chicks captive reared by Steve Laurence & Staglands Wildlife Park	<ul style="list-style-type: none"> - Successfully released 9 falcons - Wild pairs reported in wider area - Hack box design refined 	<ul style="list-style-type: none"> - Limited resources restricted the ability to monitor survival to first breeding thus limiting the assessment of success - Reports of wild pairs breeding in the area could not be unequivocally linked with the releases - A lack of detailed knowledge on the status of the falcon population in the area made it difficult to establish the benefits beyond supplementing the local population - Strong negative local reaction to falcon releases

Where: Kakepuku Mountain, Waikato When: 2005 to present Who: Wingspan Birds of Prey Trust in collaboration with the Kakepuku Mountain Conservation Project. Chicks captive reared by Wingspan. Otorohanga Kiwi House, Hamilton Zoo & Staglands Wildlife Park also provided chicks on occasion	<ul style="list-style-type: none"> - Released 31 falcons - An increased number of wild pairs have been reported breeding in the wider area suggesting that these releases have successfully contributed to the restoration of falcons in the area - Large advocacy successes in local community 	<ul style="list-style-type: none"> - Limited resources restricted the ability to monitor survival to first breeding thus limiting the assessment of success - No breeding falcons reported on Kakepuku Mountain to date - Reports of wild pairs breeding in the wider area have not as yet been unequivocally linked with these releases
Where: Vineyards in Marlborough When: 2005 - present Who: 2005 – 2011 International Wildlife Consultants Ltd., 2011 - present The Marlborough Falcon Trust. Chicks initially taken from wild nests – later relied on captive reared chicks. On occasion Wingspan also provided chicks for release	<ul style="list-style-type: none"> - Released 53 falcons - Successfully established 7 wild breeding pairs on several vineyards in the Marlborough region - Determined that falcons can be effectively used for pest control in an agricultural landscape - Successfully modified hack-box design - Identified that electrocution is a serious threat to falcon survival in some landscapes - Large advocacy successes in local community 	<ul style="list-style-type: none"> - Survival of released birds severely limited by electrocution, seriously hampering the ability of the project to restore the falcon population in most of the target area - Releases are now restricted to areas with a low density of power lines - Predation by cats and persecution by humans common - Limited data collection has reduced the ability to implement adaptive management processes to maximise the success of the releases
Where: Vineyards in Otago & Canterbury When: 2011 - present Who: Wingspan Birds of Prey Trust	<ul style="list-style-type: none"> - Released 5 falcons - Supplemented local falcon population 	<ul style="list-style-type: none"> - A lack of post-release monitoring makes it difficult to establish survival and successful breeding as a result of the releases

A limitation of all the releases summarised in Table 2 has been a lack of monitoring, analysis and reporting of the information necessary to evaluate the success of the releases. Without suitable pre and post-release monitoring and reporting it is not possible to objectively assess what elements of a release might need to be refined to maximise success. Even more importantly, without appropriate monitoring through to the point of first breeding, it is not possible to determine how successful the releases are being at establishing breeding pairs into the target area. If supplementing local populations is the aim rather than the restoration of a breeding population, although highly desirable, monitoring may not be as essential (likewise in the case of rehabilitated birds). However, where releases aim to restore local populations, monitoring and reporting on all elements of a release should be viewed as an important component of the release programme. Not placing an appropriate level of effort on monitoring and data collection or taking the required time to consider and report on the findings, risks placing a significant amount of energy and resources into releases that are constantly failing to achieve their objective – with no ability to recognise this and no chance of adapting methods to improve success. Because a lack of resources is most often the reason for a lack of monitoring being implemented, it is recommended that resources are focussed into a limited number of release sites such that monitoring is given priority over increasing the number of release sites. The amount of effort put into monitoring should reflect the degree to which we understand the factors affecting the success of the release programme. Thus, although monitoring is always recommended, once success has been consistently established over a range of sites, the amount of resources put into monitoring should be reduced to allow an increase in the number of release sites (if required).

The aim of several of the release programmes outlined in Table 2 were/are involved in supplementing falcon populations in regions where falcons already occur i.e. within the baseline population distribution (section 2.2). Although supplementing local populations is a valid aim (and no doubt has advocacy value), with limited resources being available with which to establish release programmes and implement appropriate monitoring, future resources would be better put into

releases in regions where falcons no longer occur or are in very low numbers i.e. within the potential population distribution (section 2.2).

