

HIHI CONSERVATION



www.hihiconservation.com

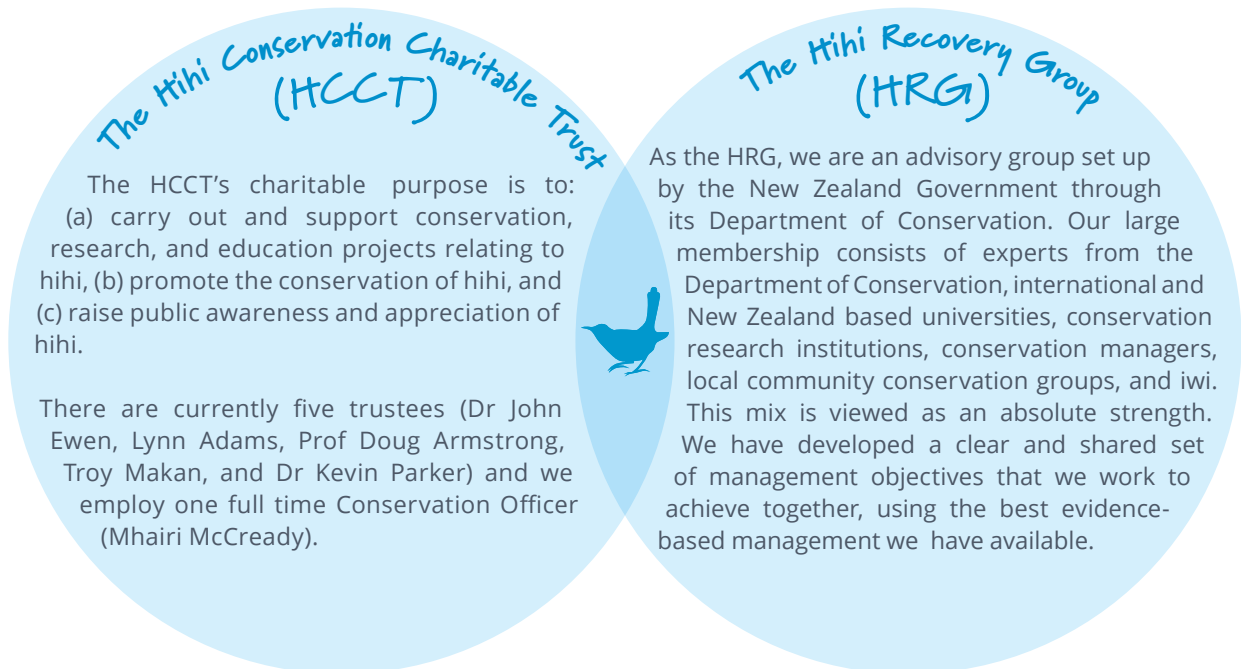
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HIHI RECOVERY

Who's Who

We are a bunch of people that are passionate about hihi and tasked with guiding their recovery. To do this most effectively, we are structured around two groupings:



The relationship between the HCCT and HRG?

Both groups are centered around a shared mission: hihi recovery. HCCT's mission is designed to fully support the national management objectives outlined by the Hihi Recovery Group. As a registered charity, the HCCT can seek funds to help achieve these goals.

Hihi Recovery Group Members

CHAIRS

Lynn Adams
Department of Conservation

Dr John Ewen
Zoological Society of London

MEMBERS

Auckland Council
Bruce Harrison
Matt Maitland

Auckland University of Technology
Dr John Perrott

Bushy Park Tarapuruhi Trust
Mandy Brooke

Department of Conservation
Neil Anderson
Lee Barry
Jane Haxton
Troy Makan
Dr Kate McInnes

Hihi Conservation Charitable Trust
Mhairi McCready

Massey University
Prof Doug Armstrong
Dr Liz Parlato

Ngāti Manuhiri

Parker Conservation Ltd
Dr Kevin Parker

Rotokare Scenic Reserve Trust
Fiona Gordon

Sanctuary Mountain Maungatautari
Dr Janelle Ward

Shakespeare Open Sanctuary Society
Maree Johnston

Supporters of Tiritiri Matangi
Morag Fordham
John Stewart

U. of Auckland - Waipapa Taumata Rau
Sarah Bailey (Student)
Laura Duntsch (Student)
Dr Anna Santure
Dr Annabel Whibley

University of Chester
Dr Vix Franks

University of Helsinki
Dr Rose Thorogood

University of Otago
Freya O'Sullivan (Student)

Waikato Regional Council
Dr Kate Richardson

Zealandia Te Māra a Tāne
Rachel Selwyn
Dr Danielle Shanahan

Zoological Society of London
Dr Caitlin Andrews
Dr Patricia Brekke
Ashleigh Marshall (Student)
Fay Morland (Student)
Misa Shimizu (Student)

Specialist Advisors
Dr Stefano Canessa (U. Bern)
Dr Sarah Converse (U. Washington)
Hannah Sipe (Student, U. Washington)

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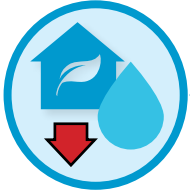
@hihinews

OUR OBJECTIVES



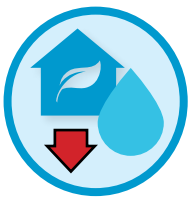
Increase the total number of hihi nationwide

We aim to increase the number of hihi populations across New Zealand and the total number of hihi in them.



Increase the natural ecological setting of the hihi

Nest boxes and sugar water are provided to help hihi survive and reproduce, but we want more natural sites without the need for these.



Reduce the cost of managing hihi populations

Managing hihi bears many financial costs which we want to minimise. Two major expenses are the provision of nest boxes and sugar water.



Increase awareness and appreciation of hihi

We wish to raise the awareness and appreciation of hihi by local residents and visitors to New Zealand. This charismatic and striking bird is little known or understood, which is something we are working hard to change.

Special Thanks To Our Sponsors

NATIONAL



BUSHY PARK TARAPURUHI



TIRITIRI MATANGI



ROTOKARE



ZEALANDIA

Donald and Pamela Paterson Trust

Help Save the Hihi!

Interested in sponsoring hihi recovery? To find out more about the Hihi Conservation Charitable Trust, visit www.hihiconservation.com or email mhairi@hihiconservation.com

THE HIHI

He manu ririki te Hīhī e noho kau ana i ngā ngahere o Niu Tīreni. I tēnei wā tonu, ka whakarōputia te manu Hīhī he manu mate haere ki tō te rautaki 'Threat of Extinction' o Te Papa Atawhai.

I mua i te taenga mai o tauīwi mā, ka rere whānuitia te Hīhī ki Te Ika a Māui whānui me ōna moutere. Heoi, i te paunga o te rautau tekau mā iwa, ka noho motuhake aua manu rā ki Te Hauturu-o-Toi. Nō te taenga mai o ngā kararehe tauhou, o te mate manu, me te muru kohanga, ka mate haere te Hīhī.

Mai rā anō ko te Hīhī he manu kaikai miere (te whānau manu o 'Meliphagidae'), he whanaunga pātata ki te komako me te tui. Ahakoa tonu, he tūhuratanga anō tā te aronui 'Phylogenetic', he manu motuhake te Hīhī, ā, he tātai anō tōna ki tōna ake whānau, arā ko te 'Notiomystidae'.

He rerekētanga motuhake tōna, arā, ka mahi ai te Hīhī kanohi ki te kanohi. He rerehua te tame o tēnei tū manu, he pango, he kowhai tea, he mā ōna tae. Kāore i te pērā te uha o tēnei manu, ka mau i a ia te kākāhu parauri, me ōna neko mā kei ōna parirau.

I te tau 1980, ka timata te mahi atawhai mō te Hīhī, nā wai nā wai, atu i Te Hauturu-o-Toi, e ono ngā wāhi whakamarumarū anō hei kāinga mō te Hīhī. Nā te mahi atawhai, ka nui haere te maha o ngā Hīhī, ahakoa tonu, he manu mate ā-moa tonu. Ko ngā kararehe kaikai manu, ko te mate manu, ko te korenga o te ira whakaurutau, me te rāweke kāinga ngā āhuatanga e whakararu ana i te orangatonutanga o te Hīhī.

FUN FACT

Male hihi have two white ear tufts that can be raised to display dominance. Males with longer ear tufts tend to have greater mating success.

