

Transfer of bellbirds and whitehead from Kapiti Island to Mana Island, July 2010



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Cover: Barry Dent releases a whitehead onto Mana Island. Photo: David Cornick.

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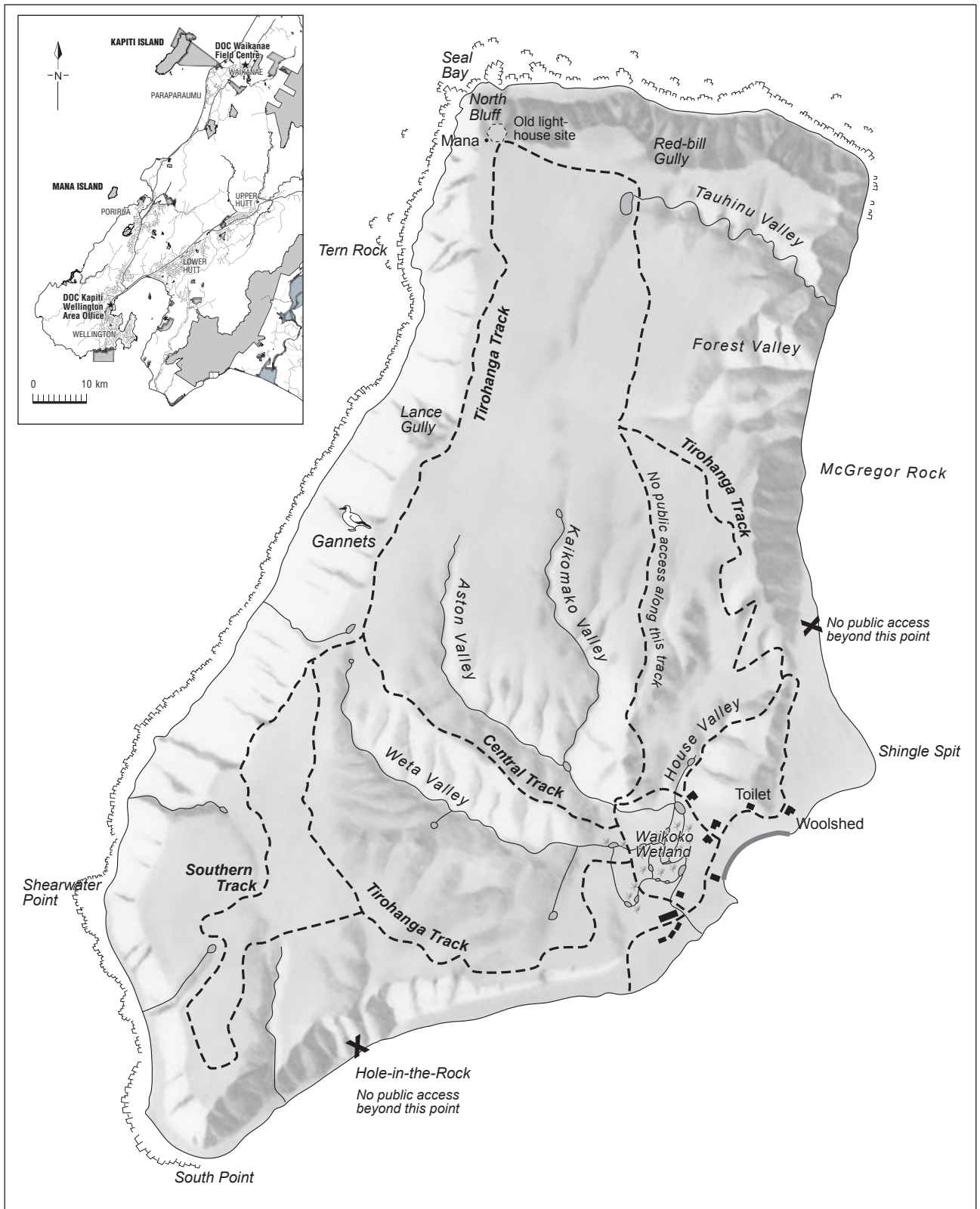


Figure 1. Location and spatial extent of Mana Island.

Introduction

Mana Island is a 217 ha scientific reserve approximately 2.5 km from the adjacent mainland, off Porirua, north of Wellington (fig. 1). The island was farmed for over 150 years, the last stock being removed in 1986. A regenerating forest remnant remained at this time, totalling around 2 hectares. A revegetation programme commenced in 1987, and a total of over 500,000 trees have been planted to create a low forest canopy and open shrubland community.

The island has been free of mammalian predators since mice were eradicated from Mana in 1989–1990. There is a network of contingency bait stations checked monthly, and a rodent audit using tracking tunnels is completed every 3 months.

The island is home to several regionally and nationally threatened plant and animal species. In addition, eight bird species have been introduced, including three species of burrowing seabirds, takahe, and the New Zealand shore plover. A small wetland restored in 1999 now has a population of brown teal/pateke which were released in 2001. Mana also has a lizard population of ten species, four of which have been translocated to the island. Two weevil species have also been translocated to Mana.

The reintroduction of bellbirds and whiteheads forms part of an overall ecological restoration programme for Mana Island (see Mana Island Ecological Restoration (Miskelly, 1999). This programme comprises the restoration of habitat, flora and fauna. The Friends of Mana Island Incorporated Society (FOMI) was formed with the principal objective of supporting and assisting the Department of Conservation (DOC) in implementing the restoration plan for Mana Island.

Community conservation groups such as Forest and Bird, FOMI and various tramping clubs, school groups and members of the local community have contributed a large number of volunteer hours to many of the conservation projects on Mana Island and to assist the two permanent DOC staff. In addition, Forest and Bird raised sponsorship funds for the mouse eradication project and FOMI has funded and lead many of the species introductions.

The island is within part of both bellbird and whitehead former range, and remains of both species are recorded in middens on Mana Island (Miskelly, 1999).

The purpose of the translocation was to:

- To re-establish bellbird/korimako and whitehead/pōpokatea to Mana Island.
- To enhance public awareness through advocacy and public participation in the conservation management of the bellbird and whitehead populations on Mana Island. This will be achieved by involving skilled volunteers (FOMI/OSNZ) in the translocation and post-release monitoring. Once populations are established, the public will be able to see and hear these species when visiting the island.
- If successful, this transfer would create another potential point of dispersal for bellbirds and whiteheads to recolonise other parts of the Wellington region naturally (e.g., bush areas and margins on the adjacent mainland from Makara to Pukerua Bay).
- To provide a site for the possible natural re-establishment of the threatened long-tailed cuckoo/koekoeā (*Eudynamys taitensis*), which parasitises whitehead nests (threat status (2008): Naturally Uncommon).
- To use the populations, once they are well established, as a potential source for translocations to other suitable habitats.

Methods

Pre-trip preparations

Several discussions were had with Area staff, Kapiti Island staff, and external groups that had attempted bellbird and whitehead translocations in the past—Zealandia (Karori Sanctuary), Tim Lovegrove (ARC, Ark in the Park), Chris Smuts-Kennedy (MIET – Maungatautari). The information from these sources was very valuable in the planning of this transfer—in particular experiences shared regarding timing of transfer, captive diet, and logistics of transfer from island to island. Screening requirements were also refined with help from Kate McInnes, and Massey vet staff offered use of a resident vet to assist with screening and sampling the birds as the DOC veterinarian was unavailable during July.

