CARDRONA ALPINE RESORT / NEW ZEALAND | TREBLE CONE

The KĀREAREA PROJECT

YEARS 1-5 SUMMARY REPORT

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EXECUTIVE SUMMARY

This report summarises five years of kārearea / NZ falcon / sparrowhawk research in the greater Wānaka area. Despite being an endemic species, with a high threat classification and low population density, kārearea are poorly studied. The objective of the project is to inform conservation management of NZ falcon in the southern New Zealand South Island high country. Our aim is to estimate the breeding population size and territory size, quantify nest survival rates and causes of nest failures, estimate adult survival rates, and identify management actions that benefit the conservation of this endemic raptor.

During breeding seasons one to four we surveyed approximately 30,000 hectares. In the fifth-year, surveys extended to West Wānaka, Hāwea, and Luggate, increasing the gross area surveyed by approximately 22,000 further hectares. Due to the land area being almost all in private ownership, we did not have access to the entire area, so the effective area is smaller.

We confirmed 14 pairs in the study area, identified a further possible 10 pairs, and found six birds on territories that weren't apparently paired with a mate. A very coarse pair per area estimate of 25 pairs in 52,000 hectares suggests one pair of kārearea per 2080 hectares / 21 km2. But this is very likely an underestimate.

Nest survival data has been collected from 22 nesting attempts. Eleven of the 22 nests fledged chicks, and eleven failed. Four of the nests were found when the chicks had already fledged. Our intention is to estimate nest survival using statistically robust daily survival methods. But our sample size of 11 total successful nests, minus the four nests that were found when the chicks had already fledged, does not provide a sufficient sample size for robust statistical analysis. For now, it is clear that successful nests result from less than half of nesting attempts.

Of the eleven failed nests, none were depredated by native avian nest predators. Four nests were lost to ferrets *Mustela furo*, two to cats *Felis catus*, one due to a possum *Trichosurus vulpecula* and one due to hedgehog *Erinaceus europaeus* attack (with human disturbance contributing also). A further nest failed due to human disturbance and the remaining one for unknown reasons.

Twenty-seven kārearea have been uniquely marked with a combination of a metal and coloured plastic leg-bands. Of the 27 leg-banded, 14 were adults, and the remaining 13 were chicks. The number of female kārearea that have gone missing from territories during or between breeding seasons is both interesting and concerning. If female mortality is higher than male, then there may be an imbalance in the sex-ratio of the kārearea population.

We identified three anthropogenic causes of kārearea injury or mortality; human disturbance during nesting, window-strike and shooting.

Lastly, we detail the community outreach aspects of the project, and future plans for continued research, education and advocacy.

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INTRODUCTION

In 2019 Cardrona Alpine Resorts Ltd (CARL) established a conservation project to inform the local conservation status of the endemic raptor kārearea / New Zealand falcon / sparrowhawk / *Falco novaeseelandiae* in the Cardrona Valley, and Otago high country generally.

Kārearea / New Zealand falcon Falco novaeseelandiae occur in a broad range of habitats, including tussock grasslands, old-growth native forest, seral regrowth forest, farmland, plantation forestry and urban and peri-urban areas. They are considered widespread but rare: the breeding population was estimated in the 1970s as some 4,000 pairs (Fox 1977) and numbers of breeding pairs remain poorly known. The New Zealand Department of Conservation estimates the population as 'Uncertain but likely between 5,000–8,000'. This estimate stems from coarse data, extrapolation and doesn't state if just adult birds are included in the total, or juveniles also.

The Department of Conservation recognises three ecological 'forms' of kārearea; bush, Eastern and Southern. The 'Southern form' inhabits Fiordland, Stewart Island and the Auckland Islands, and the 'bush form' are found in the North Island, mainly south of Hamilton, and NW South Island as far south as Greymouth. The 'eastern' form of the kārearea (Falco novaeseelandiae) occurs in the eastern South Island. The threat status of the eastern kārearea was recently revised back to Threatened–Nationally Vulnerable, the threat status they were prior to 2016. Between 2016 and 2021 kārearea were classed in the less-serious At-Risk–Recovering threat status (Robertson et al. 2013; Robertson et al. 2017; Robertson et al. 2021).