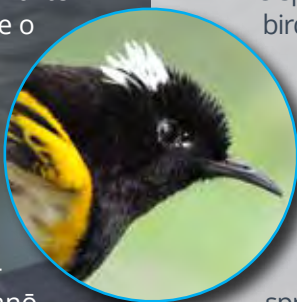
The hihi is a small (30 – 40g) forest-dwelling passerine endemic to New Zealand. At present, the species is classified as nationally vulnerable by the Department of Conservation's 'Threat of Extinction' system.

Pre-European times, the species was distributed throughout the North Island and its offshore islands. However, by the end of the 19th century the only population that remained was that on Te Hauturu-o-Toi. The disappearance of the hihi was most likely due to introduced predators, habitat loss and disease.

The hihi was long considered to be a honeyeater (family Meliphagidae) closely related to korimako and tūi. Phylogenetic analysis, however, has revealed that it is taxonomically distinct from this lineage and has been subsequently placed as the sole member of its own family, the Notiomystidae.

The species is also behaviourally unique as the only bird known to copulate face-to-face. The males are one of New Zealand's most strikingly-coloured birds with black, bright yellow, and white plumage. Females are a less conspicuous brown but also have white wing bars.

Management of the species began in 1980 and there are now six reintroduced populations spread across northern New Zealand in addition to the remnant population on Te Hauturu-o-Toi. Under intensive management the hihi has been steadily increasing in numbers but is still at risk of extinction. Introduced predators, disease, the loss of genetic diversity and environmental disturbances continue to pose a risk to the long-term viability of the species.



A Brief History of Hihi Conservation

1980

The first ever translocation of hihi brings birds from Te Hauturu-o-Toi to Taranga (Hen Island). The population sadly fails but inspires the beginning of an important conservation strategy for the species.

1991

The Kapiti Island hihi population is established with birds from Te Hauturu-o-Toi and remains to this day the oldest reintroduced population.

1995

A population is established on Tiritiri Matangi Island, which becomes a very successful population and a source for many future translocations.

2005

Hihi are reintroduced to Zealandia Te Māra a Tāne in Wellington with birds from Tiritiri Matangi.



CURRENT POPULATIONS

Since 1980, translocation has been used to grow our hihi populations. Prior to the first translocation, Te Hauturu-o-Toi (Little Barrier Island Nature Reserve) had the only hihi population left despite the species having once been found throughout northern New Zealand. Birds were originally translocated from Te Hauturu-o-Toi, but after a population on Tiritiri Matangi Island was established, this became the primary source for many translocations, sometimes with a mix of birds from other sites for genetic reasons. As of 2022, six reintroduced populations exist throughout New Zealand, all of which are actively managed through non-native predator control, supplementary feeding, provision of nest boxes, management of parasites, and population monitoring. The success of the conservation strategies employed by the Hihi Recovery Group can best be seen by the steady increase in both the estimated population sizes and number of hihi populations. Population sizes are estimates of adult numbers derived from a state-of-the-art integrated population model combining resighting and breeding data (Parlato et al. 2021).

Te Hauturu-o-Toi

Population: 1000 - 3000

Tiritiri Matangi Island

Population: 200

Sanctuary Mountain Maungatautari

Population: 76

Rotokare Scenic Reserve

Population: 65

Bushy Park Tarapurui

Population: 50

Kapiti Island

Population: 135

Zealandia Te Māra a Tāne

Population: 103

2009

Hihi are reintroduced to the Waikato region at Sanctuary Mountain Maungatautari.

2013

Hihi are reintroduced to the Whanganui region at Bushy Park Tarapurui.

2017

Hihi are reintroduced to the Taranaki region at Rotokare Scenic Reserve.

2019

The total number of hihi in reintroduced populations surpasses 600 for the first time.

2020

The latest hihi translocation brings birds to Shakespear Open Sanctuary but sadly fails due to a concurrent stoat incursion.



HIHI NEWS

Hiihi Featured in Global Study of Adaptive Evolution



One of the greatest challenges wild animals face is how to adapt to a changing world, particularly with the growing threat of climate change. If species cannot find a way to survive and reproduce, they may ultimately face extinction. But can adaptation happen fast enough for species to overcome these obstacles?

We typically think of evolution as occurring on geologic timescales, but new evidence published in the journal *Science* suggests species may be able to adapt much more quickly. Led by Timothée Bonnet (Australian National University), a team of 40 researchers from around the world quantified rates of adaptive evolution in 19 different wild





animal populations, including two hiihi populations (Tiritiri Matangi Island and Zealandia Te Māra a Tāne). Overall, the collective dataset represented an astounding 2.6 million hours of fieldwork and produced a surprising result: the average species may have twice as much evolutionary 'fuel' as previously thought, an uncommonly optimistic finding in these challenging times.

Importantly, not all species exceeded expectations, and hiihi were a notable exception. With a much weaker adaptive potential, hiihi will likely have a harder time responding to environmental change than other species. While this result could be disheartening, it also underscores just how effective hiihi management has been at keeping this species alive. If it weren't for ongoing conservation efforts – including supplementary feeding, pest control, and habitat restoration – hiihi would no doubt be in much greater trouble, so it is essential that all of our sites keep up the good work.

Reference: Bonnet T., et al. (2022) Genetic variance in fitness indicates rapid contemporary adaptive evolution in wild animals. Science 376(6596):1012-1016.

New Zealand Conservation Week Showcases Hiihi Science

Following a successful inaugural event in 2020, the Hiihi Conservation Charitable Trust hosted its second annual Hiihi Science Evening on 10 September 2021, this time as part of New Zealand Conservation Week. Alyssce Te Huna (Department of Conservation) welcomed the virtual attendees with a karakia, which was followed by a lineup of five lightning talks (right) from early career researchers representing just some of the breadth of hiihi research. Nearly 200 viewers tuned in live from New Zealand and seven other countries, reminding us that the hiihi's ongoing story of recovery is inspirational to many.



New foundations for hiihi conservation genomics
Sarah Bailey

From pedigree to genomics: Measuring inbreeding in hiihi
Laura Duntsch

Is individual variation relevant to hiihi population dynamics?
Dr Liz Parlato

Human vs. machine: Comparing post-release monitoring methods for a hiihi translocation
Dr Vix Franks

Who heals the forest? Individual hiihi differ in pollination behaviours
Dr Caitlin Andrews

For More Hiihi Science:

- * Stream the 2021 Hiihi Science Evening talks at www.tinyurl.com/hiihiyoutube
- * Follow @hiihinews on Twitter for science updates + details for our 2022 Science Evening
- * Read more Research Highlights on **Page 25** of this report



Foundation North Bolsters Growing Tiritiri Matangi Population

Managing a hihi population is no easy task. Between refilling feeders, checking nest boxes, and monitoring survival, the workload is enormous but essential for keeping our hihi populations healthy. Over the past three years, management of our largest reintroduced population on Tiritiri Matangi Island has been intensifying as breeding has soared past 200 fledglings per year. While certainly a cause for celebration, this also presented new challenges. As the 2021-22 season approached, the Hihi Conservation Charitable Trust anticipated that the standard team of one hihi volunteer supported part-time by our national Hihi Conservation Officer would no longer be sufficient to keep up with the pace of breeding on Tiritiri Matangi. The challenge was how to source additional help.

Enter Foundation North: a national non-profit supporting community initiatives across four focus areas, including Whakahou taiao (Regenerative environment). HCCT applied for a Quick Response Grant and was generously awarded \$15,000. This went directly toward increasing capacity on Tiritiri Matangi by contracting an early-career conservation professional to help with breeding season management. We were thrilled that

Emma Gray, who volunteered at Bushy Park Tarapurui last season, was able to join the Tiritiri Matangi team. Having an extra set of hands on island dedicated to hihi ensured that, even with the increased workload,

management could be carried out to the highest standard. It also provided a major upskilling opportunity for a budding New Zealand conservationist; Emma gained intensive on-the-ground conservation experience and is well on her way to achieving a Level 2 Bird Banding qualification.



Foundation North's generosity was felt strongly on Tiritiri Matangi this year, but the benefits extend much further. The population is the main source of hihi for translocations, so promoting its growth is crucial for the wider hihi programme. By working together to conserve hihi as a taonga, we are helping to shape a future where native species and forests are once again flourishing for all to enjoy.

