Ark in the Park Kōkako Survey Report 2024

Summary report prepared for Forest and Bird

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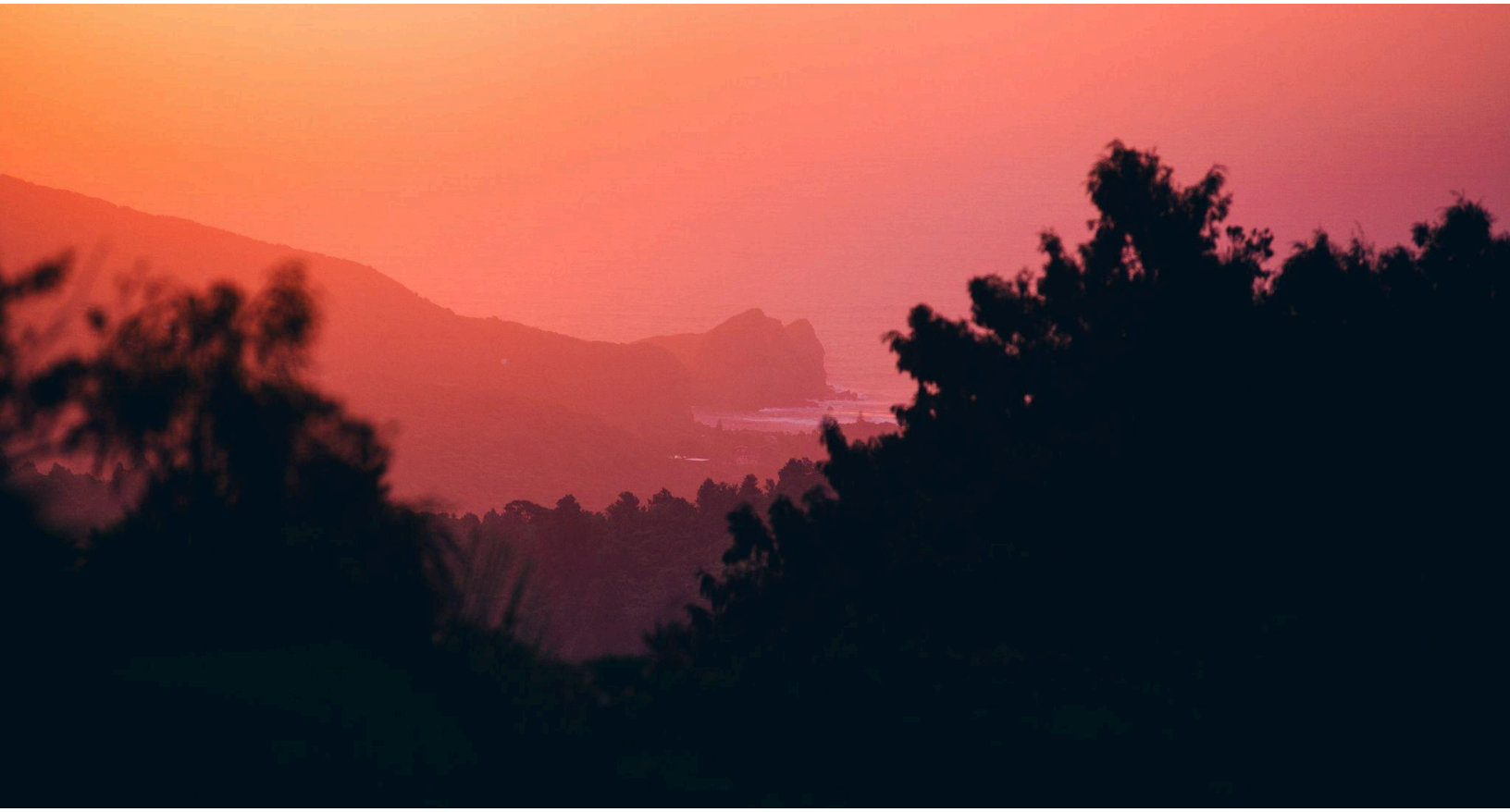

Summary

Ark in the Park (AiP) is a native forest restoration project within the Waitākere Ranges in the Auckland region and currently extends over approximately 2,400 hectares. It is a collaborative project between Forest and Bird and Auckland Council, supported by mana whenua Te Kawerau ā Maki.

North Island kōkako (*Callaeas wilsoni*) were lost from the Waitākere Ranges in the late 1950s. Following the implementation of predator control at AiP in 2002, a total of 47 adult kōkako were translocated to AiP between 2009 and 2016 in an effort to reestablish the species at the site.

In this report, we detail the results of a kōkako survey carried out in September 2024, covering areas within AiP and adjacent Spraggs Bush where kōkako had been detected either during recent surveys, or by acoustic recording devices (ARDs) deployed during spring 2024. This survey was coordinated by AiP and was conducted by a total of six experienced kōkako surveyors, supported by three Auckland Council trainees. The 2024 survey followed the territorial adult census methodology outlined in the Kōkako Recovery Group's Standard Management Techniques document (Flux et al., 2019).

12 kōkako pairs and 11 territorial singles were recorded across the 1,050 hectares surveyed within AiP and Spraggs Bush. This is a decline from 16 pairs and 6 territorial singles recorded over the same area during the previous survey in 2022 (Grierson, 2022), continuing a trend of decline observed since 2019. The high ratio of territorial single to paired kōkako observed in this survey is indicative of a male bias in the population. An additional 2 pairs and 1 single were recorded outside of AiP.

The primary recommendation of this report is that the methodologies used to control mammalian predators at AiP, particularly ship rats, are urgently adapted with the objective of meeting target indices for kōkako recovery, in order to protect the kōkako at the site and to allow for successful nesting. The target outcomes of predator control for kōkako recovery are the maintenance of a ship rat tracking index (RTI) below 5% throughout the kōkako breeding season (approximately October to March), and a residual possum trap catch index (RTCI) of 1% by the start of the kōkako breeding season (Flux et al., 2019). It is further recommended that predator control be expanded to adequately buffer kōkako territories on or adjacent to the current AiP boundary.

