TE REO O TE REPO
KEI KONEI TONU AU

THE VOICE OF THE WETLAND
I AM STILL HERE

EDITED BY YVONNE TAURA
CHERI VAN SCHRAVENDIJK-GOODMAN
AND BEVERLEY CLARKSON

Te reo o te repo – Kei konei tonu au = The voice of the wetland – I am still here / edited by Yvonne Taura, Cheri van Schravendijk-Goodman, Beverley Clarkson. -- Hamilton, N.Z. : Manaaki Whenua – Landcare Research, 2021.

1 online resource

ISBN 978-0-947525-77-4 (electronic)
ISBN 978-0-947525-78-1 (print)

I. Taura, Y., ed. II. Manaaki Whenua – Landcare Research New Zealand Ltd.

Published by

Manaaki Whenua – Landcare Research
Private Bag 3127, Hamilton 3216, New Zealand

This handbook was funded by Manaaki Whenua – Landcare Research (Strategic Science Investment Funding (SSIF) for Crown Research Institutes from the Ministry of Business, Innovation and Employment's Science and Innovation Group).

Editors:

Yvonne Taura (Ngāti Hauā, Ngāti Tūwharetoa, Ngāi Te Rangi, Ngāti Ranginui, Ngāti Uenuku – Manaaki Whenua), Cheri van Schravendijk-Goodman (Te Atihaunui a Pāpārangi, Ngāti Apa, Ngāti Rangi), and Beverley Clarkson (Manaaki Whenua).

Peer reviewers:

Anne Austin (Manaaki Whenua) and Monica Peters (people+science).

Design and layout:

Abby Davidson (Abby Davidson Design)

Manaaki Whenua
Landcare Research

Cover image: Waihora Lagoon, Pureora Forest Park, is a marsh wetland type. It dries out in summer to reveal low-growing herbaceous vegetation. Photo: Susie Elcock

Te Reo o Te Repo

Kei konei tonu au

The voice of the wetland – I am still here

2021

Edited by

Yvonne Taura
Ngāti Hauā, Ngāti Tūwharetoa, Ngāi Te Rangi,
Ngāti Ranginui, Ngāti Uenuku
Manaaki Whenua

Cheri Van Schravendijk-Goodman
Te Atihaunui A Pāpārangi, Ngāti Apa, Ngāti Rangi

Beverley Clarkson
Manaaki Whenua

CONTENTS

page

ACKNOWLEDGEMENTS

It was with the support and vision of the Waikato Raupatu River Trust (Waikato-Tainui) that *Te Reo o Te Repo – The Voice of the Wetland* was published in 2017. The editors wish to acknowledge the inspiration of tribal members, especially Donna Flavell (CEO, Te Whakakitenga o Waikato Inc.), Rahui Papa (past Chairman, Te Arataura o Waikato-Tainui), and members of Te Arataura o Waikato-Tainui at that time.

The editors would also like to thank the following people for their valuable contributions to *Te Reo o Te Repo – Kei konei tonu au*.

Contributors

Antoinette van der Weerden (WINTEC)

Brenda Greene

Bryan Newton (Ngāti Maniapoto, Ngāti Raukawa)

Cathy Buntting (Pokapū Akoranga Pūtaiao)

Corinne Watts (Manaaki Whenua)

Duane Wilkins (Toitū Te Whenua)

Elizabeth Pakai (Ngāti Kahungungu, Ngāti Rangi, Ngāti Uenuku)

Erina Watene-Rawiri (Waikato-Maniapoto, Ngāi Te Rangi – Taihoro Nukurangi)

Garth Harmsworth (Te Arawa, Ngāti Tūwharetoa, Tūhourangi, Ngāti Raukawa – Manaaki Whenua)

Haimona Waititi (Te Whānau-ā-Apanui, Ngāti Porou, Ngāi Tahu)

Hēmi Whaanga (Ngāti Kahungungu, Ngāi Tahu – Te Whare Wānanga o Waikato)

Jo Pleydell (Ngāi Tāmanuhiri – Te Tumu Paeroa)

Joanne Murray (Te Rarawa, Ngāti Hine, Ngāpuhi)

Jonni Hazeline Koia (Waikato-Tainui, Ngāti Whātua)

Julian Williams (Ngāti Makirangi)

Katrina Christison (Tidy Gardens)

Kelly Ratana (Ngāti Tūwhareota, Te Arawa – Taihoro Nukurangi)

Keri Thompson (Ngāti Hauā)

Ngahuia Herangi (Waikato-Maniapoto)

Pauline Waiti (Te Rarawa)

Rangi Mahuta (Waikato)

Rawiri Hapuku (Ngāti Kahungungu, Ngāi Te Whatuiāpiti, Te Rangikoianake)

Robert Hoare (Manaaki Whenua)

Robert Pa Ropata McGowan (Ngā Whenua Rāhui)

Robin Hape (Ngāti Kahungungu, Ngāi Te Whatuiāpiti, Te Rangikoianake)

Shannon Te Huia (Ngāti Maniapoto, Ngāti Raukawa)

Talitha Wanden (Ngāti Maniapoto, Ngāti Raukawa)

Te Kura Pohatu (Ngāti Kahungungu, Ngāi Te Whatuiāpiti, Te Rangikoianake)

Tom Roa (Ngāti Maniapoto – Te Whare Wānanga o Waikato)

Quinton Tunoho (Ngāti Maniapoto, Ngāti Raukawa)

Vadelia Wirihana Le Geyt (Ngāti Kahungungu, Ngāi Te Whatuiāpiti, Te Rangikoianake)

Waikarere Gregory (Te Rarawa, Te Aupōuri, Ngāti Kahu, Ngāpuhi, Ngāi Tahu)

Waikohu Keelan (Ngāti Pōrou)

Wendy Henwood (Te Rarawa)

Wirihana Raihana (Ngāti Porou – Te Tumu Paeroa)

Images

© **Athena Rhodes**

© **Bartek Wypych**

© **Eddie van Uden**

© **Erica Sinclair Photography** – Erica Sinclair (Te Whānau ā Apanui)

Jamie Watson (Ngāti Tāmatea, Ngāti Maru, Ngāti Pukenga, Ngāti Hine)

© **John Nelson**, all rights reserved (CC BY-NC 2.0)

© **Jon Sullivan**, some rights reserved (CC BY-NC 2.0)

Jonathon Brownrigg

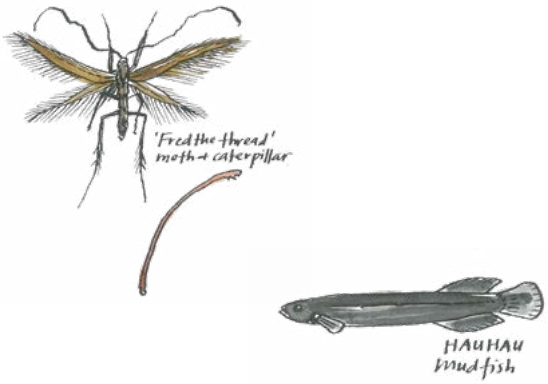
© **Oscar Thomas**

© **Raewyn Adams**

© **Rawhitiroa Photography** – Te Rawhitiroa Bosche (Ngāpuhi, Ngāti Kahu)

Te Kawa Robb (Ngāti Ranginui, Ngāti Awa)

© **Tony Foster**, rights reserved (CC BY-NC 2.0)



ARTIST APPRECIATION

We were fortunate to have the support of two talented artists who were commissioned to create original artwork and a photographer who gave permission to use his extensive collection of natural world images. We wish to take this moment to acknowledge their contribution to *Te Reo o Te Repo – Kei konei tonu au.*

TE KURA ORMSBY

Ko Taupiri tōku maunga

Ko Waikato tōku awa

Ko Ngāruawāhia tōku tūrangawaewae

Ko Te Kura Ormsby tōku ingoa

Ko ringatoi Māori ahau

Te Kura is a contemporary Māori artist and studied at Toihoukura in Tūranganui-a-Kiwa (Gisborne) and Te Wānanga o Aotearoa in Rāhui Pōkeka (Huntly). She has a passion for colour and loves incorporating colour and patterns in her designs: believing each colour has a whakapapa, she is particular with the colours used for her artwork. Inspired by tā moko after she recieved her own moko kauae (traditional female facial tattoo), Te Kura was motivated to help revitalise tā moko and moko kauae for her people, by becoming a tā moko artist. She has also been stimulated by *he kōrero tuku iho* of Māori and Polynesian culture, and loves to translate oral history into visual artwork. She is inspired both by traditional art such as whakairo, raranga, kōwhaiwhai, and tā moko uhi and by experimenting with contemporary media such as watercolour – her favourite medium because it effortlessly creates a magical and whimsical look when splashed across a page.

'I believe that art heals people, Indigenous people in particular. Healing for us to tell our stories through art and keep our culture alive, he taonga tuku iho.'

Contact details for Te Kura Ormsby

https://www.instagram.com/tekuraarts

Ngā atua wāhine o te repo – Goddess series.
Original artworks for the *Te Reo o Te Repo* cultural wetland series.

Artwork medium – watercolor pencil and ink

Wainui-ātea – The Clear Mighty Waters

As the goddess of inland waters, rivers, and swamps, *Wainui-ātea* is represented in shades of blues, purples, and greens. Her makawe (hair) has been over emphasised with the use of kapua (clouds) to represent her connection to *Rangi* (Sky Father) as his second wife. Her poho (chest) is adorned with intricate patterns to represent her connection to rainwater and inland waters. The ocean waves symbolise an embrace with her son *Te Moana-nui a Kiwa* (Great Ocean of Kiwa), keeping him close to her poho to nurture and care. The moko kauae shows *Wainui-ātea* is a female goddess.

Para-whenua-mea – The Muddy Soil of Mother Earth

As the goddess of muddy soil, *Para-whenua-mea* is represented in shades of browns, oranges, and yellows. *Para-whenua-mea* is referred to as water that emanates from her mother (Deity of the Mountains) as pure spring water. She cascades down the slopes of her mother, falling as a waterfall, then gliding across the surface of the plains (represented by the bold triangles), merging with the streams to form large rivers (represented by the bold lines), while depositing silt along the riverbanks. *Para-whenua-mea* is a powerful, destructive, spirited, and potent force. The moko kauae shows *Para-whenua-mea* is a female goddess.

Hine-i-te-repo – The Elemental Femininity of the Swamp

As the goddess of the swamp, *Hine-i-te-repo* is represented in shades of greens and browns. The main focus is her kanohi (face) because when the artist thinks of a swamp she thinks of a taniwha (water spirit), with big eyes looking back from a dark boggy environment. Along her eyelashes and eyebrows are hints of different wetland plants, such as reeds, toetoe and raupō. Throughout the image are patterns and symbols (triangles, lines and arrows, and dots) that represent the flora and fauna of the swamp. The moko kauae shows *Hine-i-te-repo* is a female goddess.

MONICA PETERS

(people+science)

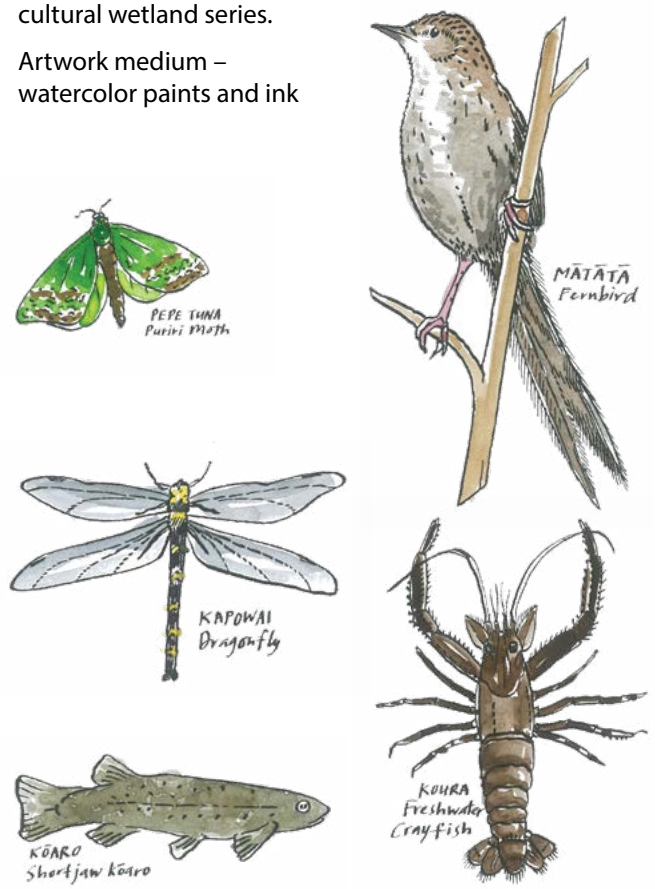
Monica is a consultant working at the interface between science, conservation, and the public. Her day jobs mostly span research, science communication, and governance with illustration as an occasional creative outlet. She has always seen art and science as complimentary. While studying fine arts, Monica also worked in conservation, later gaining a PhD in community-led environmental restoration and citizen science. She is fascinated by plants and drawing is the best way to explore and understand their structure. Over the last two decades, Monica's conservation work has taken her to many different wetlands, from nearly pristine to completely degraded. Her hand-drawn diagrams help others gain insights into the beauty of these complex, intriguing, and underappreciated ecosystems. As visual cues, they are one small piece in the information puzzle to help guide the long journey toward wetland restoration.

Contact details for Monica Peters

https://monicalogues.com

Te Repo o Aotearoa – wetland habitats, and native flora and fauna. Original artworks for the *Te Reo o Te Repo* cultural wetland series.

Artwork medium – watercolor paints and ink



NEIL FITZGERALD

© Neil Fitzgerald Photography

Neil is a part-time nature photographer with a particular interest in the wildlife and landscape of Aotearoa. While birds are a permanent interest and a large feature in his photo collection, he also enjoys photographing the smaller, often overlooked wildlife, like insects, or fine details in a vast landscape, hoping to show them in a way that encourages people to pause and appreciate them a little more. He believes the best photographs often come from having a deep understanding of the subject, but also that photography itself can be a powerful learning tool. From cryptic birds to plants that eat animals, reflections of snow-capped mountains in a tarn to a flower in the lens formed by a drop of water, Neil finds endless photographic opportunities and challenges in wetlands.