Despite being an endemic species, with a high threat classification and low population density, kārearea are poorly studied. A single PhD from the 1970s is the broadest examination into the species biology (Fox 1977). The two other main lines of examination into the species date from the early 2000s. Those two lines of research focus on kārearea in nationally unique (due to the extensive contiguous area) Central North Island plantation forestry (Seaton 2007; Stewart and Hyde 2004), and the use of the species to control exotic pest bird species on vineyards in Marlborough (Kross 2013; Seaton et al. 2011). Kārearea are a conspicuous presence in the South Island high country, and forests, but knowledge to inform conservation management is sorely lacking.

The objective of this study is to inform conservation management of NZ falcon in the Cardrona Valley and surrounding area, Central Otago. This area is representative of the South Island high country. Some population demographic parameters — statistics of population health– are critical to the conservation management of any species. Vital parameters not known for falcons in the mountainous Central Otago area are:

- Population size (number of breeding pairs)
- Territory size
- Population trends (stable, increasing or decreasing)
- Breeding success (productivity)
- Survival rates of adults and juveniles
- Methods to mitigate breeding failure or adult / chick mortality based on site-specific information

At the end of a five-year conservation project, we aimed to have established:

- A population size estimate of NZ falcons in the Cardrona Valley area via extensive surveys, establishing a baseline estimate for future population trend assessment.
- An estimate of breeding success, identification of causes of breeding failure, and possible methods to reduce causes of breeding failure identified (e.g. control of introduced predators)
- A study population to allow adult and juvenile survival rates to be estimated (colour leg-banded adults and juveniles)
- Insight into potential human-caused mortality (such as electrocution in uninsulated power infrastructure, window strike, or persecution) allowing mitigation of these threats.

The location of kārearea nests was not shared widely to avoid disturbance to nesting birds from humans. It is critical that for the welfare of kārearea, and the privacy and continued support of farmers providing access, that nest locations are kept confidential.

Efforts to increase the awareness of kārearea and the conservation status of the species were concurrent to the scientific aims of the project. Developing a rapport with the farming and wider community, and learning from farmers about their interactions with kārearea, has been a significant aspect of the work.

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METHODS

Site access

All work was carried out in the Cardrona Valley and greater Wānaka area, Central Otago (Fig. 1). The vast majority of kārearea habitat in the focal area is in private ownership. Liaising with farmers to gain permission to access their land, learn about their experiences with kārearea, and build good working relationships, was therefore of high importance. We also engaged with the Southern Hemisphere Proving Ground for access to their road network, allowing access from there to farm tracks. We communicated with the wider Wānaka community to raise awareness of the project and encourage vigilance and reporting about kārearea sightings around people's residences.

Site and nest survey

Falcon survey relied on observations of falcon activity (calling, food carrying) and territorial defensive behaviour of adult falcons while one or two observers walked through an area. Surveys from observation points with good vantage over likely kārearea habitat were also used extensively.

We surveyed widely, using occasional brief playback of falcon calls from a small hand-held speaker. Recorded kārearea defence calls were broadcast for 20 seconds (call-playback), or for a shorter period if a response was detected. Call playback locations were spaced approximately 200 m apart and were chosen based on the local topography and vegetation cover. Sites ideally allowed the broadcast call to transmit unobstructed by vegetation or terrain in the immediate area and provided a good range of vision for detecting approaching kārearea. The field-person observed for any kārearea activity 10 minutes after call-playbacks were broadcast. Any sighting or falcon call was followed up by searching in close swathes through the area. Once approaching a nest, falcon pairs typically display aggressive defensive behaviour (dive-bombing an intruder) that we used to locate the nest and if appropriate to enable capture for marking (leg-banding) falcons.

The age and sex of observed kārearea was determined by plumage and size. Adult plumage (> 1 –2 year-old) is distinguishable from juvenile birds (< 1-year-old), and females are approximately twice the size of males (Fox 1977) (Fig. 2).

We recorded kārearea sign (prey remains, regurgitated pellets and excrement) and activity (roosting, hunting, breeding). If we encountered nesting behaviours, we then determined the activity of the birds. Kārearea are prone to nest disturbance, and potential abandonment prior to laying eggs and in the first two weeks of incubation. If it was determined that birds may be in the early stages of nesting, we therefore quickly vacated the immediate area and observed from a concealed location >200 m distant, with the aid of binoculars.

