

Kōkako Nest Monitoring Report

Ark in the Park 2023-24

Summary report prepared for Forest and Bird

Madeleine Powers



Pūtahi in flight. Photo credit: Grant Capill.



Table of Contents

Introduction.....	3
Methodology.....	5
Nest Monitoring Outcomes.....	8
Discussion.....	11
Key Recommendations.....	15
Acknowledgements.....	16
References.....	17

Introduction

North Island kōkako, *Callaeas wilsoni* (henceforth kōkako) belong to the endemic New Zealand wattlebird family Callaeidae, an ancient family of birds which includes the North and South Island tīeke or saddleback (*Philesturnus rufusater* & *P. carunculatus*), the data deficient South Island kōkako (*Callaeas cinerea*) and the extinct huia (*Heteralocha acutirostris*).

Prior to human habitation, kōkako were common in forests throughout the North Island. Until recently, kōkako were nationally threatened with extinction, and the primary driver for their decline was ongoing nest depredation by ship rats (*Rattus rattus*) and possums (*Trichosurus vulpecula*), following historical habitat clearance. By 1999, the national kōkako population had been reduced to approximately 330 pairs (Innes et al., 1999). All extant mainland populations must be managed against introduced mammalian predators via sustained predator control for the duration of the kōkako breeding season (Innes et al., 2020). Following the instigation of predator control across 11 remnant populations, and the translocation of kōkako to establish 14 new populations, the national kōkako population has increased to over 2,000 pairs by 2020 (Burns, pers. comm.) and the species has been re-classified as ‘at risk- recovering’ (Robertson et al., 2016).

Between 2009 and 2016, 47 North Island kōkako (*Callaeas wilsoni*) were translocated to Ark in the Park to reestablish the species in Auckland’s Waitākere Ranges, following their extirpation from the area in the 1950s. Ark in the Park (henceforth ‘Ark’) is a project managed by Forest and Bird in partnership with Auckland Council, with support from mana whenua Te Kawerau ā Maki. Introduced mammalian predators are controlled over approximately 2,400 hectares to promote the recovery of native flora and fauna.

During the 2023-24 nest monitoring period, seven kōkako pairs were observed within the predator-controlled area and a further pair was observed beyond the Ark area. These kōkako comprised four translocated kōkako and 12 Ark bred kōkako. Three translocated single kōkako were also seen during this period, and an additional three unbanded singles. There was no population census carried out in 2023 due to contractor availability. The last full census occurred

in 2022, when 18 territorial pairs were identified (2 of these residing outside the Ark), with a total of 40 individual kōkako identified, and a further 11 unidentified. (Unidentified kōkako were unable to be called-in to have their status as banded or unbanded confirmed. The unidentified birds were confirmed as separate to those already identified). This is the highest number of territorial pairs identified at the Ark, a slow increase from the previous full census in 2018 which identified 16 territorial pairs. Banding checks helps to determine the level of recruitment and natal dispersal distances and will increase the accuracy of future surveys.

To help determine whether the predator control methodologies used at Ark this season were sufficient to ensure kōkako population growth, seven kōkako pairs were monitored between November 2023 and February 2024 during the breeding season. One additional pair was monitored outside Ark. Of the seven pairs of kōkako monitored within Ark, two produced fledglings. The pair monitored outside Ark, within the Auckland Council Hochstetter frog management area, successfully produced fledglings. No nests were found during the monitoring period; nesting success was recorded after identifying pairs with fledglings. It is not known whether nesting attempts were made prior to monitoring beginning, or post-monitoring finishing. Without finding nests and monitoring closely, probable causes of any nest failures are also not known, however, predation is the main cause of kōkako nest failure, including at the Ark (see previous nest monitoring reports at <https://arkinthepark.org.nz/research/>). All monitored nesting adults were observed to be present at the end of the nesting season.

Territorial kōkako pairs will attempt to nest at least once during every breeding season. The exception is same-sex pairings. Therefore, if a pair is known to have attempted nests in the past, it can be assumed that they will do so every season.