Contact details for Neil Fitzgerald

https://www.neilfitzgeraldphoto.co.nz

Pāpango (NZ Scaup; *Aythya novaeseelandiae*).
Photo: © Neil Fitzgerald

A red percher dragonfly (*Diplacodes bipunctata*) covered in heavy dew, at Lake Ohia gumland, Northland. Photo: © Neil Fitzgerald

FOREWORD

E kore tātau e mōhio ki te waitohu nui o te wai kia mimiti rawa te puna

We never know the worth of water until the well runs dry

Te Wharehuia Milroy (Ngāi Tūhoe)

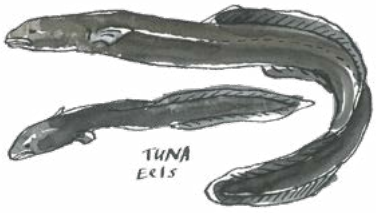
He mihi tautoko

E ngā mana, e ngā waka, e ngā reo, e ngā karangatanga maha o ngā hau e whā, tēnei te mihi atu ki a koutou katoa. Papatūānuku e takoto mai nei, te whenua, te taiao, ngā taonga repo, whangaia kia tupu kia pūāwai, he taonga tuku iho, tihei mauri ora!!

It gives me great delight to introduce *Te Reo o Te Repo – Kei konei tonu au.* The second volume of the *Te Reo o Te Repo* cultural wetland handbook series provides a range of examples of Indigenous Māori values, knowledge, and perspectives, from across Aotearoa New Zealand, illustrating the diversity of these precious wetland ecosystems and their characteristic properties, life forms, and inter-connections. This handbook is the culmination of much effort, bringing together many individuals and organisations to share their ngākau whiwhita (passion), tikanga and mātauranga Māori (cultural values and knowledge), wheako (experiences), whakaaro (thoughts and ideas), and tūhononga ki te repo (connection to wetlands) and kaitiakitanga (guardianship). It includes chapters from whānau (families), hapū (sub-tribes), iwi (tribes), tangata whenua and mana whenua (people of the land), local kaitiaki (guardians), and kairangahau (scientists and researchers), drawing on a wide range of knowledge and experience from different tribal regions (rohe) around Aotearoa.

The editors have successfully woven these diverse values, knowledge, and perspectives through a rich whāriki (tapestry) of 16 new chapters ranging from whānau, marae, hapū, and iwi-led restoration projects and practical demonstrations, to academic research, including: whakapapa (ancestral connections) and whakataukī Māori (proverbs); rongoā Māori (traditional medicine); iwi-led dune lakes restoration; iwi-led wetland restoration and monitoring; Geographic Information System (GIS) mapping; and cultural indicators – taonga plant and animal species (culturally important) provide underpinning of cultural resources and mātauranga Māori based tools and approaches. This new addition to the wetland handbook series provides a helpful guide for those embarking on wetland restoration as well as highlighting the importance of mātauranga Māori and whānau, hapū, and iwi involvement in these processes. Based on experiences from knowledgeable practitioners and contributors, the handbook explains the cultural significance of repo that can help define whakaarotau (priorities) for repo restoration.

Wetlands are: *'permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions (RMA)' and are manifest as a variety of forms such as lakes, rivers, streams, dune lands, estuaries, swamps, bogs, marshes.* For iwi Māori, repo are much more than this and reflect a deep history and kōrero (set of narratives) of whakapapa stories (pūrakau), beliefs, origins, dependencies, uses, and activities that are an essential and integral part of the cultural landscape (whenua, Papatūānuku) and te ira tangata (the human dimension). The mauri (life force, vitality, essence) of repo is linked to the overall concept of ecological health and human well-being and prosperity. The continuation and strengthening of whakapapa between the ecosystem and tangata whenua is an important demonstration of this continued existence, connection, and interdependency that helps sustain the mauri. Whakapapa can be explained through generations, layers, and interconnections through many important kupu (words) and korero i te reo Māori (language). As illustrated in this handbook, repo are reservoirs for mātauranga, hauora (health and wellness), and utilisation and are regarded by Māori as taonga (treasure) with historical, social, environmental, cultural, economic, and spiritual significance. Although more than 90% of repo throughout Aotearoa have already been destroyed, many rōpū (groups) are now



committed to restoring and enhancing these valuable ecosystems. In these circumstances it is important to think not only about wetland extent (the total area) but also about the condition and quality of repo (e.g. te mauri) that sustains life-supporting capacity, and how te mauri o te repo might be replenished, sustained, and enhanced.

In Māori, many names and classifications are used for repo, for example, repo, reporepo, kōrepo, wairepo, tāpokopoko, poharu, and roto. These have been handed down through centuries from tūpuna (ancestors) and knowledgeable experts (e.g. tohunga, mātanga). Repo are typically wet areas (e.g. wāhi māku, haumāku) important as part of an overall land-system that regulates and accommodates water levels and flooding. Repo contain significant habitats for a large number of taonga species – plants, animals, fish, birds, reptiles, insects, and micro-organisms. As a significant taonga in itself, repo support high levels of intrinsic, cultural, and spiritual value, sustaining biodiversity and a diverse range of customary resources, including mahinga kai (food gathering sites), significant spawning grounds for fish, a nursery for plants and birds, a pātaka (storehouse) for materials such as raranga (weaving), rongoā (Māori medicinal use), kai (food), and construction of whare (houses). They also support many important customary activities and uses that include waka ama (canoe regatta) and kaukau (swim, bathe). Wetlands are often personified as ngā whatukuhu o Papatūānuku – the kidneys of the earth, acting like giant sponges or filters across the whenua (land). They have the ability to cleanse the water of excess nutrients and sediment, control flood water and pollutants, and act as important carbon sinks and reservoirs (removing carbon dioxide from the atmosphere). Reflecting a range of integral values repo sustain life, support well-being, and reinforce cultural identity.

Repo are therefore integral parts of the landscape critical to the efficient functioning of our whenua and the healing and sustenance of Papatūānuku (Earth Mother). It is vital to restore, sustain, and enhance the mauri of such systems, including all aspects of the ecosystem from the water, the nutrients, the plants and animals, and the intricate interconnecting and interdependent parts and webs. Ecosystem benefits (services) from repo are wide ranging (e.g. customary resources, water regulation and filtering, recycling nutrients, biodiversity, carbon sequestration, climate regulation, plants, fish and birds, reservoirs). Our aspirations in this landscape must be to return repo as a taonga to an acceptable state in line with our values and knowledge systems. We cannot turn back time, but we can achieve our aspirations by learning through deep knowledge sources from the past and present, such as those highlighted by this handbook. These sources are based on the teachings of our tūpuna, from the experiences and practices we lead, and from the actions we take to restore and sustain the whenua. As human beings we must empower, strategize, and put into place a set of actions that improves the environment for future generations. **There is no more important lesson than the power of collaboration when we agree to work together for a common purpose or goal – especially one that benefits our whenua and Earth Mother Papatūānuku.**

Whāia e koe te iti kahurangi, ki te tūohu koe, me he maunga teitei

Garth Harmsworth (Te Arawa, Ngāti Tūwharetoa, Tūhourangi, Ngāti Raukawa)

Toi Rangahau Māori, Principal Scientist
Manaaki Whenua

Ka mea ake te repo:

'Me he manawa whenua, e kore taku reo e ngaro!

Kei konei tonu au. Kei konei tonu tātou.'

The wetland replied:

'My voice will never be lost, like a spring, it bursts forth from the land!

I am still here. We are all still here.'

INTRODUCTION

YVONNE TAURA (NGĀTI HAUĀ, NGĀTI TŪWHARETOA, NGĀI TE RANGI, NGĀTI RANGINUI, NGĀTI UENUKU), CHERI VAN SCHRAVENDIJK-GOODMAN (TE ATIHAUNUI A PĀPĀRANGI, NGĀTI APA, NGĀTI RANGI), BEVERLEY CLARKSON (MANAAKI WHENUA)

Ka mea ake te repo:
'Me he manawa whenua, e kore taku reo e ngaro!
Kei konei tonu au. Kei konei tonu tātou.'

The wetland replied:
'My voice will never be lost, like a spring, it bursts forth from the land!
I am still here. We are all still here.'

Te Reo o Te Repo – Kei konei tonu au is the third publication of the wetland handbook series written to promote the health and well-being of repo (wetlands) throughout Aotearoa New Zealand.

DESPITE EVERYTHING, OUR REPO ARE STILL HERE

The year 2020 will be long remembered as one of the toughest years of the 21st Century, given the onset of the virus COVID-19, and the incredibly overwhelming impacts felt in health, educational, and economic sectors around the world.

Testing the wetland delineation protocols along a dry-wet gradient, Taranaki. Photo: Beverley Clarkson

Previous page: Waihora Lagoon, Pureora Forest Park, is a marsh wetland type. It dries out in summer to reveal low-growing herbaceous vegetation. Photo: Susie Elcock

The leadership of Aotearoa – five million strong – faced the virus head-on almost immediately, seeking to protect communities from its effect on our health, and shut down the country's borders. For the first time in living memory, the Prime Minister, Rt Hon Jacinda Ardern, asked her fellow Kiwis (New Zealanders) to temporarily close factories, shops, and offices, hang up the car keys, and 'noho ki te kāinga – stay at home'.

CALL OF THE TWO WILDS
SUPERMARKETS AND NATURE

The months of March and April 2020 gave us a collection of some of the strangest national memories – flour-gate and toilet-paper-gate – when New Zealanders frantically raced to stock up their pantry and bathroom supplies before the COVID rāhui (lockdown), causing the odd hiccup in the domestic supply system.

Perhaps the most astonishing experience for people around the world, was the way in which nature responded to the human shutdown. Marine life such as dolphins swam into estuaries where they hadn't been seen for decades; bird song seemed to double in volume as flocks of birds appeared in oddly quiet urban centres; wild animals came out of the forests to wander suddenly quiet streets; air pollution dissipated; unnatural noises and artificial lighting dropped to a mere murmur. Geological scientists revelled in the ability to finally be able to hear the vibrations of the Earth thanks to the removal of the steady traffic of cars, trucks, and trains. This became a period of environmental enlightenment – when humans were suddenly hit with the realities of their impact on nature, and the actual insignificance of their presence in the bigger picture.

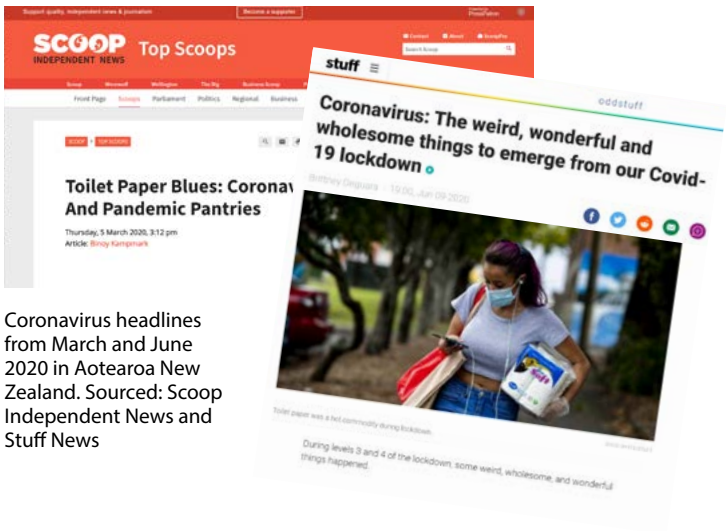
From that was (re)born a strong movement calling for global governments to learn from the experience and find a better way to co-exist with nature.

A number of businesses throughout Aotearoa strongly lobbied the New Zealand government to invest in a greener economy. Environmental advocacy groups (including the National Wetland Trust of New Zealand) developed media campaigns; and, thanks to the headspace created by being stuck at home, a generation of innovatives and creatives were reawakened.

Sadly, as this excitement swelled within the community, the absence of basic enforcement and protection of our environment during lockdown led to increasing reports of illegal wetland drainage, destruction, or attempts to undermine wetland protection across the motu (country).

Soon after the rāhui, the New Zealand Government released the new and improved Essential Freshwater Package, as part of a national direction to protect and improve our rivers, streams, lakes, and wetlands. After months of revision, renegotiations, and hard pushes from those working within and around freshwater systems, we finally saw a real change in the way wetlands are to be viewed within land use planning and policy.

In particular, the National Policy Statement for Freshwater Management 2020 (NPS-FM 2020) includes new policies to avoid further loss of extent of natural inland wetlands, protect wetland values and promote wetland restoration. New wetland delineation tools based on vegetation, hydric soils, and wetland hydrology provide more robust guidance for the identification of wetland areas. With only 10% of wetlands remaining nationally (Fig. 1), there is a growing recognition that we must prevent any further ecological and environmental losses, as had been promised by the once ground-breaking Resource Management Act 1991 (RMA 1991). However, the single-minded nature of some people and illegal behaviour regarding the drainage and destruction of wetlands during the March and April 2020 rāhui, highlighted that wetland protection may still be a pipedream until the Government commits to enforcing regulations of such behaviour.