Contents

1. Background

1.1 Kōkako

The North Island kōkako (henceforth 'kōkako') belongs to the endemic New Zealand wattlebird family *Callaeidae*, an ancient family of birds containing five species including the extinct huia (*Heteralocha acutirostris*), the extant North Island and South Island tīeke/saddleback (*Philesturnus rufusater & P. carunculatus*) and the South Island kōkako (*Callaeas cinerea*) which is currently listed as data deficient.

Prior to human habitation, kōkako were common in forests throughout the North Island and Aotea / Great Barrier Island (Salvador et al., 2019). The species experienced a major decline across its range during the 20th century, falling to around 330 pairs by 1999, mostly spread across 11 relict sites (Innes et al., 2020). Although the early decline of kōkako was linked to habitat destruction and

fragmentation, the depredation of kōkako eggs, chicks and nesting females has been identified as the key agent limiting population growth at unfenced mainland sites, with ship rats (*Rattus rattus*), brushtail possums (*Trichosurus vulpecula*), and stoats (*Mustela erminea*) identified as the primary threats (Innes et al., 2020). All existing populations must be protected against introduced mammalian predators by effective and sustained pest control (Flux et al., 2019).

Translocations have been carried out to reestablish the species in areas where they were previously extirpated, to establish safe populations in sanctuaries free of mammalian predators, and to genetically bolster small relict populations. The total population of kōkako increased to 2,000 pairs by 2020 as a result of effective predator control and translocation (Innes, 2013 [updated 2022]). In response, the status of the North Island kōkako has improved to threatened - nationally increasing' (Robertson et al., 2021) and 'Least Concern' by the International Union for the Conservation of Nature (Birdlife International, 2024). However, after growing steadily for the past two decades, the total recorded kōkako population declined from 2023 and 2024, following the most recent survey results at a number of sites (Rhys Burns, pers comm.).

1.2 Study Site

AiP is situated within Te Piringa/Cascade Kauri Park and the Waitākere Ranges Regional Park in the Auckland region; approximately 20 kilometres west of Auckland CBD. The Waitākere Ranges sit on an uplifted dissected plateau composed of resistant volcanic material, supporting one of the two largest blocks of contiguous indigenous forest in the Auckland region (Denyer et al., 1993). AiP currently extends over approximately 2,400 hectares of regional parkland, ranging in elevation from 40 to 409 metres above sea level. The study site is bounded by Te Henga Road to the north, Scenic Drive to the east, and Piha Road to the south. This area supports a high diversity of vegetation and wildlife, with vegetation throughout most of the site comprising a complex and diverse mosaic of primary or secondary kauri-podocarp-broadleaf forest, with regular emergent rimu (*Dacrydium cupressinum*) and kauri (*Agathis australis*) (Denyer et al. 1993). Prior to historic milling and farming, kauri covered a greater extent of the site, but still dominates in northern blocks and in several significant stands of secondary growth. Naturally regenerating farmed areas feature a canopy dominated by kanuka (*Kunzea ericoides*), rimu, toro (*Myrsine salicina*) and heketara (*Olearia rani var. rani*).

Most ungulate browsers, including deer and goats, are absent from the site, with pigs present at low to moderate levels. As such, the forest understorey is currently mostly intact. In particular, important kōkako food species such as kanono (*Coprosma grandifolia*), karamu (*Coprosma robusta*), puka (*Griselinia lucida*), tataramoa (*Rubus cissoides*), māpou (*Myrsine australis*), porokaiwhiri (*Hedycarya arborea*), and toro are all relatively abundant and widespread.

Predator control within AiP began in 2002, targeting ship rats, possums and mustelids (*Mustela spp.*) over approximately 250 hectares around Pukematekeo maunga. The area under management steadily increased to cover 1,200 hectares by 2009, and 2,270 hectares by 2017. The adjacent Spraggs Bush reserve of approximately 25 hectares was included under AiP management from late 2023.

Ship rat and possum control is carried out over the management area primarily using a network of Philproof Mini bait stations on a 100 by 50 metre grid (but with a 100 by 100 metre grid in 'N block'). The primary toxin utilised over the past 22 years has been the second generation anticoagulant brodifacoum, although some small scale trials of first generation anticoagulants or DoubleTap (an anticoagulant/cholecalciferol mix) have been undertaken in several blocks from 2018. Rat monitoring has typically been carried out two to four times annually at AiP, and a summary of all rat indices recorded over the kōkako breeding period (October through March) from 2009 to 2024 is provided in Appendix Two. Whilst rats were mostly suppressed to target indices between 2009 and 2012, the RTI at AiP has exceeded the target of 5% in each monitor over the past 10 kōkako breeding seasons.

Possum control within AiP has been supplemented with Timms kill traps, and these are being incrementally replaced with Envirotools Flipping Timmy kill traps. However, no site specific possum monitoring has been carried out within Ark in the Park. Periodic ground-based predator control targeting possums has been carried out by Auckland Council over the wider Waitākere Ranges from 1998 (Lovegrove and Parker, 2023), and possum abundance in areas neighbouring AiP has been monitored annually following national protocols (Warburton 1997).

Feral cats (*Felis catus*) and mustelids may be suppressed through secondary poisoning (via brodifacoum) (see Alterio, 1996), and are also controlled at AiP by targeted trapping using SA2 kill traps. The current AiP mustelid trapping network includes 339 single set DOC 200 traps, 24 double-set DOC 200 traps and 3 DOC 250 traps, giving a trap density of one device per 6.6 hectares.

Kōkako were reintroduced to AiP in 2009, following their extirpation from the Waitākere Ranges in the late 1950s. Between 2009 and 2016, a total of 47 adult kōkako were translocated to AiP. Of these, a total of 29 came from Pureora Forest Park, 16 were from Mapara Wildlife Management Preserve and 2 from Tiritiri Matangi Island (Table One). The 47 translocated kōkako comprised 25 males and 22 females.