To determine the nesting success of breeding kārearea we installed two trail cameras at each nest, (Model: Bushnell Core Trail Cameras). The cameras were to record if chicks successfully fledged from the nest and if introduced mammalian predators visited nests and caused nest failure due to disturbance to breeding birds or depredation (of eggs, nestlings or adults). Both cameras were set with an infrared motion-detection function, to take three images.

Figure one. Boundaries of kārearea surveys in the greater Cardrona Valley and Wānaka area, depicted as red dashed lines.

Figure two. An adult female (left) and a juvenile female (right) kārearea. Note that these birds (part of a separate study) illustrate two types of leg-bands used to mark individuals.

RESULTS AND DISCUSSION

Population size estimate

We conducted extensive surveys for kārearea in all five field seasons of this project. In the first four years we focused on the area from the lower Cardrona Valley to where the Cardrona River meets the Clutha, out to Mt Barker and to approximately 3km south of the Cardrona Hotel, in the Cardrona Valley (Fig. 1). This area is approximately 30,000 hectares. In the fifth-year, surveys extended to West Wānaka, Hāwea, and Luggate, increasing the gross area surveyed by approximately 22,000 further hectares. Importantly though, due to the land area being almost all in private ownership, we did not have access to the entire area, so the effective area is smaller.

Because kārearea will use the same territory in successive years, our surveys in each season first determined if pairs detected in previous seasons were still holding territories. Checking if pairs were still on a territory in a subsequent spring is far quicker than finding pairs with no prior knowledge. Due to this, the number of known pairs increased over the five years of surveys. Our fifth-year survey results are therefore the most comprehensive.

In year five, we confirmed 14 pairs in the study area, identified a further possible 10 pairs, and found six birds on territories that weren't apparently paired with a mate. We say apparently because we can't exclude that a particularly wary mate was present but not observed, or that a nest failed around the time that we surveyed, the pair were less active in the period immediate after nest failure, and time or budget constraints resulted in fewer visits to the territory than was ideal. But given that pre-nesting and nesting kārearea are generally conspicuous, and become more conspicuous as the nesting attempt progresses, we are mostly confident about where we haven't found kārearea.

It should be noted that kārearea radius of activity also changes significantly through the year, with birds having a much smaller radius of activity during the breeding season (Horikoshi et al. 2017). So even if a nesting attempt is unsuccessful, the birds will generally be active in a concentrated area, and we would expect to encounter them in surveys provided that at least five or six visits are made to the area throughout the breeding season.

A very coarse pair per area estimate of 25 pairs in 52,000 hectares suggests one pair of kārearea per 2080 hectares / 21 km2. But this is very likely an underestimate as we did not have permission to access all areas in the 52,000-hectare area. Still, it is interesting to compare that coarse estimate to territory size reported elsewhere. Kārearea in plantation forestry have larger home range sizes in winter (radio tracked females 32 km2 and males 15 km2) (Horikoshi et al. 2017). In comparison, in forestry, radiotracking showed the breeding season mean home-range sizes were 9.2 km2 for males and 6.2 km2 for females (Seaton et al. 2013). Territories averaged 3.80 and 3.95 km apart in open farm country in Marlborough and North Canterbury, respectively, with the hunting range of a kārearea pair estimated as 14–15 km2 (Fox 1978a).

A similarly coarse assessment of the number of pairs in conifer plantation forestry areas in Coastal Otago estimated 20 km2 of conifer plantation per pair, but this did not account for the additional non-plantation forest habitat mosaic those pairs may use (Rexer-Huber and Parker 2022).

From survey results we can therefore state that although we have recorded kārearea in all types of habitats within the study area, the species territories are not contiguous in the landscape. Instead, there appears to be vast areas of what appears to be acceptable habitat, where kārearea are absent.

Breeding success

Over the five summers of falcon research, nest survival data has been collected from 22 nesting attempts. The earliest that kārearea initiated incubation was late August, and the latest late December. Climatically late August is very much still winter, with frequent sub-zero temperatures and snow. Kārearea incubate for 25 – 35 days and chicks fledge the nest-scrape at 25 to 32 days (Seaton and Hyde 2013).

Eleven of the 22 nests fledged chicks, and eleven failed. Four of the nests were found when the chicks had already fledged. Fledged chicks being provisioned by parents are noisy and conspicuous, and more readily found than nests during the incubation or nestling stage.