A comprehensive equipment/gear list was formulated and added to as the planning progressed (see Appendix 4). All gear was boxed and sealed ready to go prior to departure for Kapiti Island, minimising biosecurity risk.

Catching

Mist nets were set up on the afternoon of 12 July 2010 but were not opened to catch birds that day. Nets were set in areas that had been successful during earlier transfers for bellbirds or whiteheads and other species or in areas where either species were observed.



Jason Christensen, and Clint Purches observe as David Cornick retrieves a bellbird from a mist net.
Photo: Richard Gill.

By-catch

Mist netting indiscriminately catches all similar size birds. These individuals were released near the capture site but away from the direction of the net. To help with planning of future translocations, all species caught were recorded to determine catch rates.

Processing and disease screening

Once removed from nets whitehead and bellbirds were quickly carried in cloth capture bags to the processing room near the aviaries. Birds were weighed, banded and wing measurements were taken. If birds were to be screened, they were given a physical exam, blood was taken from the xx vein in the wing for a blood smear (white cell count and haemoparasite check). A cloacal swab was taken to test for salmonella, yersinia and campylobacter. Faecal samples were taken from capture bags to test for internal parasites (worms and coccidia).

An institutional permit was obtained to catch, metal and colour band birds that were to be translocated to Mana Island (permit number 2010/013).

Bellbirds were given an opportunity to drink jam water by dipping the tip of their beak into the liquid and waiting for them to lap this up. All birds were then taken to the aviary, and released from the hand on the ground. They were watched until they flew.

Aviary setup and bird care

Aviary furnishing

Bellbirds were separated by sex into two aviaries and whitehead were held together with up to 20 in each flight. Kapiti Island has three existing flights available, and an additional aviary was set up using the Zealandias portable aviary (2 × 3 metres with a double door system). All aviaries were furnished with fresh vegetation consisting of a mix of soft vegetation with suitable perches, and food species. Large branches were firmly attached with cable ties to the aviary walls to cushion hard surfaces and to provide refuges. Large branches were also added to the centre of the aviary to minimise the flight distance between perches. Food shelves or hanging platforms were added to hold food.

Food

Sliced fresh pear, apple, mandarin and oranges was provided throughout the aviary, primarily by fixing slices to tree branches, but some was scattered on the floor and platforms. At least three whole sliced fruits of each type was placed in the aviary during set up with an additional two pieces of each fruit added every day. Jam water was placed in two dishes in each aviary, one dish of soaked sultanas and one dish of mealworms. Sugar water was placed in two hummingbird feeders for bellbirds only and an abundance of extra mealworms and wax moth larvae was placed in whitehead aviaries. For this transfer 20,000 mealworms and 5,000 waxworm larvae were ordered. See Appendix 5 for bird recipes.

Freshwater was provided in several containers, stones were placed in each to allow birds to also bath in water.

Transfer

Planning for the transfer allowed for boat (charter) transport to Kapiti, car transport to Mana Marina and boat (DOC boat *Mana Ranger III*) to Mana Island. Four-wheeler would be used to transport birds to released locations. Helicopter flight from Kapiti to Mana was planned for as a contingency if weather prevented boat transport.

Release

It was planned that birds would be released in an even ratio (where sex was known) and number at three sites, namely: Forest Valley, House Valley, and Weta Valley; distributing birds into suitable habitat throughout the Mana Island. Sugar feeders were also placed at release sites; and at a few other locations near tracks, to encourage bellbirds to feed at these sites; and as a useful monitoring tool. The birds were released from their boxes at each release site, then a thorough check of each box was undertaken to ensure no birds were left in boxes. This included removing the vegetation and food placed in each box for transfer. Band combinations of all birds released at each site were recorded (see Appendix 1, 2).

Results

Pre-trip preparation

Boxed gear was transported to Kapiti Island with the capture team. All equipment needed was provided and available.

Catching

Sixteen nets were set up for day one on 13 July 2010—main track (eight nets), helicopter track (five nets), right angles to helicopter track (one net), north of visitor shelter near picnic tables (two nets), and stream by viewing hide (one net). Three more nets were placed behind the toilets for the morning of 15 July 2010. At night, nets were furled, raised above 1.5 metres and tied closed with flax string to prevent anything being caught while nets were unattended.

Nets were opened at approximately 7.30 a.m. and closed at 4.30 p.m. which allowed enough light at the end of the day for birds to settle into the aviary and eat before darkness. On 15 July nets were closed by 12.00 noon to allow whitehead to settle undisturbed in their aviary before transfer the next day.

All bellbirds were caught by midday on 14 July and birds were left to settle into the aviaries for two days. Half the whiteheads were left undisturbed for two days but the slower catch rates of whiteheads meant birds in the second aviary had only one day to settle before transfer. Unfortunately, scales used in the second aviary were unreliable so it was not possible to determine whether the differing holding periods affected birds' weight gain/loss.

Birds were transferred in corflute pet carry boxes (442 × 310 × 240 mm) furnished with a permanent wooden perch secured to the box. Each box had holes in the side and top of the boxes; each holes was covered in mesh, the lid was taped closed and extra holes were taped to prevent escape. Additional vegetation was placed in each box, comprising a mix of suitable food (e.g., hangehange, five finger) and perches (e.g. kānuka). The box was loosely full of vegetation, allowing space for birds to move within. Additional food was placed in each box (a selection of apple, pear, orange and mealworm for bellbirds, mealworms and waxmoth larvae for whiteheads), the morning of the transfer.

Bycatch

A list of species caught as by-catch is included in table 1. Note that kākā, kererū and most tūi could be tipped out of nets, significantly reducing the handling needed.

Table 1: Number of birds caught in mistnets as by-catch

SPECIES	TOTAL CAUGHT	SPECIES	TOTAL CAUGHT
Tūi	47	Fantail	2
Bellbird ¹	35	Welcome swallow	1
Kākāriki	8	Kākā	1
Saddleback	8	Kererū	1
North Island robin	6	Blackbird	1
Silvereye	5	Yellowhammer	1
Hihi	2 ²		

¹ Does not include birds caught for the translocation

² recapture banded G/M-G/PF C-88285; unbanded bird banded B/M-B C-86134



Amelia Leary of FOMI retrieves a bellbird from a mist net.
Photo: David Cornick.

Processing and disease screening

Disease screening results

All physical examines showed birds were in good body condition. Body weight for all birds was within normal ranges from the Kapiti populations (Empson, 2002). The samples taken from each bird is summarised in Appendix 3.

- Cloacal swab for salmonella, yersinia, and campylobacter were all negative (see Appendix 3).
- Blood smear for white cell count (WBC) was conducted for only two birds. For bellbird B-120339 WBC Heterophil = 88%, Lymphocytes =12%. For bellbird B-120344 WBC Heterophil = 92%, Lymphocytes = 8%. Thrombocyte for both birds was adequate.
- Faecal sample for internal parasites was clear for asc, capi het strol. Coccidia results are shown in Appendix 3.