Hihi Recovery Group Reflects on Shakespear Translocation

There is no greater excitement than adding a new hihi population to the map. A successful reintroduction signals the species is moving forward on its path to recovery. But even with the immense planning that goes into every translocation, these efforts are never without risk. Sadly, the Hihi Recovery Group was reminded of this with its latest attempt to establish a new hihi population at Shakespear Open Sanctuary.

In June 2020, 40 juvenile hihi were translocated from Tiritiri Matangi Island just 3.5 km across the bay to Shakespear, a stunning 500-ha reserve enclosed by a pest exclusion fence. Hopes were high following the release, but it was soon discovered that the fence



had been breached by a stoat. These introduced predators pose one of the greatest threats to native birds. To make matters worse, the stoat was a pregnant female, increasing the incursion to nine stoats once she gave birth.



Despite hanging on for 17 months, the last hihi was sighted at Shakespear in November 2021. This translocation serves as a difficult but important reminder of how vulnerable hihi are to introduced predators and how crucial pest control efforts are to their recovery. However, there are reasons for hope. With pest control and habitat restoration, hihi can thrive: even while battling a stoat incursion, the Shakespear hihi produced seven fledglings in their first breeding season, with evidence of successful natural nesting. And, thanks to the hard work of the Shakespear team, the sanctuary was once again declared pest-free in February 2022, reclaiming its status as a haven for native species.

HIHI NEWS

Hihi Monitoring Gets A High-Tech Upgrade



For nearly three decades, it has been a rite of passage for every hihi hatched in a nest box to receive a flashy set of colour bands when they turn 21 days old. This tradition opens up a world of possibilities for monitoring, management, and research. With a unique combination of two colours on one leg plus one colour and one metal band on the other (above left), each hihi becomes individually identifiable. Using binoculars to 'read' a bird's band combination, observers can then relate every bit of data they collect to that individual – whether they are tracking survival and reproduction, collecting blood samples for genetic analysis, or studying social networks.

The ability to fine-tune analyses to the individual level has always been a hallmark of the hihi programme. While many ornithological programmes employ similar banding techniques, few are able to band as many birds in their study populations as we can at most hihi sites. On Tiritiri Matangi Island, for example, all female hihi nest in nest boxes, so every bird in the population can be banded before fledging. This means family relationships are known for every hihi on the island, spanning back generations.

Despite the many benefits of colour banding, however, it is not a perfect system. Locating and



observing individual birds requires enormous effort. The amount of data that can be collected is finite, limited by the size of the field team and their working hours. Poor lighting conditions, especially at sites with high forest canopy, can also make it difficult to read colour bands. This can occasionally result in incomplete band readings or misidentifications.

As technology keeps advancing, wildlife programmes are employing more advanced methods for monitoring animals. Some technologies enable individuals to be identified and tracked remotely, facilitating the collection of much larger datasets than could ever be achieved through direct observation alone. Always striving to keep the hihi programme at the forefront, members of the Hihi Recovery Group began exploring how best to modernise hihi monitoring back in 2015. After researching different options, they selected a technology called Radio Frequency Identification (RFID).

In the context of wildlife monitoring, RFID involves attaching a tiny computer chip storing a unique identification number to an animal. Special RFID 'readers' are then placed in key locations throughout the environment to 'read' these numbers when tagged animals come in close proximity. This is the

same technology behind the microchips in our pets and tap-and-go credit card payments, but it has also gained popularity for wildlife studies. While the RFID reader's limited range is a downside, a major advantage is the size of the RFID chips. Only a few millimetres long, they can be attached unobtrusively even to small birds like hihi with no effect on their wellbeing or behaviour.

It took several years and many prototypes but, with the help of the Department of Conservation's Electronics Team, the Hihi Recovery Group finalised a design for a new hihi band in 2020. The custom, injection-moulded colour bands fit hihi perfectly and hold a built-in RFID chip. They have already been fully rolled out on Tiritiri Matangi, where each nestling now receives two colour bands on one leg and one long RFID colour band on the other (previous page, right), and all six supplementary feeding stations are equipped with RFID readers. Adults in the population will receive a band upgrade next time they are caught for normal population monitoring, and the bands will be introduced gradually to all other sites.

While direct observation will always play a central role in hihi monitoring, RFID technology provides a major boost to data collection that will undoubtedly lead to many new discoveries and insights – all in support of hihi recovery. Below, we highlight one way RFID has already been put into action to help hihi.



Human vs. Machine: Comparing Post-Release Monitoring Methods for a Hihi Translocation



The recent translocation of hihi to Shakespear Regional Park in 2020 (Page 6) was the first where all released hihi were fitted with RFID bands. RFID readers were deployed on every supplementary feeding station to enable continuous recording of visitation by tagged birds. By comparing which hihi were seen during in-person visual surveys (the standard method for assessing post-release survival) to which individuals were recorded over the same period by the new RFID system, we aimed to determine how effectively the new technology tracks survival of released birds and the translocation's outcome.



Preliminary analyses by Dr Vix Franks and colleagues suggest the RFID approach provides a comparable population estimate to traditional survey methods. However, the continuous recording from RFID tags offers finer-scale data by tracking daily trends in feeder usage by individuals. We are now using this detailed information to assess whether hihi tend to increase or decrease their use of feeders just before they disappear from a population. Combined with traditional surveys, this information may help us understand the outcomes of translocations by assessing short-term behavioural changes at the individual level.

HIHI NEWS

Celebrating the Career of a Hihi Icon: Doug Armstrong *Reflections by John Ewen*

Here we were, crammed into a small maroon hatchback lovingly named “Butch” – three Johns (Perrott, Roygard, and Ewen) and one Doug Armstrong, heading off on an adventure to Mokoia Island! It was early morning and a pleasant day – some would say surprisingly so for Palmerton North, but not Doug! Once we made it up to Mokoia, we spent the next week scouting out the island's hihi during the day and reporting back on the day's work and other random topics in the evenings while soaking up nature's warmth in Hinemoa's Pool. I was there to help Doug's first two MSc students, John P. and John R., with their hihi projects. That was enough to hook me in as the third John and MSc student!



*Some of the 'Massey gang', mid-90s:
(l-r) John Perrott, Isabel Castro,
John Ewen, and Doug Armstrong*



MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

Fast forward to 2022 and Massey is still linked to many hihi research projects thanks largely to Doug and his post-doc Liz Parlato. Doug is now in his last year at Massey University, but we are hoping still many years from his last with hihi! At this transition, the Hihi Recovery Group and Hihi Conservation Charitable Trust want to take a moment to reflect on his immense contribution and say thanks.

That was 1994, Doug's second year on staff at Massey University and my third year as an undergraduate, inspired by Doug's lectures in the Department of Ecology. Ace of Base was rocking the pop charts, The Fitz was a thing in Palmy, and a bunch of us were feeling out our future directions as fledgling ecologists under Doug's paternal eye. In those days, Massey was the research hub of all things hihi and Doug was at its heart.



Doug and Kat Armstrong, mid-90s

A string of Johns (there was also John Ashton, who followed me) might make you guess Doug had a thing for Johns! Perhaps – but it also provides an (admittedly rather poor) example of a pattern often seen in small sample sizes that is purely the result of chance. This heuristic (known as 'the belief in small numbers') is a trap we too often fall into when seeking patterns and solutions for the recovery of threatened species like hihi, and it can hinder the effectiveness of our conservation interventions.



Doug has made a niche for himself working with the uncertainty surrounding small populations and sparse datasets. Throughout his career, he has navigated this challenging 'evidence-scape' to show how we can still make rational, evidence-based management decisions and use monitoring to inform our strategies. A seminal paper showcasing his approach (published in 2007 in the Journal of Applied Ecology) is highly cited and remains a rare example of adaptive management in species recovery, using the hihi of Mokoia Island as a case study.

Doug's research achievements are well respected and recognised. Most recently, he was elected as a Fellow of the Royal Society of New Zealand in 2020 and received the 2021 Te Tohu Taiao Award for Ecological Excellence from the New Zealand Ecological Society. But Doug isn't one to show off with awards and prizes. His genuine passion is for the animals he studies and the people he works with. We understand how our hihi populations are doing because of the models he has helped build. Our supplementary feeding of hihi is largely the result of his ideas. Our future adaptive management approach is growing from a seed he planted years ago.



Most importantly, over the course of his career, Doug has brought an entire whānau along with him – his 'academic children, grandchildren, and great-grandchildren' – who continue to work with hihi, one of many species to have benefited from Doug's focus. The strong friendships Doug generates with his team are lasting, continuing to inspire those privileged to work with him to do good work but also to work in a good way. Truly, we are standing on the shoulders of a giant!