There is a statistical bias towards finding successful nests, versus failed nests, because successful nests exist for longer so have a higher probability of being found. To account for this statistical bias, daily nest survival can be estimated (White and Burnham 1999). Our intention is to estimate nest survival using statistically robust daily survival methods. But our sample size of 11 total successful nests, minus the four nests that were found when the chicks had already fledged, does not provide a sufficient sample size for robust statistical analysis. But given that the ratio of nests found versus nests that were successful (here, 11/22, or 50%), is an overestimate, successful nests clearly result from less than half of nesting attempts. A greater sample size of nests will allow robust nest survival estimates.

A kārearea research project in Coastal Otago that collected nest survival data over seven breeding seasons found apparent nest survival was 67%. Whereas daily nest survival to account for the bias towards positive nests determined that nest survival was 42% (SE 0.10, CI 0.25 – 0.64)(Parker et al. in prep).

It is also interesting to note that three of the four nests found during the incubation stage were in areas that had restricted access during lambing. The timing and duration of restricted access during lambing is widely variable between farms, but frequently interferes with access to areas for up to six weeks. It is possible that the nests found after lambing prevented our accessing areas, were second nesting attempts after a failed first nesting attempt. If this is the case, valuable nesting information, like the cause of failure for example, is lost due to restricted access.

Visits to nest by non-predatory mammals was also common, most commonly domestic stock, but also wild ungulates and lagomorphs (Fig. 3).

Causes of nesting failure

All kārearea nests were on the ground (Fig.4), and therefore accessible to the full suite of introduced mammalian predators in the area, not just predator species that climb well. Of the eleven failed nests, none were depredated by native avian nest predators (Australasian harrier *Circus approximans*, black-back gulled *Larus dominicanus*, spur-winged plovers *Vanellus miles*). Eight nest depredation events were attributable to depredation by introduced mammalian predators. Four nests were lost to ferrets *Mustela furo*, two to cats

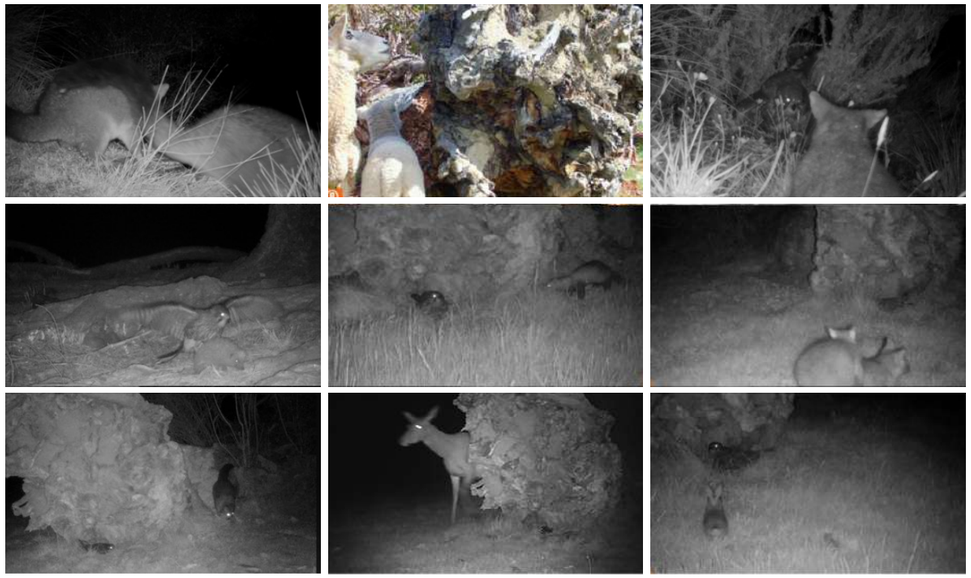

Figure three. Mammalian visitors to kārearea nests are common. Some are nest predators (cats, possums, ferrets, hedgehogs), others are agricultural (cattle, sheep, deer) and some are feral (deer, rabbits, hares).

Felis catus, one due to a possum *Trichosurus vulpecula* and one due to hedgehog

Erinaceus europaeus attack (with human disturbance contributing also). A further nest failed due to human disturbance and the remaining one for unknown reasons. All four of the ferret caused failures were at the chick stage. There are more cues available for predators during the chick phase of nesting, as the nest-scrape is smellier due to chick waste and prey remains accumulating at the nest, more noise from chick vocalisations, and more activity as both parent bring food to the nest-scrape. Both cat caused failures were during incubation. One of those was in a very busy public area and human disturbance occurred also. The birds leaving the nest frequently due to human disturbance may have increased the probability that a predator like a cat or hedgehog depredated a nest. A cat also depredated an adult female at one nest.