It is recommended that the findings of this report are used to guide adaptations to predator control within the Waitākere Ranges. The principal recommendation is that the annual control of mammalian predators is continued and, most importantly, enhanced across all known kōkako territories. As directed by the Kōkako Recovery Group (KRG), at sites employing continuous pest management the target is to reduce ship rat and possum abundances to <5% rat tracking

index (RTI) and <5% residual trap catch (RTC) at all times throughout the breeding season (early November to late March) (Flux et al., 2019).

It is further recommended that the predator control network be expanded and/or intensified around existing kōkako pairs with territories close to the Ark boundary, or beyond the Ark, to better protect them. This may increase adult kōkako survival as well as maximising breeding success, thereby improving the likelihood of long-term persistence of the Waitākere kōkako population.

Methodology

Annual monitoring of the breeding success of a sample of kōkako pairs at Ark is an important measure of reproductive success. Breeding success is determined by intensely monitoring a sample of at least six kōkako pairs within the Ark throughout the breeding season (table 1); the previous breeding success monitoring occurred in 2020-21.

Of the seven target pairs to monitor this season, which had been confirmed present in the 2022 survey, it was determined that four were present this season while three were confirmed as territorial singles (table 1). As a result, four additional pairs were also monitored to bring the total number of pairs monitored over the season to eight (table 2). One pair monitored this season were not within the Ark, and therefore their success does not reflect directly on Ark outcomes.

One pairing consisted of banded kōkako (pair 2), and two pairs consisted of one banded and one un-banded kōkako (pairs 1 and 3). Pair two, and the banded individuals from pairs one and three have been monitored in previous seasons. Pair one and three occupy the same territory as in previous seasons, but it is unknown whether the unbanded kōkako within the pairing is the same individual from previous years. Pairs seven and eight appear to occupy the same territory as pairs located in previous censuses, but it is unknown if they are the same pairs.

Determining the proportion of nests from which at least one chick fledges is a more accurate representation of juvenile output than surveying for fledglings, as in years of high fruit availability, kōkako pairs can fledge two, and rarely three, successive clutches. They may also have up to five failed nest attempts in a season (Flux et al., 2006).

Table 1: Confirmed status of kōkako pairs identified for monitoring through 2023-24 breeding season.

Notes: * Gordon and Kiwitea were not initially on the list to be targeted but were role-called in case they were still a pair. Gordon was confirmed as single (male).

** Cloud and Niño are outside of the Ark management area.

*** Due to Grant holding a territory in Spragg Bush for multiple years, a pest control network maintained by the Ark was established here in late 2023/early 2024.

Pair	Location	Kōkako for 2023-24 nest finding	Confirmed pair or single (sex) during roll-call
1***	Spragg Bush	Grant (YY-GM) + UB	Pair
2	N (20)	Ranginui (YM-LO) + Mānuka (M-YB)	Pair
3	IW (3)	Pūtahi + UB	Pair
4	AWS (10)	Tahi Kaha + ?	Single (male)
5	IW (6)	Kapua + ?	Single (male)
6	AWN (11)	AWN North (UB pair)	Pair
7**	IW track start	Cloud + Niño	Single (male)
8*	N (11)	Gordon + Kiwitea	Single (male)

Table 2: Kōkako pairs monitored through the 2023-24 breeding season

*Note: *Pair six are located outside of Ark management area, but in an Auckland Council Hochstetter frog pest control area.*

Pair	Location	Male	Status	Female	Status
1	Spragg Bush	UB	Ark Bred	Grant	Ark Bred
2	N (20)	Ranginui (YM-LO)	Translocated (Mangatutu)	Mānuka (M-YB)	Translocated (Waipapa)
3	IW (3)	Pūtahi (YR-RM)	Ark Bred	UB	Ark Bred
4	AWN (11)	UB	Ark Bred	UB	Ark Bred
5	Gleeson access	UB	Ark Bred	UB	Ark Bred
6 *	Piha Road	UB	Ark Bred	UB	Ark Bred
7	N (16)	UB	Ark Bred	UB	Ark Bred
8	CGN (1)	UB	Ark Bred	UB	Ark Bred

Nest searching was carried out by one experienced kōkako ecologist, with the help of a trainee, and two other experienced kōkako ecologists. Best practice methodology was followed, as detailed by Flux and others (2019).