Coronavirus headlines from March and June 2020 in Aotearoa New Zealand. Sourced: Scoop Independent News and Stuff News

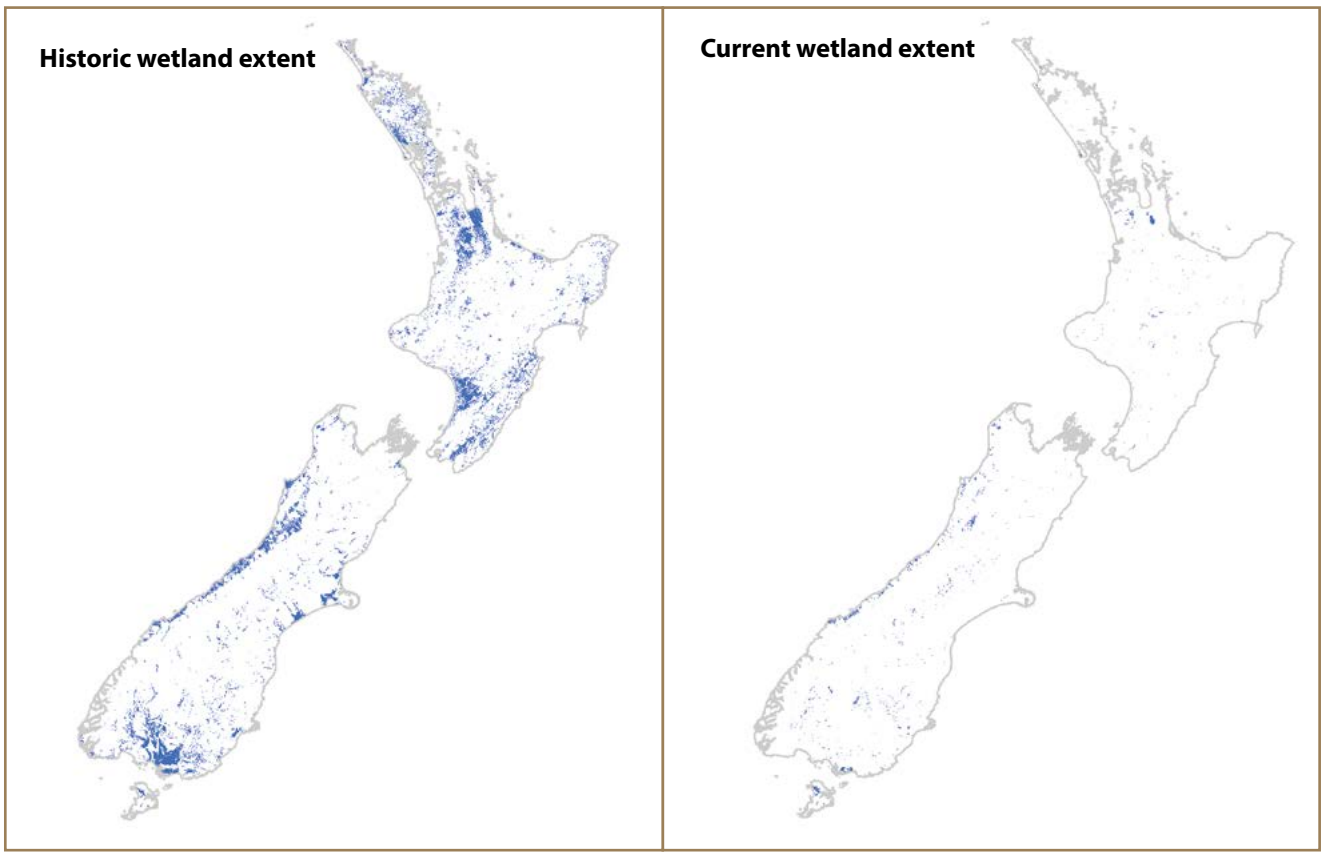


Figure 1. Maps of wetland historic (1840) and current (2008) extent (represented in blue) throughout Aotearoa. Adapted from Ausseil et al. 2008, Manaaki Whenua – Landcare Research

KEI KONEI TONU AU
I AM STILL HERE

A study into wetland loss between 1996 and 2018 emphasised that, despite the Resource Management Act, which came into effect in 1991 and legislates for wetland protection, nearly 5,500 ha of wetlands have been destroyed. Most of this loss occurred between 2008 and 2012, when many wetlands were converted to pastoral farming.

Table 1 illustrates the changes that occurred regionally, and the percentage of wetlands lost. We note that all regions had wetland losses, apart from the smallest unitary authority, Whakatu (Nelson, South Island), with notable examples of individual large patches being lost in Waikato (221.1 ha) and Southland (202.9 ha).

Despite the challenges faced by wetlands throughout Aotearoa over the past 150 years, and especially within the last 30+ years, repo are STILL HERE. Despite the impacts to native wetland plant and animal species, they too are STILL HERE – albeit hanging on a more precarious precipice. Fundamentally, however, the hapū (subtribes) and iwi (tribes) associated with wetland systems for centuries are also STILL HERE.

The pārera, grey duck (*Anas superciliosa*) with the green speculum is one of our rarest native water bird species due to a huge reduction in numbers and cross breeding with exotic mallard ducks (*A. platyrhynchos*) with the purple speculum. Photo: © Raewyn Adams

Despite growing evidence of the parallel impacts of loss of our mātauranga (knowledge) associated with freshwater and marine systems, there are still relicts of that mātauranga, which could respond to a jump start. In some cases, our people (kaitiaki (guardians) from iwi and hapū) on the ground have achieved this, despite the odds, through the implementation of their own restoration programmes of action and business development in restoration spaces such as nurseries, restoration planting teams, Māori-centred and driven research programmes, or through active participation in policy development and implementation.

Table 1. Aotearoa New Zealand regional freshwater wetland loss 1996–2018

Region	Total in 1996_ha	Area lost since 1996_ha	% of 1996 extent lost	# patches lost	Average patch size lost_ha	Biggest patch lost_ha
Auckland	1310	11	0.8	2	5.4	7.1
Bay of Plenty	4235	32	0.7	7	4.5	10.1
Canterbury	18165	243	1.3	13	18.4	53.8
Gisborne	708	104	14.7	19	5.5	43.1
Hawke's Bay	1723	13	0.8	6	2.2	5.3
Manawatu-Whanganui	8537	92	1.1	22	4.2	5.9
Marlborough	873	4	0.4	1	3.5	3.5
Nelson	10	0	0.0	0	0	0
Northland	15420	380	2.5	40	9.5	87.7
Otago	24456	341	1.4	40	8.5	76.4
Southland	40936	2709	6.6	270	10	202.9
Taranaki	2615	83	3.2	56	1.5	7
Tasman	**3572**	15	0.4	4	3.7	6.5
Waikato	34275	484	1.4	39	12.4	221.1
Wellington	3325	100	3.0	22	4.6	23.6
West Coast	32562	788	2.4	77	10.2	65.7
Total	192722	5394	2.8	618	8.7	221.1

Derived from the Land Cover Database, see Denyer and Peters 2020

Te Reo o Te Repo – Kei konei tonu au provides additional snapshots from the repo to further enable or build on the jumpstart of mātauranga, and therefore, to support the platforms our people are building to be better positioned within the re-imaginings required for our future relationships with our environment.

As editors, the key message we want to share, based on what we've learned during the writing of *Kei konei tonu au*, is that nothing is ever truly lost, unless it is extinct. Our repo are not yet extinct nationally, although they are increasingly becoming endangered locally, as are their plant and animal species. Our traditional knowledge is not yet extinct either, although it is challenged by the gradual disappearance of native species that helped form that knowledge in the first place.

With this recognition comes a growing realisation of our responsibility to facilitate and expand knowledge to help our people and other passionate communities engage more meaningfully with wetland protection and restoration. It is especially heartening to see the faces of the next generation – our tamariki and rangatahi – featuring in a number of chapters in this volume. With them in mind, we have the responsibility to leave them a positive legacy. We need to use more appropriate and ethical tikanga (customary values and practices) and science, and the tools we have at our disposal to support knowledge regeneration in a way that is culturally and socially meaningful. We must champion its appropriate application in decisions related to the health and well-being of repo throughout Aotearoa. We can and must make a positive difference for the wetlands and wider freshwater and marine systems we still have left.

Kia kaha koutou katoa

Ka mea ake te repo: *'Kei konei tonu au. Kei konei tonu tātou.'*

The wetland replied:
'I am still here. We – all of us (including the people) – are still here.'

The diminutive swamp helmet orchid (*Corybas carsei*), once typical of northern restiad bogs, is now just hanging on in a single locality in Waikato. Photo: Bruce Clarkson

Longfin tuna (eel; *Anguilla dieffenbachi*), a highly valued cultural resource for Māori, have suffered large declines in population, partly due to wetland drainage and are now considered to be 'At risk – Declining'. Photo: Erina Watene-Rawiri

Co-editors of the *Te Reo o Te Repo – The Voice of the Wetland* handbook series, Cheri van Schravendijk-Goodman, Yvonne Taura, and Beverley Clarkson. Photo: Manaaki Whenua

HOW TO NAVIGATE AND USE *TE REO O TE REPO*

Handbook structure

The articles in *Te Reo o Te Repo – Kei konei tonu au* are a small sample of research, contributed by whānau and kairangahau from all over the motu. This edition has many examples from the Waikato region, to the result of a long-standing research partnership between Waikato-Tainui and Manaaki Whenua – Landcare Research. However, research topics from other areas of the motu are also included to provide readers with a broad range of wetland restoration activities. Whānau, marae, hapū and iwi, and kairangahau Māori are working together to enhance cultural priorities for repo restoration. Each article discusses the personal journey taken by the kairangahau and the whānau involved, to promote the connections, understanding, and learnings for the restoration of their repo. The handbook is divided into three sections.

Section One: Process of engagement

Environmental restoration work in Aotearoa cannot be undertaken without involving tangata whenua, as the Indigenous people whose culture and identity come from the land (hence 'people of the land'), and who have existed within the local environment for many generations. However, making the first step to engage with people from another culture and with a different worldview can be a daunting experience. This section explores some examples of engagement processes relevant to mahi (work) with tangata whenua.

Section Two: Cultural Resources

Many things – living and non-living – can be considered to be cultural resources. In the context of *Te Reo o Te Repo*, these are naturally sourced materials associated with repo, which are considered valuable by tangata whenua and are incorporated into the local culture. Articles in this section aims to shine a spotlight on a number of rare and endangered wetland species, so that we can rebuild mātauranga, and better support the health and wellbeing of our repo.

Section Three: Mātauranga Māori

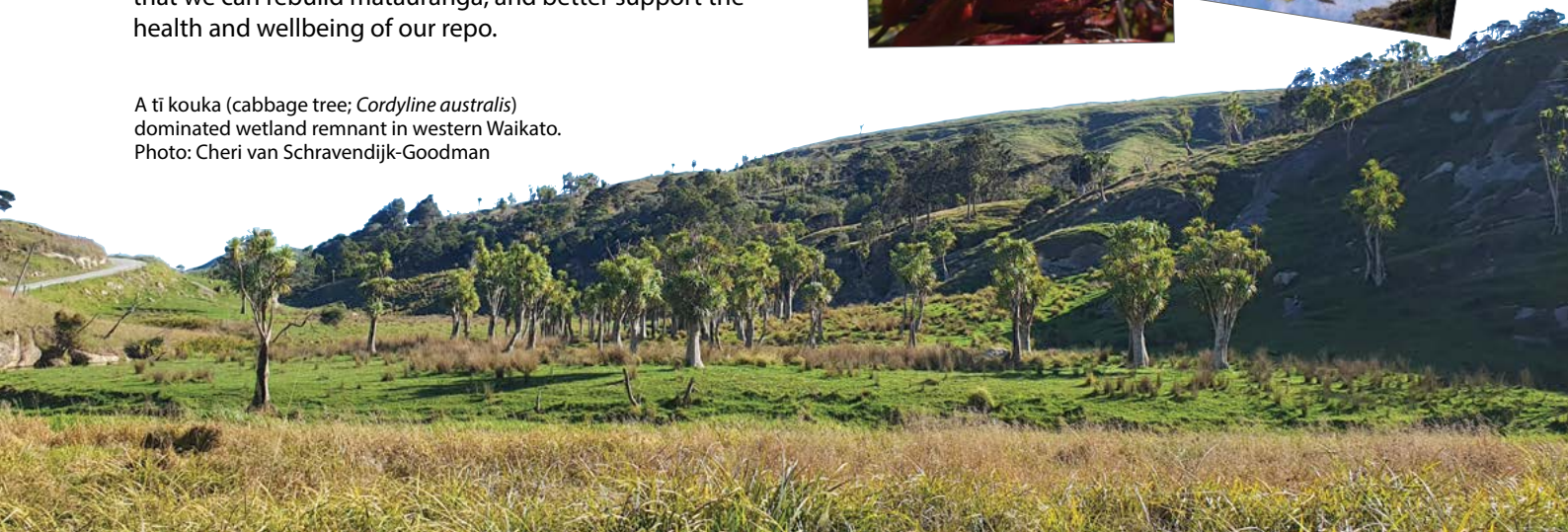
Tools and Approaches

Mātauranga Māori (Māori knowledge) is a multifaceted knowledge system that reflects an understanding of the world from an indigenous cultural perspective and is intimately linked through whakapapa (connections to place and natural resources). This section explores the application of mātauranga Māori and whakapapa for the restoration of repo by tangata whenua.

The *Te Reo o Te Repo* cultural wetland handbook series are available for free download.

Te Reo o Te Repo – The Voice of the Wetland
https://www.landcareresearch.co.nz/publications/te-reo-o-te-repo

Te Reo o Te Repo – Kei konei tonu au: The Voice of the Wetland – I am still here
http://www.landcareresearch.co.nz/publications/te-reo-o-te-repo-kei-konei-tonu-au



A tī kouka (cabbage tree; *Cordyline australis*) dominated wetland remnant in western Waikato. Photo: Cheri van Schravendijk-Goodman

HOW OUR STORIES CONNECT ACROSS THE LANDSCAPE

12. **Ngā roto tāpokapoka – Te hiku o te ika: Dune lakes restoration**
Dune lakes, Te Hiku, Te Tai Tokerau

2. **Tiaki manaakitia te tāngata, tiaki manaakitia te taiao – Resilience of people and environment**
Mangaonua and Mangaone Catchments, Waikato

5. **Te Reo o Te Repo – The language of the swamp**
Pūrekireki Marae, Pirongia, Waikato

6. **Pulling nature back from the brink – Weaving culture, science, art and *Sporadanthus***

7. **Swamp Maire**
Te Pūaha o Waikato, Waikato

8. **Restoring and enhancing tuna**
Rāhui Pōkeka, Waikato

13. **Me pēwhea te whakarauora i ngā repo o Ngāti Maniapoto**

15. **Wharekorino Wetland enhancement project – Enhancing a significant site of plenty**
Wharekorino Wetland, Tokanui, Kihikihi, Waikato

14. **Poukawa te waiū – Poukawa the life force**
Lake Poukawa, Te Hauke, Te Matau a Māui

● *Chapter locations from Te Reo o Te Repo*
○ *Chapter locations from Te Reo o Te Repo – Kei konei tonu au*

Aotearoa | New Zealand

1. **Te haerenga o ngā pukapuka repo – Connecting wetlands and people through stories**

3. **When hands hear the landscape speak – Reconciling te reo o te repo and landscape design**

4. **Ngā rongoā o ngā repo – A wetland perspective**

9. **The wetland paddlers of Aotearoa – Ducks, swans and grebes**

10. **Te reo tipu – Kaupapa Māori views of molecular research with rākau rongoā o ngā repo used for Type II Diabetes (T2D)**

11. **Tuia ngā repo me ngā tāngata – Reconnecting communities with their wetlands**

16. **GIS mapping tools for wetland projects**

MĀORI CONVENTIONS USED THROUGHOUT THE HANDBOOK

Haimona Waititi (Te Whānau-ā-Apanui, Ngāti Porou, Ngāi Tahu)

Official languages of New Zealand

Throughout the handbook, we have used both te reo Māori and English as they are official languages of Aotearoa New Zealand. A comprehensive glossary of all Māori terms used throughout the handbook can be found at the end of the handbook.

