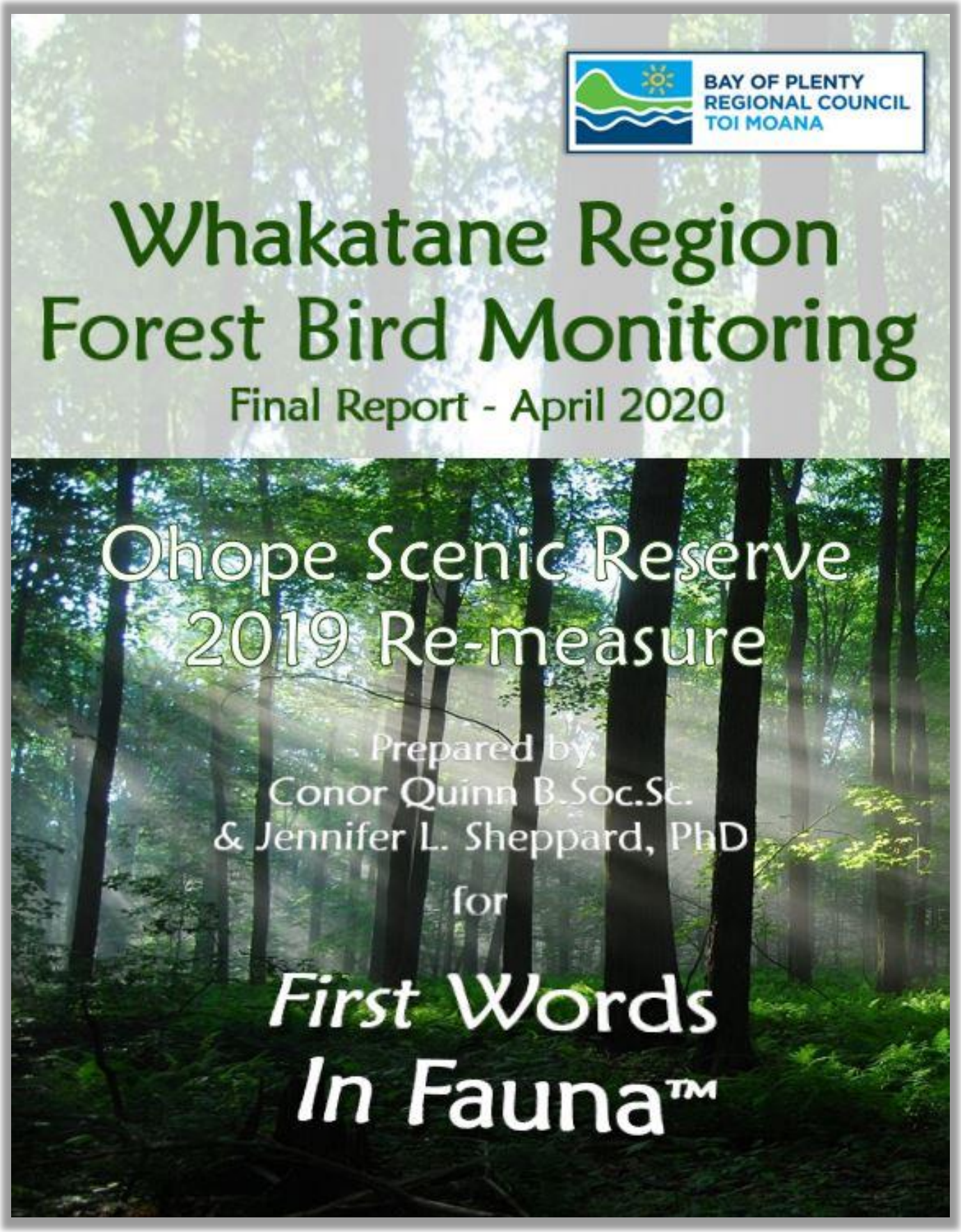
BAY OF PLENTY
REGIONAL COUNCIL
TOI MOANA
Whakatane Region
Forest Bird Monitoring
Final Report - April 2020
Ohope Scenic Reserve
2019 Re-measure
Prepared by:
Conor Quinn B.Soc.Sc.
& Jennifer L. Sheppard, PhD
for
First Words
In Fauna™

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1 Executive Summary

Small bird counts were conducted on 32 transects in the Ohope Scenic Reserve (OSR), Bay of Plenty between 24th October and 15th November 2019. The main objective of this project is to investigate the effectiveness of the predator control programme conducted at OSR. Forest birds are known to exhibit rapid population growth in response to predator reduction and thus are a good indicator of operation success. Five-minute bird counts (5MBCs) were also conducted this year to allow for site comparison with other similar projects conducted in New Zealand. This is the second set of 5MBC data after counts were first carried out in 2017.

The 2019 re-measure represents the eighth year of bird monitoring at the Reserve using our best practice, peer reviewed methodology and the twelfth full breeding season subject to intensive predator control. It is the first year of results since initiating a biennial monitoring regimen, meaning monitoring was not conducted in 2018 and will be conducted again in 2021.

Relative abundance for indigenous species has increased significantly from 2011 to 2019, suggesting that ongoing predator control continues to enhance the indigenous bird population and habitat health in the OSR. An increase in species diversity, with weka and whitehead detected for the first time in 2019, supports that assertion.

After a sharp population peak for most indigenous species in 2017 at appears as if the Reserve is experiencing a period of stabilisation, with some species having decreased in relative abundance since 2017, potentially mirroring an earlier trend in the predator control cycle. Factors underpinning such a trend may include bird population dynamics, food competition and habitat limitations. Future re-measures will help determine if the OSR is close to reaching carrying capacity for indigenous species, or if this stabilisation period flows through to another growth surge for species such as bellbird, tui and tomtit.

An investigation into the migratory path of shining cuckoo uncovered a potential link between the Australian bushfire catastrophe and a negative impact on shining cuckoo arriving on New Zealand shores in the second half of 2019, while analysis of NI robin indicated that the population has stabilised in recent years due to a variety of potential variables. Monitoring re-measures conducted at nearby sites, Mokorua Bush Scenic Reserve (MBSR) and Kohi Point Scenic Reserve (KPSR), confirmed that the 2014 translocation project has assisted in developing a stable population across the area, well beyond OSR boundaries.

As multiple years of monitoring data are needed to accurately interpret any emerging trends, the recommendation is that biennial monitoring continues, aligned with a consistency in approach for subsequent transect and 5MBC re-measures.

2 Introduction

Ohope Scenic Reserve (489 ha) is a remnant of indigenous coastal and semi-coastal forest of significant biodiversity value located to the east of Whakatane, Bay of Plenty. The land is administered by the Department of Conservation (DOC), and is jointly managed by DOC and Te Runanga O Ngati Awa through the management committee Te Tapa Toru a Toi.

Forest bird monitoring has been implemented in the Ohope Scenic Reserve since 2009 and is one of several tools used by the Bay of Plenty Regional Council (BOPRC) to monitor biodiversity outcomes. The main objective of forest bird monitoring in the Reserve is to provide information about temporal variation in bird abundance in response to management actions (primarily introduced predator control).

Intensive possum (*Trichosurus vulpecula*) and rat (*Rattus rattus*; *Rattus norvegicus*; *Rattus exulans*) control has been carried out annually since 2008 with an expectation that overall forest health would improve over time and that the abundance of indigenous birds would also increase. Mustelid (*Mustela erminea*; *Mustela nivalis*; *Mustela furo*) control, in the form of traps is also regularly conducted. The 2019 data reflects the results of twelve (2008-2019) consecutive breeding seasons subject to intensive predator control.

This is the eighth year of birds surveyed at OSR using the monitoring design implemented in 2011 (see Campbell 2012 and 2013 for details) and the first year since a biennial monitoring regimen was introduced for OSR, Mokorua Bush Scenic Reserve (MBSR) and Kohi Point Scenic Reserve (KPSR), as per previous recommendations (Quinn and Campbell 2017). Consequently, these three sites were not re-measured in 2018.