The first few weeks of observation were used as a roll-call to confirm target pairs, as no recent survey results were available. The purpose of this roll-call was to determine if territorial kōkako found in the 2022 census were still paired and in the same location this breeding season. Roll-call was also used later in the season to find additional kōkako pairs to monitor (table 2).

Nest monitoring was based on observations of adult activity, including incubation or brooding time, observation of nest building, frequency of adult visitation, and observations of food carrying.

Following any suspected fledging, pairs were monitored to confirm the number of successfully fledged chicks. Definite evidence for the presence of juvenile kōkako, following Flux et al. (2019):

- a. Very small (pea-sized) pink lilac wattles, sometimes concave and brown/olive plumage.
- b. Short tail (c.f. Adult length).
- c. Emergent down on thighs, head or neck or “peaked” tips to feathers. Brown tinge to plumage (all observations apply).
- d. Third (or more) bird(s) travel with adults for at least 5 minutes or 100m and is fed by them. ‘Travels with’ means all birds traveling within metres of each other without overt aggression such as chasing.
- e. Third (or more) bird stashed by parents, and both parents are seen to return to feed it. Stashed birds must remain in sight while parents feed and then leave.

Nest Monitoring Outcomes

Monitoring did not start this season until November; nesting activity had likely already begun, and nest attempts may have been missed entirely. Kōkako typically make their first nest attempt early in the season, and do not delay nesting until later in the season. Monitoring this first attempt becomes more important if they only have one attempt the entire season. Nest monitoring concluded at the end of February 2024, but in previous seasons nesting attempts did not conclude until early April, so further attempts may have been missed. In total, kōkako were monitored over a 16-week period this season, out of a possible 25 week-long season (this includes December where monitoring did not occur due to contractor availability).

Of the seven potential pairs identified for monitoring using census data from 2022 and subsequent observational data from 2023, four were confirmed to still be territorial pairs occupying the same territory (table 1). Three birds were confirmed as territorial singles, and these birds are all known to be males. Kapua was seen in the 2022 census paired with Ātaahua, but was confirmed as single this season. Niño was confirmed as single in February. No nests were located during the 2023-24 breeding season, and a total of three fledglings were observed

within the Ark management area. One pair was observed with two fledglings, and one pair was observed with one fledgling. Two fledglings were also observed just outside of the Ark Management Area, to the south in the Auckland Council Hochstetter frog area (figure 1). The last nest monitoring at Ark (2020-21) confirmed six fledged chicks from four nests produced by six target pairs, and a total of 13 nests found over the season (Rogers & Bryden, 2021).

Table 3: Nests located and fledglings observed for monitored pairs 2023-24.

Pair	Nests found	Outcomes
1. UB & Grant	0	-
2. Ranginui & Mānuka	0	-
3. Pūtahi & UB	0	Fledged (2)
4. Awn UB pair	0	-
5. Gleeson access UB pair	0	Fledged (1)
6. N (16) UB pair	0	-
7. CGN (1) UB pair	0	-

Two of the seven monitored pairs successfully fledged chicks; none of the parents were translocated birds, therefore no new founders were identified this season. In addition, one pair outside of the Ark management area produced chicks. It can be assumed that the five other pairs made nesting attempts that were unsuccessful. It is possible that no nest attempts were made if pairs comprised same sex birds. It is also possible that nesting attempts were made during December when the pairs weren't being monitored, and that these were also unsuccessful due to the absence of fledglings.

It is not known what the causes of nest failure were for any attempts that may have been made, as this is determined by observing the nests and looking for signs of depredation. Possible causes of kōkako nest failure include predation by rats, kahu (swamp harrier), possums, mustelids, or cats.