Bi-lingual names of government agencies

Most government departments and agencies throughout Aotearoa have bilingual names. Throughout the handbook, the Māori name has been used in preference of the English name, for those organisations with registered bilingual trade names. Within the articles the abbreviated version of the organisation may also be used. Agencies with bilingual trade names such as:

- Manaaki Whenua – Landcare Research/MWLR
- Te Papa Atawhai/Department of Conservation/DOC
- Āta mātai, mātai whetū/AgResearch
- Taihoro Nukurangi/National Institute of Water and Atmospheric Research/NIWA
- Te Whare Wānanga o Waikato/University of Waikato/UoW

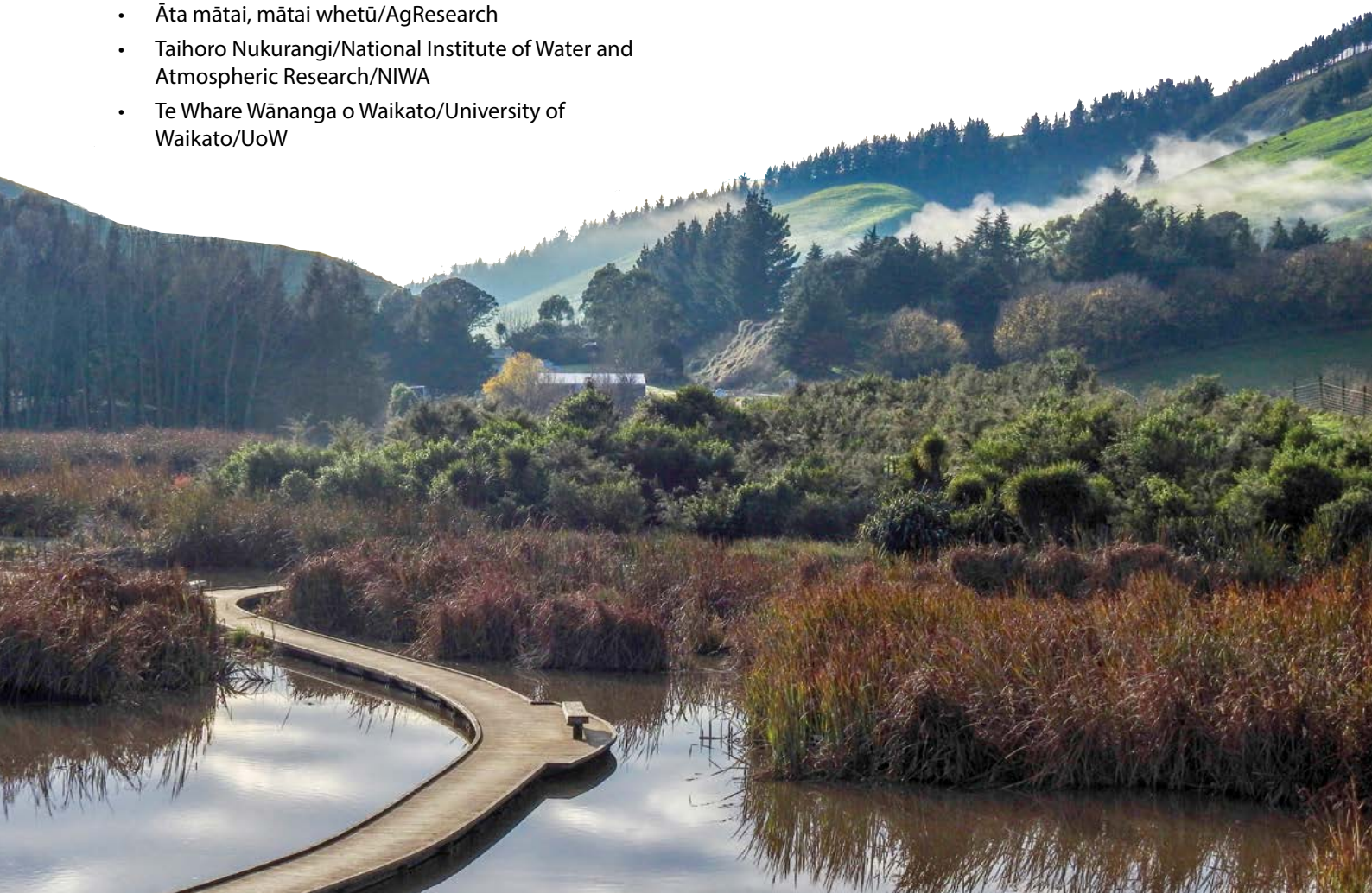
Flora and fauna species

The Māori names for native flora and fauna species have been used in preference to common and scientific names. A comprehensive glossary of all flora and fauna species used throughout the handbook can be found at the end of the handbook.

Whakataukī – Proverbs

For many of the articles within the handbook, we have used Māori proverbs called whakataukī or whakatauākī, which are sayings that reflect the thoughts, values, and advice of past generations. They are usually very succinct and often use metaphor to convey key messages. Proverbs are important to the revival of the Māori language – they have flair, imagery, and metaphor embodying the uniqueness of the language. Māori proverbs comment on many aspects of Māori culture, including history, religious life, conduct, ethics, land, warfare, love, marriage, and death. While, some sayings refer to cultural practices or attributes that have since changed or no longer exist, most can be adapted and applied to present-day situations. The Māori proverbs chosen for selected articles within the handbook, help highlight the importance of the topic from a cultural perspective.

Pekapeka Wetland and boardwalk meandering through the restored wetland, Te Hauke, Hawkes Bay. Photo: © John Nelson



Tribal affiliations

Māori, the Indigenous people of Aotearoa, have a holistic worldview that respects and acknowledges the environments to which they are connected. One of the environments on which Māori place great importance is the natural world. Māori will identify themselves through their connection to an ancestral maunga (mountain), awa (river), moana (ocean), waka (canoe), hapū, iwi, and tūpuna (ancestors) before their own name.

This is known as a pepeha (formulaic tribal identity expression). Because of this symbiotic relationship, the role Māori play as kaitiaki (guardians) is of great importance.

The authors of this handbook have their tribal affiliations following their name rather than their professional title, as you might find in other handbooks of similar format. This is intended to recognise that these authors are first and foremost indigenous to Aotearoa and therefore are upholding their role as kaitiaki. Fortunately, most of our contributors have found employment with research institutions or organisations tasked with environmental management, to allow further expression of their roles as kaitiaki. Their professional title, however, is not at the centre of who they are.

Tribal dialect

Māori are a tribal people. Each tribe is unique on many levels. These unique characteristics are historical and have developed over time. They can extend from dialectal language differences to tikanga (customs) and are anchor points for tribal identity and mana motuhake (independence, self-determination).

Each of the author's research has remained in the language and dialects that they have chosen to use, and for this reason, no attempts have been made to standardise the Māori terms used across this handbook. Because of these tribal differences, different tribes have different dialects that are used in the handbook. For example, Waikato-Tainui (tribal people of the Waikato region) use double vowels instead of a macron (which is the more common way of writing), i.e. whaanau instead of whānau, hapuu instead of hapū. this style of writing does not change the meaning of the term. Taranaki (tribal people of the Taranaki area) are known for their 'dropped' or aspirated 'h'. Having different names for the same species of plants and animals is also common among tribes – whitebait has many different names throughout the country: matamata, īnanga, īnaka, karohi, karohe, etc.

These differences are acknowledged in this handbook in recognition of the mana motuhake of each tribe.

Kaitiakitanga at work – community support for the lake environments, Te Hiku schools planting day, Lake Onepū, Te Tai Tokerau (Northland). Photo: © Rawhitiroa Photography

TERMINOLOGY

Beverley Clarkson and Cheri van Schravendijk-Goodman

Terminology and jargon are everywhere, particularly within the ecological restoration space. Although, the majority of us may be able to communicate in English, it doesn't mean that we actually understand each other! This can definitely be the case when different cultures meet to work on a shared kaupapa (matters for discussion) or take (issue), and even across different research disciplines.

A good example where we can all trip each other up is when we refer to the origin of a species:

- **Native** refers to an organism that is indigenous to, or originating from a given area, in this case Aotearoa New Zealand
- **Exotic** refers to an organism from another country but can sometimes also refer to an organism that comes from another region within Aotearoa. Other similar terms include introduced, alien, non-indigenous and non-native. It is important that everyone becomes clear on which definition applies at the start.

These definitions can be complicated further when references are then made as to whether a species is:

- **Endemic** means that the organism occurs naturally (native) only in Aotearoa or some part of Aotearoa
- **Invasive** is the introduction of an exotic (in most cases) organism, which has the potential to spread and cause harm to human health, the economy and the environment.

Sometimes the words 'pest' or 'weed' are also used in a similar context to 'invasive'. Depending on the situation and goals of the restoration programme, there can be subtle differences:

- A **weed** is usually defined as a plant that is not wanted and requires some type of intervention to remove it. Weeds are mainly exotic species but they can also be native
- A **pest** is more general and refers to both plants and animals (usually insects or small animals). Again, it generally means an organism that is not wanted, and may require some intervention to manage.

Pests and weeds may also be invasive, which can require significant funds to manage, to eradicate, and to repair the damage they have created. It is also important to remember, that something that might be considered a weed or pest to one person or group, may not necessarily mean the same thing to another.

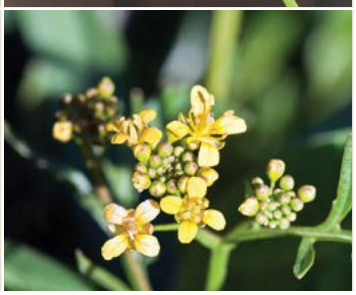
In some situations, 'weedy' or 'pest' organisms may be valued as a culturally important kai (food), e.g. puha (sow thistle) or morihana (common gold fish). Some invasive species may have also held historical value such as the brown bull-headed cat fish which was considered to be an important food item to some Waikato kaumātua (elders) when 'native trout' (adult whitebait) become harder to source.

An exotic tree that is high on the list for recommended control along freshwater systems: alder (or 'rākau Pākehā' as they called it), has an interesting cultural history along the Waikato River, where it was once a source of income for local tangata whenua who worked on the river barges. The trees were harvested to fuel the barges because they can be burnt green (freshly harvested) at high heats. This does not mean that tangata whenua in the area prefer the alder over a stand of kahikatea or native reed bed.

However, understanding the history of an organism (whether exotic or native) opens the door for enhancing understanding of our shared values; provides for greater shared learnings; and may even provide clues as to how these organisms could be better managed and utilised.

Towing barge of harakeke (NZ flax) on the Waikato River near Churchill, Waikato c. 1900. Photo: Sir George Grey Special Collections, Auckland Libraries, AWNS-19000413-6-2

Examples of native versus exotic plants

Native plants		Exotic plants	
Pūrekireki, pūrei Swamp sedge *Carex secta* and *C. virgata* *Carex secta.* Photo: Beverley Clarkson		Yellow sedge *Carex demissa* Grey sedge *C. divulsa* *Carex demissa.* Photo: TrevorJames	
Ūpoko-a-tangata Giant umbrella sedge *Cyperus ustulatus* *Cyperus ustulatus.* Photo: Wayne Bennett		Umbrella sedge *Cyperus eragrostis* *Cyperus eragrostis.* Photo: Jeremy Rolfe	
Kōwhitiwhiti, poniu, panapana Native watercress *Rorippa palustris* and *R. divaricata* *Rorippa palustris.* Photo: Jeremy Rolfe		Wātakirihi Common watercress *Nasturtium officinale* and *N. microphyllum* *Nasturtium officinale.* Photo: Jon Sullivan	

THE NEW ZEALAND THREAT CLASSIFICATION SYSTEM

Throughout the handbook, we shine a spotlight on native species that are classified under the New Zealand Threat Classification System. This system lists plants and animals of Aotearoa New Zealand according to their threat of extinction in the following categories:

Threatened

Threatened species have the greatest risk of extinction.

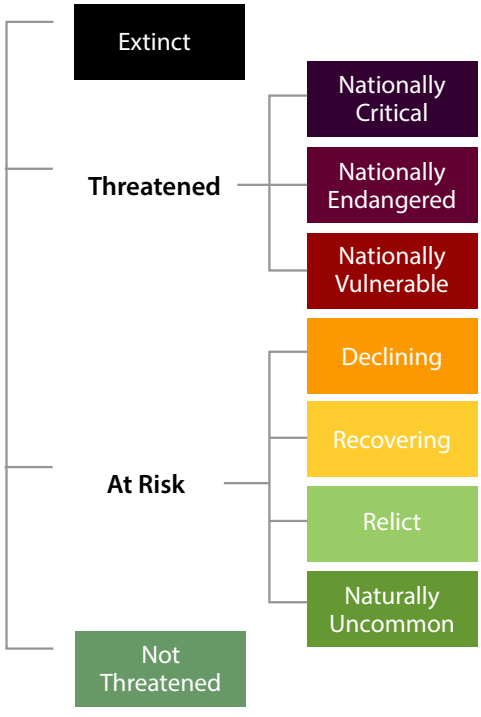
- **Nationally Critical:** most severely threatened, facing an immediate high risk of extinction
- **Nationally Endangered:** facing high risk of extinction in the short term
- **Nationally Vulnerable:** facing a risk of extinction in the medium term.

At Risk

At Risk species are not considered Threatened but can become so if the decline continues or if a new threat arises.

- **Declining:** population declining but still common
- **Recovering:** small population but increasing after previously declining
- **Relict:** small population stabilised after declining
- **Naturally Uncommon:** naturally small population and therefore susceptible to harmful influences.

For more information, go to the Te Papa Atawhai (DOC) website: https://www.doc.govt.nz/nature/conservation-status



Relationship of the New Zealand Threat Classification System

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Ausseil AG, Gerbeaux P, Chadderton WL, Stephens T, Brown D, Leathwick J 2008. *Wetland ecosystems of national importance for biodiversity: Criteria, methods and candidate list of nationally important inland wetlands*. Landcare Research Contract Report LC0708/158. Lincoln, New Zealand: Landcare Research.

Denyer K, Peters M 2020. *The root causes of wetland loss in New Zealand: An analysis of public policies and processes*. Hamilton, New Zealand: National Wetland Trust. https://www.wetlandtrust.org.nz/wp-content/uploads/2021/05/ROOT-CAUSES-OF-WETLAND-LOSS-IN-NZ_Jan-2021.pdf

Dymond JR, Sabetizade M, Newsome PF, Harmsworth GR, Gaelle-Ausseil A 2021. *Revised extent of wetlands in New Zealand.* New Zealand Journal of Ecology (2021) 45(2): 3444. https://newzealandecology.org/nzje/j45_2

Howell C 2008. *Consolidated list of environmental weeds. Department of Conservation Research and Development Series 292*. Wellington, New Zealand: Department of Conservation. https://www.doc.govt.nz/globalassets/documents/science-and-technical/drds292.pdf

Te Taura Whiri i te Reo Māori 2012. *Guidelines for Māori language orthography*. Wellington, New Zealand: Te Taura Whiri i te Reo Māori.