The human disturbance was all at public areas. The first two at separate nests close in proximity, located on either side of the Clutha River at the Albert Town Reserve and Albert Town Campground, and the third was beside a very popular river white-water play area in Hawea.

Twenty-two is a lower number of nest events than we'd hoped to have followed over the five seasons. Reasons for this are a delayed start to the project due to Department of Conservation delay in approving a research permit, complex mosaic of mostly private land ownership and therefore access permissions, the large territories of kārearea in the area, travel and survey times durations, varying levels of access during lambing and lastly, nests failing before we can find them.

This last point is supported by the number of pairs found, versus nests. In each year of the project, more kārearea pairs were found than nests, and for many pairs no nesting attempt was recorded. This is because kārearea use the same territory in successive years, meaning pairs found in previous years surveys were quick to confirm if still present there, allowing more time to survey new areas, and subsequently more pairs being

Figure four. Examples of kārearea nest-scrape locations. All are on the ground.

located. But a strong increase in known pairs has not resulted in a larger sample size of nests. We think this is due to nests failing before we can find them. Much more survey and monitoring effort is expended on non-nesting pairs then pairs where we have found nests. Once a nest is found, and cameras put in place to monitor it, we don't need to visit the area regularly. Whereas pairs that are showing all the behaviours of a breeding pair but for which a nest has not been found, need to be regularly visited to check if they have nested yet. We have no way of knowing if a nest attempt has failed between visits

Methods to mitigate nest failure

Our nest monitoring revealed depredation of eggs and chicks by introduced mammals to be the most significant cause of nest failure. Ferrets and cats were the most recorded kārearea nest predators. Control of these predators will benefit kārearea. Rabbit control operations must also impact kārearea at times, given that rabbits presumably provide a large proportion of prey for ferrets and cats. If rabbit numbers drop swiftly, those predators reliant on them may prey-shift to species like kārearea.

Human disturbance also featured as a cause of nest failures, in two highly public areas (a reserve and a campground), and almost certainly at least contributed in a third area. In the last example, a helmet was found at the nest site, with a single earmuff missing from it. We were informed that a local resident was determined to mow the grassed public area adjacent to the falcon nest, and we suspect the helmet was knock-off the lawn-mowing person by a kārearea defending its' nest. Unfortunately, there is a strong risk that kārearea will injure themselves when they encounter a helmet at full speed flight when defending their nest. These injuries, like broken legs for example, can result in the mortality of the bird through directly, or indirectly from starvation, for example. Ongoing advocacy and education directed towards farmers and others who may encounter nesting kārearea is important.

Study population for survival rate estimates

Twenty-seven kārearea have been uniquely marked with a combination of a metal and coloured plastic leg-bands, allowing the bird to be identified as an individual with binoculars. Of the 27 leg-banded, 14 were adults, and the remaining 13 were chicks.

A larger number of leg-banded kāreaea was expected at the end of the five year period. But kārearea can only be captured whilst nesting, and then only once they are a few weeks into incubation, so the large number of failed nests has impacted on the number of capture opportunities. Capturing kārearea is also a time intensive process, involving most of a day. Time focused on captures is antagonistic to finding nests. In this project time spent on captures has been a lower priority to finding nests for nest survival data as identifying and managing nest predators is likely the least difficult conservation management action to implement for kārearea.

The number of female kārearea that have gone missing from territories during or between breeding seasons it is both interesting and concerning. If female mortality is higher than male, then there may be an imbalance in the sex-ratio of the kārearea population. For example, a single territory has had three different females in five breeding seasons. A second territory had two females in two seasons, but this example may have just been due to a 'divorce' or the natural mortality of the female mate. A third territory has had two females in three breeding seasons.

In one case we found that a female kārearea had two male mates that were courtship feeding her. This type of scenario is also the best explanation for the behaviours observed for another pair that were very conspicuous and apparently about to breed in the lower reaches of Cardrona ski-field, but then completely disappeared during the middle of the breeding season.