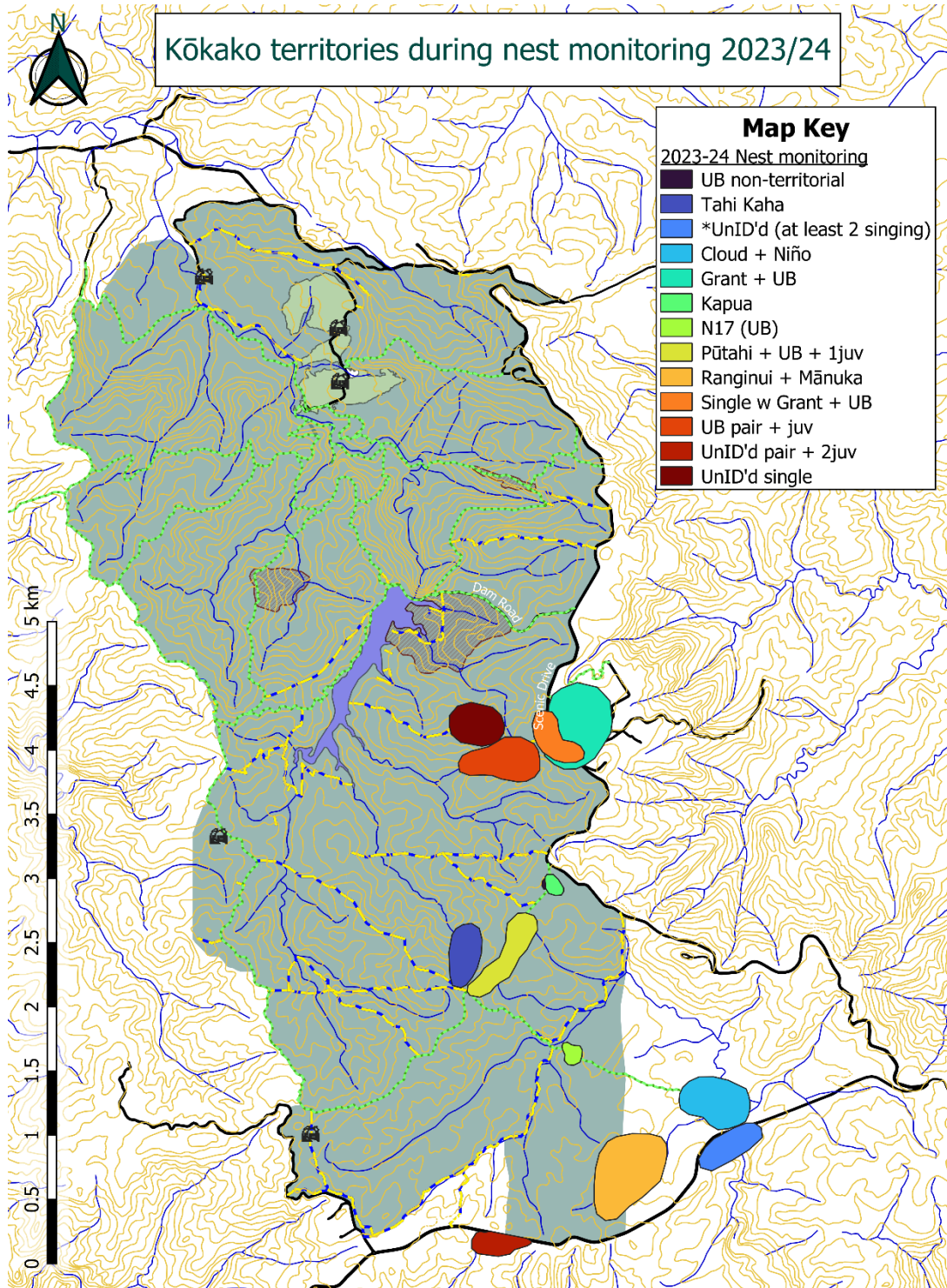


Figure 1. Territories identified during 2023/24 nest monitoring.

Tracking tunnel monitoring indicated rat numbers were high during the breeding season, with both monitors during the breeding season exceeding the <5% rat tracking index (RTI) target set

by the KRG. Tracking tunnel monitoring results (averaged over the entire predator control area) were 32.9% RTI in November 2023, and 39.3% RTI in February 2024, with the external control line having 100% and 90% RTI respectively. Dedicated possum monitoring is not currently undertaken at the Ark. At other sites where kōkako breeding outcomes have been monitored, breeding success has been insufficient to promote population growth where rat indices exceed 5%. (Innes et. al. 1999).

