

# Kōkako Nest Monitoring Report

Ark in the Park 2020-21

Summary report prepared for Forest and Bird

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# 1. 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 Waitakere 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 Te Kawerau a Maki. Introduced mammalian predators are controlled over approximately 2,270 hectares in an effort to promote the recovery of native flora and fauna.

During the 2020 Ark kōkako survey and subsequent nest monitoring period, 14 pairs were observed within the predator controlled area and a further pair was observed beyond the Ark area. This total comprised 7 translocated kōkako and 23 Ark bred kōkako. The number of territorial pairs found within Ark was a decrease from 16 pairs recorded in the 2019



survey. While the 2020 kōkako survey was conducted over a smaller area than that in 2019 due to restrictions imposed by Covid-19, all areas where kōkako were observed in 2019 were included in the 2020 survey.

To help determine whether the predator control methodologies used at Ark this season were sufficient to ensure kōkako population growth, six kōkako pairs were closely monitored through the breeding season between October 2020 and April 2021.

Thirteen kōkako nests were located, including at least one nest from each of the six monitored pairs. Four (31%) monitored nests were successful, producing a total of six fledglings. Of the nine monitored nests that failed, eight (62%) failed due to known or assumed egg or nestling depredation, while one nest (7%) failed due to egg inviability. All monitored nesting adults were observed to be present at the end of the nesting season.

It is recommended that the findings of this report are used to guide adaptations to predator control within the Waitakere Ranges. The principal recommendation is that the annual control of mammalian predators is continued and enhanced across all known kōkako territories. The target of this control as directed by the Kōkako Recovery Group (KRG) is to reduce ship rat and possum abundances to a 1% rat tracking index (RTI) and a 1% residual trap catch (RTC) respectively by November each year, as well as continued suppression of ship rats below 5% RTI through the kōkako breeding season (Flux et al., 2019).

It is further recommended that the predator control grid at Ark be expanded 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 Waitakere kōkako population.



## 2. Nest Monitoring Methodology

Annual monitoring of the breeding success of a sample of kōkako pairs at Ark (Figure 1) is an important measure of reproductive success. As with the three previous seasons, breeding success was determined by intensively monitoring a sample of six kōkako pairs within Ark throughout the breeding season (Table 1).