The only significant finding was high levels of coccidia in most of the pooled samples. This led to a recommendation that birds be treated with piglet suspension of the drug “Baycox” (active ingredient: toltrazuril), diluted to 10mg/ml and given 0.05 ml per bird by mouth once (dose of 25 mg / kg per bird). The best option was to treat birds when they were caught in the aviary, prior to putting them in boxes and transfer. This added extra time to processing, but provided an extra opportunity to feed bellbirds jam water before they were placed in their transfer box. Up to five birds were placed in each box. Bellbird sexes were kept apart.

Table 2: Weights and wing measurements of bellbird and whitehead showing weight change during their time in captivity on Kapiti Island.

SPECIES	CAPTURE WEIGHT (g)			TRANSFER WEIGHT (g)			WING LENGTH (mm)		
	Mean	S.D	N	mean	S.D.	N	Mean	S.D.	N
Whitehead									
all birds	18.1	2.5	37	18.5	2.3	20	71.9	4.4	38
males	17.7	2.4	17	17.7	2.1	12	72.6	4.4	21
females	18.7	2.8	20	19.1	2.4	8	71.1	4.3	17

Bellbird

all birds	24.9	3.9	41	-	-	-	81.9	6.2	50
males	28.7	1.3	19	27.0	1.5	21	87.6	3.2	24
females	21.5	1.5	22	-	-	-	76.6	2.2	26

Sexing

Sexing of both species was done on plumage colouration only. It was expected that all juvenile bellbird would have gone through a moult to their adult plumage, and this was also assumed for whitehead. However it proved difficult to sex some whitehead as the colouration of the white head was indistinct. The one known juvenile that was caught (identified by the yellow in the corner of its bill) indicated that it was possible that some birds may have still been in juvenile plumage. The identified juvenile died while in the aviary and it is assumed that this bird was still dependant on adults for feeding. The same problem was encountered by Karori during a whitehead transfer in May when several juvenile birds died in the aviary.

Bellbird sexing was presumed to have been accurate as there was distinct colour difference in birds, and none exhibited an intermediate colouration. Juveniles of the previous season would have presumably completed their winter moult to adult plumage (P. Reese *pers com.*), although we noted that tail feathers were still moulting for most birds. The statistically significant difference between the weight of male and female bellbirds ($t=16.38$ $df=39$ $p<0.001$), is consistent with other studies (Robertson et al. 1983)

Sexing whiteheads was difficult and was not apparent from plumage alone. There was intermediate coloration for some birds and these were arbitrarily assigned a sex. Where there was ambiguity, birds were generally assigned to females.

Fourteen of 36 whiteheads (three birds had measurements missing), were females using Robertson et al. (1983) body weight against wing length criteria, of these 8 females were incorrectly assigned as males indicating plumage was completely unreliable with this observer (L.A), see fig. 2. The sex composition of the transferred population has male bias.

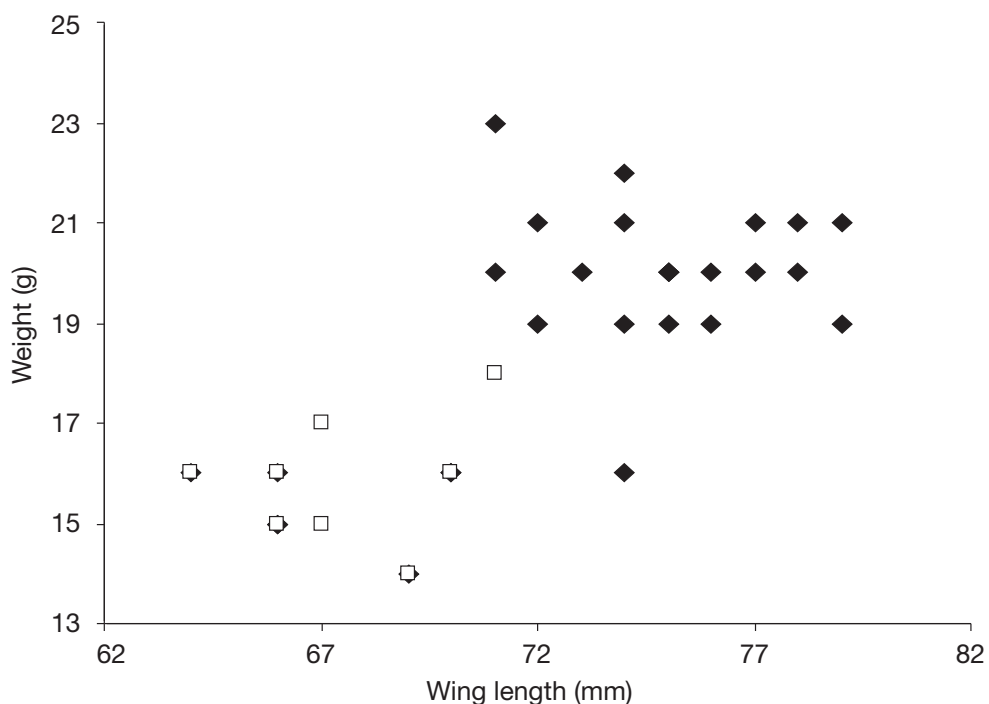


Figure 2. Whitehead plot of body weight against wing length (□ assumed female; ◆ assumed male). Note data from several birds may overlap on points marked on this graph.

Aviary set up and care

Aviary furnishing

The dense furnishing provided in the aviary was very suitable in providing plenty of cover for birds, retreat sites in case birds were fighting, cover for when people entered the aviary to provide food and as a cushioning for birds flushing. No additional furnishing was needed once birds were in the aviary, although branches of food was provided daily in all aviaries.

Food

Whitehead were feed twice per day and ate an abundance of mealworms and waxmoth. Fruit and jam water was also eaten, and some cheese and soaked sultanas were eaten. There was no difficulty with birds feeding and it is likely that all/most birds feed on mealworms very soon after entering the aviary.

Bellbirds were feed each morning with all options of artificial food, and natural fruit was added daily. Bellbirds consumed sugar and jam water, ate small amounts of sultanas and mealworms and an abundance of fresh fruit.

For both species the person entered the aviary quietly and slowly, and averted eyes from the birds as much as possible. Discrete paths were used to access parts of the aviary, movement was slow allowing birds to move away, minimising disturbance.

The number of mealworms and waxmoth larvae was adequate, and we would have had enough for one extra day. Separation of wax moth larvae from their webs was very time consuming but necessary to allow birds access to the larvae. We ordered large mealworms but small mealworms were received, with additional time we could have grown the mealworms to larger size, probably requiring less mealworms per bird.

Water bowls were cleaned every second day and freshwater added.

Transfer

The two catch teams of two people started the day at 7.30 a.m. placing food in transfer boxes. Catching started at 8.30 a.m. and was completed at 12.30 p.m. There were no breaks taken during this time, and the teams were rushed to meet the 12.30 p.m. deadline when the helicopter arrived.

Prior to catching most of the vegetation was removed from the aviary. Catching generally involved one person catching birds with a soft net, while the other herded birds towards the net. The bird was then placed it in a catch bag, was weighed, drenched then feed. The last birds were more difficult to catch and most vegetation was removed to get the last birds.