Useful websites

Department of Conservation – Te Papa Atawhai

The NZ Threat Classification System
https://www.doc.govt.nz/nature/conservation-status

Wetlands
https://www.doc.govt.nz/nature/habitats/wetlands

Ducks Unlimited NZ
https://ducks.org.nz/wetlands

Essential Freshwater package
https://environment.govt.nz/what-government-is-doing/areas-of-work/freshwater/e/freshwater-reform

Fish and Game New Zealand
https://fishandgame.org.nz/environment/protecting-nz-game-bird-habitats/wetlands

National Policy Statement for freshwater management
https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-freshwater-management

National Wetland Trust of New Zealand
https://www.wetlandtrust.org.nz

New Zealand Plant Conservation Network
https://www.nzpcn.org.nz

Resource Management Act 1991
https://www.legislation.govt.nz/act/public/1991/0069/latest/DLM230265.html

Te Reo o Te Repo – The Voice of the Wetland
https://www.landcareresearch.co.nz/publications/te-reo-o-te-repo

Tuihonoa Te Reo o Te Repo
https://www.sciencelearn.org.nz/images/4473-tuihonoa-te-reo-o-te-repo

Wetland Restoration Handbook
https://www.landcareresearch.co.nz/publications/wetland-restoration

Also check the websites of your local Regional and District Councils, and local marae, hapū, and iwi

SECTION ONE:

PROCESS OF ENGAGEMENT

1.
TE HAERENGA O NGĀ PUKAPUKA REPO CONNECTING WETLANDS AND PEOPLE THROUGH STORIES

YVONNE TAURA (NGĀTI HAUĀ, NGĀTI TŪWHARETOA, NGĀI TE RANGI, NGĀTI RANGINUI, NGĀTI UENUKU), CHERI VAN SCHRAVENDIJK-GOODMAN (TE ATIHAUNUI A PĀPĀRANGI, NGĀTI APA, NGĀTI RANGI), BEVERLEY CLARKSON (MANAAKI WHENUA)

Mehemea ka moemoeā ahau, ko ahau anake
Mehemea ka moemoeā tatou, ka taea e tātou

If I dream, I dream alone. If we dream together, we shall achieve

Princess Te Puea Herangi (Waikato)

We wish to acknowledge all the authors and contributors – whānau, hapū and iwi members, and collaborating researchers – and the wide readership and supporters of the wetland handbook series. Without your incredible insight, wealth of knowledge, and passion to protect and restore wetlands throughout Aotearoa New Zealand, these handbooks would never have had the same impact.

We particularly acknowledge Monica Peters for her role in developing the *Wetland Restoration – a handbook for New Zealand freshwater systems,* helping to transform a scientific technical guide into a user-friendly resource for local communities undertaking wetland restoration. Monica has continued her contribution for *Te Reo o Te Repo – The Voice of the Wetland* handbooks, as both a peer-reviewer and illustrator. We also acknowledge Abby Davidson for her stunning layouts and design interpretation, which helped bring the shared narratives to life.

Funding was provided by the New Zealand Ministry of Business, Innovation and Employment for the Manaaki Whenua — Landcare Research Restoring wetland ecosystem functioning MBIE Programme (Contract C09X1002, 2010—2016) and Strategic Science Investment Fund.

– Ngā mihi, nā Yvonne mātou ko Cheri, ko Bev

With the release of *Te Reo o Te Repo – Kei konei tonu au*, the wetland handbook series of collected stories of Aotearoa New Zealand wetlands increases to three. It has taken a little over a decade to get to this point, and each handbook has been an evolution of the narratives that shaped the previous handbook. This chapter outlines our journey of developing the wetland handbook series, how the handbooks have helped enrich relationships between people and their wetlands, and more important, the interpersonal relationships of these communities.

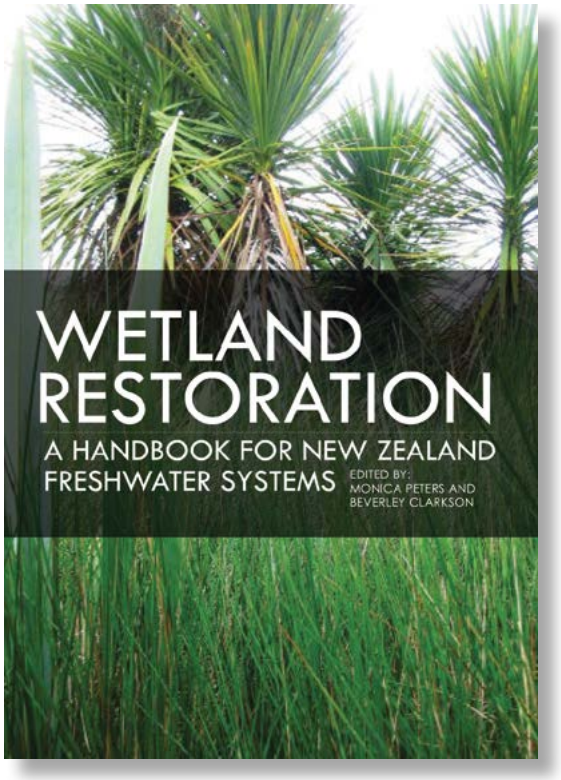
What a recreated restiad wetland might look like in 5 years' time. Using digital aids to visually see the long-term goals. Photo: Monica Peters

Previous page: Te Tira Hoe o Waikato, Te Tupuna Awa o Waikato – paddling crew of tribal members from Waikato-Tainui on the ancestral Waikato River. Photo: Waikato-Tainui

HANDBOOK NUMBER ONE
WETLAND RESTORATION – A HANDBOOK FOR FRESHWATER SYSTEMS

Monica Peters and Beverley Clarkson

The ***Wetland Restoration*** handbook, published in 2010, approaches the practicalities of restoring freshwater wetland ecosystems from a western science perspective. The handbook provides processes and valuable insights for wetland biophysical restoration targeted at a wide-ranging audience from agency land managers to community groups and private landowners.



Wetland Restoration – a handbook for freshwater systems was viewed by practitioners as an important resource in filling a gap for wetland restoration activities. For a long time, wetlands remained the poor cousin of land-based restoration activities because so many had been erased from the landscape and forgotten. If not for the few dedicated researchers, agency and council supporters, iwi (tribes) and hapū (subtribes), landowners, and community groups still advocating for their recognition, many more wetlands could have completely disappeared from modern memory, giving way to bigger cities or enhanced pastoral-based economies.

The handbook became an important mechanism for better communicating and promoting techniques for wetland restoration and shining a light on the stories of community relationships with these systems. With reader-friendly language and eye-catching layouts, including images of communities and practitioners restoring local wetlands, various wetland types and landscapes, and hand-drawn illustrations, the handbook transformed complex issues and processes into simple best practice. Handbook users were able to understand the many stages required to improve the condition of wetlands, without being overwhelmed by scientific or policy jargon, or by complicated restoration strategies and plans. Essentially, the Wetland Restoration handbook set the communication and design format for the future wetland handbook series.

However, missing from this handbook was the kōrero (narrative) of tangata whenua Māori (Indigenous peoples of Aotearoa) and the long-existing relationship that was well understood between them and their environment before European settlement in the early 19th Century. Restoration was viewed primarily through a biophysical western science lens rather than through a more inclusive, culturally informed lens that promoted and raised awareness of wetland Māori values, knowledge, perspectives, priorities, aspirations, and restoration approaches. By identifying this gap, the Waikato Raupatu River Trust – the Environment and Settlement Unit for Waikato-Tainui Te Whakakitenga Incorporated – collaborated with Manaaki Whenua – Landcare Research to focus on iwi-led wetland priorities, research, and restoration initiatives. The concept of *Te Reo o Te Repo – The Voice of the Wetland* was born.

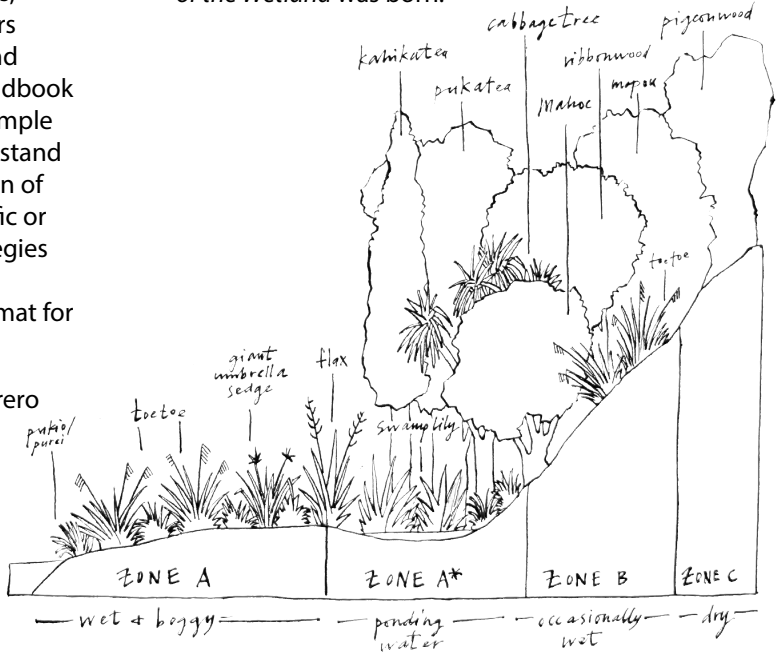


Diagram of vegetation planting zones to help develop a wetland restoration plan. Illustration: Monica Peters

HANDBOOK NUMBER TWO
TE REO O TE REPO – THE VOICE OF THE WETLAND

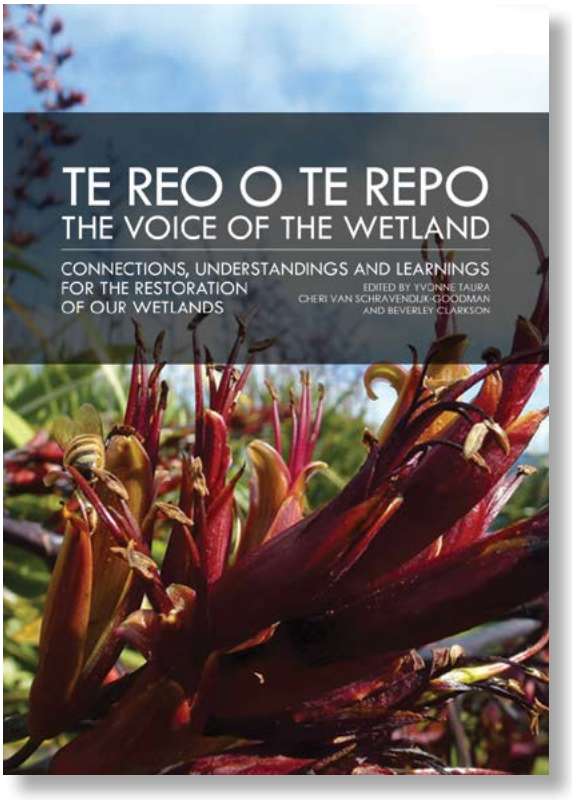
Connections, understandings and learnings for the restoration of our wetlands

Yvonne Taura, Cheri van Schravendijk-Goodman, and Beverley Clarkson

Following the ***Wetland Restoration*** handbook, this culturally focused handbook simmered for 4 years within an associated wetland research programme before it manifested in 2014–2016. ***Te Reo o Te Repo – The Voice of the Wetland*** was published in early 2017.

Te Reo o Te Repo – The Voice of the Wetland: Connections, understanding and learnings for the restoration of our wetlands was framed around a series of projects undertaken by iwi and hapū across the motu (country). The handbook also included stories exploring broader interactions between Māori and some of the more well-known native wetland plant and animal species, such as kuta (giant spike sedge; kutakuta, ngāwhā; *Eleocharis sphacelata*), harakeke (NZ flax; *Phormium tenax*), kōura (freshwater crayfish; *Paranephrops* spp.), and matamata (whitebait; īnanga, īnaka; *Galaxias* spp.). However, as we explored the stories from our contributing authors, we discovered additional gaps in the ways our narratives were being shared.

Ruru. Credit: © Janice McKenna



We found that cultural narratives about native wetland species were slowly fading due to ongoing wetland decline and limited funding opportunities. National priorities also directed funding towards key species, often based on popularity, such as terrestrial bird species, rather than on iwi priorities. As a consequence, iwi and hapū were faced with the difficult decision of compartmentalising their mātauranga (knowledge) and targeting protection efforts when and where they could.

Overtime, *Te Reo o Te Repo – The Voice of the Wetland* took on a life of its own, and we realised that we needed to promote priorities identified by Māori that were being overlooked due to the national prioritisation and decision-making frameworks at the time. We reflected on kōrero shared within our mahi (work programmes), or read in literature, and realised that our repo were asking us to consider the 'big picture'.

As a result, we decided to highlight some of the lesser appreciated native wetland species such as noke (earthworms; various species), ruru (morepork; koukou, rurukoukou; *Ninox novaeseelandiae*), and kawau (black shag; *Phalocrocorax carbo*), and even diatoms – microscopic aquatic organisms – zooplankton. Interspersed with this are narratives on herbicidal versus manual control of weed species, and wetland restoration according primarily to a broader Māori worldview. This handbook provided a much-needed space to record lived experiences and observations.

Te Reo o Te Repo – The Voice of the Wetland was launched on World Wetlands Day (2 February 2017), and the conversation that was started between our people and their wetlands and wider freshwater systems gradually became louder and louder. We are not sure of the role this handbook played in encouraging this conversation. We would like to think it might have connected multiple, wide-reaching conversations that helped reveal centuries-worth of interactions and environment-human resilience, as well as highlighting the value of traditional knowledge in better understanding the needs of our repo.