Table One: Kōkako translocated to Ark in the Park 2009-2016.

Release Year	**Source Site**	**Number of Birds**
2009	Waipapa (Pureora)	6 (2 males, 4 females)
2010	Tiritiri Matangi Island	2 (1 male, 1 female)
2010	Mapara	3 (1 male, 2 females)
2010	Tunawaea (Pureora)	11 (6 males, 5 females)
2011	Waipapa (Pureora)	4 (2 males, 2 females)
2015	Mapara	3 (2 males, 1 female)
2015	Mangatutu (Pureora)	8 (5 males, 3 females)
2016	Mapara	10 (6 males, 4 females)
TOTAL		**47 (25 males, 22 females)**

Kōkako post-release monitoring has continued annually following the initial reintroduction of kōkako, except for in 2023 when no contractors were available. As 22 of the 26 kōkako translocated to AiP between 2009 and 2011 were fitted with backpack mounted radio transmitters, initial movements were able to be tracked using radio telemetry. Following the expiration of the batteries of these transmitters, subsequent monitoring has followed the territorial adult census methodology as detailed in Flux et al (2019). Given the size of AiP, Acoustic Recording Devices (ARDs) have been utilised annually to determine presence or absence of kōkako in outlying areas of the project, thereby delimiting the extent of the area covered using the territorial adult census method.

Post-release survival of translocated kōkako was high, with 41 of the 47 (87%) translocated kōkako resighted following release, 37 (90%) of which were observed solely, or most recently, within AiP.

Recruitment of translocated birds was also high, with 31 of the 41 (76%) resighted kōkako observed to be paired and holding a territory within or adjacent to AiP between 2011 and 2022. Whilst the number of kōkako pairs within AiP increased from 5 in 2014 to 17 by 2019, in part due to the supplemental translocations in 2015 and 2016, they did not increase in subsequent surveys, with between 14 and 16 pairs recorded in each survey from 2020 to 2022 (Grierson, 2022).

2. Survey Methodology

The 2024 kōkako survey at Ark in the Park was conducted by a total of six experienced kōkako surveyors, with between three and five surveyors working each day. These surveyors comprised four contractors and two Auckland Council rangers. Surveyors were supported by three Auckland Council trainees, who each worked alongside an experienced surveyor for three days.

The survey covered approximately 1,050 hectares of the AiP managed area, including the adjacent Spragg Bush, and was completed in 48 person days between September 4 and September 19, 2024. The survey area covered the southern and eastern parts of the project area, including all areas where kōkako were recorded during the previous three surveys in 2020, 2021 and 2022 (see Figure One). Other areas were not surveyed as no kōkako had been observed in these areas either in recent surveys or during the 2024 ARD survey. This included the western portion of CGN and AWN blocks, and D block.

An additional 100 hectares of contiguous forest outside the current AiP boundary was also surveyed over 2 further person days on September 18 and 19. This included approximately 40 hectares to the southeast around the lower Ian Wells track, and approximately 60 hectares to the south of Piha Road within the 370 hectare Hochstetter Block, where Auckland Council controls ship rats, possums and mustelids. These areas were surveyed due to past observations of kōkako, and recent detections by ARD devices.

The methodology for this survey followed the territorial adult census method as detailed in Kōkako Standard Management Techniques document (Flux et al., 2019). Transects followed parallel bait lines approximately 200 metres apart. Transects were walked from dawn until approximately noon on fine mornings whilst listening for kōkako. When kōkako were not heard, pre-recorded mews and song were broadcast using Foxpro NX4 playback units at 200 metre intervals along each transect to try to

elicit a response. Both the mew and song recordings used for this survey were recorded at Ark in 2024.

Playback at each survey point consisted of:

1) 3 AiP mew calls, followed by a 5 minute listening period;
2) 3 AiP mew calls, followed by a 5 minute listening period;
3) 30 seconds of AiP song, followed by a 5 minute listening period.

All birds seen or heard were followed to determine whether they were territorial, to identify whether individuals were banded or had any other distinguishing characteristics such as holes in wattles, and to determine whether they were single or paired. All follows were recorded on handheld GPS units.

Following Flux et al. (2019), kōkako were determined to be territorial if the following was achieved:

a) One follow of at least 20 minutes, during which a single or pair sang full song, or;
b) Two follows of at least 10 minutes each on two different days in the same location, during which a single or pair sang full song, or;
c) One follow of at least 15 minutes if the kōkako were observed to be the same pairing in the same territory as the preceding year, or;
d) One follow of at least 20 minutes by an experienced observer in which at least one typical pairing behaviour was exhibited (mutual preen, mutual feed, bill tap, roosting side by side, moving closely).

As the majority of kōkako at AiP are now unbanded, additional methods were used to delineate pairs and singles to reduce the likelihood of inaccuracies stemming from the double counting or clumping of sightings. First, surveyors working in parallel were in radio communication. Where adjacent unbanded pairs or territorial singles were followed concurrently, they could immediately be determined to be separate. Second, distinguishing characteristics such as tail moult patterns and wattle descriptions were noted to delineate sightings or indicate that two sightings may be of the same bird(s).