SITE UPDATES

Over the past year, staff, volunteers, and researchers have been hard at work monitoring and caring for our seven hihi populations. In the next 14 pages, we recognise their efforts, reflect on challenges, and celebrate successes. To track progress relative to the Hihi Recovery Group's objectives (Page 2), we report the following metrics for each site:

The estimated number of adults in the population at the start of the last breeding season (September 2021), derived from an integrated population model

AT A GLANCE

 adults in population	 fledglings produced	 females using nest boxes
 sugar water consumed	 volunteer hours	 visitors to the site

The amount of sugar water (in litres) consumed at supplementary feeders in the past year

The number of chicks fledged from monitored nests in the most recent breeding season

The number of females that nested in nest boxes during the past breeding season (from monitoring data) as a percentage of the total number of females in the population (estimated from an integrated population model)

Monitored by each site

TIRITIRI MATANGI ISLAND



BACKGROUND

Tiritiri Matangi Island is a wildlife sanctuary and one of New Zealand's most exciting conservation projects. The island was stripped of nearly all its native bush following human occupation. Thanks to dedicated restoration efforts, approximately 60% of the island is covered in native bush today. All mammalian predators have been eradicated, and the island is now home to native birds, reptiles, and invertebrates. The project is managed by the Department of Conservation in partnership with the Supporters of Tiritiri Matangi Incorporated.

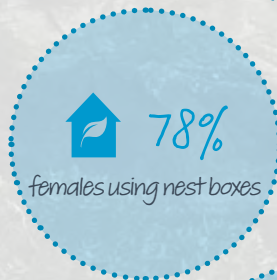
Tiritiri Matangi is frequently used as the source for hihi translocated to other sites and continues to be the focus of many research projects contributing to our knowledge of the species. Of the thousands of people who visit the island every year, over 4,600 are students. The Growing Minds programme, run by the Supporters of Tiritiri Matangi Incorporated, funds 1,200 students from low decile schools who would not otherwise have the opportunity to visit the island.



adults in population



fledglings produced



females using nest boxes



sugar water consumed

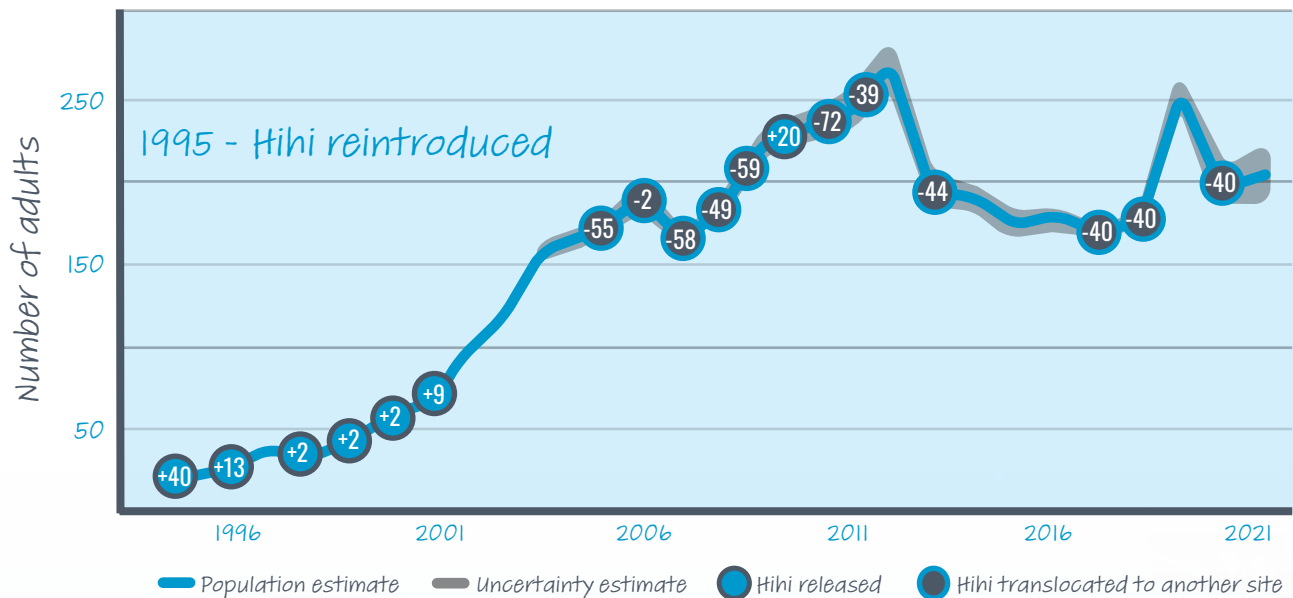


volunteer hours



visitors to the site

POPULATION SIZE



NEWS

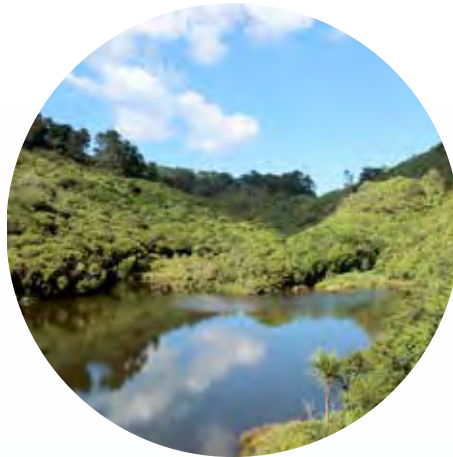
After surpassing 200 fledglings for three consecutive years, hopes were high that the Tiritiri Matangi population would extend this impressive streak yet again. But as spring rolled on, the hihi team waited (and waited some more) for the breeding season to gain momentum. As was the case across all of our hihi sites, it proved to be a challenging season for the birds. Nevertheless, the 64 breeding females rallied to produce a total of 167 fledglings, a respectable haul considering many were first-time breeders and only 1/3 attempted a second clutch.

Even with fewer chicks to band, this whirlwind season kept the hihi team as busy as ever. Thanks to generous funding from Foundation North (Page 6), the team expanded to three, with Emma Gray and Freya O'Sullivan joining Hihi Conservation Officer Mhairi McCready. Battling Covid-19 lockdowns, they took turns getting stuck on-island, with Deborah Smith (last year's hihi volunteer) even stepping in to help cover a two-month stint. A breath-taking island may not be a bad place to spend lockdown, but there was no rest for Team Hihi as they put in a tremendous effort to ensure the birds were well-fed and looked after every single day.



The very first chick of the season was banded on the same day New Zealand left lockdown behind for its new Covid-19 'traffic light system.' Naturally, the hihi team celebrated by giving him a vibrant set of red, orange, and green 'traffic light' bands (above). This chick also happened to be the heaviest of the season at 51 g, versus the typical 30-45 g. We hope that spotting this not-so-little guy and his peers around the island will be a reminder of the perseverance that the hihi team (and hihi themselves) showed throughout the pandemic.