Discussion

Kōkako populations established through translocation are inherently genetically bottlenecked (bottlenecked meaning to have reduced genetic variation in the population). As such, it is important to maximise survival and productivity to maintain maximum genetic diversity within the population. The key factor limiting kōkako productivity at mainland sites is ongoing nest predation from introduced mammals, especially ship rats and brushtail possums, which prey on eggs and chicks. Continued nest depredation (and the loss of adults, particularly females) slows the rate of population growth, resulting in an increased sensitivity to genetic drift (loss of particular genotypes and diversity overtime) and inbreeding depression (reduced ability to survive and reproduce due to impact of inbreeding) (Innes et al., 2020). Maintaining genetic diversity is important for long term population persistence as it defines the evolutionary potential of the population - the capacity of a population to adapt to new selection pressures (Franklin and Frankham, 1998).

To increase the likelihood of long-term persistence of kōkako in the Waitākere Ranges, the genetic diversity of the Ark in the Park kōkako population needs to be carefully managed to limit the loss of genetic variation due to drift and minimise the probability of inbreeding while the population is still small (Weiser, 2014). The genetic diversity of this population can be maintained by ensuring:

- 1) That adult survivorship is high - via suitable predator control methods to reduce the abundance of mammalian predators to protect kōkako, particularly nesting females.

2) That sufficient numbers of translocated individuals recruit into the population - via extending predator control around founders establishing on the boundary or beyond the existing Ark in the Park area.

3) That population growth is maximised to maintain genetic diversity - via monitoring kōkako nesting success and using these outcomes to guide effective predator control strategies to achieve the targets described elsewhere in this report, thereby boosting productivity.

Breeding success was low this season with an output of 0.4 fledglings per monitored pair. Outputs in previous years were 1 fledgling per monitored pair in 2020-21, 0.33, 0.67 and 0 per pair in 2017-18, 2018-19 and 2019-20 respectively. Nest monitoring over the 2023-24 kōkako breeding season at Ark in the Park indicated that, while breeding success was higher than in two previous seasons, nest output remains low overall.

While kōkako pairs may have multiple unsuccessful nesting attempts before fledging their first clutch, they may also have multiple successful clutches in seasons where food is more abundant, provided they have enough time left in the season, as shown by Ātaahua's two successful attempts during the 2020-21 season. In previous breeding seasons at Ark, kōkako were often not successful with their first nesting attempt (all pairs except Ātaahua and Kapua were unsuccessful fledging their first nest attempt in the 2020-21 season). Rogers and Bryden (2021) noted that pairs would have likely re-nested had they been successful in early season attempts, and this would have had a significant impact on fledgling output.

As no nests were found this season, we cannot say how many nesting attempts were made, and what the causes of failure may have been. In previous seasons however, half have failed due to egg predation or egg inviability, and half due to chick predation. Research at other sites has shown that the depredation of eggs and chicks by ship rats and brush-tailed possums are the main cause of kōkako nest failure.

Three male birds that were seen paired either in the 2022 census or in subsequent observations in 2023, were single during the 2023-24 breeding season. This suggests a loss of females from the population, possibly due to predation of females whilst nesting. Loss of females from a population is a concerning trend, as this impacts the long-term viability of kōkako at Ark.

The rat tracking indices recorded across Ark both before and during the kōkako breeding season exceeded the <5% RTI target recommended for kōkako recovery. In November 2023 the rat index across Ark was 32.9% RTI, while in February 2024, as kōkako pairs continued to attempt new nests, the rat index rose to 39.3% RTI. No rat monitoring was conducted between these dates. The KRG recommends that rat monitoring is undertaken on November 1 or at the onset of kōkako nesting (typically, late September to early October at Ark) and thereafter at 6-8 weekly intervals through the breeding season. Possum abundance at Ark was not monitored this season. While three (unlocated) nests reached a stage at which chicks were no longer known to be vulnerable to ship rats, further suppression of rat abundances to target levels for kōkako recovery will reduce early-stage losses and may contribute to increased productivity.