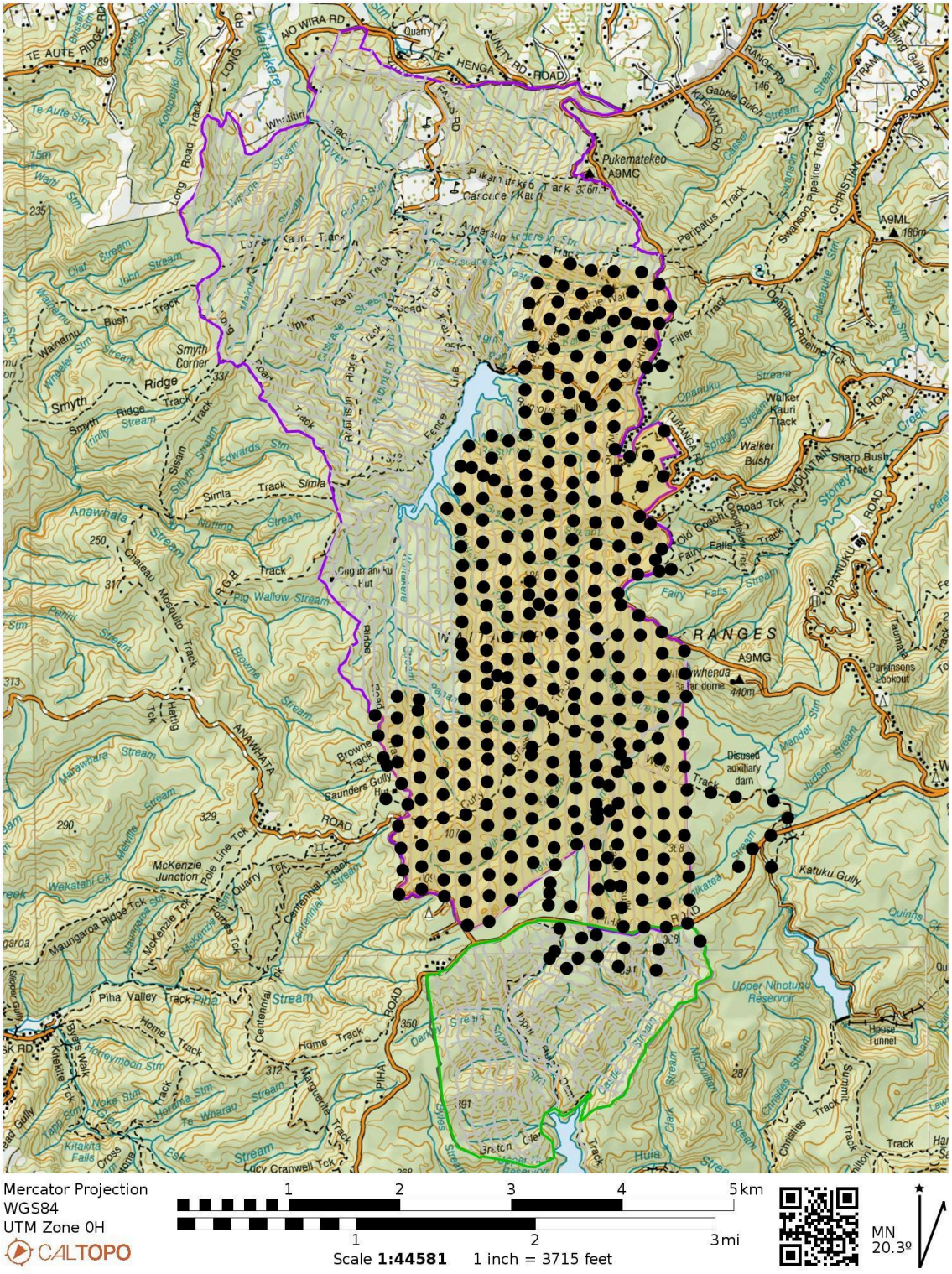

Figure One: Map of 2024 Ark in the Park playpoints. Current Ark in the Park area (purple outline) and Auckland Council Hochstetter's Block (green outline) are shown. The yellow shaded area indicates the 1,050 hectare survey area within AiP.

All follows were saved on GPS units. In instances where surveyors could not determine whether the kōkako being followed were different to previously located birds, attempts were made to 'drag' them across the previous follow using playback. If the kōkako being followed sung full adult song in an area where another follow had previously been recorded, and no other kōkako were encountered, these two follows were conservatively recorded as the same bird(s).

In areas where birds were heard but not identified, or where unbanded pairs or territorial singles could not be differentiated during the initial survey period, a team of surveyors returned on a subsequent morning to conduct a 'stake-out' to determine whether these observations were of one or multiple pairs or singles, or to identify whether individuals were banded.

3. Results

A total of 12 kōkako pairs and 11 territorial singles were recorded during the 2024 survey within AiP management areas (Figure Two). This is a decrease from the previous survey in 2022 when 16 pairs and 6 territorial singles were observed over the same area (Figure Three).

In addition, two pairs and one territorial single bird were located outside AiP.