OSR, MBSR and KPSR are all subject to the same predator control regimen and are managed under one Biodiversity Management Plan by BOPRC (along with the Ngāti Awa Kawenata and Dodds Covenant). OSR is jointly managed by DOC and Te Rūnanga o Ngati Awa through the management committee Te Tapa Toru a Toi, while MBSR and KPSR are administered by Whakatāne District Council. Partners in the Whakatāne and Ōhope Sites Environmental Programme include Bay of Plenty Regional Council, Department of Conservation, Whakatāne District Council, Te Rūnanga o Ngāti Awa, Te Tapa Toru a Toi, Ngāti Awa Group Holdings Limited and Whakatāne Kiwi Trust.

As all three sites are in relatively close proximity to one another and connectivity exists between OSR and KPSR, and OSR and MBSR (Fig. 1), by way of stands of pohutukawa (*Metrosideros excelsa*) and pockets of native bush, respectively, it is worthwhile assessing any similar bird population trends that appear across these sites.

Figure 1. Location Of The Three Whakatane Monitoring Sites.

This is particularly relevant for North Island (NI) robin (Toutouwai; *Petroica longipes*; At Risk-Declining) as 40 pairs were translocated in May 2014 to boost the number of breeding pairs in the OSR (Walter and Palmer 2014). The goal was for the translocated birds to boost the remnant population and increase breeding capacity and genetic diversity of the species in the OSR. The translocation project was predicated upon ten successful years of pest management in the Reserve and the fact that a small recorded population of the species was already present. The translocated birds have since dispersed across the three Whakatane monitoring sites and have been observed in KPSR and MBSR (Quinn and Campbell 2018). Post-release dispersal by NI robin is common, with sites like the OSR that have high connectivity to suitable habitat having the lowest probability of retention of translocated birds (Parlato and Armstrong 2012). Since a population peak in 2015, NI robin numbers in the OSR have reduced, before appearing to plateau between 2016 and 2017. This stabilisation trend for NI robin is expected to continue in the 2019 results.

The primary objective of this report is to present and discuss a summary analysis of temporal trends in the relative abundance of common indigenous birds between 2011 and 2019 as the result of predator control in the OSR. Understanding temporal trends in bird abundance will help managers to gauge the success of the predator control programmes and inform strategic decision making for predator control going forward.

3 Methods

All transects are located within the Ohope Scenic Reserve. Information about the study site and its biodiversity characteristics can be found in the 2011 monitoring report prepared by FWIF (Campbell 2012).

The rationale for the current monitoring design and information about historical designs is outlined in previous FWIF reports (Campbell 2011, 2012).

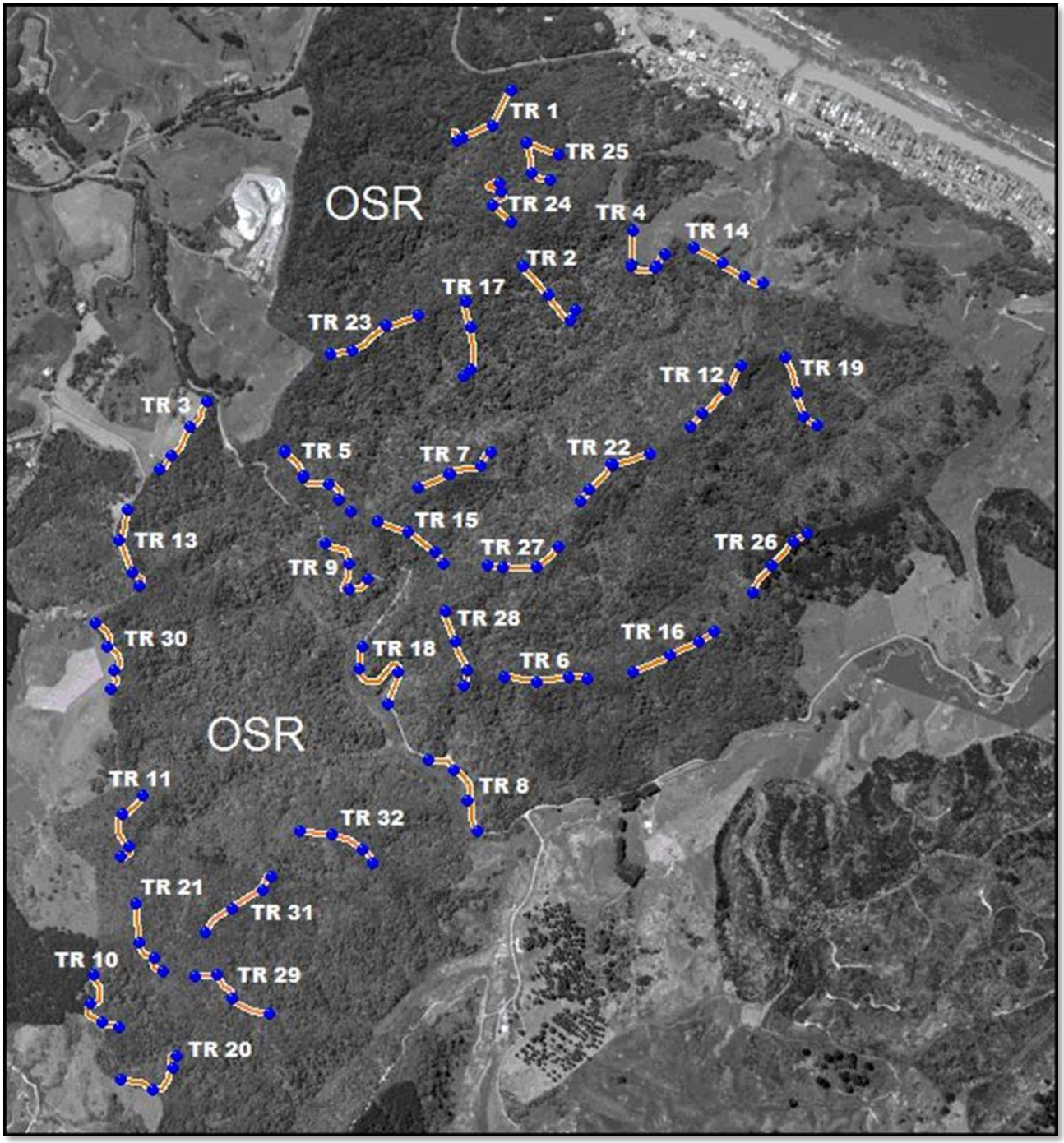

Figure 2. Current Transect Set-up In Ohope Scenic Reserve.

3.1 Transect Placement

Transects of 250m in length were placed within the study area prior to initial baseline bird monitoring, with minimum distances of 150m between each transect on even terrain and 200m on steep terrain. This amount of separation is required to reduce the chances of double counting a given bird. All thirty-two transects follow bait lines, suitable tracks or purposely cut tracks to ensure monitoring is conducted within our Health and Safety parameters (Fig. 2).

GPS coordinates for each transect have been recorded. Instructions on how to reach transects are also detailed, as well as a difficulty grading for each, in Appendix A.

3.2 Transect Bird Counts

Transect line counts were used to measure relative bird abundance in the spring/early summer of each year. Count methodology followed Dawson and Bull (1975), except where otherwise stated.

Three individual counts were carried out at each transect between 24th October and 15th November 2019. In an effort to reduce the amount of variation caused by daily patterns in bird abundance, each transect was visited once during each of the following times: early morning (6-10am), mid-day (10am-1pm) and afternoon (1-4pm).

The observer walked at a consistent slow pace along a given transect and identified and counted all the birds seen or heard perpendicular to that transect. No individual bird was knowingly counted more than once along transects.

As per the recommendation from a peer review of the forest bird monitoring projects, that an additional, suitably experienced observer should be used in future, to reduce the period over which surveys are undertaken, and provide redundancy if individual observers become unavailable (Fitzgerald et al 2019) we assessed the impact another observer would mean for this specific site. This project is one the largest of the five forest bird sites monitored in the Whakatane District and a time benefit analysis determined that using another observer would assist in shortening the monitoring time period, considering the requirements of the methodology and the annual addition of 5-Minute Bird Counts (5MBCs). Therefore, to maintain the current fieldwork window and include 5MBCs within that time period, two skilled observers (Conor Quinn and Amy Quinn, FWIF) conducted all counts. To assist in overcoming observer bias the observers monitored a minimum of one day together onsite at the OSR to develop process consistencies around slow walk transect timing and bird recognition.