Some of the coccidia drench was lost during transportation to Kapiti and only enough for approximately half of the birds was available. Birds caught first were drenched and it is assumed this was a random sample of birds in each aviary.

The scales in one capture group were consistently weighing birds lighter than the other teams scales (which was the only scale used on capture days) and so this data was not used meaning we could only analyse male bellbirds and half the whiteheads (see table one). One female bellbirds (B-120332) weight data was removed from capture weight analysis because her weight (32 g) exceeded the maximum weight of all birds including the heaviest male, it is assumed that this weight was a measurement error.

Because of the extra processing time required to drench birds, it was decided to transfer birds by helicopter. This allowed more time for birds to be on Mana before dark.

Release

The helicopter (single-engined Squirrel) arrived on Mana Island at approximately 1.00 p.m. The birds in their transfer boxes, one passenger and some of the gear were unloaded; and once the helicopter departed, a short karakia and mihimihi was performed by Kahu Ropata from Ngāti Toa.

Birds in the boxes were sorted and grouped for each release site; and the first group of both species (nine whiteheads and 17 bellbirds) were carried on foot to House Valley and released at approximately 1.25 p.m. The second group of birds (10 whiteheads and 15 bellbirds) were transported by foot and released into Weta Valley at 1.45 p.m. The final group of birds (19 whiteheads and 11 bellbirds) were driven up to Forest Valley by four-wheeler and released at 2.20 p.m.

All birds captured and boxed on Kapiti Island were released on Mana Island alive and well. It was observed on releasing the birds that they had eaten large amounts of the food provided in boxes, particularly the fruit sections. A table showing the release site of each bird is included in Appendix 1.

Aviary mortality

Full necropsy results are reported in Appendix 6.

Bellbird

C-89537 or C-89533 died from coccidial enteritis with presumptive secondary bacterial enteritis. B-120301 the cause of death was unknown. B-120308 there was unknown cause of death. B-120329 there was unknown cause of death. B-120338 probably died from moderate intestinal coccidiosis. B-120341 the cause of death was unknown. C-895539 the cause of death possible head trauma.

Whitehead

Two whiteheads died. One was a juvenile, and, in hindsight, it seems likely this bird died from starvation because it was still dependant on adults to feed.

Budget

Transfer costs	\$7950
Volunteer time (preparation/planning)	80 hours
DOC staff (preparation/planning)	160 hours
DOC and volunteer time (transfer)	360 hours

Post-release monitoring effort has not been estimated (NB: at this stage fortnightly post-release monitoring has been scheduled – approx 4-6 volunteer hrs per fortnight). DOC staff time for post-release monitoring is approx 4hrs/fortnight (transportation, sugar water feeders, and data collation)

Recommendations

- Consider transferring additional whitehead and bellbird to even the balance of females (especially whitehead) and to reach the target of 60 birds for each species.
- Where possible, monitor the different weight changes of individuals left for a variety of times at “rest” in the aviary, in order to determine the optimal holding regime.
- Consideration should be made to dose all bellbird and whitehead for coccidia prior to transfer as preventative for all translocations in the future.
- Juvenile whitehead (identified by yellow marking in the corner of the bill), are to be immediately released from the capture site and not transferred.
- Note that dependant juvenile whitehead can be present in the population at any time of the year.
- Continue to monitor the survival of individuals, and monitor the establishment of the two species populations
- Only consider maintaining a banded population of either/both species, if considerable effort can be made to ensure a large samples of birds are marked and resighted, or additional research is approved.

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Acknowledgements

As with any translocation, a great number of people have worked in the background to make the project successful, not the least has been Friends of Mana Island members and DOC staff who have contributed extensive efforts to restore Mana Island, which has allowed this release to be possible.

We would like to specifically thank:

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- Barry Dent and David Cornick for help releasing birds on Mana Island;
- Frank Higgott for his connections with Ngāti Toa, organising tangata whenua representatives for the transfer and for numerous boat trips needed for the planning and execution of the transfer.
- Barry Dent and Sue Freitag for arranging fabulous food and menu and for being available during the transfer to discuss logistics;
- Colin Ryder for his drive, enthusiasm and fund raising skills;
- Baukje Lenting for her advice and execution of disease screening, liaising with labs and her great company and calmness during busy times on Kapiti Island.
- Raewyn Empson and Matu Booth from Zealandia (Karori Sanctuary) who shared their experiences and data on bellbird and whitehead transfers;
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- Tim Lovegrove (ARC) and Chris Smuts-Kennedy (MIET) for sharing experiences on bellbird transfers;
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- Sara Treadgold for helping with logistics and cleaning up the aviary after the transfer
- David Cornick, Amelia Geary and Sara Treadgold for the unenviable task of catching birds in aviaries on the transfer day;
- Wayne Boness for his knowledge of helicopters and for his organisation of them late at night.
- Mike Ashby from Biosupplies for advice on captive bird diet and for providing thousands of waxworm and mealworm larvae for the transfer
- Ned, Hayley and pilot James and crew from Helipro Wellington and the team at Helipro Paraparaumu for transportation of people and birds
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- Brett Gartrell, Kerri Morgan and Stuart Hunter of IVABS at Massey for veterinary advice and necropsy results.
- New Zealand Veterinary Pathology for advice and for providing the screening results as quickly as possible to enable the transfer to go ahead

Appendix 1

Band combinations and morphometric data for bellbirds caught for transfer to Mana Island

METAL BAND NUMBER	LEFT LEG	RIGHT LEG ¹	SPECIES	DATE CAUGHT	DRENCHED (Y/N)	WING LENGTH (mm)	CAPTURE WEIGHT (g)	AGE (A/J)	SEX (PLUMAGE)	SEX (weight against wing length)	TRANSFER WEIGHT (g)	DATE RELEASED	RELEASE SITE
B-120301	FP/M	R/R	Bellbird	13.07.2010	n/a	78			F			dead	
B-120302	FP/M	R/G	Bellbird	13.07.2010	N	73			F		19	17.07.2010	Forest V
B-120303	FP/M	R/PG	Bellbird	13.07.2010	Y	78			F		17	17.07.2010	Weta V
B-120308	FP/M	R/B	Bellbird	13.07.2010	n/a	76	21		F			dead	
B-120309	FP/M	R/Y	Bellbird	13.07.2010	Y	78	23		F		17	17.07.2010	HouseV
B-120312	FP/M	R/O	Bellbird	13.07.2010	N	72	21		F		14	17.07.2010	HouseV
B-120315	FP/M	R/W	Bellbird	13.07.2010	Y	76	20		F		15	17.07.2010	HouseV
B-120316	FP/M	R/K	Bellbird	13.07.2010	N	77	21		F		14	17.07.2010	Weta V
B-120335	FP/M	G/R	Bellbird	13.07.2010	N	75	21		F		17	17.07.2010	HouseV
B-120320	FP/M	G/G	Bellbird	13.07.2010	Y	78	22		F		16	17.07.2010	HouseV
B-120321	FP/M	G/PG	Bellbird	13.07.2010	N	73	20		F		13	17.07.2010	Forest V
B-120322	FP/M	G/B	Bellbird	13.07.2010	N	75	23		F		15	17.07.2010	HouseV
B-120336	FP/M	G/Y	Bellbird	13.07.2010	Y	78	23		F		16	17.07.2010	Weta V
B-120326	FP/M	G/O	Bellbird	13.07.2010	N	78	22		F		15	17.07.2010	Forest V
B-120327	FP/M	G/W	Bellbird	13.07.2010	Y	75	22		F		17	17.07.2010	HouseV
B-120328	FP/M	G/K	Bellbird	13.07.2010	Y	77	20		F		15	17.07.2010	Weta V
B-120329	FP/M	PG/R	Bellbird	13.07.2010	n/a	76	18		F			dead	
B-120331	FP/M	PG/G	Bellbird	13.07.2010	Y	82	22		F		16	17.07.2010	Weta V
B-120332	FP/M	PG/PG	Bellbird	13.07.2010	N	80	32 ²		F?		15	17.07.2010	HouseV
B-120333	FP/M	PG/B	Bellbird	13.07.2010	N	80	23		F		16	17.07.2010	HouseV
B-120334	FP/M	PG/Y	Bellbird	13.07.2010	N	77	22		F		14	17.07.2010	HouseV
B-120337	FP/M	PG/O	Bellbird	13.07.2010	Y	77	23		F		15	17.07.2010	HouseV
B-120338	FP/M	PG/W	Bellbird	13.07.2010	n/a	76	24		F			dead	