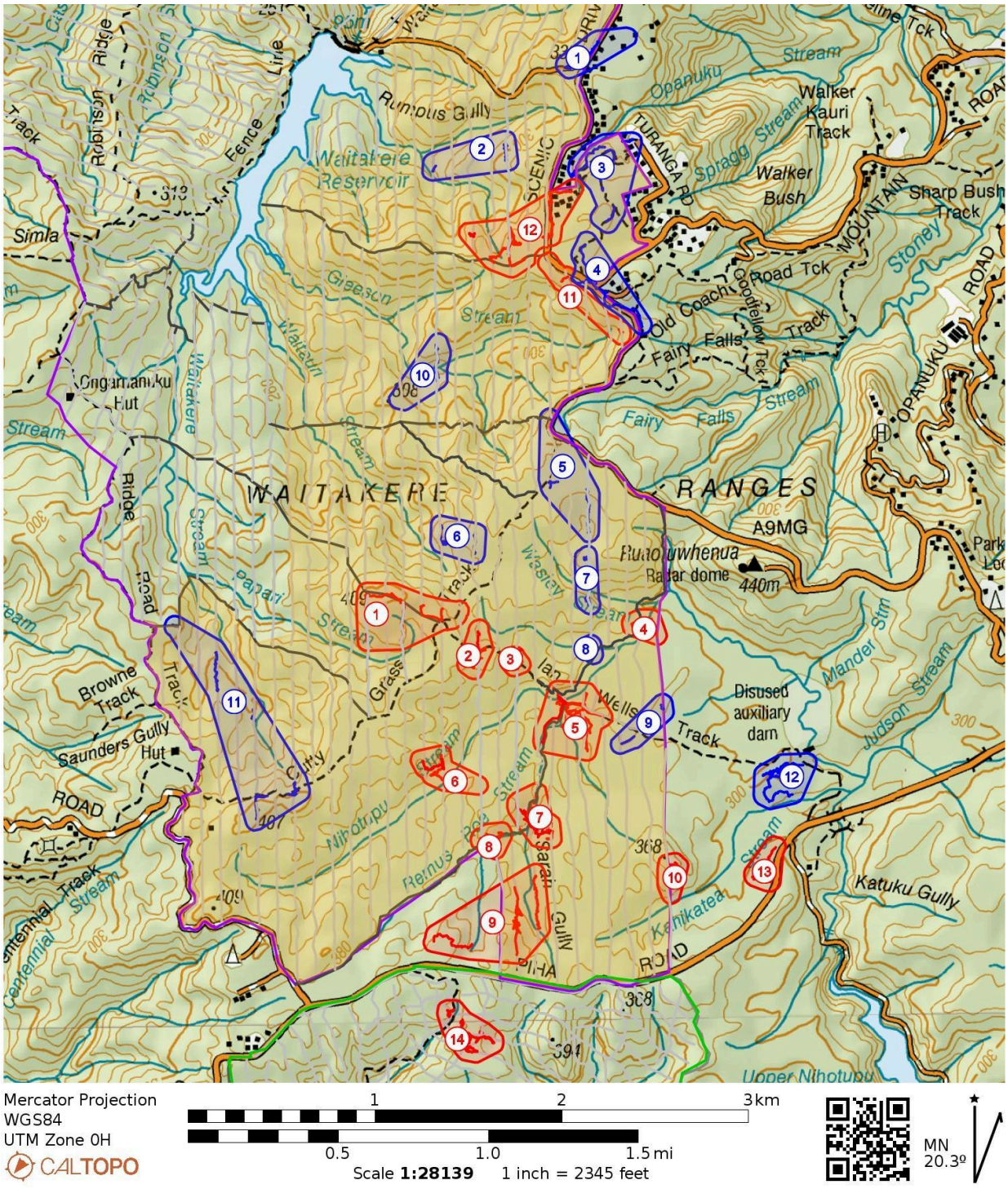

Figure Two: Distribution of kōkako pairs (red polygons) and territorial singles (blue polygons) in the 2024 AiP survey. The 1,050 hectare survey area within AiP management is indicated by yellow shading. The AiP management area is indicated by the purple outline.

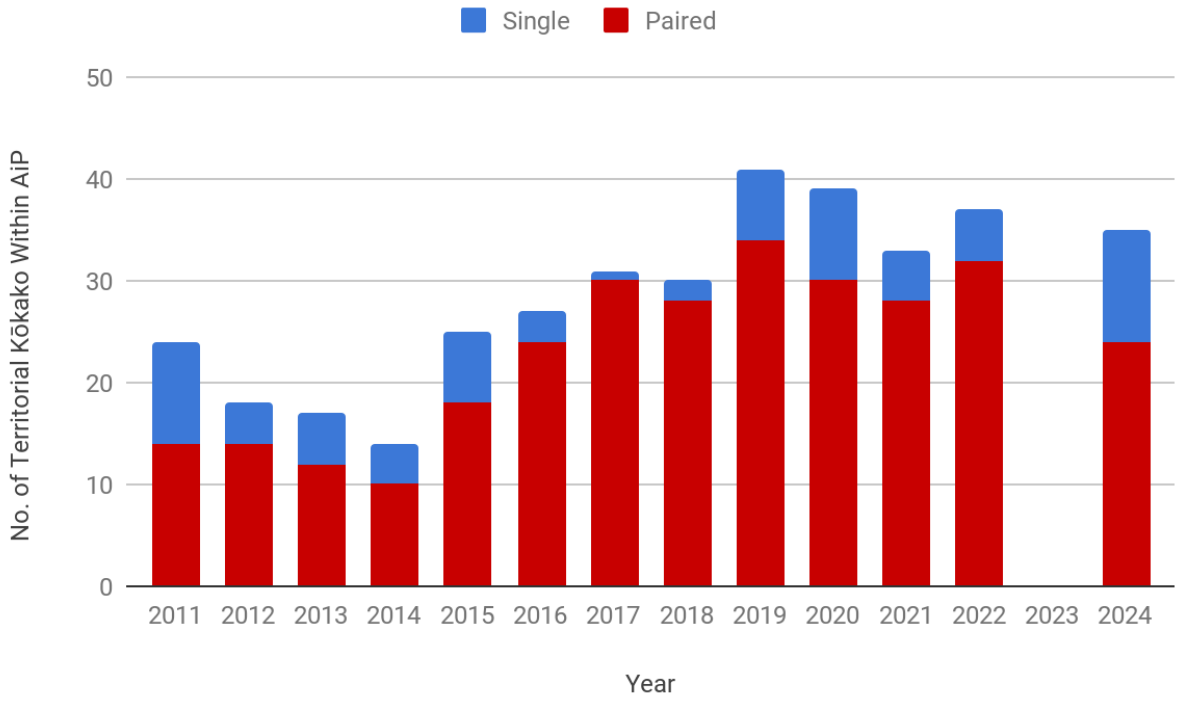

Figure Three: Change in the number of territorial kōkako recorded within AiP during surveys from 2011 to 2024.

Eight territorial kōkako observed within AiP during the 2024 survey were confirmed to be banded, comprising three translocated kōkako, four birds that were banded at AiP as nestlings, and one bird for which only a partial band combination (-GW) was observed (see Table Two). A further two territorial kōkako observed outside AiP management areas were banded; one translocated Mangatutu bird paired to an unbanded mate within the Hochstetter's Block, and one AiP-bred bird near the southern end of Ian Wells track. All banded kōkako seen had been observed during at least one prior survey.

While the number of paired translocated kōkako observed in surveys at AiP has declined in each survey since 2017 (see Figure Four), the total number of paired AiP-bred kōkako recorded (including both banded and unbanded birds) has not changed significantly since 2019.

One unbanded non-territorial kōkako was observed during the survey. However, using the territorial adult census methodology, we do not attempt to locate or quantify the number of non-territorial individuals.