An example of count data sheets for transects and 5MBCs can be found in Appendix B. Copies of raw data sheets and raw data in excel format were also supplied to BOPRC.

3.3 5-Minute Bird Counts (5MBCs)

Another single series of 5MBCs were conducted in OSR this year for potential comparative analysis in subsequent years and comparative analysis with other similar projects in New Zealand. A 5MBC was conducted at the beginning and end of each of the 32 transects, for 64 total replicates completed during the fieldwork window. Count methodology followed Dawson and Bull (1975), with a one-minute wait period initiated upon arriving at the location, prior to beginning each five-minute measure. All birds seen or heard were identified, included on the field sheet and marked in one of three distance categories: <20 m, 20–100 m, and >100 m. No individual bird was knowingly counted more than once. These 5MBCS will be conducted each year transect re-measures are conducted at the site. Comparative analysis of 5MBCs in results and discussion of those results may be included in subsequent reports.

Two skilled observers (Conor Quinn and Amy Quinn, FWIF) conducted all 5MBC counts at OSR.

A table detailing the results can be found in Appendix D. Copies of raw data sheets and raw data in excel format were also supplied to BOPRC.

3.4 Data Analysis

Abundance estimates and statistical analyses

Relative abundance for transects describes how species are representative throughout a given area and allows for a comparable index of each species between sites and over time. Given that data has been collected from this site by the same methodology since 2011, this was a suitable approach that allowed easy comparisons between years and within species. We calculated relative abundance as:

$$abundance = \frac{\sum(average\ birds\ per\ transect)}{total\ number\ of\ transects}$$

We tested whether counts were different between species and years using ANOVA and then performed a Tukey's Post Hoc Test which allowed for multiple comparisons between years and species. Tukey's test is more suited than one-way ANOVA's for comparing multiple means than when there are more than two groups as it reduces the chance of type 1 error.

Not all data collected from this site is presented in this report. Many species, including some indigenous species, were so sparsely distributed that trends in their abundance are difficult to determine statistically. In order to make the statistical analyses as robust as possible, only data from species that were counted on a large proportion of transects ("common species") are generally included. The exception to this rule is NI robin, because of its significance as an indicator species. All other indicator species were common on transects.

A comparison for spread of NI robin across transects was included this year, following on from the analyses conducted in the combined Whakatane Region Bird Monitoring 2017 Report. Spread is shown as the percentage of transects occupied by at least one NI robin.

4 Results

Thirty-one species were detected during the 2019 survey including 13 endemic, 5 native and 13 introduced species. This was the same diversity of species detected in 2012, but otherwise this diversity was higher than in previous years. Whitehead (pōpokatea; *Mohoua albicilla*), weka (woodhen; *Gallirallus australis greyi*), and greenfinch (*Carduelis chloris*) were new records for this site. NZ falcon (karearea; *Falco novaeseelandiae*) had previously been reported in 2012, 2014 and 2017 but was absent again this year. This was the first year since surveys began that shining cuckoo (Pīpīwharauroa, *Chrysococcyx lucidus lucidus*) was not detected on every transect. A complete list of common, scientific and Māori names for 2019 can be found in Appendix C.

Counts of common indigenous species; bellbird (korimako, *Anthornis melanura*), fantail (pīwakawaka, *Rhipidura fuliginosa placabilis*), grey warbler (riroriro, *Gerygone igata*), kereru (wood pigeon, *Hemiphaga novaeseelandiae*), kingfisher (kōtare, *Todiramphus sanctus vagans*), NI robin, shining cuckoo, silvereye (tauhou, *Zosterops lateralis lateralis*), tomtit (miromiro, *Petroica macrocephala toitoi*), tui (parson bird, *Prosthemadera novaeseelandiae*) and introduced species; blackbird (*Turdus merula*) and chaffinch (*Fringilla coelebs*), were greater in 2019 than when surveys began in 2011 ($Tukey_{Indigenous}$: est = -4.26, t = -5.56, $p < 0.001$; $Tukey_{Introduced}$: est = -2.14, t = -7.80, $p < 0.001$; Figure 3). Counts of indigenous species were relatively the same as 2016 survey results, but was lower than the previous survey in 2017 when there was a large peak in abundance (Tukey2016: est = 0.28, t = -0.74, p = 0.87; Tukey2017: est = 3.82, t = 4.99, $p < 0.001$; Figure 3). Counts of introduced birds appeared greater than the previous 2017 survey but this change was insignificant (Tukey: est = -0.69 t = -2.53, p = 0.19; Figure 3).

Relative abundance of bellbird, fantail, kingfisher, shining cuckoo, tomtit and tui decreased since the previous survey in 2017 (Figure 4; Table 2). This was the first significant decrease for bellbird, tomtit and tui, however abundance estimates are still greater than when this survey methodology began in 2011. Abundance estimates of fantails and kingfishers have fluctuated over the years and current estimates indicate there is no change since surveys began in 2011 (Figure 4; Table 2). Counts of shining cuckoo decreased for the second time since surveys began, and although this significance is marginal, abundance estimates of 2019 do not differ from the low estimate of 2014 (Tukey: est = -0.90 t = -2.57, p = 0.17; Figure 3). Relative abundance of grey warbler, NI robin and silvereye remain unchanged since the previous 2017 survey but greater than when surveys began in 2011 (Figure 4; Table 2).

Our tracking spread for NI robin increased immediately following the translocation project in 2014. Since the 2015 peak spread at 87.5% the figures have remained steady, between a band of 43-53%, 2016 to 2019 (Figure 5).

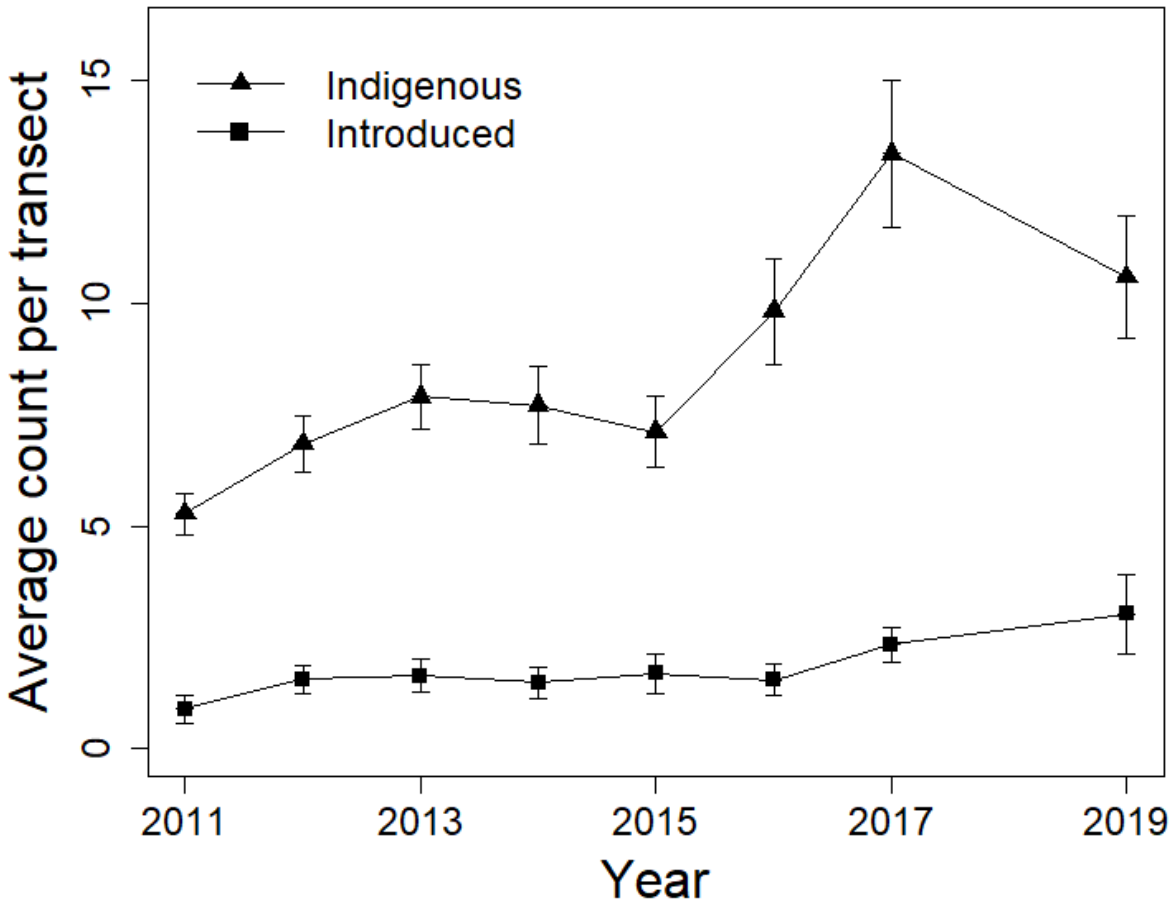

Figure 3. Relative abundance of ten common indigenous (triangles) and two introduced (squares) birds detected along 32 survey transects between 2012–2017 and 2019 in Ōhope Scenic Reserve.