As per Rogers and Bryden's (2021) recommendation, where nests are being monitored, it is recommended that 'ring of steel' trapping is continued to reduce the likelihood of ship rats preying upon eggs and young chicks. However, while additional ring of steel trapping around monitored nests may increase the likelihood of successful fledging, as the kōkako population increases, the proportion of nests that may be protected in this way declines. In this regard, the baseline predator control should be sufficiently effective to ensure high adult survivorship and productivity.

One nest containing eggs was suspected to have been preyed upon by kahu in the 2020-21 season, and kahu were seen several times in close proximity to kōkako pairs during the 2023-24 season. Kahu (*Circus approximans*) are a natural predator of kōkako nests and target both eggs and chicks of any age. Kahu were responsible for the failure of 8% of monitored kōkako nests in studies at Rotoehu between 1990 and 1994 (Innes et. al, 2005).

As ship rats are not known to prey upon kōkako chicks past 10 days old (Innes, pers. comm.), it is likely that the failures of nests with chicks aged 12-27 days old (four nests in the 2020-21 season) is attributable to possums, stoats, kahu, or cats. Whilst mustelid and possum control are also undertaken within Ark, it is notable that the majority of kōkako territories are within 500 meters of the Ark boundary, and that two pairs included in monitoring this season were outside of the Ark management area. Predation from reinvading predators is more likely to occur to pairs outside of Ark, or within 500m of its boundary. Although, this may vary depending on the management that is taking place outside of Ark. For example, one of the pairs monitored this season that successfully fledged chicks was located outside of the management area, but within an area where Auckland Council is undertaking predator control to protect Hochstetter frogs (an endangered endemic species of frog) and other biodiversity values. It is recommended that possum monitoring is carried out within Ark to determine whether more intensive possum control is necessary to promote increased breeding success for kōkako.

Increasing the area managed against mammalian predators to buffer established kōkako pairs within Ark, and to protect kōkako pairings establishing beyond Ark in the Park, would increase population growth rates by improving both ongoing adult survival and nest output. The Ark in the Park Five Year Plan 2016-2021 includes provisions for expansion where reintroduced birds are found to have established territories or nests outside, but proximate to, the current managed area (AiP, 2016) as has taken place with the expansion of the Ark southwards since 2009, most recently that of Nihotupu and Pig Wallow blocks in 2017. Coupled with effective predator control that meets targets for kōkako recovery, these expansions will improve the likelihood of long-term kōkako population persistence at Ark.

Kōkako are considered founders when their genetic material is known to be represented within the population via their descendants. Following the nesting success of several monitored pairs in 2020-21 season, the number of translocated kōkako who are known to have successfully fledged chicks increased from 15 to 16. As all three pairs who successfully fledged chicks this season were Ark-born, we cannot say that this number has increased, although it may have in previous seasons (2021-22, 2022-23) where nest monitoring did not occur.

Two translocated kōkako observed during the 2020 Ark survey (Aumangea and Tahī Kaha) are not known to have successfully fledged chicks since their release in 2015 and 2016 respectively, despite each being monitored over several breeding seasons (with the exception of Aumangea who was not seen or monitored this season). As such, it is therefore recommended that the role of any future top-up translocations to increase the genetic diversity of the Ark kōkako population is carefully balanced against measures to increase both the survival and productivity of the kōkako already present within the Waitakere Ranges.

Key Recommendations

- Rat monitoring occurs just prior to the breeding season so rat indices are known at the start of the kōkako breeding season. If required, recommendations can then be made for additional rat control via another bait pulse and/or rings of steel around nests. If possible, do the same with possum monitoring.
- Network with other projects and managers to find possible contractors and create opportunities to build the supply and skills of future kōkako contractors.
- Work closely with Hunua managers in aiming to meet target pest indices within a similar environment, climate etc.
- Starting time for nest monitoring ideally would be late September/early October, as this is when birds are most likely to be building and/or incubating, so it increases chances of seeing this. If birds only make one attempt at nesting during the season (as was seen in many places this season, anecdotally, then it may be the only opportunity to find the nest and determine the outcome).
- Ideally visits should be at least every two weeks. It is possible to miss a nest attempt within this period if failure occurred early, but as successful nests take 50-55 days, this frequency of check gives a good opportunity to observe both incubation and chick stages. If the contractor is Auckland-based, they can visit known active pairs to determine when nesting activity is starting.
- Ideally a census should be done during the winter before the breeding season to confirm pairs and territories (this means that come spring, there is less uncertainty for the monitoring