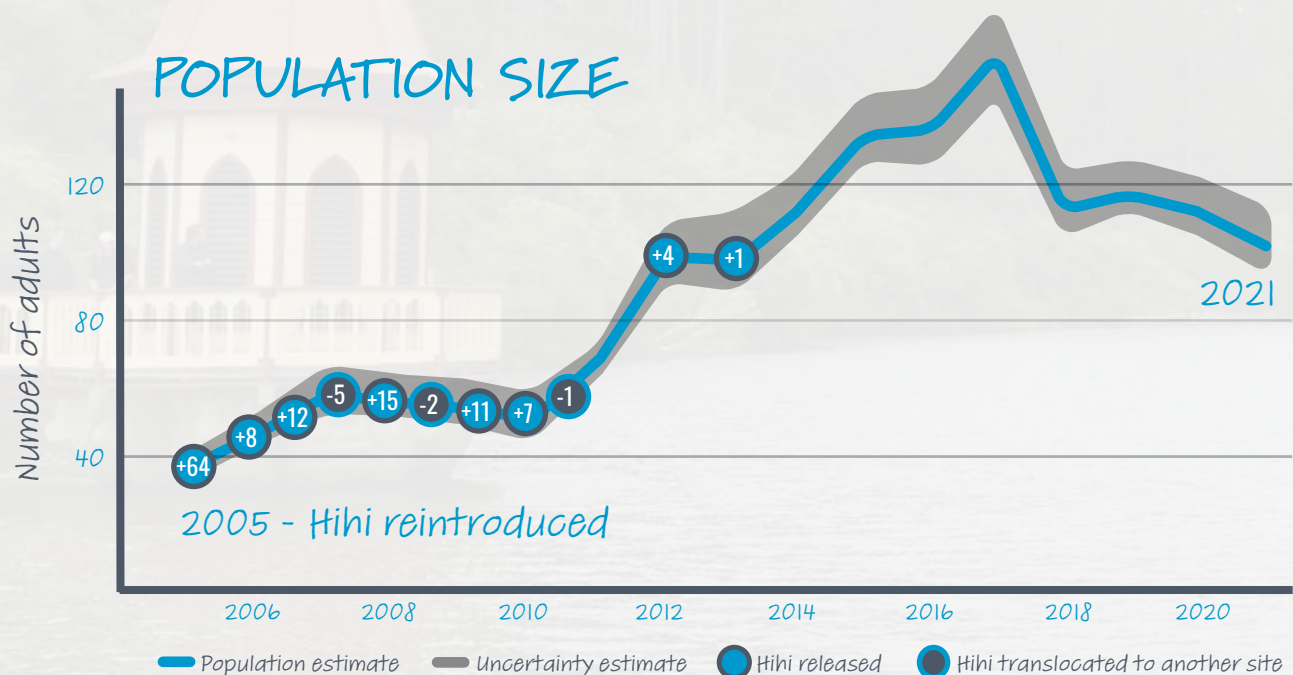
ZEALANDIA TE MĀRA A TĀNE



BACKGROUND

Located just 10 minutes from downtown Wellington, Zealandia Te Māra a Tāne is the world's first fully fenced urban ecosanctuary, with an extraordinary 500-year vision to restore a Wellington valley's forest and freshwater ecosystems to their pre-human state as closely as possible.

The ecosanctuary is a groundbreaking conservation project that has reintroduced 18 species of native wildlife back to the area, six of which were previously absent from mainland New Zealand for over 100 years. The 225-ha sanctuary valley is fully enclosed by an 8.6-km fence that excludes 14 types of mammalian predators and has seen huge success over the past 20 years thanks to dozens of community groups, hundreds of volunteers, thousands of members, and millions of dollars in donations and funding.



NEWS

Our southernmost hihi site was not immune from the challenges of this breeding season. An astonishing 22 of 37 nests failed, leading to only 33 chicks fledged from nest boxes – a record low for the site. If there can be an upside to such a tough season, it was that it gave the hihi a chance to display their fighting spirit. Almost 80% of females attempted second clutches, which extended later into the breeding season than ever before. The last eggs were laid in early March, which would have resulted in chicks fledging as late as the end of April if nests had succeeded.



This year, research student Madeleine Deacon joined us from Victoria University of Wellington Te Herenga Waka to continue a study linking spring temperatures and nest failure. Madeleine found that temperatures dropping below 12°C inside nest boxes threatened the success of clutches, and nests experiencing temperatures below 10°C typically failed. This study demonstrates how even a difficult breeding season can be a productive one for hihi conservation, as opportunities to learn more about nest failure may inform our management and help prevent future failures.



Even in a difficult season, there were glimmers of hope for the hihi at Zealandia. The sanctuary team was happy to observe that 69% of chicks this season were female. This could help rebalance the adult sex ratio, which currently favours males at a ratio of 3:1. Sugar water consumption also dropped very low over winter, with few if any hihi using the feeders from June to October as they opted for natural foods instead. Combined with the relatively high rate of natural nesting at this site, this provides great promise that the Zealandia hihi will be ready to rebound next year.



AT A GLANCE



103

adults in population



33

fledglings produced



66%

females using nest boxes



559 L

sugar water consumed



3,900

volunteer hours



96,709

visitors to the site

BUSHY PARK TARAPURUHI

BACKGROUND

Bushy Park Tarapuruhi is a 98-ha conservation area situated 24 km northwest of Whanganui on the North Island's West Coast. It comprises 87 ha of mature lowland temperate forest with tawa, pukatea, northern rātā, rimu, and rewarewa predominant, and 11 ha of gardens and pasture around a historic Edwardian-era homestead.

The land was bequeathed to the Royal Forest and Bird Protection Society in 1962 by the late G.F. Moore, a prominent Whanganui farmer. Today, the sanctuary is governed by the Bushy Park Trust in partnership with Forest and Bird and Ngāa Rauru Kiitahi, plus significant support from Horizons and DOC. Protected from major disturbance for over 100 years, the forest is a prime example of an intact forest ecosystem.


Predator control was achieved in 2005 following construction of a pest exclusion fence around the forest. This has allowed successful reintroductions of toutouwai, tīeke, pōpokotea, and hihi.



AT A
GLANCE

 50
adults in population

 13
fledglings produced

 44%
females using nest boxes

 267L
sugar water consumed

 780
volunteer hours

 10,000
visitors to the site

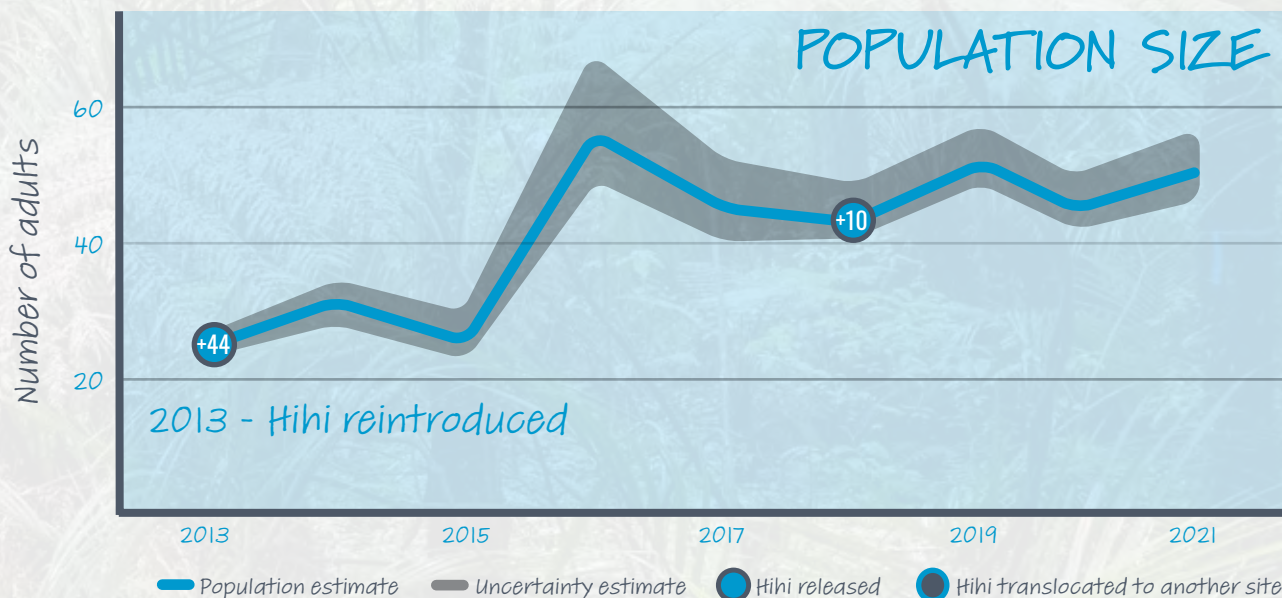
NEWS

Consistent with other sites, the hihi at Bushy Park Tarapuruhi had a quiet breeding season this year. Six females nested in nest boxes, producing a total of 13 fledglings – about half the size of last year’s cohort. A female from the original 2013 translocation has historically been one of the most reliable breeders but fledged only one chick this year. Luckily, the population welcomed a new superstar female in the 2018 release, who has produced multiple clutches since then. Her success speaks to the importance of top-up translocations for increasing genetic diversity and revitalising an aging population.

Community involvement is a hallmark of the Bushy Park Tarapuruhi hihi programme. Volunteers provide essential support for supplementary feeding and nest box monitoring. Prof. Doug Armstrong (Page 9) and students from Massey University visit annually to band chicks in nest boxes, and Hihi Conservation Officer Mhairi McCready catches and bands fledglings from natural nests. This year, site managers also enlisted the public’s help with hihi monitoring. Showing their creative flair, volunteers designed a ‘Wanted’ poster asking visitors to send in their photos of banded hihi and, particularly, the more elusive females. Even with a small population, the sanctuary’s compact size means visitors enjoy frequent encounters with hihi. Their photos provided a

useful record of hihi sightings to supplement volunteers’ observations.