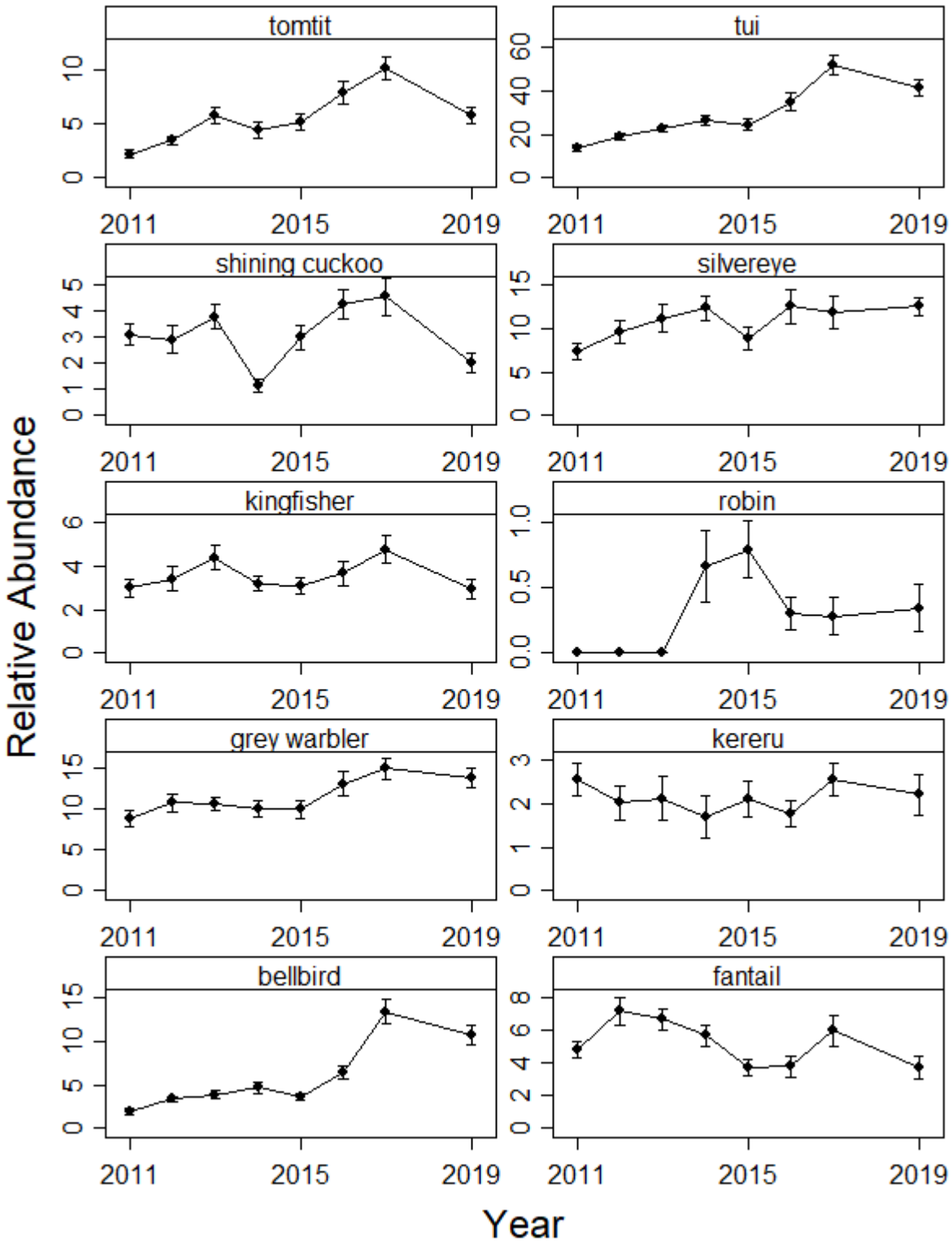

Figure 4. Relative abundance of indigenous indicator species detected along 12 survey transects between 2012-2017 and 2019 in Ōhope Scenic Reserve. Error bars represent 95% Confidence Intervals.

Table 2 – Results from Tukey Post Hoc test illustrating the differences in relative abundance for each species between the 2011 and 2019 survey years (first column) and 2017 and 2019 survey years (last column) in Ōhope Point Scenic Reserve. Estimate values indicate the mean change in relative abundance of the earliest year (i.e., the negative value of bellbird in 2011-2019 comparison indicates that abundance was lower in 2011 when compared to the baseline year of 2019). P-values less than 0.05 indicate a significant change.

	2011-2019		2017-2019	
	Estimate	P value	Estimate	P value
Bellbird	-8.80	<0.001	2.72	<0.001
Fantail	1.08	0.36	2.21	<0.001
Grey warbler	-5.01	<0.001	1.14	0.85
Kereru	0.37	0.92	0.35	0.93
Kingfisher	0.06	1.00	1.84	<0.001
NI robin	-0.34	0.04	-0.06	1.00
Shining Cuckoo	1.06	0.05	2.53	<0.001
Silvereye	-5.24	<0.001	-0.70	1.00
Tomtit	-3.55	<0.001	4.36	<0.001
Tui	-27.75	<0.001	10.47	<0.001

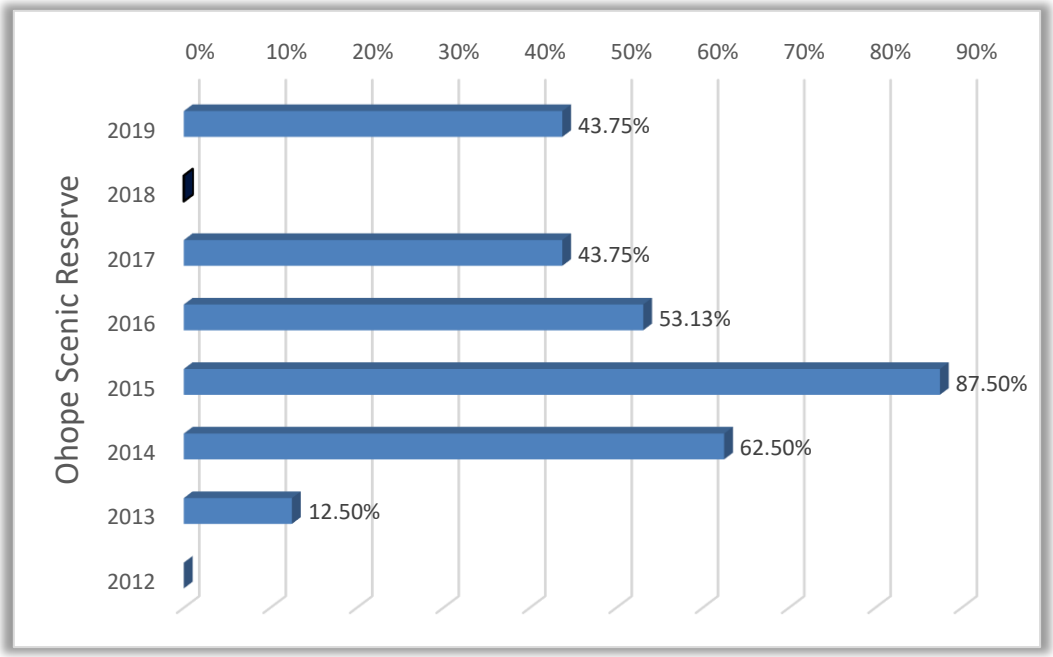

Figure 5. Spread of NI robin at OSR from the start of monitoring using the current methodology, by percentage of transects where species observed. Black squares signify monitoring had not yet begun or was not conducted that year.