Kuta woven into a small kete (kit) made with split kuta remnants. Photo: Mieke Kapa

Harakeke woven into a wahakura (bassinet for infants). Photo: Sue Scheele

Te Reo o Te Repo – The Voice of the Wetland was launched on World Wetlands Day 2017 at Lake Rotopiko, Waikato. Event was hosted by the National Wetland Trust. Co-editor Yvonne Taura is pictured with Keri Thompson, General Manager of Ngāti Hauā Mahi Trust. Photo: National Wetland Trust

Women fish for matamata on the Waikato River near Tuakau, Waikato. Photo: Te Ara – The encyclopedia of New Zealand

Hon. Eugenie Sage, Minister of Conservation 2017-2020), receives a copy of *Te Reo o Te Repo – The Voice of the Wetland*. Pictured alongside Mahuru Wilcox, Yvonne Taura, and Beverley Clarkson. National Wetland Trust symposium 2018, Napier. Picture: Supplied by Yvonne Taura

HANDBOOK NUMBER THREE
TE REO O TE REPO – KEI KONEI TONU AU

The Voice of the Wetland – I am still here

Yvonne Taura, Cheri van Schravendijk-Goodman, and Beverley Clarkson

Te Reo o Te Repo – Kei konei tonu au: The Voice of the Wetland – I am still here is the third of the wetland handbook series. Our intention was to continue advocating the voices of our repo through the voices of our people and we were prompted by a tohu (sign) from our kaitiaki (guardian) – he tuna (freshwater eel; *Anguilla* spp.). Recognising that our repo are still sadly declining, we felt we needed to maintain their presence in national conversations. *Te Reo o Te Repo – Kei konei tonu au* gifted its name as our mahi progressed, and the handbook was published in 2021.

Throughout 2020, the worldwide pandemic COVID-19 wreaked havoc on global social and economic infrastructure. Wetlands also suddenly dominated discussions with respect to:

- climate change – as important repositories for carbon sequestration
- land use and sustainability – in the provision of ecosystem services such as nutrient attenuation and flood mitigation
- retention of important biodiversity – as biodiversity hotspots and buffers
- the health and well-being of freshwater and marine ecosystems – as important buffers for land-based activities and sea-level rise.

Te Reo o Te Repo – Kei konei tonu au reminds us of the wetland systems, landscapes and interconnections that we once had, and what we are at risk of losing. The continued lack of recognition for local knowledge in relation to this loss feature throughout the handbook. The most notable observation was the decline in understanding te whakapapa o te repo – the broad relationships and connections between repo and wai (water), repo and whenua (land), and more important, repo and tāngata (people). We continue to watch the sad interplay between economics and environment, with wetlands often losing out to a financially driven line between tāngata and te taiao (natural world).

It is, however, encouraging to think the tide may finally be turning, with provisions for protection of wetlands included in the new Essential Freshwater package. This package includes the National Policy Statement for Freshwater Management 2020 (NPS-FM 2020), which has policies to avoid further loss of natural inland wetlands, protect wetland values, and promote wetland restoration.

Decline in local knowledge was originally noted in the development of *Te Reo o Te Repo – The Voice of the Wetland* but became obvious when the editorial team began compiling *Te Reo o Te Repo – Kei konei tonu au*. This was very much the case when we elected to include chapters on native wetland plant and animal species that once dominated our wet-scapes and featured in traditional accounts of tangata whenua life in Aotearoa. As we began to explore those recollections, we found 'knowledge short-circuits'where the accounts suddenly disappeared or were limited. Due, we believe, to the loss of whenua (raupatu – confiscation) and resources suffered by tangata whenua in the late 19th Century, including the suppressing of unique tribal mita (dialects) and te reo (language). Widespread conversions of wetlands to pasture, and associated hard engineering of river systems to accommodate land conversions and other human activities (e.g. hydroelectricity) followed. It is not hard to trace how knowledge and language were initially forced underground, and then began to dissipate with the significant modification of the environment and the passing of our cherished kaumātua (elders).

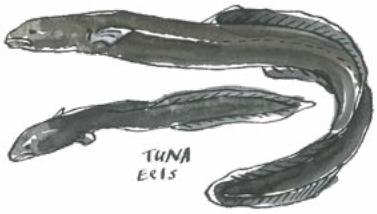
As we advocate to see greater positioning of mātauranga Māori (Māori knowledge) within environmental management decisions throughout Aotearoa, we continue to lose mātauranga as valued native species and natural habitats disappear. Thankfully, we managed to recover some suppressed mātauranga for this handbook, offering some confidence that indigenous knowledge can be revealed if prompted carefully. We are even more heartened by the moves of iwi and hapū to examine and explore their own mātauranga, and in doing so, inspired the crafting of chapters that we hope encourage journeys for others.

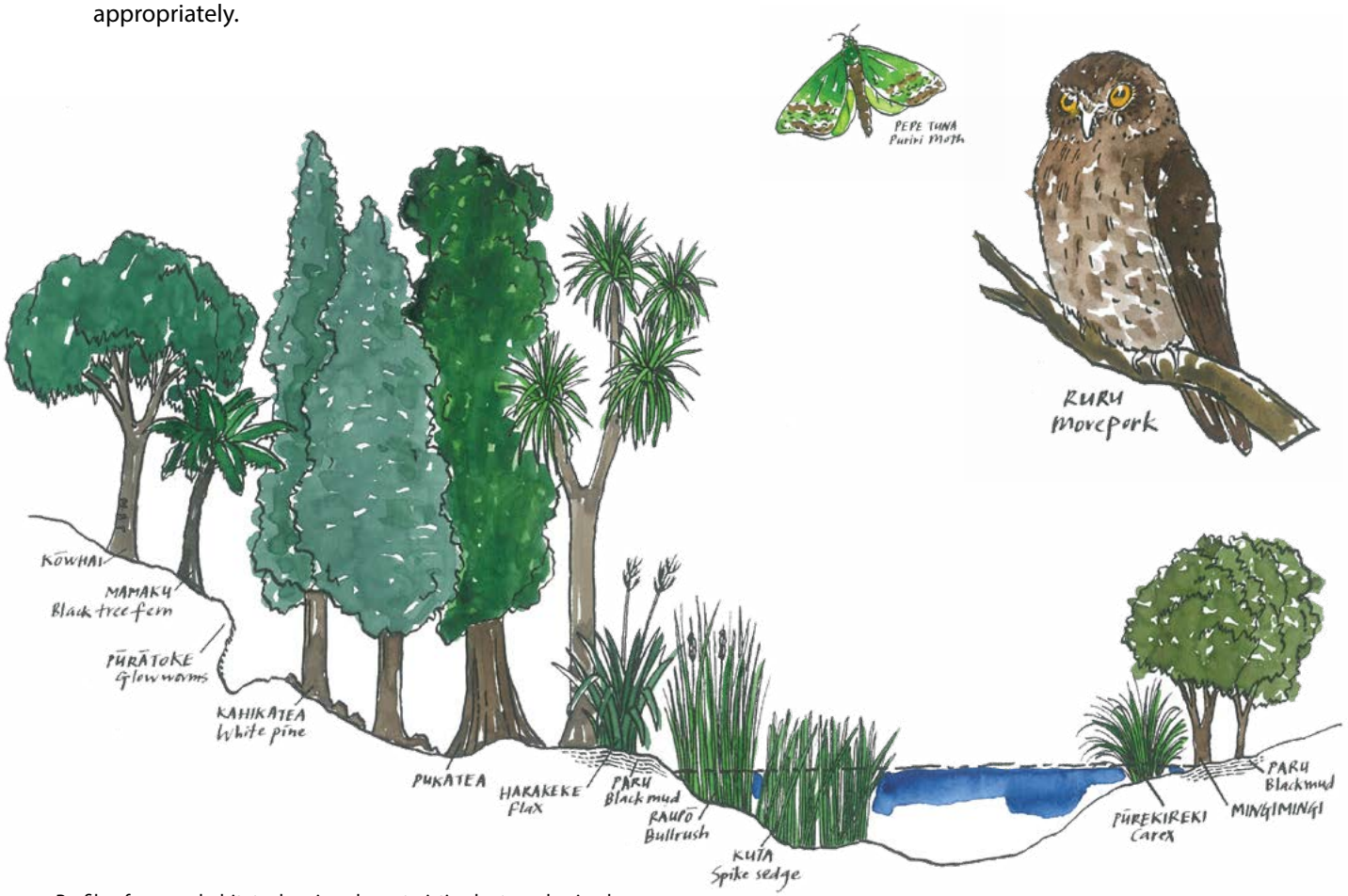
More than just a handbook – the process of people and cross-cultural collaboration

Te Reo o Te Repo – Kei konei tonu au reveals that nothing is ever truly lost. Knowledge recovery and its application, however, rely on three elements:

- rediscovery of knowledge is guided by tangata whenua
- leaders both within Te Ao Māori (Māori world view) and Te Ao Pākehā (mainstream world view) with the patience, trust, and understanding to continue the journey
- the support for collaboration to bring together the best teams of people to uncover knowledge appropriately.

Wetland Restoration – a handbook for freshwater systems focussed on wetland restoration from a biophysical perspective. ***Te Reo o Te Repo – The Voice of the Wetland*** was centred on reconnecting relationships between wetlands and people. ***Te Reo o Te Repo – Kei konei tonu au*** is about hope. It encourages us to recognise the importance of existing wetlands and to build on our remaining indigenous biodiversity and their habitats, by using our own mātauranga gifted to us from our tūpuna (ancestors), ngā taonga tuku iho o ngā tūpuna.





Profile of swamp habitats showing characteristic plants and animals.
Illustrations: Monica Peters

TE HAERENGA O NGĀ PUKAPUKA REPO
DEVELOPING THE WETLAND HANDBOOK SERIES

Knowledge affiliation refers to those with whom the knowledge resides. For some projects this may focus on western science experts in wetland ecology. Ecology is the study of the relationships between living organisms and their physical environment to understand ecosystem functioning. It also includes more reductionist, bottom-up approaches where the repo is broken into its components to better understand how the 'bits work', e.g. different nutrient acquisition mechanisms of co-habiting species that enable each to thrive in nutrient-deficient conditions. Restoration best practice, through a western science lens, involves bringing the bits back together to re-instate appropriate biota, environment and their interactions.

Knowledge from a mātauranga Maori lens is often considered more inclusive and holistic by adding additional and different dimensions, e.g., practices, observations, and knowledge transfer that informs the interactions between people and place. There are tangible benefits for integrating both western science and cultural approaches to restoration, resulting in much enhanced outcomes for the health and well-being of our repo and our people.

Many restoration practitioners work to an invisible timer attached to what feels like a pressure cooker. We feel the urge to move fast, however our presence on this earth is also much shorter than the lifetime of the natural environments in which we are attempting to work. Trying to test or 'fix'something is constrained not only by the resources available, but also by the length of time it might take for a system to change in either a positive or negative way. For some processes this can take tens, or even hundreds of years, i.e. intergenerational. This can make the lifespan of an individual human researcher feel very insignificant in the greater scheme of things. Through the narrative of those who went before us, however, we do have the benefit of hindsight, an often-unappreciated gift.

As alluded to in the wetland handbook series, local knowledge is the key to better understanding how to navigate the challenges of restoration and protection of our repo. In this regard, those who hold centuries of connection to a landscape and its resources are important architects in building the necessary holistic evaluation and decision-making framework for those spaces. In other words, they hold the key to seeing the 'pieces'as a whole. We must ensure, though, that we do not presume we have a right to claim that knowledge on the basis that we think it will help.

Crafting the wetland handbook series has demonstrated that access to local – especially indigenous – knowledge comes through a careful process of relationship building that should not be time-bound. Developing meaningful relationships requires a long-term commitment from all parties, over multiple years, and involves patience, trust, and understanding.

Kaitiakitanga at work – community support for the lake environments, Te Hiku schools planting day, Lake Onepū, Te Tai Tokerau (Northland). Photo: © Rawhitiroa Photography

TE HAERENGA TIKA
THE RIGHT PROCESS

Based on our collective experience, we have identified important elements for developing the wetland handbook series:

- Co-identifying a need for cultural knowledge – Māori wetland values
- Being clear with all parties about boundaries and expectations – the roles of everyone involved
- Building trust among ourselves, and with authors and contributors – the benefits of collaboration
- Having a shared vision – with authors and contributors in wetland restoration
- Ensuring equity in decision-making for how knowledge should be shared – controlled by authors and contributors
- Broadening the influence of the wetland handbook series – appealing to younger audiences (future kaitiaki) in our communities
- Evaluation and feedback of the wetland handbook series – monitoring the website and continued demand from the public.

Table 1 provides more detail of the journey taken to create the *Te Reo o Te Repo* cultural wetland handbook series.

Tauira from Taupiri School helping to restore their local Whangamaire Wetland, Waikato. Photo: Manaaki Whenua

Table 1: Te haerenga o ngā pukapuka repo – the journey of the *Te Reo o Te Repo* cultural wetland handbook series

Action	What did we do?	Who was involved?	Result
Co-identification of a need for cultural knowledge ***Where to find stories from tangata whenua about their repo?***	• A cultural knowledge gap was co-identified	• Waikato-Tainui technicians and tribal members • Manaaki Whenua wetland researchers • Authors and contributors – whānau, hapū and iwi, and researchers and scientists • External peer-reviewer and graphic designer	• Co-produced cultural wetland handbooks: *Te Reo o Te Repo – The Voice of the Wetland* and *Te Reo o Te Repo – Kei konei tonu au*
Clarity about boundaries and expectations ***Who does what, when, and why?***	• Discussions of intent for the cultural wetland handbooks with Waikato-Tainui • Formalised proposed outcomes • All boundaries and expectations were revisited at every stage	• Waikato-Tainui technicians • Editing and design teams – both wāhine Māori and Pākehā with a shared passion for repo • Authors and contributors	• Waikato-Tainui: acknowledging their role as co-designers of the *Te Reo o Te Repo* series • Editing and design teams: regular hui and clear communication • Authors and contributors: clear process of control over chapter content

Action	What did we do?	Who was involved?	Result
Building trust ***What are the co-benefits of working together?***	• Regular hui and clear communication • Agreed on control of process: authors control over chapter content and intent; editors/ design team ensure consistent format and style • Recognised author contributions with a koha (gifting) of a printed hardcopy	• The editing and design teams • Authors and contributors	• For some authors and contributors: their chapter was their first publication • For others: the handbook provided much recognition that they were not alone on their journey • The collaboration resulted in cultural wetland handbooks that were relatable to a wider audience
A shared vision ***Why, and for whom are we doing this?***	• Created a space to share kōrero • Reached out to whānau, hapū and iwi undertaking wetland restoration • Extending to researchers and scientists working in fields connected to wetland systems	• The editing and design teams • Authors and contributors • Feedback from readers and users of the wetland handbook series	• Important for readers to see themselves in the content • Promoting stories 'through the voices of authors'and 'the voices of their people and cultural landscapes'
Equity in decision-making, particularly knowledge sharing ***Who decides what?***	• Co-identified ideas and aspirations with authors and contributors • Ensured authors and contributors controlled the sharing of what (knowledge) and how (language) • Shared priority-setting within editing team based on feedback of previous wetland handbooks	• The editing and design teams • Authors and contributors • Feedback from readers and users of the wetland handbook series	• Ensured authors and contributors had full control over their chapters: content (knowledge and language), images, and layout • Permissions sought with relevant owners of copyright and intellectual property • Lead authors were first point of contact
Broadening the influence of the wetland handbook series ***What other ways can these stories be shared?***	• Transformed knowledge for educational purposes – appeal to younger audience	• The editing and design teams • Authors and contributors • Science educators – Science Learning Hub • Maori educators and translator • Feedback from kura and kaiako	• Developed a suite of bilingual digital educational wetland resources from a Te Ao Māori perspective • Suitable for kura kaupapa Māori (Māori language immersion) and mainstream schools throughout Aotearoa • Ensured relevant authors and contributors were involved to guide and support development • Permissions sought with relevant owners of copyright and intellectual property
Evaluation and feedback of the wetland handbook series ***How do we know we have hit the mark?***	• The wetland handbook series are available online and free to download. Monitoring web page usage and collection of statistical data suggests regular activity • Hard copies of the wetland handbook series are distributed to tribal members, wetland managers, government agencies, and community groups.	• Whānau, hapū, iwi, and tribal members • Wetland landowners and managers • Wider public of Aotearoa	• Enhanced health and well-being of repo and associated communities as a result of using the wetland handbook series • Greater appreciation and understanding of cultural wetland values • Demand for reprinting of the handbook series

WHERE TO NEXT?