Always looking to the future, the Bushy Park Tarapuruhi team has undertaken a new project to reforest 4 ha of paddocks inside the pest exclusion fence. They have been mindful to select plants that are known food sources for hihi, particularly during the breeding season when sugar water consumption is typically highest. Ecological restoration is a key part of hihi recovery, and we can’t wait to see how the hihi enjoy the (literal) fruits of this labour in the future.



KAPITI ISLAND

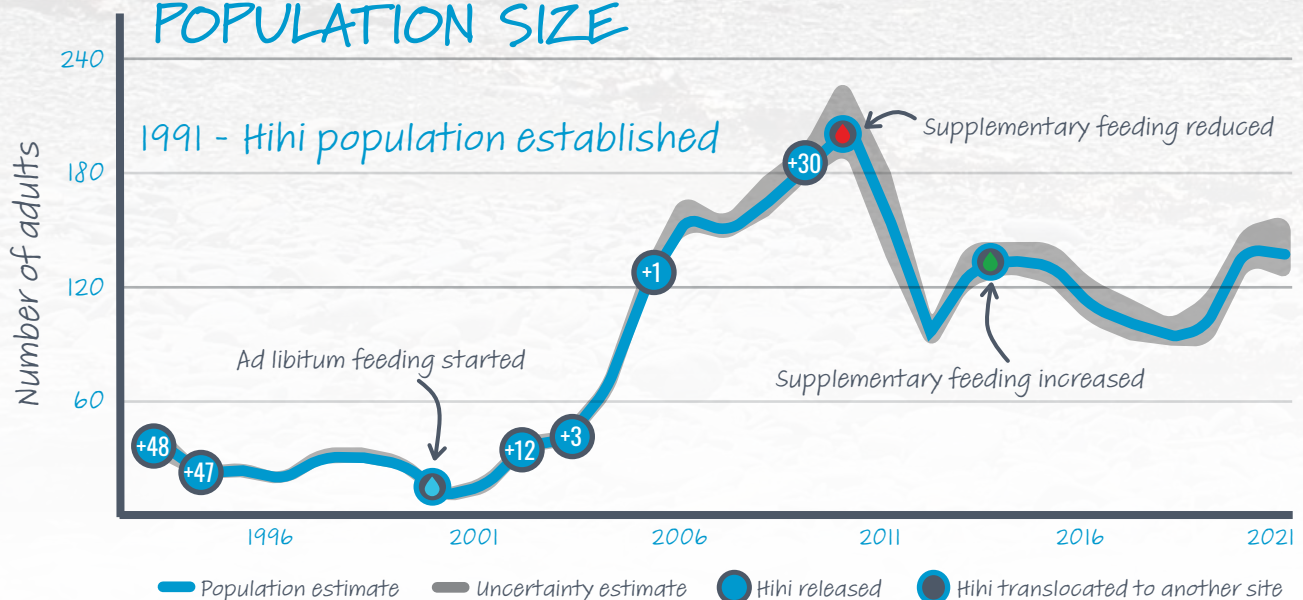
BACKGROUND

Kapiti Island is one of New Zealand's oldest protected areas, with most of its landmass being gazetted as a Nature Reserve in 1897. Located 5.5 km off the west coast of the lower North Island, it is 1,965 ha in size and 521 m at its highest point. The island was largely cleared for farming in the 1800s but has been naturally regenerating since. Possums and rats were eradicated by 1997, leaving the island free of introduced mammalian predators. Following a stoat incursion in 2010, the island was once again declared 'introduced predator free' in January 2013.

Hihi releases began on Kapiti in 1983 but were unsuccessful until 1991, when the current population took hold. Today, hihi favour two main areas of the island within major catchments descending from the summit. These areas have the highest plant diversity and rainfall and contain a large portion of the island's mature trees and old growth forest, which offer natural nesting cavities.



POPULATION SIZE



NEWS

Kapiti Island and Sanctuary Mountain Maungatautari are home to the only two reintroduced hihi populations where females nest exclusively in natural tree cavities. Because of this, we have much less data about the success of each breeding season, apart from what we can infer from observations of unbanded fledglings. If other sites are any indication, the Kapiti Island hihi likely had a challenging breeding season in 2021-22. However, the estimated population size has gone up thanks to a concerted effort by the island's staff and volunteers to catch and band birds over the last few years. This year, a total of 16 adults and 11 juveniles were banded, bringing the total estimated population size to 135 adults.

Hihi management is a strenuous activity on Kapiti due to the island's steep terrain. As at most hihi sites, supplementary feeding is carried out by a dedicated team of volunteers. From September through April, pairs of volunteers work ten-day rotations. Sugar water is carried up a steep hill in a concentrated form to lighten the load. Once at the top, volunteers trek off the public tracks



to access the feeders, where the sugar is diluted with water from a collection tank. Much of the sugar that is put out for hihi is ultimately consumed by korimako. Developing feeders that can exclude korimako remains a high priority for the island, as this could greatly reduce the load that must be carried uphill.


This year, the hihi team observed that some of the hihi's preferred food plants flowered over a much longer period than usual. As a result, hihi almost completely disappeared from the feeders between January and March. If next year brings a similar abundance of food, then we could continue to see the Kapiti population thrive and stake its claim as one of our most natural populations.



AT A
GLANCE

 135
adults in population

 unknown
fledglings produced

 0%
females using nest boxes

 3,587 L
sugar water consumed

 2,196
volunteer hours

 17,669
visitors to the site

ROTOKARE SCENIC RESERVE

AT A GLANCE



65

adults in population



28

fledglings produced



35%

females using nest boxes



276 L

sugar water consumed



400

volunteer hours



30,000

visitors to the site

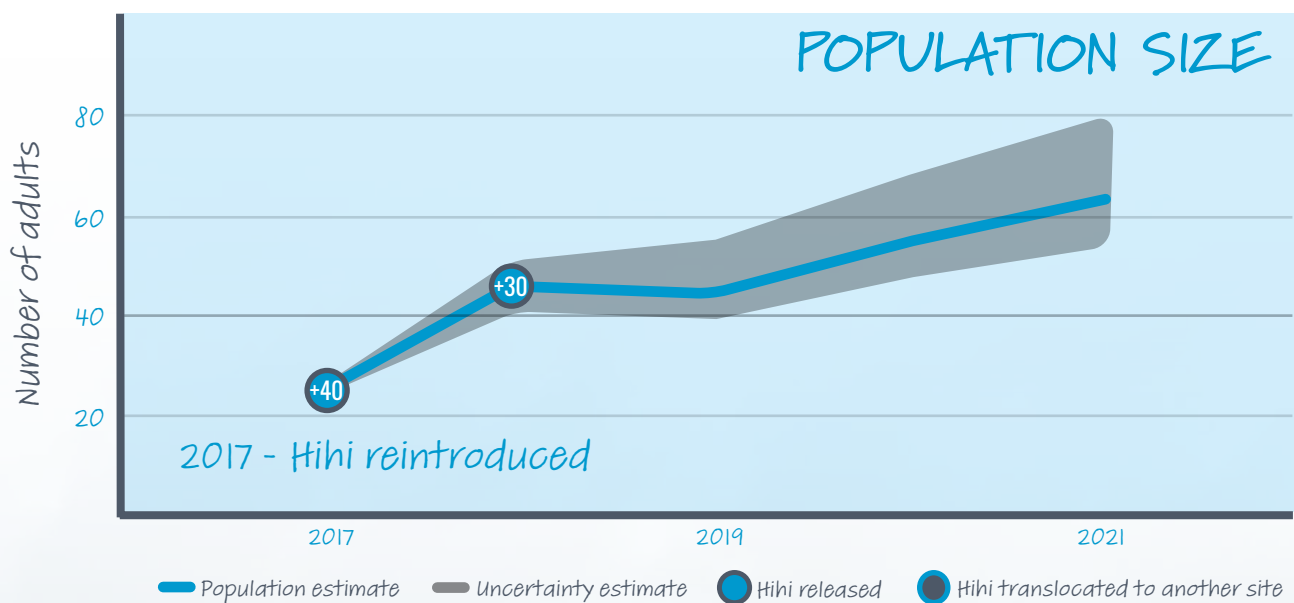


BACKGROUND

Rotokare Scenic Reserve is a stunning 230-ha hill-country catchment containing beautiful forest, wetlands, and a 17.8-ha natural lake, all protected by an 8.2-km pest exclusion fence. Hihi were reintroduced in 2017, ending a 130-year absence from the Taranaki region. Just 12 km from the township of Eltham, Rotokare is a popular recreation spot for boating, walking, and simply enjoying the beautiful scenery.