5 Discussion

The 2019 monitoring season marks the eighth year of forest bird monitoring in the Ohope Scenic Reserve (OSR) since the peer reviewed (Fitzgerald *et al* 2019) best practice methodology was introduced in 2011, and twelfth consecutive breeding season subject to intensive predator control. It is the first year of results since initiating a biennial monitoring regimen, meaning monitoring was not conducted in 2018 and will be conducted again in 2021.

Relative abundance for indigenous species has reduced from a sharp peak in 2017, but the increase from 2011 to 2019 remains significant. However, there is no significant difference between 2016 and 2019 and low but consistent growth between 2015 and 2019 would likely be the trend if the sharp peak of 2017 was removed. There is also the possibility that as the twelfth year of intensive pest control is concluded the results mirror the "hump and slump" phenomenon that was detected by the ten-year combined modelling of all Whakatane monitoring sites conducted in 2017 (Quinn and Campbell 2018). That hypothesis considered the likelihood that bird abundance surged during initial years of pest control and then experienced a correction around the three to five-year mark. It may be that this cycle is repeating itself, albeit with a much larger overall population, around years ten to twelve. The 2021 re-measure should shed further light on this potential trend.

At an individual level all common indigenous species detected, apart from fantail, kereru and kingfisher, show significant increases in relative abundance between 2011 and 2019, suggesting that ongoing predator control continues to enhance the indigenous bird population and habitat health in the OSR. Counts for bellbird, fantail, kingfisher, shining cuckoo, tomtit and tui all dropped significantly between 2017 and 2019, but do seem to mirror the "hump and slump" phenomenon for the relative abundance of the total indigenous population observed, with most species having at least remained steady since 2016. It may be possible that the Reserve is close to carrying capacity, if 2017 remains the population peak, but subsequent re-measures will be needed to support such an assertion, while variables other than pest pressure and climate change should also be considered. Inbreeding depression, food scarcity and competition may slow growth rates for some indigenous species when limitation by predation is alleviated (Innes et al 2010). This could also include competition from exotic species assimilating to native flora and habitat, as introduced species has shown its first significant increase at OSR since monitoring began.

Multiple observations of weka at OSR for the first time, and across all three monitored sites, would indicate that the resident population is growing. A ground dwelling bird, similar to kiwi, weka is susceptible to predation and breeds well when there is an absence of predators (Bramley and Veltman 1998; Williams et al 2012), so ongoing population increases may indicate low pest pressure at OSR. The presence of whitehead for the first time is another very positive sign for OSR bush vitality as they are also sensitive to habitat loss (Gill and McLean 1992). We would expect the spread of long-tailed cuckoo to mirror that of host whitehead in future years if the whitehead population continues to grow and cuckoo follow their hosts into new territory, especially if the whitehead population becomes robust enough to support higher levels of parasitism (Lawson *et al* 2020). As at other sites, any emerging trends of this type will be tracked for comparative analysis.

A common trend in 2019 across all three monitored sites was the significant reduction in the relative abundance of shining cuckoo. This may be climate change related, albeit indirectly, with investigations into Australian bushfires and climate change links ongoing[1]. Shining cuckoo generally travel to New Zealand to breed from western Pacific islands August to October, with a transit stop in the forests of northeastern Australia, between the Coral Sea and Brisbane (Williams *et al* 2006). In that area, from June 2019, forest fires were burning, with a combination of major fires combining in the area from late August 2019 to form several immense fires (Huf and Mclean 2020). The forest damage was catastrophic, meaning much of the transit zone for shining cuckoo was either burning, destroyed or smoke shrouded, resulting in depleted food sources and a compromised transitory path. As shining cuckoo has displayed phenological responses to climate change (Both et al. 2006), it is conceivable that these contributing factors resulted in fewer shining cuckoo

[1] https://www.worldweatherattribution.org/wp-content/uploads/WWA-attribution_bushfires-March2020.pdf

making it to New Zealand shores and thus, a reduced population in the Whakatane District. The OSR also experienced a significant reduction in relative abundance of shining cuckoo in the 2014 monitoring year. In that year two major bush fires did occur within the same transit zone during the migration window, but did not cover as much forest as in 2019[2]. In the following years bush fires in the transit zone were less severe, until the catastrophe of 2019. No monitoring was conducted in 2014 at MBSR for comparison, but shining cuckoo numbers at KPSR did show reduced numbers in 2014 and 2015. Subsequent re-measures may shed further light on the validity of this hypothesis.

Only a single observation of kaka (at OSR) across the three sites during monitoring could support an assertion that there was a low availability of some fruit crops across the area in 2019, as opposed to 2017, when there was a population spike for most indigenous species with a good proportion of fruit in their diet (Quinn and Campbell 2018). Kaka breed most intensely in years when podocarp trees produce abundant fruit crops (Powlesland et al 2009) and lower availability of this food source may also impact the conspicuous of bellbird (Spurr *et al* 2011), tui (Castro and Robertson 1997) and kereru (Powlesland *et al* 2009). Lower fruit availability may have been a contributing variable to the reduced observations for these species in 2019 as fruit feeding in the canopy naturally increases conspicuousness (Conor Quinn, 2019 *Pers*. *Ob*.).

The results for NI robin would indicate that the population continues to experience a phase of stabilisation, with estimated spread and relative abundance remaining steady since 2016. An assessment of several NI robin studies (Williams et al 2012) found that not all translocated populations increase in subsequent years, even with lower pest pressure. These studies ruled out a variety of potential variables, including poisoned bait consumption. However, it may be that population density and territory size impact NI robin foraging and breeding behaviour, with those in higher density populations more active than those residing in larger territories (Godfrey 2003). It is therefore possible that the initial population gains from the breeding season following the translocation project were due to relatively close proximity of breeding pairs, which resulted in increased fecundity in the short term. As birds and fledglings dispersed from the OSR, allowing territories of remaining birds to expand, fecundity then reduced and the overall population stabilised.

Hypotheses around population density and territory size in relation to fecundity may apply to many species other than NI robin and the unintended consequences of creating pest-free environments for indigenous bird species could result in a variety of differing scenarios around carrying capacity for individual monitoring sites. Increased knowledge around the inter-dependence of certain species and population dynamics in regard to food competition and habitat limitations can only assist in ensuring future pest control programmes have the most informed pathway to success.

The significant improvement of relative indigenous bird abundance since the establishment of monitoring illustrates the effectiveness of predator control programmes. While increasing diversity of indigenous species, including weka and whitehead in 2019, and stabilisation of the NI robin population across the local area, shows how continuous and intensive pest control can support ongoing habitat and species enhancement over the long term.

Breeding success and bird conspicuousness naturally fluctuate from year to year so multiple years of monitoring data are needed to accurately interpret any emerging trends. Therefore, it is recommended biennial monitoring continues, aligned with a consistency in approach for subsequent transect and 5MBC re-measures.

[2] https://en.wikipedia.org/wiki/2014%E2%80%9315_Australian_bushfire_season

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Appendices

Appendix A details GPS references for transect start and end waypoints and directions to transects.

Appendix B are photos of the Field Sheet Masters used for fieldwork.

Appendix C details Common, Scientific and Maori names of birds.

Appendix D details the raw results from 5MBC counts conducted as part of 2019 fieldwork.