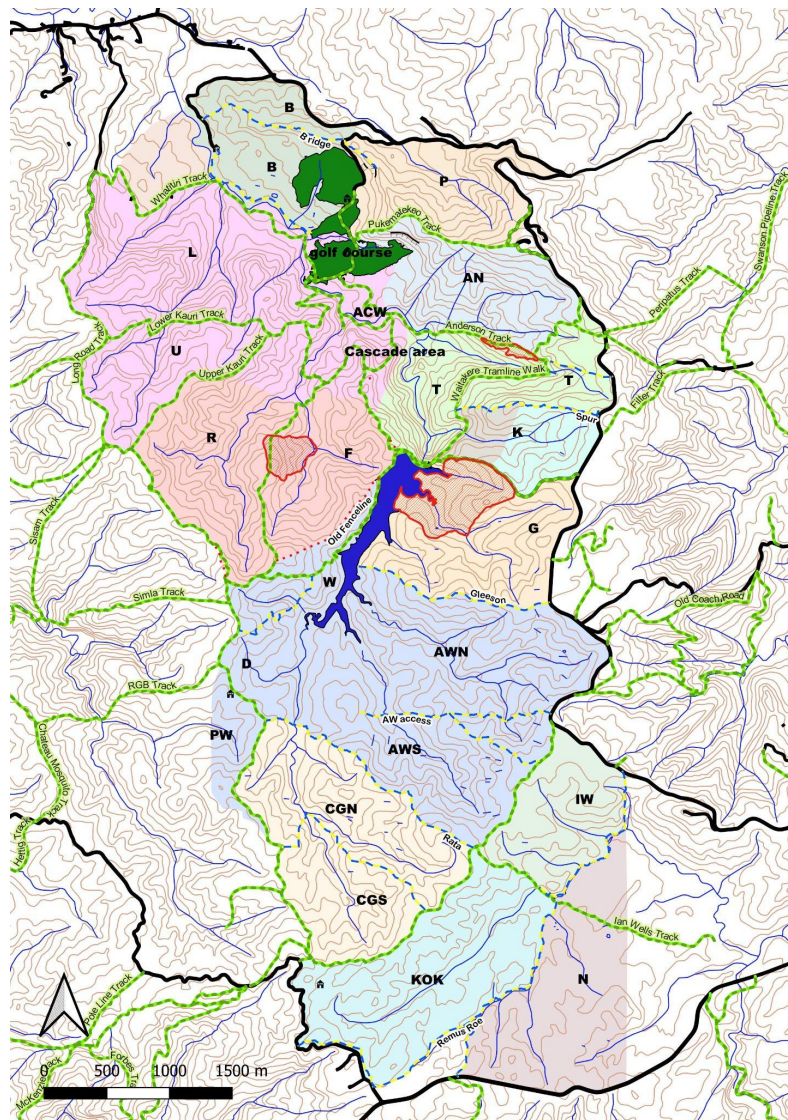


Figure 1: Ark in the Park (shaded areas), Waitakere Ranges. Source: AiP



As a result of the large number of nesting attempts made by target pairs, and the length of the season compared with previous years, no additional pairs were followed during or at the completion of the season to check for fledglings.

Three pairings monitored over the 2020-21 season comprised two banded kōkako, and could be determined to be the same as those monitored in the previous season. A fourth pair comprised a translocated male monitored for the past three seasons, but paired to a new banded mate this season.

The final two pairs comprised an unbanded pair, and a banded Ark-bred bird paired to an unbanded bird. While these pairs occupied the same territories as previously monitored pairs, it is unknown whether the unbanded kōkako within the pairings are the same individuals.

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).

Banding pulli also helps to determine the level of recruitment and natal dispersal distances, and will increase the accuracy of future surveys.

Table 1: Kōkako Pairs Monitored through the 2020-21 Breeding Season

Pair	Location	Male	Status	Female	Status
1	IW (3)	Kapua (RY-RM)	Ark Bred	Ataahua (YM-OG)	Translocated (Mapara)
2	N (20)	Ranginui (YM-LO)	Translocated (Mangatutu)	Manuka (M-YB)	Translocated (Waipapa)
3	Rata access	Pūtahi (YR-RM)	Ark Bred	Unbanded	Ark Bred
4	N (11)	Gordon (YM-YB)	Translocated (Mangatutu)	Kiwitea (YM-GB)	Translocated (Mangatutu)
5	AWN (5)	Aumengea (YM-YG)	Translocated (Mapara)	Grant (YY-GM)	Ark Bred
6	IW (10)	Unbanded	Ark Bred	Unbanded	Ark Bred



Nest searching was carried out by experienced kōkako ecologists supported by volunteers, following best practice methodology as detailed by Flux and others (2019). Subsequent monitoring of nest activity was conducted by a team of trained volunteers. Nest monitoring was based on observations of adult activity, including incubation or brooding time, frequency of adult visitation and observations of food carrying.

Nests were typically observed every four to five days. All nests were accessed by experienced kōkako ecologists to determine clutch sizes, to band chicks when aged between 11-17 days, and in the event of failure in an attempt to determine the cause.

After nests were located, they were individually protected using a 'ring of steel' comprising between 10 and 18 snap traps (Victor Professional) baited with peanut butter, targeting ship rats. One ring of steel also included a Timms trap baited with apple targeting possums.

Following suspected fledging, pairs were monitored to confirm the number of successfully fledged chicks. Following the best-practice juvenile survey method (Flux et al., 2019), each pair was followed for at least two hours. Individual follows were of at least 45 minutes to contribute to the two hour total.

Definitive 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 (cf. adult length).
- c. Emergent down on thighs, head or neck or "peaked" tips to feathers. Brown tinge to plumage (all observations to apply).
- d. Third (or more) bird(s) travels with adults for at least 5 minutes or 100 m *and* is fed by them. 'Travels with' means all birds travelling 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.



### 3. Nest Monitoring Outcomes

As with the previous two nesting seasons, the 2020-21 season began relatively early, with the first nest this monitoring period located on October 19, 2020 and backdated to the commencement of incubation in the second week of October. Kōkako nesting attempts monitored did not conclude until the first week of April (around 25 weeks); a longer season than either 2019-20 (18 weeks) or 2018-19 (22 weeks).