¹ Colour Codes: R = red, W= white, K = black, B = blue, PB = pale blue, G = middle green, PG = pale green, O = orange

² data considered an error so not used in analysis

METAL BAND NUMBER	LEFT LEG	RIGHT LEG ¹	SPECIES	DATE CAUGHT	DRENCHED (Y/N)	WING LENGTH (mm)	CAPTURE WEIGHT (g)	AGE (A/J)	SEX (PLUMAGE)	SEX against wing length)	TRANSFER WEIGHT (g)	DATE RELEASED	RELEASE SITE
B-120341	FP/M	PG/K	Bellbird	14.07.2010	n/a	77	22		F			dead	
B-120342	FP/M	B/R	Bellbird	14.07.2010	N	75	22		F		12	17.07.2010	HouseV
B-120343	FP/M	B/G	Bellbird	14.07.2010	N	75	19		F		13	17.07.2010	Weta V
C-89531	FP/M	Y/R	Bellbird	13.07.2010	N				M		25	17.07.2010	HouseV
C-89580	FP/M	Y/G	Bellbird	13.07.2011	Y	94			M		26	17.07.2010	Forest V
C-89532	FP/M	Y/PG	Bellbird	13.07.2012	Y	86			M		26	17.07.2010	Forest V
C-89533	FP/M	Y/B	Bellbird	13.07.2013	n/a	86			M			dead	
C-89534	FP/M	Y/Y	Bellbird	13.07.2014	N	89			M		27	17.07.2010	Weta V
C-89535	FP/M	Y/O	Bellbird	13.07.2015	N	87			M		26	17.07.2010	HouseV
C-89536	FP/M	Y/W	Bellbird	13.07.2016	N	85	29		M		31	17.07.2010	Forest V
C-89537	FP/M	Y/K	Bellbird	13.07.2017	n/a	89	26		M			dead	
C-89538	FP/M	O/R	Bellbird	13.07.2018	Y	84	31		M		26	17.07.2010	Weta V
C-89539	FP/M	O/G	Bellbird	13.07.2019	n/a	98	27		M			dead	
C-89540	FP/M	O/PG	Bellbird	13.07.2020	n/a	88	29		M			dead	
C-89541	FP/M	O/B	Bellbird	13.07.2021	Y	87	29		M		28	17.07.2010	Weta V
B-120323	FP/M	O/Y	Bellbird	13.07.2022	Y	86	30		M		28	17.07.2010	Weta V
C-89542	FP/M	O/O	Bellbird	13.07.2023	N	88	30		M		27	17.07.2010	HouseV
C-89543	FP/M	O/W	Bellbird	13.07.2024	N	86	26		M		27	17.07.2010	HouseV
C-89544	FP/M	O/K	Bellbird	13.07.2025	Y	86	28		M		27	17.07.2010	Weta V
C-89545	FP/M	W/R	Bellbird	13.07.2026	N	89	30		M		27	17.07.2010	Forest V
C-89546	FP/M	W/G	Bellbird	13.07.2027	N	85	29		M		29	17.07.2010	Forest V
C-89547	FP/M	W/PG	Bellbird	13.07.2028	Y	87	29		M		29	17.07.2010	Weta V
C-89548	FP/M	W/B	Bellbird	13.07.2029	Y	83	28		M		26	17.07.2010	Forest V
C-89549	FP/M	W/Y	Bellbird	13.07.2030	Y	89	29		M		26	17.07.2010	Forest V
C-89550	FP/M	W/O	Bellbird	13.07.2031	N	90	29		M		28	17.07.2010	Forest V
C-89551	FP/M	W/W	Bellbird	13.07.2032	N	88	28		M		25	17.07.2010	Weta V
C-89552	FP/M	W	Bellbird	13.07.2033	N	85	29		M		25	17.07.2010	Weta V
C-89553	FP/M	K/R	Bellbird	14.07.2010	N	87	29		M		28	17.07.2010	Weta V

¹ Colour Codes: R = red, W = white, K = black, B = blue, PB = pale blue, G = middle green, PG = pale green, O = orange

² data considered an error so not used in analysis

Appendix 2

Band combinations and morphometric data for whitehead caught for transfer to Mana Island

METAL BAND NUMBER	LEFT LEG	RIGHT LEG	SPECIES	DATE CAUGHT, KAPITI IS.	DRENCHED (Y/N)	WING LENGTH (mm)	CAPTURE WEIGHT (g)	AGE (A/J)	SEX (plumage)	SEX (weight against wing length)	TRANSFER WEIGHT (g)	DATE RELEASED, MANA IS.	RELEASE SITE
B-120304	FP/M	R/R	Whitehead	13.07.2010	Y			A	F	unk	15	17.07.2010	Forest V
B-120310	FP/M	R/G	Whitehead	13.07.2010	Y	66	16	A	F	F	16	17.07.2010	Forest V
B-120319	FP/M	R/PG	Whitehead	13.07.2010	Y	72	19	A	F	M	20	17.07.2010	HouseV
B-120330	FP/M	R/B	Whitehead	13.07.2010	N	75	19	A	F	M	20	17.07.2010	Forest V
B-120339	FP/M	R/Y	Whitehead	13.07.2010	Y	74	19	A	F	M	20	17.07.2010	HouseV
B-120345	FP/M	R/O	Whitehead	14.07.2010	Y	71	18	A	F	F	19	17.07.2010	HouseV
B-120346	FP/M	R/W	Whitehead	14.07.2011	Y	79	21	A	F	M	22	17.07.2010	Forest V
B-120347	FP/M	R/K	Whitehead	14.07.2012	Y	73	20	A	F	M	21	17.07.2010	HouseV
B-120350	FP/M	G/R	Whitehead	14.07.2013	N	70	16	A	F	F	12	17.07.2010	Weta V
B-120352	FP/M	G/G	Whitehead	14.07.2014	Y	72	21	A	F	M	18	17.07.2010	Weta V
B-120354	FP/M	G/PG	Whitehead	14.07.2015	Y	74	21	A	F	M	17	17.07.2010	Forest V
B-120355	FP/M	G/B	Whitehead	14.07.2016	Y	66	16	A	F	F	12	17.07.2010	Forest V
B-120359	FP/M	G/Y	Whitehead	15.07.2010	Y	64	16	A	F	F	14	17.07.2010	HouseV
B-120360	FP/M	G/O	Whitehead	15.07.2010	Y	78	21	A	F	M	17	17.07.2010	Forest V
B-120362	FP/M	G/W	Whitehead	15.07.2010	N	71	20	A	F	M	20	17.07.2010	Weta V
B-120363	FP/M	G/K	Whitehead	15.07.2010	N	71	23	A	F	M	18	17.07.2010	Weta V
B-120367	FP/M	PG/R	Whitehead	15.07.2010	Y	66	15	J	F	F		dead	
B-120368	FP/M	PG/G	Whitehead	15.07.2010	N	67	17	A	F	M	11	17.07.2010	Weta V
B-120305	FP/M	Y/R	Whitehead	13.07.2010	Y	73		A	M	unk	18	17.07.2010	Forest V
B-120306	FP/M	Y/G	Whitehead	13.07.2010	Y	75		A	M	unk	17	17.07.2010	Forest V
B-120307	FP/M	Y/PG	Whitehead	13.07.2010	N	76	20	A	M	M	20	17.07.2010	Forest V