Our role as the editing team was to promote and raise awareness of wetland values through sharing Māori knowledge, perspectives, priorities and aspirations, and restoration approaches from kaitiaki (guardians) and kairangahau (researchers) around the motu (country). More recently, collaboration with Pokapū Akoranga Pūtaiao (Science Learning Hub), a team of experienced web-based science educators, produced a suite of bilingual digital educational wetland resources drawn extensively from Māori-led wetland research in the ***Te Reo o Te Repo*** cultural wetland handbook series. The Hub team were actively seeking opportunities to showcase mātauranga Māori driven science research to meet the growing demand from kaiako (teachers) to understand Te Ao Māori relating to Te Ao Tūroa (the natural world). Our purpose was to create resources that enable understanding of wetland ecology, connect kura (schools) to their local repo, and increase engagement with science in partnership with mātauranga Maori. Such understanding and involvement will encourage kaiako, tauira (students), and whānau to become effective kaitiaki of repo in Aotearoa.

The continual sharing of wetland cultural narratives belongs now to the champions of future wetland restoration projects – our tamariki (children), mokopuna (grandchildren), rangatahi (youth), kaitiaki and local communities. Never underestimate the wisdom of our younger generation – they absorb and observe more than we realise. When designing hui (gatherings) with tangata whenua, and with the guidance of the hapū, whānau and iwi, make sure tamariki and rangatahi are accommodated and engaged in the discussions.

For those seeking to help communities play a stronger role in the decision-making for wetland restoration and protection, we return to this guiding whakatauākī (proverb):

Mehemea ka moemoeā ahau, ko ahau anake. Mehemea ka moemoeā tātou, ka taea e tātou

If I dream, I dream alone. If we dream together, we can achieve

Princess Te Puea Herangi (Waikato)

The importance of developing a wetland handbook series became obvious for a number of communities – both Māori and Pākehā. This wetland series enabled us to capture the shared narratives and experiences of all parties and create resources that told the story of our repo more equitably. We could not have achieved our vision without the many whānau, hapū and iwi, and experts (both Māori and Pākehā) who offered to contribute to this kaupapa (project). Our repo were calling for help and we have tried to raise their voices, either through the voices of their affiliated people, or the voices of the plant and animal species that are dependent on these repo.

Our repo are still here…
they are worth fighting for!

Hon. Eugenie Sage, Minister of Conservation 2017-2020, visits tauira at Taupiri School, Waikato, to discuss the importance of wetlands and their restoration. Photo: Manaaki Whenua

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Peters M, Clarkson B 2010. *Wetland Restoration: A Handbook for New Zealand Freshwater Systems.* Lincoln, New Zealand: Manaaki Whenua Press. https://www.landcareresearch.co.nz/publications/wetland-restoration

Taura Y, van Schravendijk-Goodman C, Clarkson B eds 2017. *Te Reo o Te Repo – The Voice of the Wetland: Connections, understandings and learnings of our wetlands.* Hamilton, New Zealand: Manaaki Whenua – Landcare Research and Waikato Raupatu River Trust. https://www.landcareresearch.co.nz/publications/te-reo-o-te-repo

Taura Y, van Schravendijk-Goodman C, Clarkson B eds 2021. *Te Reo o Te Repo – Kei konei tonu au. The Voice of the Wetland – I am still here.* Hamilton, New Zealand: Manaaki Whenua – Landcare Research. https://www.landcareresearch.co.nz/publications/te-reo-o-te-repo-kei-konei-tonu-au

Useful websites

Essential Freshwater package
https://environment.govt.nz/what-government-is-doing/areas-of-work/freshwater/e/freshwater-reform

National Policy Statement for freshwater management
https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-freshwater-management

Educational resources

EnviroSchools
https://enviroschools.org.nz

Fish and Game
https://fishandgame.org.nz/education/wetlands-activities

Manaaki Whenua
https://www.landcareresearch.co.nz/discover-our-research/biodiversity/species-and-ecosystem-conservation/restoring-wetland-ecosystem-functioning

National Wetland Trust
https://www.wetlandtrust.org.nz/what-we-do/resources

Science Learning Hub – Pokapū Akoranga Pūtaiao
Resources in te reo Māori
https://www.sciencelearn.org.nz/images/4473-tuihonoa-te-reo-o-te-repo
Resources in te reo Pākehā
https://www.sciencelearn.org.nz/resources/3001-repo-wetlands-a-context-for-learning

Te Papa Atawhai
https://www.doc.govt.nz/get-involved/conservation-education/resources/wetland-life

Whitebait Connection
https://www.whitebaitconnection.co.nz

Contact details for Yvonne Taura

Email: tauray@landcareresearch.co.nz

2.
TIAKI MANAAKITIA TE TĀNGATA, TIAKI MANAAKITIA TE TAIAO
RESILIENCE OF PEOPLE AND ENVIRONMENT

KERI THOMPSON (NGĀTI HAUĀ),
WAIKOHU KEELAN (NGĀTI POROU)

Me wehi ki te Atua – Me whakahōnore te Kīngi Māori – Ka puta ka ora

To fear God is the beginning of wisdom, to honour the king is unity

Wiremu Tāmihana Tarapīpipi Te Waharoa (Ngāti Hauā)

I konei ngā kupu o te Kaiwhakawahi Kīngi a Wiremu Tāmihana Tarapīpipi Te Waharoa taenoa mai ki tana tamaiti a Tupu Taingakawa te Tumuaki o te Kīngitanga.

These are the words of the first Kingmaker, Wiremu Tāmihana Tarapīpipi Te Waharoa and all of the Kingmakers since, including his son Tupu Taingakawa.

Values (shown in a word cloud) important to whānau interviewed for the Ngāti Hauā Wetland Mauri Framework project 2019. Photo: Ngāti Hauā Mahi Trust

Previous page: Kaitiaki in training, tamariki of Ngāti Hauā working in the nursery, Morrinsville. Photo: Ngati Hauā Mahi Trust

Restoration planting at Pukemoremore Wetland. Photo: Ngāti Hauā Mahi Trust

Ehara te toa o te kaupapa nei i te toa takitahi, he toa takitini. Nā whero, nā pango i oti ai te mahi, i whaongia tēnei kete mātauranga, ā, he kai kei ēnei ringa. Nō reira, e te hapai ō, e kore te puna mihi e mimiti.

We would like to acknowledge our kaumātua and whānau (past and present) of Ngāti Hauā that worked tirelessly within the Ngāti Hauā rohe to establish the kaitiaki journey we are privileged to be on today. Our strength comes from being supported by our whānau, hapū, and iwi that whakapapa to our marae of Ngāti Hauā: Rukumoana, Kai a te Mata, Raungaiti, Waimakariri, and Te Iti o Hauā.

We are humbled to be guided by the wisdom of our Trustees that reflect the Ngāti Hauā iwi, church, and community partnerships established in 2010. Ngāti Hauā iwi: Mr Anaru Tarapīpipi Te Awataia Thompson ONZM (Chair), Mr Haki Wirihana, and Mr Kaka Hoani. Anglican Church: Archbishop Sir David Moxon KNZM CSTJ and Canon Pine Campbell. Community representatives: Mr Hugh Vercoe ONZM, QSM ED JP (Vice Chair) and Mrs Debbie Nowell JP.

Thank you to past Trustees and kaimahi: Mrs Te Ao Marama Maaka, Mrs Linda Raupita, Mr Hone Pene, Te Maapi Simich-Pene, Te Aroha Drummond, and Weka Nightingale-Pene.

We would also like to acknowledge all the funders and those key individuals in those organisations who have supported the Trust over the years. Our vision: ***the growing of plants and of people*** – to train kaimahi to become kaitiaki and grow native plants to strengthen and restore our taiao is becoming a reality because of your aroha, manaaki, and tautoko. Thank you: Ngāti Hauā Tribal Trust, Ngāti Hauā Iwi Trust, Waikato-Tainui, Waikato River Authority, Anglican Action, Mercury Energy, DV Bryant Trust, Trust Waikato, Len Reynolds Trust, Te Puni Kōkiri, Te Papa Atawhai (Department of Conservation), Waikato Catchment Ecological Enhancement Trust, Taihoro Nukurangi (NIWA), Te Manatū Whakahiato Ora (Ministry of Social Development), Te Kaunihera ā Rohe o Waikato (Waikato Regional Council), Te Kaunihera o Kirikiriroa (Hamilton City Council), Te Kaunihera ā Rohe o Matamata-Piako (Matamata-Piako District Council), Te Kaunihera ā Rohe o Waipā) Waipā District Council, and Manaaki Whenua – Landcare Research.

Tēnei anō te tuku mihi ki a koutou.

– Ngā mihi, nā Keri māua ko Waikohu

BUILDING RESILIENCE IN A CHANGING WORLD

When we were first asked in mid-2019 to write a chapter for *Te Reo o Te Repo – Kei konei tonu au*, about the journey of Ngāti Hauā Mahi Trust, we felt very confident that our story could inspire others. Talking about what we love, live, and breathe everyday sounded pretty easy! We were in the middle of another successful year with our two nurseries at Morrinsville and Mangateparu in the Waikato region. We participated and managed projects that were meaningful to our people – with repo (wetlands) restoration especially increasing. Our mahi (work) had received national recognition with the NZ Biosecurity – Te Puni Kōkiri Māori Award, and the NZ Plant Conservation Network Award, which confirmed that the guidance set by our tūpuna (ancestors), and upheld by our trustees, was on track.

But towards the end of 2019, our industry, leaders, and communities noticed something astray offshore. By early 2020, we watched as countries struggled with the global pandemic we all came to know as COVID-19. We watched helplessly as the virus hit our shores and our Prime Minister, Rt Hon Jacinda Ardern, moved Aotearoa New Zealand into an urgent lockdown to protect our borders and susceptible communities. While our 'Team of 5 million' successfully held the virus at bay, the impacts on businesses, including ours, were significant. This was because we were only to engage in work that was considered 'essential' to the health and emergency services or for supply of food, water, and power.

Planting native trees was not considered to be an essential service. So, like other small businesses, we began to fret about how we were going to keep thousands of plants alive, whether our contracts were going to be halted due to budget tightening, and, more important, ensuring our kaimahi (staff) could continue to keep food on their table and a roof over their heads.

Coronavirus headlines from March 2020 in Aotearoa New Zealand. Source: The New Zealand Herald

Suddenly, our story took a sharp turn left (or maybe even right) as we navigated what felt at the time to be a very new and challenging situation.

It dawned on us, however, that our people have been here before – invasions from the Settler Government in the early 19th Century and followed closely by Raupatu (confiscation of Māori lands) came immediately to mind. We had even lived through the last pandemic in the early 20th Century, the Spanish Flu in 1918. Despite all odds, our people, and our enterprises have endured. Why? Well, that is the story we would like to share with you now.

Weeds outgrowing the native plants during the Covid-19 lockdown, Mangateparu nursery. Photo: Ngāti Hauā Mahi Trust

Kaimahi practicing 'work bubble' and 'social distancing' practices for the first planting job after Covid-19 restrictions allowed them to plant again, Mangateparu nursery. Photo: Ngāti Hauā Mahi Trust

NGĀTI HAUĀ

Titiro mai ngā kōhatu o Ngāti Hauā

Mai Te Aroha maunga mai i Te Raki, tērā a Tamaterā ngā kaitiaki

Titiro ki Tai Rawhiti, Ngāti Maru tēna

Tōna kōrero mai Te Aroha ki Katikati ki ngā kurī a whārei ki tikirau

Te Hauāuru mai Te Aroha ki Taupiri, tēnā ā Ngāti Paoa, me Wairere

Titiro mai ki te tonga Te Aroha ki Wairere, tēnā ā Ngāti Hauā e mihi mai nei

Titiro ki Wairere ki Maungatautari

Ka huri ahau ki Te Pātetere ki Raukawa te Ihingarangi o Ngāti Korokī ngā kaitiaki o tēnā maunga

Engari, titiro ki Maungatautari ki Te Raki ki Taupiri e ngunguru e mihi mai nei

Ngāti Hauā i waenganui ko tōna kōrero, he piko he taniwha, te maunga o ngā Kīngi

Look to my mountain rocks from
Te Aroha to the North

I see the hapū of Tamatera
people of the land, the caretakers

Look to the beginning of the sun to the East, Ngāti Maru, Ngāti Pukenga, from

Te Aroha to Katikati as people of the land and the caretakers, from the howling dogs of Te Arawa

Te Arawa to the outskirts of Mātaatua
we humbly beseech thee

Look to the West, from Te Aroha to Taupiri,
Ngāti Paoa, Ngāti Wairere

Look to the South Te Aroha to Wairere,
Ngāti Hauā we greet you within

Look to the western side from Wairere to
Maungatautari amongst our neighbours

Te Arawa, Mātaatua, Ngāti Raukawa
Te Ihingarangi o Ngāti Korokī

Look to the North from Maungatautari
to the mountain of Kings, Taupiri

– Eru Kaukau (Ngāti Hauā)

This tauparapara – ***Ngā kōhatu whakatū mai te rohe o Ngāti Hauā – The rocks that establish the territory of Ngāti Hauā***, is an oral explanation of the historical geography of Ngāti Hauā which is largely defined by significant landmarks, predominantly the location of maunga (mountains) – Te Aroha, Maungatautari, and Taupiri. The tauparapara (poetic chant) also acknowledges the maunga and the neighbouring iwi and hapū in which Ngāti Hauā share these borders (Fig. 1).