Insight into anthropogenic mortality

Over five years we've gained only one direct insight into causes of adult mortality that aren't attributable to depredation by introduced mammalian predators: an adult male flying into a window. A second male was observed flying into a window, but the collision was not fatal. On that occasion the bird sat sprawled out on a deck for 15 minutes, before taking flight to a nearby tree. The bird was clearly vulnerable to depredation by domestic cat or dog during the 15 minutes of presumably being stunned after the collision with the window. A third window strike event resulted in the bird being rehabilitated for a considerable period of time in captivity, and then being release back into the Cardrona Valley.

Wānaka is a rapidly growing community. In the five-year period of this project, five kārearea territories have had construction projects of tens of houses commence in the immediate area of the kārearea territory. As an affluent community, much of the housing has extensive large glazing (windows), and these pose a significant threat to kārearea survival. Especially corner windows, or windows positioned such that kārearea can see through the building and may attempt to 'shoot the gap'. Given the species flies well more than 100 kilometres per hour, collisions are very often fatal. Or as the above example illustrates, may contribute to a fatal depredation event.

Persecution (shooting) is known to occur in the area when kārearea are deemed to be a threat to domestic poultry. An adult female kārearea was found dead in the Wānaka area, and necropsy by Massey University's Wildbase determined that the bird had been shot. Despite the shot kārearea being discovered on May 7, two days after the opening of the duck-hunting season, the bird had not been shot with a shotgun but rather what appeared to be a .22 calibre rifle.

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CONCLUSIONS

After five breeding seasons of researching kārearea in the South Island high country, a considerable amount has been learned about the breeding population size, territory and nest site locations, reproductive success rates, population threats, and possible management options to address some of the threats.

Kārearea in Cardrona Valley and beyond into the greater Wānaka area have large territories, that are not contiguous in the landscape. Yet the areas that do not support breeding pairs of kārearea are not clearly different to the areas that do. Our limited data show that less than half of nesting attempts are successful. We think that the resulting low productivity, combined with potentially female biased adult mortality from depredation by introduced mammalian predators, window-strike and likely electrocution, results in a significantly smaller kārearea population than is possible.

SCIENTIFIC RECOMMENDATIONS

- Collect further nest survival data to allow for robust daily nest survival.
- Collect further survival data for adults to understand if there is a difference in male and female survival rates.
- Conduct fine scale (GPS) kārearea tracking work to determine fine scale habitat use, and spatial risk assessment.
- Quantify the electrical infrastructure in the area, overlay it with kārearea GPS tracks and if necessary, investigate if mitigation options should be considered.

Figure five. From left to right, volunteers Dan Orbell and Eve Buckland, Project Lead Ewan Mackie, supporter and volunteer Karen Day, and landowner and volunteer Sarah Stewart.

COMMUNITY ENGAGEMENT

Over the five-year progression of this project, advocacy and education has played a minor supporting role to the scientific objectives. Nevertheless, we are buoyed by the interest we have received and information that has resulted from volunteer engagement, public talks, local and national media articles, and reports to the projects webpage. The project is well known locally now, and that supports better data acquisition, and awareness of the conservation status of kārearea.

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FUNDING

The Kārearea Project has built a sound funding base in our first 5 years. This has comprised of direct funding from Cardrona/Treble Cone, supplemented by donations from guests when purchasing season passes online (guests are offered the opportunity to donate to the 4 projects that comprise the “Cardrona/Treble Cone Foundation”). Additionally, the project has received donations from various trusts, private companies and philanthropic individuals (see Acknowledgements section). This has enabled the first 5 years of research and provides a good platform to launch the next phase. A significant increase in funding has recently been achieved through a generous 3-year commitment of support from the Cardrona Distillery.

This funding covers the project’s annual operational expenses, which mostly comprises field work and minimal associated costs (vehicle fuel, leg-bands, capture equipment). Additional funding will be sought to purchase specialist equipment for this next phase of the project. Specifically, for advocacy and education live feed transmitting cameras and associated setup/ operational costs. In addition, provided that the Department of Conservation approves our application to conduct GPS tracking on a sub-sample of kārearea in our research area, GPS tracking devices will be purchased to inform spatial risk assessment.

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NEXT PROJECT PHASE

The growth of the project has seen the study area increase from the Cardrona Valley to the entire Upper Clutha basin. As such, the project now covers a large area, allowing a higher number of breeding pairs to be followed. This requires significant field work, as described in the Methods and Results sections above.