13 nests were located, including at least one nest from each target pair (Table 2). A single nest was located for two of the six monitored pairs, two nests were located for two pairs, three nests for one pair, and four nests for the final pair. The behaviour of one pair for which a single nest was located (Aumengea and Grant) suggested that at least one additional nest attempt was made. No fledglings were observed with this pair through the nesting season, so it is assumed that any subsequent nesting attempts were unsuccessful.

Six of the kōkako nests located were built in, or supported by, kiekie clumps; mostly in hardwood tree species and one in a nikau. Seven nests were twiggy platforms built amongst branches, including two in a tawa, two in totara and one each in a rimu, hinau and miro.





Table 2: Nests located for monitored pairs 2020-21

Pair	Nest No.	Date Found	Egg No	Chick No	Bands	Rat Catches /100 trap nights	Outcome
Ataahua & Kapua	1	19/10/20	1+	1	GM-RY	0	Fledged (1)
Ataahua & Kapua	2	26/12/20	2+	2	GM-WB, GM-RB	0	Failed - chick Predation
Ataahua & Kapua	3	1/2/21	1	1	GM-LB	0.72	Fledged (1)
Gordon & Kiwitea	1	12/11/20	3	0		0	Failed - egg predation
Gordon & Kiwitea	2	26/11/20	3	?		0	Failed - egg/chick predation
Gordon & Kiwitea	3	27/12/20	3	2	GM-BB, GM-GM	0.88	Failed - chick predation
Gordon & Kiwitea	4	25/2/21	3	2	GM-OB, GM-YO	2.27	Fledged (2)
Ranginui & Manuka	1	12/11/20	3	0		0.60	Failed - egg inviability
Aumengea & Grant	1	12/11/20	1+	0		0	Failed - egg predation
IW10 Unbanded Pr	1	13/11/20	2	0		N/A	Failed - egg predation
IW10 Unbanded Pr	2	14/11/20	3	2	GM-WR, GM-GW	0.31	Fledged (2)
Pūtahi & Unbanded	1	27/11/20	3	2	GM-GO, GM-RO	1.68	Failed - chick predation
Pūtahi & Unbanded	2	11/2/21	2+	2		0.91	Failed - chick predation





Four monitored nests were successful over the 2020-21 season, resulting in six fledglings produced in total by the six target pairs.

One nest failed as a result of egg inviability, with eggs abandoned following the 18-day incubation period.

Of the remaining eight nests to fail, four failed at the egg or young chick stage. Rats were implicated in three of these failures, with the nests containing small fragments of shell and rat faeces. The fourth nest contained larger shell fragments, with shape of shell edges implicating kahu predation. However, without camera evidence we cannot definitively determine the predator involved.

Four other nests failed when chicks were aged between 12-27 days. As ship rats are not known to prey upon kōkako chicks in this age range, the predators may have been possums, mustelids, kahu or cats. Chicks were cleanly removed in three of these instances, with no predator faeces or other evidence detected. In the fourth instance, one chick was found dead below the nest with no signs of depredation, and the nest was inactive with the remaining chick assumed to have been depredated. Nest disturbance by a large predator can cause a nest to fail, even if only part of the clutch is taken by the predator.

A total of 17 rats were caught in the rings of steel over 2951 trap nights (0.58 rats per 100 trap nights) whilst nests were active. This is significantly lower than the catch rate in the 2018-19 and 2019-20 breeding seasons (0.86 and 0.94 rats per 100 trap nights, respectively), reflective of the lower rat index (10% RTI) achieved in spring 2020.

## 4. Discussion

Kōkako populations established through translocation are inherently genetically bottlenecked. As such, it is important to maximise survival and productivity in order 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) serves to slow the rate of population growth, resulting in an increased sensitivity to genetic drift and inbreeding depression (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 Waitakere 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.

Nest monitoring over the 2020-21 kōkako breeding season at Ark in the Park indicated that, while breeding success was significantly higher than the previous three seasons, with 1 fledgling produced per monitored pair compared with 0.33, 0.67 and 0 fledglings per pair in 2017-18, 2018-19 and 2019-20 respectively, nest output remains low overall.