Pest Control

Of any of the options available to support falcon conservation, it is arguably the control of introduced mammal pests over large areas that has the potential to benefit falcon populations the most. Reducing the densities of introduced mammal predators supports falcons by improving breeding success and survival. Similarly, the control of introduced mammal browsers improves habitat quality increasing prey abundance, and ultimately improving falcon breeding success and survival. As such, it is the actions of the Department of Conservation (DOC), Animal Health Board (AHB), Local Government and a small number of private organisations (including some forestry companies) that undertake widespread, landscape level pest control operations that potentially benefit falcon conservation the most.

Wingspan does not have the resources to undertake pest control operations on the scales required to significantly benefit falcons. However, by supporting research into pest control techniques that benefit falcons, by advocating for sensible policies on pest control and by vocally supporting organisations that implement large scale pest operations, Wingspan can make a significant contribution to the reduction of mammal pests over large areas of New Zealand.

9.2.2 Advocacy

In recognition that in order to successfully support the conservation of a species, people and communities must be aware of and sympathise with the target species, advocacy activities at Wingspan have focussed on educating people about New Zealand falcons, engaging them through a personal hands-on experience and using this as a platform to make people aware of the threats they face e.g. it is hoped that by showing people how spectacular and unique falcons are that fewer birds will be shot. This has been done through a variety of media, including public displays, an annual journal and through a dedicated website. However, how these elements might be modified in the future is not covered in this plan (this is provided in Wingspans Education and Advocacy Strategic Work Programme), rather this plan covers advocacy in terms of policy and best-practice and how these might be influenced to enable broad scale changes to support falcons directly.

The best example of this type of advocacy work thus far has been the collaboration of Wingspan, Massey University and the forestry industry in the development of best-practice management protocols to support falcons in exotic plantation forests. Since falcons were discovered breeding in the Central North Island in the late 1990's (Stewart & Hyde 2004), it has come to light that falcons occur in exotic pine plantations throughout much of their current range (Pawson et al. 2010). By advocating for these protocols to be established as industry best-practice Wingspan has the potential to aid falcon populations nationwide, not only within plantation forests but also in surrounding areas as healthy populations of falcons can potentially act as source populations for areas where breeding success and survival might be limited (Seaton 2007).

Therefore it is recommended that if Wingspan is to influence large scale landscape changes to support falcons, a strong focus should be given to the development of workable management recommendations specific to that land-use and to advocating for these to be taken up as industry best practice and/or nationwide standards.

9.2.3 Research

To date the bulk of research on New Zealand falcons has focussed on describing the ecology of the species, with a particular focus on the threats to its conservation. Below is a brief overview of the research undertaken on New Zealand falcon relevant to this conservation action plan.

Research on the New Zealand falcon began in earnest with Nick Fox's 1970s doctoral study on the biology of the species (Fox 1977). By outlining three taxonomic forms and describing the falcons nesting biology, hunting behaviour, population size and distribution Fox provided the basis for conservation management of the species.

With the subsequent formation of the Raptor Association of New Zealand and a groundswell of interest in falcons, Fox's research was steadily built upon through the 80's and 90's. Research at this time included descriptions of falcon populations in the King Country (Hedley & Hedley 1982), the Paparoas (Hyde 1987) and the Auckland Islands (Hyde 1993, Hyde and Worthy 2010). While other studies included a description of the dispersal behaviour of young falcons (Lawrence and Gay 1991), a national breeding survey (Lawrence 2002) and an MSc thesis by Laurence Barea which for the first time described the habitat use, diet and nest site selection of falcons in a bush habitat (Barea 1995).

Wingspan Birds of Prey Trust was formed in the early 1990's. In these early years, Debbie Stewart described techniques for the breeding and rearing of falcons in captivity (Stewart 1995) and soon followed these with the development of techniques for hack-releasing falcons into the wild (Stewart & Hyde 2002). Significantly, the first falcon chicks raised at Wingspan were rescued from a nest located in an exotic pine plantation, a habitat that previously had not been considered particularly suitable for breeding falcons. This prompted Wingspan to begin a monitoring programme in Kaingaroa Forest to describe the nesting biology of falcons in this habitat (Stewart & Hyde 2004). The discovery of falcons using pine forests provided an opportunity for a whole host of research projects on this species and Massey University Associate Professors John Holland and Ed Minot, with the support of Wingspan and the forestry industry, continue to foster research on the ecology of falcons in this habitat today (e.g. Holland & McCutcheon 2007, Seaton 2007, Thomas 2008, Thomas 2011).