Colour Codes: R = red; W = white; K = black; B = blue; PB = pale blue; G = middle green; PG = pale green; O = orange; M = metal; FP = fluorescent pink

METAL BAND NUMBER	LEFT LEG	RIGHT LEG	SPECIES	DATE CAUGHT, KAPITI IS.	DRENCHED (Y/N)	WING LENGTH (mm)	CAPTURE WEIGHT (g)	AGE (A/J)	SEX (plumage)	SEX (weight against wing length)	TRANSFER WEIGHT (g)	DATE RELEASED, MANA IS.	RELEASE SITE
B-120313	FP/M	Y/B	Whitehead	13.07.2010	N	75	20	A	M	M	19	17.07.2010	Forest V
B-120314	FP/M	Y/Y	Whitehead	13.07.2010	Y	69	14	A	M	F	15	17.07.2010	Forest V
B-120311	FP/M	Y/O	Whitehead	13.07.2010	Y	75	20	A	M?	M	21	17.07.2010	Forest V
B-120317	FP/M	Y/W	Whitehead	13.07.2010	Y	76	19	A	M	M	18	17.07.2010	Forest V
B-120318	FP/M	Y/K	Whitehead	13.07.2010	N	15	15	A	M	unk	16	17.07.2010	Forest V
B-120324	FP/M	O/R	Whitehead	13.07.2010	Y	69	14	A	M	F	15	17.07.2010	HouseV
B-120340	FP/M	O/G	Whitehead	14.07.2010	N	66	15	A	M?	F	15	17.07.2010	Forest V
B-120344	FP/M	O/PG	Whitehead	14.07.2010	Y	75	20	A	M	M	18	17.07.2010	Forest V
B-120348	FP/M	O/B	Whitehead	14.07.2010	Y	77	20	A	M	M	20	17.07.2010	Forest V
B-120349	FP/M	O/Y	Whitehead	14.07.2010	Y	77	21	A	M	M	18	17.07.2010	HouseV
B-120351	FP/M	O/O	Whitehead	14.07.2010	N	70	16	A	M	F	14	17.07.2010	Weta V
B-120353	FP/M	O/W	Whitehead	14.07.2010	Y	67	15	A	M	F	16	17.07.2010	Forest V
B-120356	FP/M	O/K	Whitehead	14.07.2010	Y	74	16	A	M	F	11	17.07.2010	HouseV
B-120357	FP/M	W/R	Whitehead	15.07.2010	N	78	20	A	M	M	19	17.07.2010	Weta V
B-120358	FP/M	W/G	Whitehead	15.07.2010	Y	64	16	A	M	F		17.07.2010	Weta V
B-120361	FP/M	W/PG	Whitehead	15.07.2010	Y	66	15	A	F?	M		dead	
B-120364	FP/M	W/B	Whitehead	15.07.2010	Y	79	19	A	M	M	17	17.07.2010	Weta V
B-120365	FP/M	W/Y	Whitehead	15.07.2010	Y	70	16	A	M	F	11	17.07.2010	Weta V
B-120366	FP/M	W/O	Whitehead	15.07.2010	Y	74	22	A	M	M	16	17.07.2010	HouseV

Colour Codes: R = red; W = white; K = black; B = blue; PB = pale blue; G = middle green; PG = pale green; O = orange; M = metal; FP = fluorescent pink

Appendix 3

3a. Bellbird samples and pooling of samples submitted for disease screening

ID NUMBER (metal leg band)	BLOOD SMEAR	BLOOD DIFFERENTIAL	BLOOD PARASITE	FRESH FAECAL (number indicates pooled sample)	FAECAL RESULTS	CLOACAL SWAB (number indicates pooled sample)	CLOACAL RESULTS	PCV (%)	TP (g/L)
C-89580	y	n/a	nil	y (1)	coccidia (8800)	y (1)	nil	51	30
C-89546	y	n/a	nil	y (1)	coccidia (8800)	y (1)	nil	45	33
C-89532	y	n/a	nil	y (1)	coccidia (8800)	y (1)	nil	60	30
C-89550	y	n/a	nil	y (1)	coccidia (8800)	y (1)	nil	55	33
B-12030*	y	n/a	nil	n	-	y (1)	nil	50	31
B-120303	y	n/a	nil	n	-	y (2)	nil	56	25
C-89531	n	-	-	n	-	y (2)	nil	n	n
C-89535	y	no result	no result	y (1)	coccidia (2900)	y (2)	nil	54	30
B-120302	y	n/a	nil	y (2)	coccidia (2900)	y (2)	nil	52	35
C-89534	y	n/a	nil	y (2)	coccidia (2900)	y (2)	nil	55	28
B-120341	y	n/a	nil	y (2)	coccidia (2900)	y (3)	nil	60	not enough serum
B-120342	y	n/a	nil	n	-	y (3)	nil	55	not enough serum
B-120343	y	no result	no result	y (2)	coccidia (2900)	y (3)	nil	48	30
C-89553	y	no result	no result	y (2)	coccidia (2900)	y (3)	nil	50	31
B-120338	n	-	-	y (3)	coccidia (14000)	n	-	n	n
C-89536	n	-	-	y (3)	coccidia (14000)	n	-	n	n
B-120309	n	-	-	y (3)	coccidia (14000)	n	-	n	n
C-89537	n	-	-	y (3)	coccidia (14000)	n	-	n	n
B-120312	n	-	-	y (3)	coccidia (14000)	n	-	n	n
C-89538	n	-	-	y (4)	coccidia (200)	n	-	n	n
C-89539	n	-	-	y (4)	coccidia (200)	n	-	n	n
C-89540	n	-	-	y (4)	coccidia (200)	n	-	n	n
B-120308	n	-	-	y (4)	coccidia (200)	n	-	n	n

Please note: * B-12030 was transcribed incorrectly, there is a digit missing. Being a female bellbird, this animal is probably one of the following: 120308, 120309 or 120301.