Appendix A - GPS Grid References and Location Instructions for Transects

Transect	Grid Ref Easting	Grid Ref Northing	Transect Difficulty Grading 1 = Low 2 = Med 3 = High	Location Instructions
TR1			3	From the Ohope Rd & Pohutukawa Avenue & West End Rd entrance opposite the beach, follow the main track until the first track junction is reached. Take right at T junction. Transect begins on disused track approx. 200m from T junction on loop track. Transect intersects with bait line at D8. A section of this transect includes walking on the stream edge which floods after rain. Transect is very slippery after heavy rain – complete in dry conditions.
Start	1954060	5790361		
250m /end	1953902	5790210		
TR2			2	From the Ohope Rd & Pohutukawa Avenue & West End Rd entrance opposite the beach, follow the main track until the first track junction is reached. Follow the left-hand loop track until it rejoins the main track. Then follow the main track until you reach the first Kiwi Point Station wooden bench. Approx. 2 metres from the bench is a pink triangle on a tree at a bearing of 100° mag. Follow the pink flagging and triangles to the start of TR2 at H1.
Start	1954094	5789843		
250m /end	1954249	5789712		
TR3			1	From top Burma Rd car park follow the main Nga Tapuwae O Toi track for approx. 50m. At the top of the first set of wooden steps on the right-hand side follow the pink flagging to bait station A3, follow the bait line back to A1 which is the start of TR3.
Start	1953160	5789440		
250m /end	1953017	5789241		
TR4			1	From the Ohope Rd & Pohutukawa Avenue & West End Rd entrance opposite the beach, follow the main track until the first track junction is reached. Follow the left-hand loop track, approx. ¾ up the loop track, (20 mins from car park) until you reach a clearing on the left-hand side of the track where the fence line and farm is visible. It is also marked with a white triangle and pink flagging on a tree on the LH side of the track 'To BM TR4 + TR14'. Cross the fence, turn right and follow the fence line at a bearing of approx. 90° mag until you reach the marked fence post signalling the start of TR4. Note: E line follows the fence line.
Start	1954422	5789947		
250m /end	1954514	5789877		
TR5			1	From top Burma Rd car park follow the main OSR track towards Ohope for approx. 100 m until you reach G line on the RH side. A tree on the RH side is marked with a white triangle 'To BM TR 5, 15, 7 & 6'. Follow pink flagging and pink triangles to the start of TR5 which is at G1, approx. 10m in.
Start	1953388	5789295		
250m /end	1953548	5789151		
TR6			2	From top Burma Rd car park follow the main OSR track towards Ohope for approx. 100 m until you reach G line on the RH side. A tree on the RH side is marked with a white triangle 'To BM TR 5, 15, 7 & 6'. Follow pink flagging, pink triangles and other white direction triangles to the U line. You will pass TR28, which starts shortly after U1. TR6 starts at U5.
Start	1954042	5788625		
250m /end	1954283	5788619		
TR7			3	From top Burma Rd car park follow the main OSR track towards Ohope for approx. 100 m until you reach G line on the RH side. A tree on the RH side is marked with a white triangle 'To BM TR 5, 15, 7 & 6'. Follow pink flagging, pink triangles and other white direction triangles, TR7 starts at G9.
Start	1953784	5789185		
250m /end	1954002	5789290		
TR8			1	Starts at the OSR boundary fence at the bottom of Burma Rd inside the lower gate. The transect follows the road. A tree on the LH side is marked to signal transect start.
Start	1953958	5788169		
250m /end	1953817	5788379		
TR9			1	From top Burma Rd car park continue on Burma Rd approx. 500m past the gate. A tree on the RH side is marked to signal transect start.
Start	1953512	5789022		
250m /end	1953635	5788915		
TR10			1	From top Burma Rd car park follow the main Nga Tapuwae O Toi track to just before the stile goes over the fence and the track intersects with the private road. Follow pink flagging and pink triangles, this rejoins TR3. The line runs parallel to the fence line. Continue past the end of TR3 and then TR13; go past the farm house on the right-hand side. Continue following the A Line until A19 is reached. Follow fence line to A29. A29 is the start of TR10.
Start	1952821	5787740		
250m /end	1952899	5787589		

TR11			2	From top Burma Rd car park follow the main Nga Tapuwae O Toi track to just before the stile goes over the fence and the track intersects with the private road. Follow pink flagging and pink triangles, this rejoins TR3. The line runs parallel to the fence line. Continue past the end of TR3 and TR13; go past the farm house on the RH side. Continue following the A Line until A19 is reached – then follow pink flagging to F1 which is the start of TR11.
Start	1952970	5788273		
250m /end	1952901	5788091		
TR12			2	From opposite the Ohope Mobil Service station on Pohutukawa Avenue go through the gate. Follow the grassed vehicle track on the left all the way to the top. At the top turn right in a westerly direction and follow the fence line until you see a stile over the fence and a white triangle 'To BM TR 12'. Follow the pink flagging and directional markers to M19, which is the start of TR12.
Start	1954740	5789545		
250m /end	1954593	5789364		
TR13			1	From top Burma Rd car park follow the main Nga Tapuwae O Toi track until it intersects with TR3. At the end of TR 3 follow the bait line for 150m until start of TR13.
Start	1952925	5789118		
250m /end	1952960	5788897		
TR14			2	From the Ohope Rd & Pohutukawa Avenue & West End Rd entrance opposite the beach, follow the main track until the first track junction is reached. Follow the left-hand loop track, approx. ¾ up the loop track, (20 mins from car park) until you reach a clearing on the left-hand side of the track where the fence line and farm is visible. It is also marked with a white triangle and pink flagging on a tree on the LH side of the track 'To BM TR4 + TR14'. Cross the fence, turn right and follow the fence line at a bearing of approx. 90° mag until you reach the marked fence post signalling the start of TR4. Follow the fence line until TR4 finishes and the start for TR14 is 150m further along fence line. TR14 crosses stream close to transect end. Note: E line follows the fence line.
Start	1954600	5789899		
250m /end	1954807	5789793		
TR15			1	From top Burma Rd car park follow the main OSR track towards Ohope for approx. 100 m until you reach G line on the RH side. A tree on the RH side is marked with a white triangle 'To BM TR 5, 15, 7 & 6'. Follow pink flagging and pink triangles to the start of TR5 which is at G1, approx. 10m in. TR 15 starts approx. 150 metres after the end of TR5 between G5 & G7 (G6 is off the track).
Start	1953667	5789085		
250m /end	1953859	5788958		
TR16			2	From top Burma Rd car park follow the main OSR track towards Ohope for approx. 100 m until you reach G line on the RH side. A tree on the RH side is marked with a white triangle 'To BM TR 5, 15, 7 & 6'. Follow pink flagging, pink triangles and other white direction triangles to the U line. You will pass TR28, which starts shortly after U1. TR6 starts at U5. Go to the end of TR6 and TR16 starts between U10 & 11.
Start	1954422	5788638		
250m /end	1954663	5788759		
TR17			2	From top Burma Rd car park follow the main OSR track towards Ohope for approx. 12 minutes. At large redwood, where entry is marked for J line, a white marker for TR17 is on opposite side of main track. Follow markings for J line and TR17 to start of TR17 at J1.
Start	1953925	5789734		
250m /end	1953919	5789514		
TR18			1	Starts 500m up Burma Rd, marked on left hand side of the road, and follows the road.
Start	1953694	5788546		
250m /end	1953618	5788715		
TR19			3	From opposite the Ohope Mobil Service station on Pohutukawa Avenue go through the gate. Follow the grassed vehicle track on the left all the way to the top. At the top turn right in a westerly direction and follow the fence line until you see a stile over the fence and a white triangle 'To BM TR 12'. Follow the pink flagging and directional markers to fork in the track, between M21 & M20, for I line. Turn left and follow the markings for I line. TR19 begins close to I1.
Start	1954874	5789569		
250m /end	1954969	5789368		
TR20			2	From top Burma Rd car park follow the main Nga Tapuwae O Toi track to just before the stile goes over the fence and the track intersects with the private road. Follow pink flagging and pink triangles, this rejoins TR3. The line runs parallel to the fence line. Continue past the end of TR3 and then TR13; go past the farm house on the right-hand side. Continue following the A Line until A19 is reached. Follow fence line to A29, the start of TR10, and continue along fence line for 150m past the end of TR10, to find the start of TR20 between A34 & 35
Start	1952905	5787434		
250m /end	1953069	5787503		