The Rotokare Scenic Reserve Trust was formed in 2004 out of concern for the declining state of the reserve. It is a community-owned, community-driven project and accommodates a wide variety of local interests including conservation and recreation. The Trust led construction of the pest exclusion fence and has continued to champion a range of conservation and recreation activities, including: high-level biodiversity restoration, total eradication of 12 introduced predator species within the fence, the establishment of a high-quality environmental education programme, revegetation of 12.5 ha of land gifted from neighbouring landowners, the establishment of on-site facilities (including a Site Manager's residence, workshop, and an education centre), and the reintroduction of native species that were previously rare or locally extinct.





NEWS

Rotokare Scenic Reserve continues to impress the hihi world. Following an initial translocation in 2017, the population grew remarkably fast, reaching 50 adults even more quickly than Tiritiri Matangi. A big question, however, was how well the population would weather its first challenging breeding season. With hihi sites around the country reporting low fledgling numbers, all eyes were on our youngest hihi population – and it did not disappoint. Despite fledging eight fewer chicks than last year, the Rotokare hihi still produced 28 fledglings, an impressive number for a population that is just a fledgling itself. The most optimistic news was that a large portion of females continued to use natural nests. By the end of the season, the forest was teeming with unbanded fledglings, keeping Hihi Conservation Officer Mhairi McCready on her toes: she banded 15 birds during her last visit!



It's been another tough year for the Rotokare team following the loss of Sanctuary Manager Simon Collins in March 2021. Everyone still keenly feels Simon's absence. After holding down the fort for several months, we welcomed Sophie Tucker as the new Sanctuary Manager in August 2021. Sophie brings a fresh perspective to the sanctuary as a chartered engineer with expertise in project management, and she has been well-supported by the Rotokare team as she embarks on this new venture in conservation.

Rotokare is one of our most visited hihi sites, inviting everyone from the local community to international tourists to enjoy its trails, lake, and campsite. The sanctuary team has always been skilled at balancing conservation, education, and recreation. This year, they installed a beautiful new bench (above) near one of the hihi feeders to give the public a chance to observe hihi at a safe distance. This will make the feeders more accessible to all and encourage visitors to take a quiet moment to learn about hihi conservation.

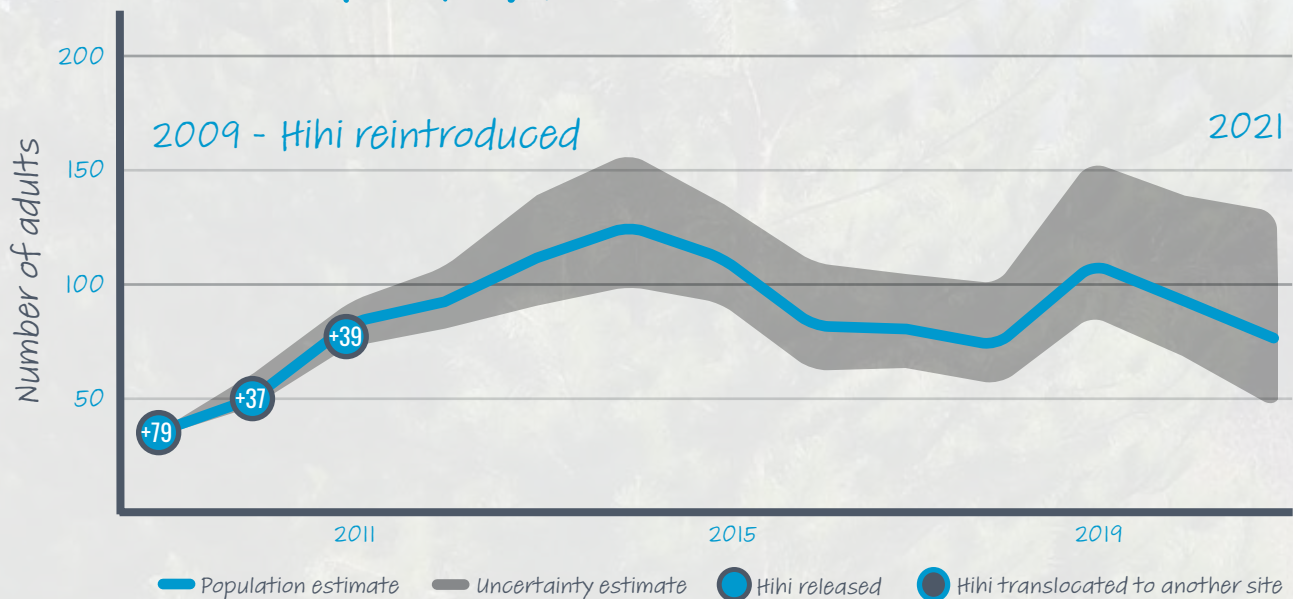
SANCTUARY MOUNTAIN MAUNGATAUTARI

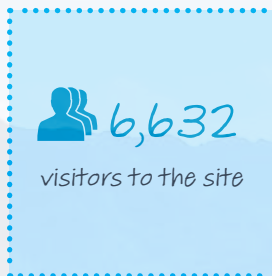
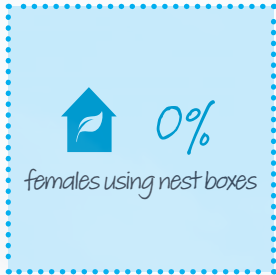
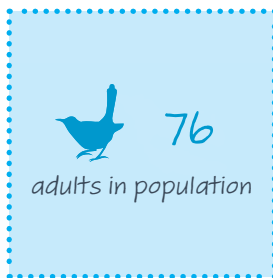
BACKGROUND

Sanctuary Mountain Maungatautari is a mainland ecological island located in the heart of the Waikato on New Zealand's North Island. This beautiful mountain sanctuary contains nearly 3,300 ha of broadleaf podocarp forest and is surrounded by a 47-km pest exclusion fence, which was completed in 2006. All mammalian predators were eradicated from inside the fence by 2007, except for mice.

The mountain's ancient forest offers a thriving ecosystem for populations of many of our most endangered species – including North Island kōkako, long-tailed bats, Hochstetter's frogs, forest geckos, tuatara, and giant wētā. Hihi are just one of 14 species that have been reintroduced to the site since the completion of the pest exclusion fence with the latest being titipounamu, introduced in May 2021.

POPULATION SIZE





NEWS

With its mature forest and rugged terrain, Sanctuary Mountain Maungatautari is one of our most difficult sites for monitoring hihi. All females nest in natural tree cavities and sugar water consumption is very low. As a result, the Maungatautari team has to get creative with monitoring in order to maximise learning about this population. Rangers and surveyors have observed that hihi seem to thrive most in the dim, damp corridors of mountain streams and valleys. Reading colour bands in these conditions is tricky, so the Maungatautari team calls upon skilled surveyors to detect banded birds each year.

Another common place to find hihi is the Te Tūi a Tāne Southern Enclosure, where there are three feeding stations regularly visited by birds. Camera traps deployed at feeders have successfully detected both banded and unbanded birds. These cameras continue to be a great source of information, and there are plans to expand camera monitoring in 2022 while also bringing in some newly-trained volunteers to help with monitoring.

More big news for 2022 is the reopening of the Northern Enclosure early this year. This means the public can once again access this area, providing opportunities to reinstate the Northern Enclosure hihi feeding station very soon.

As always, the Maungatautari team is grateful for its many supporters, including Jobs for Nature, Waikato Regional Council, Waikato District Council, mana whenua, and community funders (Trust Waikato and Wel Energy Trust). In 2021, SMM received Jobs for Nature funding specifically to employ four rangers for Xcluder fence maintenance, fence replacement, and track maintenance. With hundreds of kilometres of tracks on the mountain and a happily regenerating forest, tracks quickly become overgrown and more difficult to navigate. This is especially true of the valley tracks that hihi, in particular, love to hang out in. With over 100 km of tracks cut or maintained since the rangers started in mid-2021, we are on track for a great year of hihi monitoring ahead.