3b. Whitehead samples and pooling of samples submitted for disease screening

ID NUMBER (metal leg band)	BLOOD SMEAR	BLOOD DIFFERENTIAL	BLOOD PARASITE	FRESH FAECAL (number indicates pooled sample)	FAECAL RESULTS	CLOACAL SWAB (number indicates pooled sample)	CLOACAL RESULTS	PCV (%)	TP (g/L)	SAMPLE FOR KEVIN
B-120339	y	?	nil	y (1)	coccidia (78400)	y (1)	nil	50	not enough serum	n
B-120306	y	n/a	nil	y (1)	coccidia (78400)	y (1)	nil	46	40	y
B-120330	y	n/a	nil	y (1)	coccidia (78400)	y (1)	nil	50	not enough serum	n
B-120324	y	n/a	nil	y (1)	coccidia (78400)	y (1)	nil	46	45	y
B-120305	y	no result	no result	y (1)	coccidia (78400)	y (1)	nil	40	not enough serum	y
B-120317	y	n/a	nil	y (2)	coccidia (11200)	y (2)	nil	44	40	y
B-120307	y	n/a	nil	y (2)	coccidia (11200)	y (2)	nil	49	40	y
B-120319	y	n/a	nil	y (2)	coccidia (11200)	y (2)	nil	50	46	n
B-120304	y	no result	no result	y (2)	coccidia (11200)	y (2)	nil	44	39	y
B-120344	y	?	nil	n	-	y (2)	nil	46	40	y
B-120318	n	-	-	y (2)	coccidia (11200)	n	-	n	not performed	n
B-120313	n	-	-	y (3)	coccidia (0)	n	-	n	not performed	n
B-120310	n	-	-	y (3)	coccidia (0)	n	-	n	not performed	n
B-120345	y	n/a	nil	y (3)	coccidia (0)	y (3)	nil	47	42	y
B-120346	y	n/a	nil	y (3)	coccidia (0)	y (3)	nil	48	43	y
B-120347	y	n/a	nil	y (3)	coccidia (0)	y (3)	nil	40	41	n
B-120348	y	n/a	nil	y (4)	coccidia (150)	y (4)	nil	46	40	y
B-120349	y	n/a	nil	y (4)	coccidia (150)	y (4)	nil	45	43	n
B-120340	n	-	-	n	-	y (4)	nil	n	-	-

Appendix 4

Equipment list

Catching equipment

Mist nets and poles (supplied by Kapiti Island)
String/rope for guys (supplied by Kapiti Island)
Tent pegs (supplied by Kapiti Island)
Notebooks and pencils
c. 2-3 catch bags per team
Net hole mending kit (needles, scissors, fishing line/thread)
Radios (DOC) × 4 plus batteries and chargers
Cell phone contact phone numbers
First aid kit
H&S plan
Binoculars
Cruise tape or labels for bags

Banding and handling equipment

c. 20 catch bags
Hand nets (soft edge, 35 cm dia; mesh size 3.5 cm) × 2
Banding pliers × 4
Ruler × 2
Callipers × 2
Metal “B” and “C” bands
Colour “butt” bands (Both “B” and “C” size)
Datasheet/Band combo list (64 combos of 8 different colours for each species)
Notebooks and pencils
Sexing information (plumage and measurement characteristics)
Banding permit
Scales (2 × persolas, 100 g)

Aviary equipment

Cable ties (00's)
8 small shallow food containers (lids or sardine tins) for jam water, sultanas and cheese per aviary
2 nectar feeders per bellbird aviary (supplied by Kapiti Island)
2 large shallow dishes for mealworms, per aviary
Chopping board

Sharp fruit knife

Sieve for mealworms

Mealworm/waxworm containers and holding containers (10 litre buckets, hold somewhere warm)

Wombaroo for mealworms

Handsaws for furnishing aviary vegetation

Bird food (see recipes below)

Trigene for cleaning

Cleaning gear—dishwash, brushes, cloths, paper towels

Food storage containers

Big rubbish bags for leaf litter

Transfer boxes equipment:

Corflute boxes (used white type, same as for fluttering shearwater transfer) x 16 for 80 birds total, plus 5 spares, each box held up to 5 birds).

Fine mesh (same as for mesh window screens) to cover box vent holes

Duct tape

Perches—used wood dowel

Stanley knife or similar for inserting perches (2 × per box)

Appendix 5

Artificial diet provided to whitehead and bellbirds while in captivity

Jam:honey mix

Mix ¼ cup berry jam and ¼ cup honey with hot water until dissolved.

Add cold water to make 500 ml mix.

Sugar water

Dissolve ½ cup soft brown sugar in 1 cup warm water.

Add cold water to make up to 1 litre.

Soft brown sugar dissolves easily than coarser sugars

Sultana mix

Pour boiling water over a handful of sultanas and leave to soak for 24 hours.

Add sugar water or jam:honey mix to make up to c 200 ml (including sultanas)

Grated cheese

The birds sampled grated mild or edam cheese while in captivity—it was eaten in small quantities by bellbirds and moderate quantities by whitehead

Fruit sections

Cut ripe fruit across the grain and place on nails so birds can feed. Oranges, mandarin, pears and apples were eventually eaten; bananas, were also offered but little eaten

Mealworms and wax moth larvae

A handful of wombaroo insectivore mix was added to the mealworm bran mix several days prior to birds being given the worms.

Wax moth larvae were separated from their web and presented by the handful to whiteheads

For this transfer we ordered 20,000 mealworms and up to 5,000 waxworm larvae. Waxworms were in shorter supply due to winter (colder) months.

Mealworms quantities were calculated on basis of 50 “large” mealworms per bird per day (note that mealworms supplied were considered “small”).

Appendix 6

Necropsy reports

Bellbird: C-89537 or C-89533

Date Sent: 15/07/2010

Accession No.: 45103

PATHOLOGY REPORT

HISTOPATHOLOGY

All tissues examined exhibit moderate to marked congestion.

Small intestine: many of the villous tips have sloughed into the lumen. Within the tips of remaining villi, clusters of enterocytes are shrunken, hypereosinophilic and exhibit nuclear pyknosis. Small numbers of coccidial oocysts can often be observed between these necrotic enterocytes, as well as embedded within the superficial lamina propria. Clusters of gram-negative, short-rod shaped bacteria are also often found attached to necrotic enterocytes. Note however, that large numbers of these bacteria, as well as smaller numbers of gram-positive bacteria can also be seen on the surface of ingested, intra-lumina plant material. Apart from congestion, sections of heart, skeletal muscle, proventriculus/gizzard, kidney, adrenal gland, brain and testis show no obvious abnormalities.

MICROBIOLOGY

45103 Intestine No Yersinia isolated

45103 Intestine Salmonella species isolated. Identification to follow *

45103 Intestine No Campylobacter isolated

* NZVP were unable to serotype the Salmonella species isolated. It was sent to ESR Enteric Reference Laboratory for identification, ESR confirms that no salmonella is present.