Table Two: Banded kōkako observed during the 2024 kōkako survey

Territory	Band ID	Name	Source (year translocated OR season fledged)	Sex	Status in 2024	Status in 2022
Pr 10	M-Y*	Mānuka	Tunawaea (2011)	F	Paired to Unb	Paired to Ranginui (YM-LO)
Pr 8	YM-YB	Gordon	Mangatutu (2015)	M	Paired to Unb	Paired to Kiwitea (YM-GB)
Sgl 6	/-M	Tahi Kaha	Mapara (2016)	M	Single	Paired to Unb
Pr 11	YY-GM	Grant	AiP (2018-19)	F	Paired to Unb	Paired to Unb
Pr 1	YR-RM	Pūtahi	AiP (2016-17)	M	Paired to Unb	Paired to GM-WR
Sgl 5	RY-RM	Kapua	Aip (2016-17)	M	Single	Paired to Ātaahua (YM-OG)
Sgl 8	GM-RY	N/A	AiP (2020-21)	?	Single	Single
Pr 6	?-GW**	N/A	N/A	?	Paired to Unb	?
Pr 14	YM-LR	Rereahu	Mangatutu (2015)	M	Paired to Unb	?
Sgl 12	?-RM***	N/A	N/A	?	Single	?

**Mānuka's band combination was previously M-YB, but as this bird occupies the same territory as Mānuka did from 2019-2023, it is assumed to be the same bird that has lost a colour band, or the band was obscured.*

***Full band ID may be either M-GW; Grace, a female translocated from Mapara in 2010 who was last seen in 2016 in a similar territory, or may be GM-GW; an AiP bred bird from the 2020-21 breeding season not seen since fledging.*

****Could be one of 5 AiP bred birds, but likely Niño, an Ark bred bird (fledged 2015-16) holding this territory as a territorial single over the 2023-24 breeding season.*

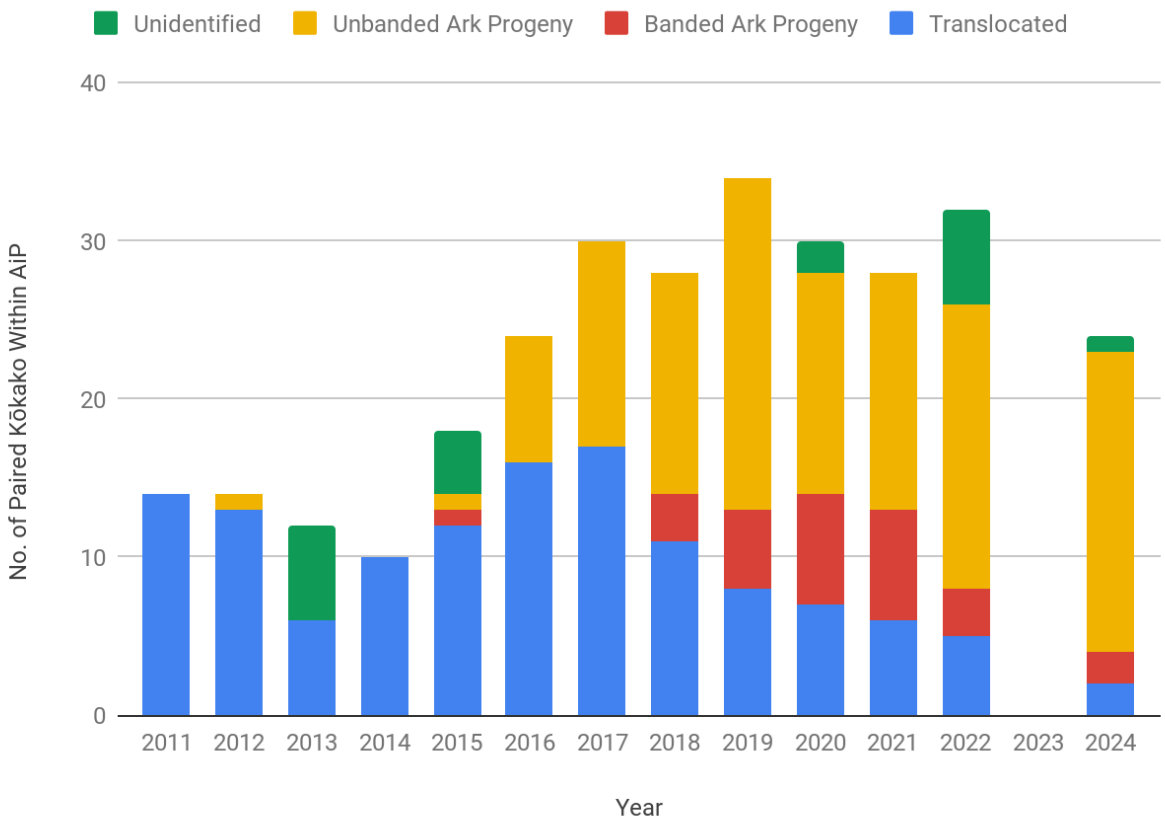

Figure Four: Change in composition of paired kōkako within AiP, 2011-2024.

4. Discussion

The results of robust kōkako population monitoring are important for ecological managers. Monitoring is a fundamental part of the translocation process, and allows managers and researchers to improve conservation outcomes by continually evaluating translocation progress within an adaptive management framework (Berger-Tal et al., 2020).

Close monitoring of small populations established through translocation is particularly important, as they are at greater risk of losing genetic diversity over time. The risk of inbreeding is heightened if numbers remain low over multiple generations. Translocated populations that remain small also face a heightened extinction risk as a result of stochastic events such as predator irruption, weather or novel pathogens (Parker et al., 2023). To retain maximum genetic variability, and to maximise the

likelihood of long term population persistence, it is therefore necessary for small kōkako populations to grow rapidly to escape from bottleneck situations until a target of 500 unrelated adults is reached (Weiser, 2015).