With increased funding for the project the intention is to increase our field work hours to enable effective coverage of the study area, and an increase in the sample size of data collected (more pairs, more nests followed, more breeding adults marked). The field work will continue to be led by Parker Conservation staff, supplemented and assisted by volunteers. To increase effectiveness a field assistant will be employed for the duration of the operational period (September – January) on a part time basis. Efficiency and flexibility could be achieved through this role being shared with other Cardrona/Treble Cone Foundation Projects. This role will not need the same level of qualification or experience as what is required from the project leads, Parker Conservation. But an individual with sound ecological understanding and strong field work background will be tremendously beneficial to the work of the project during the busy Kārearea breeding season.

Building on the modest public profile that the project has created in its first 5 years will be an important aspect of the next phase. The project will increase efforts in this space through several approaches that will be explored:

- Increase the delivery of public talks delivered to the local community.
- Submit scientific journal short-notes and articles to peer-revied journals.
- Continue to feature regularly in the Wānaka Sun, Wānaka App, Crux, and other regional news media outlets. Explore opportunities for wider reach through national media, especially those that have a specific environmentally interested readership/ audience. Examples to explore include NZ Geographic and Our Changing World Radio Show.
- Develop a stronger connection with the “Wānaka Grebes” project. Raise the profile of both projects through some shared advocacy & public engagement.
- Install additional project information boards in public places, such as the soon to be established Mt Iron Recreation Reserve.
- Deliver talks to local schools and look for opportunities to directly involve local children in the work of the project. Could combine with work or other organisations already active in this space, such as Southern Lakes Sanctuary.
- Setup and operate one or two live streaming cameras from nest sites in a future breeding season. Stream directly through a webpage that also delivers information on the project. Aim to emulate the success of raptor cameras used elsewhere, and other web based live-streaming initiatives.
- Consider a dedicated website and/or social media platform for the project.
- Leverage the reach of the project’s supporters’ communication channels and specially make use of the voice of Cardrona / Treble Cone / Realnz. The company has recently redefined its purpose as being “to help the world fall in love with conservation”. Sharing the ongoing story of the Kārearea Project aligns perfectly with this purpose.
- Explore opportunities for public artwork representing the project, such as painted Telecom junction boxes or street art murals.
- Establish a Kārearea themed art competition to raise awareness and involve members of the community. Could showcase at an event such as NZ Mountain Film Festival.
- Further develop links with environmental/ conservation focused groups/projects such as WAI Wānaka, Forest & Bird, Wānaka Backyard Trapping, Southern Lakes Sanctuary, WAO etc. Similarly continue to develop relationships with QLDC, ORC and DoC.

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Branch Creek Station

Robrosa Station

Avalon Station

Highland Burn

Run 505

Kind Farm

Hillend Station

The Larches Station

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Martin & Kay Curtis

Cardrona Alpine Resort

Cardrona Hotel

Cardrona Distillery

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Mt Cardrona Station

Wānaka Top Ten Holiday Park

Geoff & Maureen Kernick

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APPENDIX 1

	Year	Nest successful	Cause of failure	Stage Nest Found	Stage Nest Fail
1	2019	1	NG	Chicks fledged	NA
2	2019	0	Possum	Eggs	Eggs
3	2020	0	Ferret	Eggs	Chicks
4	2020	1	NA	Eggs	NA
5	2020	0	Cat	Eggs	Eggs
6	2021	1	NA	Chicks fledged	NA
7	2021	1	NA	Eggs	NA
8	2021	1	NA	Chicks small	NA
9	2021	0	NA	Eggs	NA
10	2021	1	NA	Chicks fledged	NA
11	2021	0	Humans	Eggs	Eggs
12	2021	0	Cat	Cat	Eggs
13	2022	1	NA	Eggs	NA
14	2022	0	Ferret	Eggs	Chicks
15	2022	0	Unknown	Eggs	Unknown
16	2023	0	Ferret	Eggs	Chicks
17	2023	0	Hedgehog/Humans	Eggs	Eggs
18	2023	0	Ferret	Eggs	Chicks
19	2023	1	NA	Eggs	NA
20	2023	1	NA	Eggs	NA
21	2023	1	NA	Chicks fledged	NA
22	2023	1	NA	Eggs	NA

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