Research suggesting a possible decline in the number of breeding falcons in the Marlborough hills (Gaze and Hutzler 2004) prompted the establishment of the Falcons for Grapes programme by Nick Fox and Colin Wynn in 2005 (now run by the Marlborough Falcon Trust). This programme aims to reintroduce breeding falcons into the lowland areas of Marlborough while also providing an eco-friendly method of controlling pest birds over vineyards, hence reducing damage to grapes. The corresponding research programme concentrated on determining the factors limiting the survival of falcons in this heavily modified landscape and on investigating how useful falcons were as a pest control measure (Fox and Wynn 2010, Seaton et al. 2011, Kross 2012).

In an effort to update the geographic distribution of the eastern form of the New Zealand falcon researchers at Otago University used remote sensing techniques to predict where falcon populations might occur based on the availability of suitable habitat (Mathieu et al. 2006). The Raptor Association of New Zealand also initiated efforts to improve our knowledge of falcon distribution by interrogating a variety of biodiversity databases and implementing surveys soliciting for observations of falcons (Bell & Lawrence 2009).

More recently, a multitude of reports have been authored investigating the potential effects of wind farms on falcons (e.g. Golder Associates 2012) culminating in best-practice methods for risk assessment being proposed (Seaton & Barea 2013).

At the time of writing two studies on falcons are taking place at Massey University, with the support of Wingspan. One is concerned with whether the three forms of the New Zealand falcon described by Fox (1977) hold true genetically (Lena Olley pers. comm.). The other is investigating the winter ecology of falcons, including whether 1080 pest control operations have any negative impact on falcon survival (Chifuyu Beckett pers. comm.). Noel Hyde is also currently leading investigations into the size range of Eastern and Southern falcons.

9.3 Appendix Three: Checklist of Key Targets

Appendix Three. Checklist of key targets for Wingspan and its partners to reach for each of New Zealand's birds of prey by 2018

New Zealand falcon - Karearea	✓	Morepork - Ruru	✓	Swamp harrier - Kahu	✓	Barn owl	✓
Active Management 1. Best-practice hack-release techniques for New Zealand falcon have been described and are freely available 2. Wingspan has developed, follows and freely promotes best-practice captive management techniques 3. The partnerships and resources necessary to run at least one hack-release site in Northland and Banks Peninsula have been secured 4. Falcons have been released from at least one hack-release site in Northland and Banks Peninsula 5. Monitoring suitable to establish survival until first breeding has been established at each of the three release sites 6. Permission to translocate wild chicks from pine forests in the Central North Island for release elsewhere has been thoroughly investigated		Active Management 1. Techniques for encouraging Morepork to breed in nest boxes by hack-releasing captive reared Morepork from nest boxes in a periurban environment (with a view to establishing similar releases in urban gardens at a later date) have been trialled		Active Management		Active Management	
Advocacy 7. The plantation forestry industry has implemented industry wide best-practice operating procedures suitable to reduce the impact of land preparation and harvesting operations on nesting falcons 8. Wingspan has described best-practice methods to reduce the impact of electrocution on falcons and has developed a plan to encourage the implementation of this best-practice by the industry 9. Wingspan has developed a pest management strategy to guide its support of pest control methods		Advocacy 2. Wingspan has developed a pest management strategy to guide its support of pest control methods		Advocacy		Advocacy	
Research 10. Continue to encourage research into suitable areas and support students by providing expertise 11. Confirm the Wairarapa coast is part of the baseline falcon population 12. Monitor the survival of a sample of hack-released falcons until first breeding		Research 3. Wingspan continues to encourage and support post-graduate research on the population biology of Morepork		Research 1. Support post-graduate research into the efficacy of harrier control as a threatened species and livestock management tool		Research 1. Whether the Barn owls breeding in Kaitaia arrived here naturally or are the result of captive releases has been determined	



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