Although the total number of territorial kōkako recorded within AiP during this survey was similar to the 2022 survey result, the number of territorial pairs has declined by 25% from 2022 (from 16 to 12), with a corresponding 55% increase in the number of territorial single birds (from 5 to 11) over the same timeframe. This increased proportion of territorial single kōkako is an indication of a probable male bias within the population, which we discuss in more detail in section 4.2 below.

In the following discussion, we analyse the result of this survey and recommend measures that may improve kōkako productivity and survival within the Waitākere Ranges.

4.1 Breeding success

Research by Management (RbM) studies at Kaharoa, Rotoehu and Mapara were pivotal in identifying nest predation by introduced mammals, particularly ship rats and brushtail possums, as the key factor limiting kōkako productivity at mainland sites (Flux et al., 2006; Innes et al., 1999).

Target rat indices are set by the Kōkako Recovery Group to enable sufficient breeding success for a kōkako population to grow rapidly. These targets are the reduction of ship rats to a 1% tracking index (RTI) by 1 November each year using DOC national standard monitoring methods (Gillies and Williams, 2013) when acute toxins (such as 1080) are used, or when predator control is ongoing (such as through the use of first generation anticoagulant baits in bait stations), RTI should be maintained below 5% through the kōkako breeding season (October-November to March-April).

Analyses of rat monitoring data from AiP (Appendix Two) indicate that these targets have seldom been met following the reintroduction of kōkako to the site, and not since the 2012-2013 season. Consequently, poor nesting output over time, as shown by nest monitoring at the site, has meant that the recruitment of AiP bred birds has been insufficient to replace losses of adult birds. This is likely the main reason for the decline in the number of kōkako observed in this survey.

Between 2010 and 2014, when target rat indices were met for at least part of each kōkako breeding season, all 6 located nests were successful. In contrast, from 2016 to 2021, when all recorded rat indices exceeded KRG targets, only 12 of 35 (34%) monitored nests were successful. Of the 23 failed nests, at least 20 (87%) were attributable to nest depredation. As cameras were not used on nests, the predators implicated in these nest failures were not always known.

We recommend that changes are made to the rat control methodologies used at AiP to increase kōkako breeding success. AiP has predominantly used the second generation anticoagulant brodifacoum in cereal pellet form to control rats over the past 22 years. As the continued use of a single toxin or a single bait matrix over repeated operations becomes less successful over time (Innes et al., 2024), we recommend rotating usage of toxins with different biochemistry (e.g. 1080, first generation anticoagulant, Double Tap), as well as different bait bases and masks during successive years to reduce the likelihood of target species developing learnt bait aversion (Innes et al., 2024) or toxin resistance (Sran et al., 2022). In addition, switching away from brodifacoum use at AiP will reduce the likelihood of non-target poisoning (Fisher, 2010; Masuda et al., 2013). Following the KRG recommendations (Flux et al., 2019), toxin pulses should be completed within as short a timeframe as possible to maximise effectiveness, with the aim of completing a round in two weeks, and rat monitoring should be undertaken every 6-8 weeks through the duration of the breeding season, with the objective of learning whether rat abundance remains below 5% RTI.

The target possum index recommended for kōkako recovery is a 1% residual trap catch index (RTCI) by November 1 annually (Innes et al., 2020). No site-specific possum monitoring has been undertaken within AiP, and as such, we cannot comment on the likely impact of this species on kōkako nesting success. Possum monitoring has been undertaken by Auckland Council in areas surrounding AiP, with some overlap with the AiP management area. The most recent RTCI for the Southeast Waitākere blocks, which include lines within southern AiP, recorded a 1.5% index in April 2023. We recommend that annual possum monitoring is initiated across AiP following the standardised RTCI methodology as stipulated by the KRG.

We recommend that regular landscape scale predator control using aerial 1080 to target rats, possums and stoats is instigated in the Waitākere Ranges, as effective predator control on a larger scale will help to prevent the rapid re-invasion of mammalian predators from surrounding forest back into AiP, as well as to reduce the numbers of potentially trap shy mustelids (Murphy et al., 1999).

4.2 Adult Survival

Studies of other kōkako populations have indicated that in years where predator control is not undertaken, female mortality increases four-fold (e.g Flux et al., 2006) as they are particularly vulnerable to predation by stoats and possums during incubation and brooding (Innes et al., 1999). The high proportion of territorial singles within and adjacent to AiP is likely indicative of a male bias resulting from insufficient predator control to protect nesting kōkako. Studies at other sites with male biases have also recorded male-male pairings (Flux et al., 2006), which further limit the ability for populations to grow, and may also be the case at AiP.

While a relatively high proportion of translocated kōkako were observed to pair and establish territories in or adjacent to Ark in the Park following release (31/47 or 66%), only four translocated kōkako were recorded during this survey, three of which were paired (one of which was outside AiP) and one that was observed as a territorial single. As all translocated kōkako, except for those from Tiritiri Matangi, were of an unknown age, we are unable to determine the role of age-based mortality on the declining number of these birds. While the average lifespan of a kōkako at other sites is around 13 years (I. Flux, pers comm), kōkako can live for at least 25 years (Bryden and Rogers, 2021). Only 4 of the 11 (36%) banded AiP-bred birds that recruited into the population between 2017 and 2022 are still present. As these birds were banded as nestlings between 4 and 9 years ago, the rate of decline of these known-age banded birds indicates that adult depredation is likely playing a role in the lack of population growth at AiP.

As well as improvements to possum monitoring and control detailed above, we also recommend that changes are made to mustelid control methodologies. Stoats are suspected to be important, possibly episodic predators of adult kōkako, and the KRG recommends stoat control at all kōkako sites to maximise adult survival (Innes et. al., 2020). Determining the potential impacts of stoats is difficult as there is no currently accepted monitoring methodology for the species, due to low population densities and large home ranges, but it is expected that landscape scale predator control will reduce the abundance of trap shy mustelids through secondary poisoning.