TR21			1	From top Burma Rd car park follow the main Nga Tapuwae O Toi track to just before the stile goes over the fence and the track intersects with the private road. Follow pink flagging and pink triangles, this rejoins TR3. The line runs parallel to the fence line. Continue past the end of TR3 and TR13; go past the farm house on the RH side. Continue following the A Line until A19 is reached – then follow pink flagging to F1 which is the start of TR11. Continue along F line until end of TR11, before F5, and then continue along main F line until TR21 starts close to F7.
Start	1952949	5787952		
250m /end	1953026	5787753		
TR22			1	From opposite the Ohope Mobil Service station on Pohutukawa Avenue go through the gate. Follow the grassed vehicle track on the left all the way to the top. At the top turn right in a westerly direction and follow the fence line until you see a stile over the fence and a white triangle 'To BM TR 12'. Follow the pink flagging and directional markers to M19, which is the start of TR12. Continue along M line, past end of TR12, until the start of TR22, between M14 & 13.
Start	1954470	5789287		
250m /end	1954265	5789143		
TR23			1	From top Burma Rd car park follow the main OSR track towards Ohope for approx. 7 minutes. TR23 begins on right hand side of track.
Start	1953783	5789696		
250m /end	1953524	5789582		
TR24			2	From the Ohope Rd & Pohutukawa Avenue & West End Rd entrance opposite the beach, follow the main track until the first track junction is reached. Follow the left-hand loop track until it rejoins the main track. At the top junction there is a disused track straight ahead that loops downwards. TR24 begins on the left-hand side 30m down this track.
Start	1954061	5789974		
250m /end	1954027	5790088		
TR25			1	From the Ohope Rd & Pohutukawa Avenue & West End Rd entrance opposite the beach, follow the main track until the first track junction is reached. Follow the left-hand loop track for approx. 8 minutes. TR25 starts on the left-hand side of the track.
Start	1954199	5790173		
250m /end	1954176	5790099		
TR26			2	From top Burma Rd car park follow the main OSR track towards Ohope for approx. 100 m until you reach G line on the RH side. A tree on the RH side is marked with a white triangle 'To BM TR 5, 15, 7 & 6'. Follow pink flagging, pink triangles and other white direction triangles to the U line. You will pass TR28, which starts shortly after U1. TR6 starts at U5. Go to the end of TR6. TR16 starts between U10 & 11. Go the end of TR16 and follow U line until the fence line is reached. Follow the pink flagging tape over the fence until you reach the start of TR26.
Start	1954774	5788872		
250m /end	1954938	5789048		
TR27			2	From opposite the Ohope Mobil Service station on Pohutukawa Avenue go through the gate. Follow the grassed vehicle track on the left all the way to the top. At the top turn right in a westerly direction and follow the fence line until you see a stile over the fence and a white triangle 'To BM TR 12'. Follow the pink flagging and directional markers to M19, which is the start of TR12. Continue along M line, past end of TR12. TR22 starts between M14 & 13, continue along M line until you pass the end of TR22. TR27 begins 150m along M line by M8.
Start	1954200	5789012		
250m /end	1953989	5788955		
TR28			3	From top Burma Rd car park follow the main OSR track towards Ohope for approx. 100 m until you reach G line on the RH side. A tree on the RH side is marked with a white triangle 'To BM TR 5, 15, 7 & 6'. Follow pink flagging, pink triangles and other white direction triangles to the U line. TR28 starts shortly after U1.
Start	1953867	5788817		
250m /end	1953921	5788598		
TR29			2	From top Burma Rd car park follow the main Nga Tapuwae O Toi track to just before the stile goes over the fence and the track intersects with the private road. Follow pink flagging and pink triangles, this rejoins TR3. The line runs parallel to the fence line. Continue past the end of TR3 and TR13; go past the farm house on the RH side. Continue following the A Line until A19 is reached – then follow pink flagging to F1 which is the start of TR11. Continue along F line until end of TR11, before F5, and then continue along main F line, travelling along TR21, which starts close to F7. Follow F line after the end of TR21 and TR29 starts approx. 150m along the line.
Start	1953115	5787734		
250m /end	1953265	5787883		
TR30			1	From top Burma Rd car park follow the main Nga Tapuwae O Toi track until it intersects with TR3. At the end of TR 3 follow the bait line for 150m to reach TR13. Travel along the fence line outside TR13, along A line, until you reach the start of TR30, before A8.
Start	1952831	5788785		
250m /end	1952874	5788588		

TR31			1	From top Burma Rd car park follow the main Nga Tapuwae O Toi track to just before the stile goes over the fence and the track intersects with the private road. Follow pink flagging and pink triangles, this rejoins TR3. The line runs parallel to the fence line. Continue past the end of TR3 and TR13; go past the farm house on the RH side. Continue following the A Line until A19 is reached – then follow pink flagging to F1 which is the start of TR11. Continue along F line until end of TR11, before F5, and then continue along main F line, travelling along TR21, which starts close to F7. Follow F line after the end of TR21 and TR29 starts approx. 150m along the line. From start of TR29 follow F line to F14 TR 31 starts approximately 50 before F15.
Start	1953152	5787867		
250m /end	1953350	5788035		
TR32			2	Same as TR31, go to end of TR31, which ends 25 metres before F18, continue along F line until F19. TR32 begins 20 metres before F20.
Start	1953436	5788169		
250m /end	1953650	5788071		

Appendix B

Bird Monitoring Field Sheets

Transects

TRANSECT BIRD MONITORING FIELD-SHEET

Location Name: Ohope Scenic Reserve		**Grid Refs:** E: N:		**Date:**
				Fieldworker: C Quinn
Transect No:		**Start:**		**Finish:**
Sun:	**Temp:**	**Wind:**	**Rain:**	**Other Noise:**

Species	Tally		Total No.
	Seen*	Heard*	
Australasian Harrier			
Bellbird			
Blackbird			
Chaffinch			
Falcon NZ			
Fantail			
Fernbird			
Goldfinch			
Grey Warbler			
Kaka			
Kereru			
Kingfisher			
Long-tailed cuckoo			
Magpie			
Myna			
Paradise Shelduck			
Peacock			
Pheasant			
Pukeko			
Quail, California			
Redpoll			
Robin, New Zealand			
Rosella, Eastern			
Shining Cuckoo			
Silvereye			
Skylark			
Sparrow, Hedge			
Starling			
Swallow, Welcome			
Thrush, Song			
Tomtit			
Tui			
Turkey			
Whitehead			
Yellowhammer			
Unknown			

** If seen and heard, record it only as seen*

Flowering, fruiting – record details if relevant

Plant Species	Fruit or Flowers	Rare, occasional, common, abundant, or very abundant	Notes

5MBCs

5MBC BIRD MONITORING FIELD-SHEET

Location Name: Ohope Scenic Reserve		**Grid Refs:** E: N:		**Date:**
				Fieldworker: Quinn
5MBC no:		**Start:**		**Finish:**
Sun:	**Temp:**	**Wind:**	**Rain:**	**Other Noise:**

Species	Tally and distance			Total No.
	>20m	20m-100m	100m+	
Australasian Harrier				
Bellbird				
Blackbird				
Chaffinch				
Falcon, NZ				
Fantail				
Fernbird				
Goldfinch				
Grey Warbler				
Hedge Sparrow				
Kaka				
Kereru				
Kingfisher				
Kokako				
Long-tailed cuckoo				
Magpie				
Myna				
Paradise Shelduck				
Peacock				
Pheasant				
Pukeko				
Redpoll				
Robin, New Zealand				
Rosella, Eastern				
Shining Cuckoo				
Silvereye				
Starling				
Swallow, Welcome				
Thrush, Song				
Tomtit				
Tui				
Turkey				
Quail, California				
Whitehead				
Yellowhammer				
Unknown				