TE HAUTURU-O-TOI



BACKGROUND

Located 80 km northeast of Auckland, Te Hauturu-o-Toi (or Little Barrier Island) is described as 'the most intact ecosystem in New Zealand.' Established as a nature reserve in 1895, it is considered one of the most important reserves of its kind in the world. Entry is strictly by permit only.

The island is managed in partnership between Ngāti Manuhiri and the Crown, by the Auckland region of the Department of Conservation. Te Hauturu-o-Toi is an iconic site for Ngāti Manuhiri and is of cultural, spiritual, and historic significance. The island's name comes from its highest point, 'the windblown summit of Toi.'

Te Hauturu-o-Toi's 3,083-hectare landmass makes it one of New Zealand's largest offshore island reserves. It is home to a greater number of endangered birds than any other island in the country. In addition, the island's biodiversity includes two species of bat, an endemic giant wētā, reptiles such as the northern tuatara, and over 400 species of native plants.

NEWS

Te Hauturu-o-Toi is home to our most enigmatic hihi population. Protected by the island's strict biosecurity protocols, the hihi are otherwise left to their own devices. With some of the most majestic forest in all of New Zealand, they have abundant natural foods and nest cavities available to them. As a result, our typical management activities – supplementary feeding and nest box provisioning – are not needed. Without intensive management or monitoring, we do not know exactly how many hihi are on the island, but estimates range from 1000-3000. As far as we can tell, the hihi here appear to be thriving on their own – serving as an inspiration for all of our reintroduced populations.



Opportunities to visit Te Hauturu-o-Toi are few and far between. To protect the pristine ecosystem, entry requirements are understandably strict, and the remote and rugged landscape requires careful planning before embarking on any research expedition. When hihi researchers do step foot on the island, the data collected are extremely precious and can be pored over for years to maximise learning.

In the past year alone, hihi researchers have published papers using samples collected from the Te Hauturu-o-Toi population as far back as 2003! In one of these studies, Dr Kate Lee (who completed her PhD at Waipapa Taumata Rau - University of Auckland with Dr Anna Santure) and colleagues developed a single nucleotide polymorphism (SNP) chip for hihi using long-term data from several hihi sites (Lee et al. 2021). SNP chips provide information for areas in the genome that tend to differ across individuals and can be used to answer a wide array of questions, from the genetic basis of body size to the consequences of inbreeding for small populations. This advanced technology will greatly accelerate further learning about the species, thanks to the combined effort of hihi researchers across the decades. Each expedition to Te Hauturu-o-Toi only scratches the surface of this mysterious population, and we cannot wait to see what discoveries come in the future!



RESEARCH HIGHLIGHTS

A key strength of the Hihi Recovery Group is the research partners which are part of it. Hihi populations provide a world-renowned study system in small population recovery and reintroduction biology. Each year, researchers produce high quality science examining hihi behavioural ecology, genetics, and conservation, which goes on to be published in peer-reviewed, specialist journals. We highlight a range of these which have been published in the last year below.

Alongside our long-term academic members, HRG is particularly proud to support a growing number of MSc and PhD students. We see this as a winning formula – growing both the number of hihi we have and the number of future conservation leaders for the world! This year, we especially want to congratulate Sarah Bailey (University of Auckland) for completing her MSc on the female hihi genome and Freya O'Sullivan (University of Otago) for completing her MSc on the phenology of hihi food plants.

Genomic data of different resolutions reveal consistent inbreeding estimates but contrasting homozygosity landscapes for the threatened Aotearoa New Zealand hihi

Small populations often suffer from the negative effects of inbreeding, which can dramatically reduce genetic diversity and the species' ability to adapt to environmental change. Quantifying the level of inbreeding in a population can help us evaluate just how vulnerable it is. However, detailed genomic analyses can be costly, creating a trade-off between expense and accuracy. How fine-tuned do our analyses need to be to obtain accurate inbreeding estimates?

Laura Duntsch (PhD student; Waipapa Taumata Rau - University of Auckland) and colleagues turned to our hihi populations on Tiritiri Matangi Island and Te Hauturu-o-Toi to answer this important question. Comparing inbreeding estimates obtained by fine-tuned 'SNP chip' methods (Page 24) against estimates from coarser sequencing techniques, they found that both methods produced similar measures of inbreeding.

On closer examination, however, the accuracy of the coarser method varied widely across the genome, with over- and underestimates averaging out to produce the apparently 'accurate' result. The study identifies several steps researchers can take to improve the accuracy of inbreeding estimates, regardless of the methods used. Importantly, by enhancing the accuracy of more economical methods, this study helps to make genomic techniques more accessible to a wide range of conservation programmes, which can use inbreeding estimates to inform their management strategies.

Reference: Duntsch L., Whibley A., Brekke P., Ewen J.G., & A.W. Santure. 2021. Genomic data of different resolutions reveal consistent inbreeding estimates but contrasting homozygosity landscapes for the threatened Aotearoa New Zealand hihi. Molecular Ecology 30(23):6006-6020.

*Successful use of intraspecific parental fostering in the management of an endemic threatened bird: New Zealand's hihi (*Notiomystis cincta*)*

When managing populations of highly threatened birds, it is important to give every individual its best chance of survival. Sometimes, this requires taking a young chick away from its nest if it requires veterinary care or has been abandoned or neglected by its parents. The challenge then lies in reintegrating the chick back into the wild population, particularly if it cannot be returned to its original nest. Can chicks be safely raised by foster parents, and how can we help maximize their chance of success?

Rachel Selwyn (Conservation Ranger; Zealandia) and colleagues at Zealandia Te Māra a Tāne recently faced this challenge when an 11-day-old hihi chick required urgent veterinary attention for a large swelling on its neck. After 10 days of care at Wellington Zoo, the chick fully recovered and was ready to be returned to the wild. However, the chick did not have any clutchmates, so its original nest was no longer active. Instead, the Zealandia team identified a nearby nest where a female

and her two male partners were actively rearing a chick of similar age.

At 21-days-old, the recovered chick was introduced into this nest, where it was successfully fed by all three adults. Both chicks ultimately fledged and were observed the following week being fed by one of the males. While successful instances of intraspecific fostering have been reported in other bird species, this is the first known case for hihi and one of the first for New Zealand passerines. Thanks to the Zealandia team's careful documentation of the entire process, other sites now have a promising blueprint to follow should any chicks need similar care in the future.

*Reference: Selwyn R.E., Lenting B., Beaven K.C., & E.T. Irwin. 2022. Successful use of intraspecific parental fostering in the management of an endemic threatened bird: New Zealand's hihi (*Notiomystis cincta*). Notornis 69:116-118.*

Evaluating the success of functional restoration after reintroduction of a lost avian pollinator

Conservation translocations often have dual objectives of conserving species and restoring ecological function. Evaluating the success of these objectives is essential for improving future translocations. However, post-release monitoring often focuses on species- rather than ecosystem-level outcomes, so little is known about how well translocations achieve their ecological objectives. If we put our translocations to the test, will we find that they are restoring ecological function as well as we assumed?

Here, Dr Caitlin Andrews (PhD; University of Cambridge & Zoological Society of London) and colleagues conducted a complex multi-site experiment to test how well hihi reintroductions achieve their objective of restoring pollination function. Comparing pollination across two sites where hihi have been reintroduced (Tiritiri Matangi Island and Zealandia Te Māra a Tāne) and two sites where hihi are absent (Tāwharanui Regional Park and Belmont Regional Park) revealed that plants can produce similar quantities of fruit with or without hihi. This suggests ecosystems have a degree of resilience when an important species is lost. However, plants at hihi sites produced significantly higher quality seeds, suggesting hihi bring a unique benefit to pollination that cannot be compensated through other means.

Importantly, the study shows that ecosystems that appear to have 'recovered' following the loss of a key species may have deeper functional deficiencies that are only evident through closer examination. If ecological restoration is an objective, it is therefore crucial to monitor it at multiple levels to determine where we have been successful and where deficiencies remain. This is particularly important as more conservation translocations aim to restore function, as in rewilding.

Reference: Andrews C.E., Anderson S.H., van der Walt K., Thorogood R., & J.G. Ewen. 2022. Evaluating the success of functional restoration after reintroduction of a lost avian pollinator. Conservation Biology e13892.



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