contractor of whether or not birds are definitely paired and where their territories are), or, a roll-call (surveying known pairs' areas to determine if birds are still paired or not) should occur in the early stage of the monitoring as part of the nest monitoring contract, and this should occur prior to the beginning of breeding season.

- Ideally, more than one person should be available for nest monitoring, or at least for some of the time, though this could be contractor preference. Having two people helps, particularly in challenging terrain.
- Where possible, birds monitored should be inside of Ark, to reflect the success of Ark's pest control, which is the objective of outcome monitoring.
- Focusing on paired potential founder birds that have not yet fledged chicks should be strongly considered, but in general, pairs that are accessible for monitoring and therefore for which outcomes are likely to be determined, should be prioritised.

Acknowledgements

I would like to acknowledge the warm support of the Ark in the Park team, including volunteers who offered accommodation and to help with nest monitoring, and gave me valuable information about the Ark kōkako. I would also like to acknowledge Amanda Rogers, Scott Robertson-Barnes, and Troy MacDonald for their time, knowledge and support given. Special thanks to Amanda Rogers and Dave Bryden for their support and guidance throughout the nesting season, and in providing feedback and input to this report. Thanks also to the Alpine Sport Club for accommodating me at a discounted rate at their Waitākere Hut.

References

Ark in the Park, 2016. The Ark in the Park: Five Year Plan 2016-2021. Ark in the Park Governance Group, Auckland. Retrieved From: http://www.arkinthepark.org.nz/downloads/aip-5-year-plan_2016-2021.pdf

Flux, I.; Innes, J.; Barea, L.; Burns, R.; Corkery, I.; Parker, K.A.; Speed, H.; Thurley, T.; Wills, S. 2019: Kōkako Standard Management Techniques. Wellington, Department of Conservation—doc-5897165

Flux, I.; Bradfield, P.; Innes, J. 2006: Breeding biology of North Island kōkako (*Callaeas cinerea wilsoni*) at Mapara Wildlife Management Reserve, King Country, New Zealand. *Notornis*. 53: 199-207.

Franklin, I.; Frankham R. 1998: How large must populations be to retain evolutionary potential? *Animal Conservation*. 1: 69–70.

Innes, J.; Barea, L.; Burns, R.; Corkery, I.; Flux, I.; Overdyck, O.; Parker, K.; Speed, H.; Thurley, T.; Weiser, E.; Wills, S. 2020: Priorities for Kōkako (*Callaeas wilsoni*) Conservation: Draft.

Innes, J.; Brown, K.; Jansen, P.; Shorten, P.; Williams, D. 2005: Kokako population studies at Rotoehu Forest and on Little Barrier Island. *Science for Conservation*: 30. Wellington, Department of Conservation.

Innes, J.; Hay, R.; Flux, I.; Bradfield, P.; Speed, H.; Jansen, P. 1999: Successful recovery of North Island kokako *Callaeas cinerea wilsoni* populations by adaptive Management. *Biological Conservation* 87: 201-221.

Robertson, H.A; Baird, K.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Miskelly, C.M.; McArthur, N.; O'Donnell, C.F.J.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2017: Conservation

status of New Zealand birds, 2016. New Zealand Threat Classification Series 19. Wellington, Department of Conservation. 15

Rogers, A; Bryden, D. 2021: Kōkako Nest Monitoring Report Ark in the Park 2020-21.

Weiser, E. L. 2014. Informing genetic management of small populations of threatened species (Thesis, Doctor of Philosophy). University of Otago. Retrieved from:
<http://hdl.handle.net/10523/4852>