Appendix C – Common, Scientific and Maori names of birds

Common Name	Scientific Name	Maori Name	2016 Threat Category
Australian magpie*	*Gymnorhina tibicen*	n/a	Introduced and Naturalised
Bellbird	*Anthornis melanura*	Korimako	Not Threatened
Blackbird*	*Turdus merula*	n/a	Introduced and Naturalised
California quail*	*Callipepla californica*	n/a	Introduced and Naturalised
Chaffinch*	*Fringilla coelebs*	Pahirini	Introduced and Naturalised
Common pheasant*	*Phasianus colchicus*	Peihana	Introduced and Naturalised
Eastern rosella*	*Platycercus eximius*	n/a	Introduced and Naturalised
Falcon, NZ	*Falco novaeseelandiae*	Kārearea	Recovering
Fantail	*Rhipidura fuliginosa placabilis*	Pīwakawaka	Not Threatened
Fernbird, North Island	*Bowdleria punctata vealeae*	Mātātā	Declining
Goldfinch*	*Carduelis carduelis*	n/a	Introduced and Naturalised
Greenfinch	*Carduelis chloris*	n/a	Introduced and Naturalised
Grey warbler	*Gerygone igata*	Riroriro	Not Threatened
Harrier hawk	*Circus approximans*	Kāhu	Not Threatened
House sparrow*	*Passer domesticus*	n/a	Introduced and Naturalised
Kaka (bush parrot)	*Nestor meridionalis*	Kaka	Recovering
Kereru (wood pigeon)	*Hemiphaga novaeseelandiae*	Kereru	Not Threatened
Long-tailed cuckoo	*Eudynamys taitensis*	Koekoeā	Naturally Uncommon
Myna*	*Acridotheres tristis*	n/a	Introduced and Naturalised
New Zealand kingfisher	*Todiramphus sanctus vagans*	Kōtare	Not Threatened
North Island robin	*Petroica longipes*	Toutouwai	Declining
Paradise shelduck	Tadorna variegata	Pūtakitaki	Not Threatened
Peacock*	*Pavo cristatus*	n/a	Introduced and Naturalised
Pukeko (Australasian swamphen)	*Porphyrio melanotus melanotus*	Pukeko	Not Threatened
Redpoll*	*Carduelis flammea*	n/a	Introduced and Naturalised
Starling*	*Sturnus vulgaris*	n/a	Introduced and Naturalised
Shining cuckoo	*Chrysococcyx lucidus lucidus*	Pīpīwharauroa	Not Threatened
Silvereye	*Zosterops lateralis lateralis*	Tauhou	Not Threatened
Song thrush*	*Turdus philomelos*	n/a	Introduced and Naturalised
Tomtit	*Petroica macrocephala toitoi*	Miromiro	Not Threatened
Tui (parson bird)	*Prosthemadera novaeseelandiae*	Tui	Not Threatened
Weka (woodhen)	*Gallirallus australis greyi*	Weka	Recovering
Welcome swallow	*Hirundo neaxena neoxena*	Warou	Not Threatened
Whitehead	*Mohoua albicilla*	Pōpokatea	Declining
Wild Turkey*	*Meleagris gallopavo*	n/a	Introduced and Naturalised
Yellowhammer*	*Emberiza citrinella*	n/a	Introduced and Naturalised
*Introduced species			

Appendix D - Raw Results from 5MBC counts

Station No.	Observer	Date (dd/mm/yy)	A. Harrier	Bellbird	Blackbird	Chaffinch	Fantail	Grey Warbler	Kereru	Kingfisher	Long-tailed cuckoo	Magpie	paradise shelduck	Pheasant	Robin, NI	Rosella, Eastern	Shining Cuckoo	Silvereye	Swallow, Welcome	Thrush, song	Tomtit	Tui	Yellow hammer
1a	Amy Quinn	15.11.19		4	1			4		2							1	3				8	
1b	Amy Quinn	15.11.19		6		1	4	9		1							1				3	14	
2a	Conor Quinn	11.11.19	1	2	1												2	3		1	1	9	
2b	Conor Quinn	11.11.19		1			2	4	2					1				2				9	
3a	Conor Quinn	4.11.19		1	2		1	3		1				2				2				9	
3b	Conor Quinn	4.11.19		2		3		4		1							1				1	14	
4a	Conor Quinn	5.11.19	1	2	2	5				2										2	1	17	
4b	Conor Quinn	5.11.19		2		4		3		1				1			1	2				12	2
5a	Conor Quinn	6.11.19		3		4	1	2		2							1	5			2	12	
5b	Conor Quinn	6.11.19	1	3		4		4	1								1	4			3	14	
6a	Conor Quinn	6.11.19		2		5	1	5					2	1				3			2	12	
6b	Conor Quinn	6.11.19		1			2	4		1							2	4			3	8	
7a	Conor Quinn	6.11.19		3		2		7		1						2		6			1	13	
7b	Conor Quinn	6.11.19		4	1	5	1	5										2			1	24	
8a	Conor Quinn	4.11.19			2	5		2	1	1						2		2			1	12	
8b	Conor Quinn	4.11.19		4	4	9	1	7	1	1								4			3	17	
9a	Conor Quinn	4.11.19		1	2	4		5		1								4			2	15	
9b	Conor Quinn	4.11.19		2		3			1							1	2	4			1	8	
10a	Conor Quinn	12.11.19		3	1	3		5		2				1			1	2			1	10	
10b	Conor Quinn	12.11.19		2	1		1	2					1	1				2			1	8	
11a	Amy Quinn	12.11.19		3		1	2	1	1								2				2	7	
11b	Amy Quinn	12.11.19		1	1		1	5									1	2			1	6	
12a	Amy Quinn	15.11.19		3			1	3		2								3				9	
12b	Amy Quinn	15.11.19		2				3		2							1					8	
13a	Conor Quinn	4.11.19		1	2	3		6	1	2				1			1	2			1	16	
13b	Conor Quinn	4.11.19		3	1	2		2						1				3			1	17	
14a	Conor Quinn	5.11.19		2		5		2	1	1								6		2		13	4
14b	Conor Quinn	5.11.19		4	3	7				2								5			14		2
15a	Conor Quinn	6.11.19		2				3								1	2	5			3	9	
15b	Conor Quinn	6.11.19		4		6		3													1	10	
16a	Conor Quinn	6.11.19		2	3			4		1								6				13	
16b	Conor Quinn	6.11.19		1		5		3		1				1				3				9	
17a	Conor Quinn	11.11.19			2	2	1	2		1												9	
17b	Conor Quinn	11.11.19		2	1			3		2											2	7	
18a	Conor Quinn	4.11.19		3	2	10		6	4					1				4			3	16	2
18b	Conor Quinn	4.11.19		3		7	1	6		2						1		3			1	13	
19a	Amy Quinn	15.11.19		3			1	3									2	2				11	
19b	Amy Quinn	15.11.19		6			1	6	2	1					1		2	1			3	11	
20a	Conor Quinn	12.11.19		2	3	3		2				1	1	1		1	2	2		1	3	11	
20b	Conor Quinn	12.11.19		2	3	3	2	8	2									2			2	10	
21a	Amy Quinn	12.11.19		3		1		5		1							2	1			1	6	
21b	Amy Quinn	12.11.19					2	4		2							2					8	
22a	Amy Quinn	15.11.19		4		1	1	6	2	2							2	3			2	12	
22b	Amy Quinn	15.11.19		2				6		1							2	3				5	
23a	Conor Quinn	11.11.19	1	2	2			1		2								2			1	10	
23b	Conor Quinn	11.11.19		2	2			3										6		1	2	11	
24a	Conor Quinn	15.11.19		1		2	1	2		1								2			1	7	
24b	Amy Quinn	15.11.19		4			4	3									1				3	9	
25a	Amy Quinn	15.11.19		6		1	3	7		1							2				3	11	
25b	Amy Quinn	15.11.19	1	4			3	5		1							1					3	
26a	Conor Quinn	6.11.19		3		3	1	4		1				1		2		6				13	
26b	Conor Quinn	6.11.19		3	1		2	5		1	1			1		1	1	5	1	1	2	12	
27a	Amy Quinn	15.11.19		5			3	5		2							2				1	8	
27b	Amy Quinn	15.11.19		4			2	2									1				2	6	
28a	Conor Quinn	6.11.19		2			2	4		1								3			3	6	
28b	Conor Quinn	6.11.19		3	2			7	1	1												11	
29a	Amy Quinn	12.11.19		3			1	3		1								1				6	
29b	Conor Quinn	12.11.19		1	1		2	5		1								4				8	
30a	Conor Quinn	4.11.19		2	3			4										11			1	10	
30b	Conor Quinn	4.11.19		3	1	2		2				2				2		6				15	
31a	Amy Quinn	12.11.19	1	2	1			3		1						1	3	2				9	
31b	Amy Quinn	12.11.19		4			1	4	1								3				1	7	
32a	Conor Quinn	12.11.19		1	1	2	2			1							1	5				6	
32b	Conor Quinn	12.11.19		1	1			4		1											1	7	