DIAGNOSIS

Coccidial enteritis with presumptive secondary bacterial enteritis.

COMMENTS

The lesions in the small intestine are reasonably severe, and most of the damage could probably be attributed to coccidial oocysts being released from the intestinal lining, with a secondary bacterial component. Salmonella was isolated from a swab of the intestinal lining, and is being serotyped. However, I would be hesitant to call this a primary bacterial enteritis due to Salmonella. It is possible the stress of capture has resulted in a sudden release of coccidial oocysts and has also allowed a Salmonella species already present in the gut, to overgrow. Alternatively, the Salmonella may not have caused a problem at all (it hasn't resulted in a septicaemia), and this animal may just have been a periodic intestinal shedder of Salmonella. Serotyping results of the Salmonella should hopefully be back to us by the end of this week.

Pathologist: S A Hunter

Bellbird: B120301 (FPM/RR)

Date Sent: 16/07/2010

Accession No.: **45111**

PATHOLOGY REPORT

HISTORY

This bird was caught 13/07/2010 and but was not weighed (captured by mist net) and died 16/07/2010 (weight 20grams).

GROSS FINDINGS

The bird weighed 20grams and appeared in good body condition and a good-to-moderate state of preservation. No abnormalities were noted on gross post-mortem.

HISTOPATHOLOGY

All tissues examined exhibit moderate to marked congestion. Apart from congestion, sections of skeletal muscle, heart, lungs, spleen, liver, kidney, proventriculus/gizzard, intestine, ovary, and brain show no obvious abnormalities.

MICROBIOLOGY

A swab of intestinal contents and culture of the liver were negative for Salmonella.

DIAGNOSIS

Cause of death unknown.

COMMENTS

There is no indication of an infectious process or trauma. There are no signs of capture myopathy or a catecholamine-induced cardiomyopathy. A swab of intestinal contents and culture of the liver were negative for Salmonella.

Pathologist: S A Hunter

Bellbird: B-120308 and B-120329

Date Sent: 26/07/2010

Accession No.: **45157**

PATHOLOGY REPORT

HISTORY

B-120308—female caught on 13.07.2010 on Kapiti Island. Weight 21 grams at capture. Held in quarantine aviary on Kapiti Island prior to transfer to Mana Island. Found dead on 17.07.2010

B-120329—female caught on 13.07.2010 on Kapiti Island. Weight 18 grams at capture. Held in captivity as above. Found dead on 17.07.2010. Please note the bodies were frozen.

GROSS FINDINGS

B120308: Body weight 18 grams. BCS 4/9 fair body condition. Minimal fat reserves. Hydration good. The body was in a moderate state of decomposition. Faecal matting around the vent was noted and when cleaned, intestines were found to be prolapsed through the vent. A swab was taken from the intestinal contents. All of the visceral organs were dark red in colour and oozed red tinged fluid and were moderately decomposed which made it difficult to assess organ detail. The lungs sank in formalin.

B - B120329: Body weight 19grams BCS 4/9 fair to thin body condition. No fat reserves. Mild dehydration with slightly tacky skin. The body was moderately fresh in condition. The lungs were pink and floated in formalin. No abnormalities were detected grossly for the liver, heart, lungs or kidneys. The kidneys, ovary and adrenal were all uniform dark red and difficult to assess any detail. No major gross abnormalities were observed.

HISTOPATHOLOGY

Examination of multiple tissues from both birds: most organs were too autolysed to critically interpret, those that could be examined showed no obvious abnormalities.

MICROBIOLOGY

Pooled culture of the liver was negative for Salmonella.

DIAGNOSIS

B-120308; unknown cause of death

B-120329: unknown cause of death

Pathologist: J M Ward / S A Hunter

Bellbird: B-120338 (FPM-PGW)

Accn. No.: 45112

Date Sent: 16/07/2010

PATHOLOGY REPORT**HISTORY**

This bird was caught 14/07/2010 and weighed (24grams) and died 16/07/2010 (weight 19grams).

GROSS FINDINGS

The bird weighed 19grams and appeared in good body condition and a moderate state of preservation. No abnormalities were noted on gross post-mortem.

HISTOPATHOLOGY

Liver: there are several small lymphoid aggregates within portal tracts; many of these lymphocytes have pyknotic nuclei. Spleen: there are numerous aggregates of heterophils scattered throughout the parenchyma, and many of the lymphocytes within lymphoid nodules, have pyknotic nuclei. Intestine: there are moderate to large numbers of coccidial stages within the mucosa; they comprise a mixture of intracellular sexual stages as well as intracellular and extracellular oocysts. There is little in the way of crypt loss or damage, but damage to the villous tips is difficult to assess because of autolysis and sloughing. Lung: there is moderate to marked diffuse congestion. Sections of skeletal muscle, heart, proventriculus/gizzard, pancreas, kidney, and brain show no obvious abnormalities.

MICROBIOLOGY

A swab of intestinal contents and culture of the liver were negative for Salmonella.

DIAGNOSIS

Moderate intestinal coccidiosis

COMMENTS

The precise cause of death is uncertain, but is probably due to a combination of stress and intestinal coccidiosis. There are no signs of capture myopathy or a catecholamine-induced cardiomyopathy, but lymphocytes within several internal organs are dead/dying, which can be seen with severe stress, usually due to a massive release of glucocorticoids (a stress hormone) from the adrenal glands. This bird was negative for Salmonella on both culture of the intestine and liver.

Pathologist: S A Hunter

Bellbird: B-120341 and C-895539

Date Sent: 30/07/2010

Accession No.: 45184

PATHOLOGY REPORT

HISTORY

Birds from bellbird transfer from Kapiti to Mana Island, held in captivity and died in the aviary prior to transfer

B120341. Female caught on 14.07.2010 on Kapiti Island. Weight 22 grams at capture. Found dead on 17.07.2010. Blood faecal and swab taken for screening. PCV 60%

C-895539. No history given.

GROSS FINDINGS

B-120341. Body weight 20 grams. Body condition score 6/9 - good. There were no external signs of trauma. There was mild oedema of the subcutaneous tissues of the throat region. The kidneys were pale. It was difficult to assess the body organs due to autolysis. The liver was black coloured and a sample was stored frozen for future analysis if desired. The whole body has been placed in formalin.

C-895539. Body weight 25 grams. Body condition score 5/9 fair to good. The body organs were moderately to severely autolysed. There was blood staining around the head and neck of the bird, but a source for the blood could not be found. The skull had bilateral reddening of the rostral part of the cranium and the brain, although autolysed had a well demarcated darker area of tissue that corresponded to the external reddening. There were white pasty deposits consistent with urates extending up from the cloaca to the colon.

HISTOPATHOLOGY

Examination of multiple tissues from both birds: most organs were too autolysed to critically interpret, those that could be examined showed no obvious abnormalities.

DIAGNOSIS

B-120341: cause of death unknown

C-895539 possible head trauma

COMMENTS

The second bird (C895539) appears to have sustained head trauma, again due to the decomposed and frozen/thawed carcass we cannot be 100% sure.

Pathologist: J M Ward / S A Hunter

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