We recommend that robust records of trap captures and lure types are maintained, and that traps that have not caught mustelids are moved. We likewise recommend that additional double-set DOC 200 traps are utilised, and that a variety of novel lures are cycled through traps. Using a randomised

array of baited camera traps 3-500 metres apart has been suggested as a way to measure stoat abundance, but the ideal number and distribution of cameras, and the statistical power of these networks to detect population changes requires further investigation and refinement. We recommend that the camera trapping methodology is integrated as a monitoring tool at AiP when the best practice methodology has been developed.

4.3 Area under protection

The KRG recommends that a minimum area for management of a kōkako population should start at 1,000 hectares and be expanded to 2,000 hectares as the population grows, with the aim of protecting a population of 500 breeding adult kōkako (Innes et al., 2020). Although AiP currently protects over 2,000 hectares of habitat, which appears widely suitable for kōkako, birds currently only occupy the southeastern 600 hectares of this area. 6 of the 12 pairs, and 7 of the 11 singles within AiP occupy territories within 200 metres of the current management boundary, with some of these territories known to extend beyond the boundary. Even where predator control within AiP is improved to control key threats to low levels, it is anticipated that these birds, as well as kōkako established outside the current area, will remain vulnerable to depredation and reduced nesting productivity. As such, we recommend that the current AiP area is urgently expanded to adequately buffer kōkako established on the periphery or outside of the currently managed area, by extending intensive rat and possum control at least 200m beyond the boundaries of known kōkako territories.

4.4 Kōkako Monitoring

Accurate monitoring of kōkako population trends is important to ascertain whether management interventions are working, and to inform adaptive management decision making as necessary to improve population growth. The KRG recommendation for sites with fewer than 25 pairs is for annual surveys. Surveys at each site are typically conducted either before or following the breeding season, but timing is often determined by the availability of kōkako surveyors. Whilst kōkako surveys can be conducted in any month, results may be harder to interpret between November and March, when kōkako may be nesting or moulting, leading to a reduction in responsiveness (Flux et al., 2019). As such we recommend the next survey is undertaken in spring 2025. Annual nest monitoring of a sample of kōkako pairs will also help in determining whether changes to predator control result in increased productivity.

5. Recommendations

- Urgently adapt rat control methodologies, with a target of reducing ship rat indices to 1% RTI by 1 November when one off operations (such as 1080) are used, or suppression below 5% RTI through the kōkako breeding season (monitored via 6-8 weekly RTIs).
- Rotate the usage of toxins with different biochemistry (e.g. 1080, first-generation anticoagulant, Double Tap), as well as different bait bases and masks during successive years.
- Conduct possum monitoring following best practice RTCI methodology to accurately determine possum abundance across AiP.
- Expand the current AiP area to better protect kōkako established within 200m of, or outside of, the current AiP management area.
- Integrate aerial 1080 operations, targeting rats, possums and mustelids, across AiP and the wider landscape.
- Improve stoat control methodology by integrating more double set DOC 200s, cycling through baits/lure types and expanding the control area outside AiP where possible.
- Conduct the next kōkako survey following the territorial adult census methodology in 2025.

6. Acknowledgements

Firstly, thank you to Sam Lincoln, Eduardo Colley and Forest and Bird for facilitating this mahi. We are grateful to the many volunteers involved with the predator control and monitoring at Ark. In particular, we thank Grant Capill for capturing the recordings used for the survey, Eric Wilson and Kevin Ferguson for carrying out the ARD survey. In addition, we acknowledge Christine Mansford and the team involved with line clearing work. We are also grateful to Auckland Council for their support and for providing staff to assist with the survey. The survey team comprised the authors, Mark Fisk, Troy McDonald, Ruth Cordey and Su Sinclair. Auckland council trainees were Liam Kiely, Niwa van Leeuwen, and Josh Grigg.

Ngā mihi nui, Dave and Amanda

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Appendix One: KRG Reporting 2024

Year of Survey	**2024**	**2022**	**2021**
Date of Survey Period	Sept 4-19	Aug 1- Oct 14	Early Aug - Late Oct
Area Surveyed (ha)	1,040 ha within AiP (+100 ha outside)	Ca. 1,175 ha within AiP	N/A (135 survey points within Ark, 17 outside, 35 with ARDs)
Number of person hours used to survey	288 (+12 outside)	1068 + 88 volunteer hours	832 + 77 volunteer hours
Number of Surveyors	6 + 3 trainees	2.5 FTE + 3 volunteers	N/A
Total Pairs	**12** (+**2 outside**)	**16** (+**2 outside**)	**14** (+**1 outside**)
Total Singles	**11** (+**1 outside**)	**5** (+**1 outside**)	**5** (+ **2 outside**)
Total Juveniles	N/A	N/A	2 (GM-RY + GM-WR)
Did you follow Standard methods*?	Y	Y	Y
Survey type used	TA Survey	TA Survey	TA Survey
Did you record and use new/ this years song/calls?	Yes	No	Yes

Appendix Two: Kōkako breeding season RTIs and kōkako translocated to AiP, 2009-2024

Breeding Season (October to March)	November RTI (unless stated)	Further RTIs during kōkako breeding season	No. of kōkako translocated prior to breeding season
2023-2024	32.9%	39.3% (Feb)	
2022-2023	33.6%	32.9% (Mar)	
2021-2022	22.8%	17.2% (Mar)	
2020-2021	N/A	16.5% (Jan)	
2019-2020	26.7%	N/A	
2018-2019	N/A	13.3% (Feb)	
2017-2018	21.6%	12.6% (Feb)	
2016-2017	18.3%	6.4% (Feb)	10
2015-2016	10.1% (Oct)	7.9% (Jan)	11
2014-2015	42%	33% (Feb)	
2013-2014	5.3%	11.1% (Feb)	
2012-2013	3.4%	1.1% (Feb), 2.1% (Mar)	
2011-2012	N/A	2.9% (Jan), 12% (Mar)	4
2010-2011	N/A	1.3% (Jan), 4.8% (Mar)	16
2009-2010	0.9%	7.3% (Mar)	6
Results in green met target RTI, results in red exceeded target RTI.			