Had all monitored pairs at Ark this season laying viable eggs managed to fledge at least one of their nest attempts, we may have expected at least 9 fledglings, and possibly more. 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 Ataahua's two successful attempts during the 2020-21 season. Ataahua and Kapua were the only pair to successfully fledge their first nest attempt this season. Other pairs would have likely re-nested had they been successful in early season attempts, which may have had a significant impact on fledgling output.

Of the eight monitored nests to fail due to known or suspected depredation this season, four failed at the egg or young chick stage, three of which appeared to be the result of ship rat depredation. 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.

The rat indices recorded across Ark both before and during the kōkako breeding season exceeded the 5% RTI target recommended for kōkako recovery. In August 2020 the rat index across Ark was 10.53% RTI, while in January 2021, as kōkako pairs continued to attempt new nests, the rat index rose to 16% RTI. No rat monitoring was conducted between these dates. Possum abundance at Ark was not monitored this season. While eight monitored kōkako nests reached a stage at which chicks were no longer known to be vulnerable to ship rats, further suppressing rat abundances to target levels for kōkako recovery will reduce early stage losses and may contribute to increased productivity.

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, due to the shape of eggshell fragments. 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 the four nests with chicks aged 12-27 days old were attributable to possums, stoats, kahu, or cats. Whilst mustelid and possum control is also undertaken within Ark, it is notable that the majority of kōkako territories are within 500 meters of the Ark boundary, and as such, predation from reinvading predators is more likely to occur. 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 counted as founders when their genetic material is known to be represented within the population via their descendants. Following the nesting success of several monitored pairs this season, the number of translocated kōkako who are known to have successfully fledged chicks has increased from 15 to 16<sup>1</sup>. Two translocated kōkako observed during the 2020 Ark survey (Aumengea 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. 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.

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<sup>1</sup> However, one pair (Moby and Punga) only fledged a single chick. This chick was later found dead and neither of the pair are known to have contributed further.



## Key Recommendations

- Continue and enhance ship rat control within the current Ark area, with a target of reducing ship rat abundance to a 1% tracking index (RTI) by November annually, and below 5% through the kōkako breeding season.
- Extend predator control to buffer kōkako pairs nesting near to, or outside of, the boundary of Ark. In particular, it is recommended that:
  - N block is extended both east and west to buffer kōkako in these areas;
  - Pest control is extended to the east of the existing Ark boundary via the Scenic Drive Buffer Zone, as well as in the Fairy Falls and Spragg Bush areas, to further buffer pairs established in this area.
- Undertake possum monitoring within Ark in spring 2021, using residual trap catch (RTC) to determine whether the 1% target recommended by the KRG is met.

## Acknowledgements

We are grateful to the Ark team for their continued commitment to protecting these taonga. We wish to thank Sam Lincoln and outgoing volunteer coordinator Harriet Jones for their leadership and dedication to achieving positive outcomes for kōkako. This mahi would not be possible without the fantastic efforts of the Ark kōkako team comprising Grant Capill, Mark Darin, Kevin Ferguson, Mike Siddens, Yvonne Vaneveld, Simon Lemmens, David Gauld, Christine Mansford, Karen Colgan, Klaas Blokker, Denise, Erin Grierson, Casey Will, Maddy Powers and Lewis Holmes. Thanks also to the Alpine Sports Club for accommodating surveyors at a discounted rate at the Waitakere Hut.

Nga mihi mahana, Amanda and Dave.

Photo credits: Dave Bryden (P1), Grant Capill (p7)



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## Appendix

Kōkako Recovery Group reporting: Overall Nesting Outcomes

Year	2020-21	2019-20	2018-19	2017-18
No. pairs monitored	6	6	6	6
No. nests monitored	13	4	8	4
Mean clutch size (where known)	2.7 (n=9)	2.5 (n=2)	2.0 (n=3)	2.0 (n=2)
Total no. chicks	>14	>3	>9	2
Total no. chicks banded	12	2	9	2
Total no. chicks fledged	6	0	4	2
Total no. banded chicks fledged	6	0	4	2
No. nests found: building stage	0	1	1	1
No. nests found: incubation stage	12	2	3	3
No. nests found: chick stage	1	1	4	0
No. nests to fledge young	4	0	3	1
No. monitored pairs to re-nest after fail		1	1+	1+
No. monitored pairs to re-nest after fledging		0	3	0
No. nests climbed/accessed	13	4	7	4
Comments:				