Howarth Memorial Wetland and Mt Te Aroha.
Image: © Maurice Photography

KO NGĀTI HAUĀ TE IWI
WHO WE ARE, WHERE WE'VE BEEN, AND WHERE WE'RE GOING

Ā, hoki mai te mauri ki te awa.
Ka haere mai te wairua o te oranga
i runga i te tāngata.

Returning life force to the river.
When life force returns to the river,
the spirit of good health returns to the people.

– Reverend Haki Wirihana (Ngāti Hauā)

For more than 4 centuries Ngāti Hauā have inhabited the lands and tributaries within a rohe (tribal area) that extends from the eastern suburbs of Hamilton City to Te Aroha on the eastern Hauraki Plains. Whānau (families) of Ngāti Hauā whakapapa (descend) to five marae and hapū (sub-tribes) within this rohe: Rukumoana Marae (Ngāti Werewere), Kai a Te Mata Marae (Ngāti Werewere), Raungaiti Marae (Ngāti Te Oro, Ngāti Rangi Tāwhaki), Waimakariri Marae (Ngāti Waenganui), and Te Iti o Hauā Marae (Ngāti Te Rangitaupi) (Fig. 1). Kaitiakitanga continues today with kaitiaki representatives appointed by each marae.

Traditionally, Ngāti Hauā thrived living off kai (food) grown on the whenua (land) and sourced from the awa (rivers and streams). We were leaders in the kai industry and known for supplying kai regionally, nationally, and internationally. Therefore, our interactions were facilitated by generations of experience and observations with our taiao (environment).

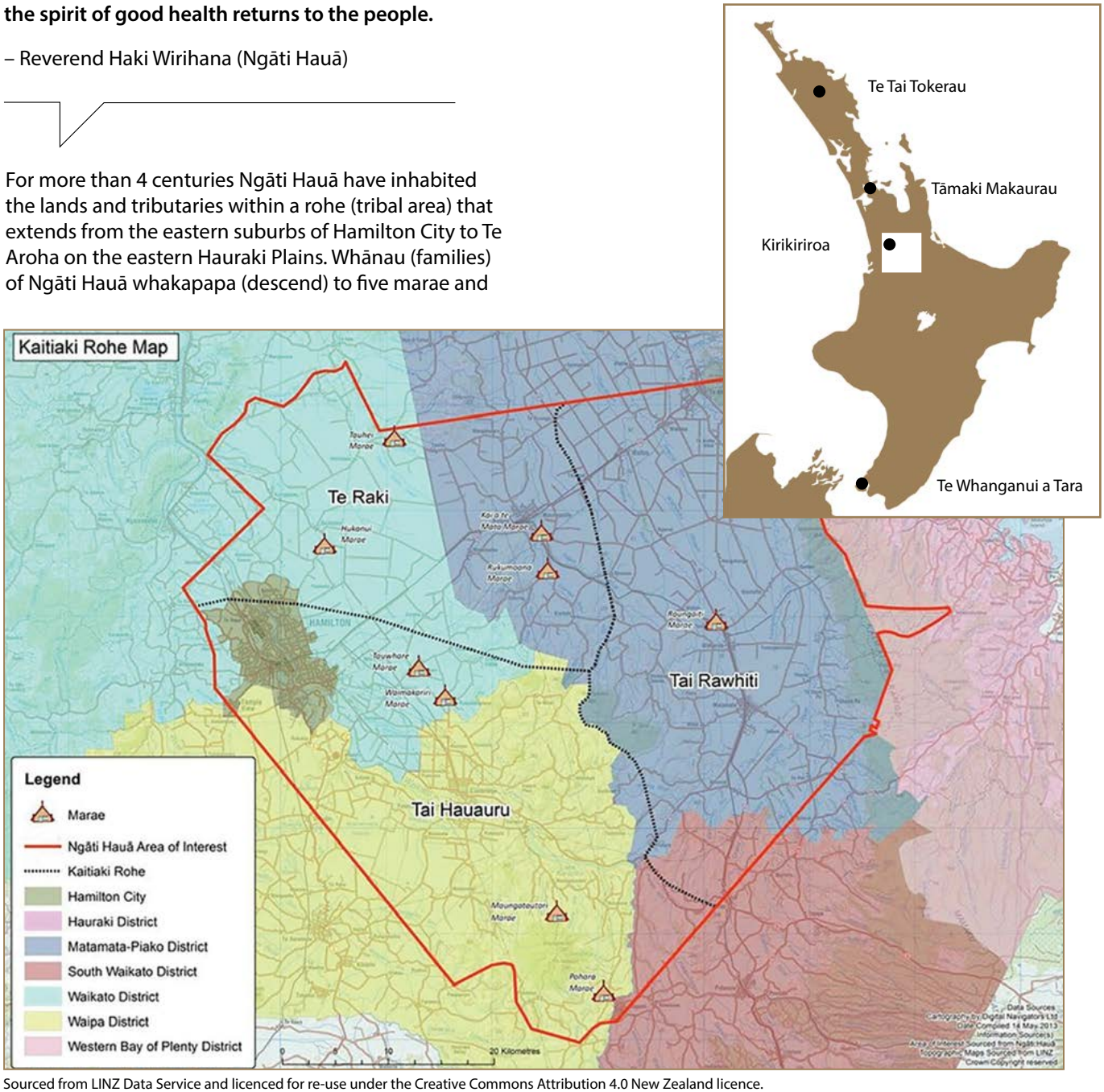


Figure 1. Map of Kaitiaki Rohe o Ngāti Hauā shows the tribal area of interest, kaitiaki rohe, marae within the rohe, and local district council areas. Source: Ngāti Hauā Iwi Trust

The catchments within Ngāti Hauā, including Mangaonua and Mangaone Streams (Fig. 2), were large repo (wetlands) that connected Ngāti Hauā to other iwi (tribes) within the Waikato and were considered important travelling routes. The catchments were also important kete (baskets) for rongoā (medicinal) gathering areas for surrounding marae, as well as puna kauhoe (recreational swimming holes) for local tamariki (children) and whānau. Repo provided a variety of natural and man-made defences from weather and natural erosion, as well as being a safe haven in times of war.

With colonisation in the mid-19th Century and the development of the industrial world, Ngāti Hauā marae, hapū, and iwi became disconnected culturally and spiritually from our Tupuna Awa o Waikato (Waikato River), devastating their sense of identity and belonging. Despite this, our mātauranga (knowledge) and tikanga (customary values and practices) handed down from our tūpuna give us a valuable 'map' for survival, ***ngā taonga tuku iho o ngā tūpuna***. These are examples of the learnings we have drawn from enhancing mātauranga about our repo and the cultural landscape we have endured for over 400 years. We need to reclaim our mātauranga, trust in our knowledge and experience, and not lose sight of what is important.

RESILIENCE LESSON #1

Our tūpuna gifted us the guidance we need to keep moving forward based on generations of experience – *ngā taonga tuku iho o ngā tūpuna*. Trust in that.

Kaimahi planting on the upper Mangaonua catchment, as part of a One Billion Trees shovel ready project, in partnership with the Waikato Regional Council. Photo: Ngāti Hauā Mahi Trust

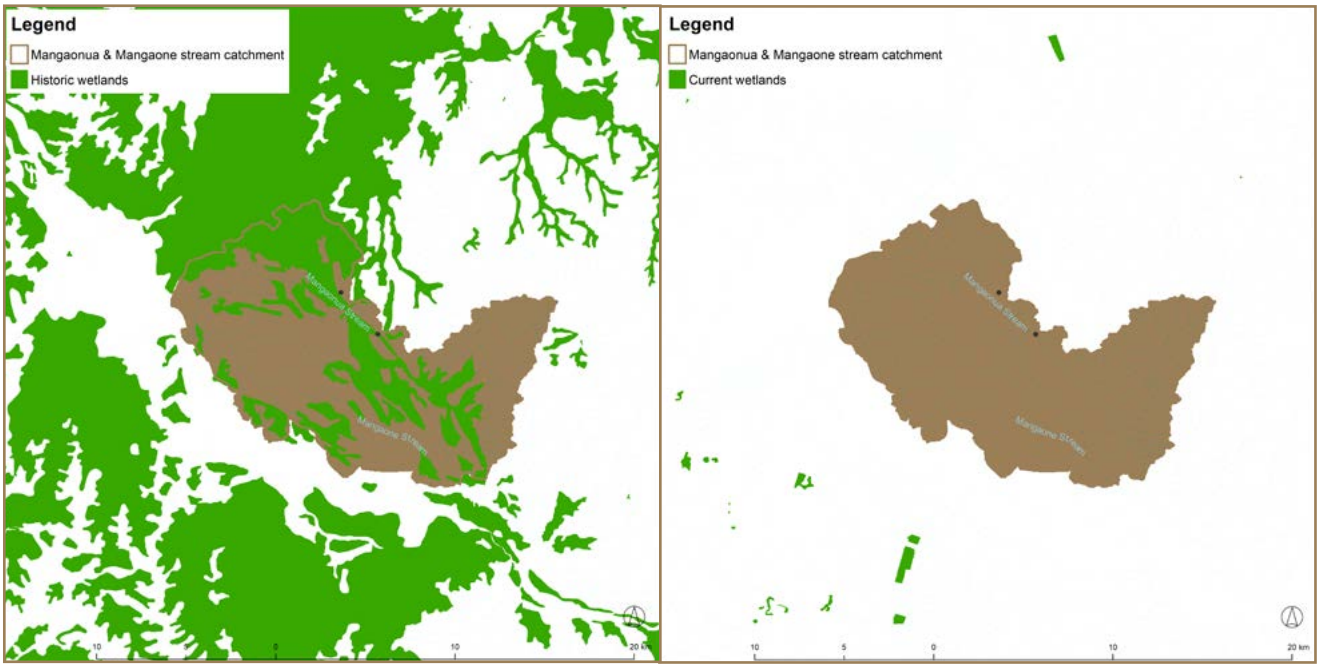


Figure 2. Maps of wetland historic (1840) and current (2008) extent (represented in green) in the Mangaonua and Mangaone stream catchments, Waikato. Adapted from Ausseil et al. 2008, Manaaki Whenua – Landcare Research

THE VISION OF WIREMU TĀMIHANA TARAPĪPIPI TE WAHAROA

Te whakapono, te ture, te aroha

Be steadfast in faith in God, uphold the rule of law, and show love and compassion to all

Ngāti Hauā Mahi Trust is an iwi-based initiative, dedicated to work in the rohe of Ngāti Hauā for the renewal of the environment through ***the growing of plants and of people***. The Trust is inspired by the vision of the prophetic chief and statesman of Ngāti Hauā, Wiremu Tāmihana (1805–1866), also known as Tarapīpipi Te Waharoa, who was the second son of paramount chief, Te Waharoa. Wiremu Tāmihana was a peacemaker who had a vision of a future for Aotearoa New Zealand.

Rangatiratanga, kaitiakitanga, manuhiritanga

Chiefly rule, guardianship, and hospitality to others

Ngāti Hauā Mahi Trust is inspired by his example, and is peopled by his descendants, iwi representatives, and colleagues from the wider community. The trust believes that Ngāti Hauā, the iwi of Wiremu Tāmihana, and their initiatives have a key role in transforming the waterways, the land, and the people of the Ngāti Hauā rohe. Just as Wiremu reached out to his own tribe, to the church, and to the wider community for the common good, so does the Trust today.

Prophetic Chief of Ngāti Hauā, Wiremu Tamihana Tarapīpipi Te Waharoa (1805–1866), portrait by Gottfried Lindauer. Image: © Auckland Art Gallery Toi o Tāmaki, gift of Mr HE Partridge, 1915

Trustees Mr Anaru Thompson (Chair) and Archbishop Sir David Moxon (Trustee) standing next to the Ngāti Hauā Mahi Trust trailer in acknowledgment of the community and council partnerships, Morrinsville nursery. Photo: Ngāti Hauā Mahi Trust

NGĀTI HAUĀ MAHI TRUST
OUR NATIVE NURSERY

Starting small and growing our base

He whakahauhau no tātou te Ngāti Hauā Mahi Trust, hei whakatupu, hei whakapakari, hei whakanui i te hauora tāngata me te taiao

Ngāti Hauā Mahi Trust strives to grow a thriving, committed work force dedicated to enhancing the health and well-being of our environment

In 1976, kaumātua of Ngāti Hauā became concerned that many whānau were moving away from the marae to seek employment in the urban centres. Ngāti Hauā Mahi Trust was established to connect Ngāti Hauā iwi members to their local community and businesses to increase employment opportunities. In 2010, a new partnership with the Matamata-Piako District Council and the Anglican Church led to the reinvigoration of an enterprise – *a native plant nursery* – to implement those earlier aspirations of reconnecting iwi members with community for job-training and tribal employment opportunities.

In 2013, Ngāti Hauā Mahi Trust began growing native plants, specifically the pioneer or early successional plants, with a goal of producing 50,000 native plants to meet the needs of key riparian and wetland projects in Waikato. In 2020, post COVID-19, we were able to strengthen our capacity and now have three nurseries based in Morrinsville, Mangateparu, and Hautapu and annually produce over 200,000 plants of 45 native species. All the plants grown and planted by the Trust have been eco-sourced from within the Waikato ecological district areas and sourced as close as possible to where they will be planted.

The aim of the projects we undertake is to restore the health and well-being of the tributaries that run through our Ngāti Hauā rohe. These include culturally significant rivers, streams, and wetland areas that share six local district council areas – Waikato, South Waikato, Matamata-Piako, Waipā, Hauraki, and Western Bay of Plenty (Fig. 1). Te Puna o Mangaonua (Mangaonua Stream) flows into Te Tupuna Awa o Waikato (ancestral Waikato River), therefore by restoring the waterways of Ngāti Hauā with mātauranga-ā-hapū, ā-iwi (tribal knowledge) as a module for our mahi, we will be supporting the much-needed healing of our Tupuna Awa o Waikato. By engaging local iwi and communities, and local and regional government and authorities, as well as research institutions, we progress with an integrated, holistic, and coordinated approach that we believe can sustain the health and well-being of our rivers for future generations. As a result, we focus on the core native species within the Waikato as identified both through our own mātauranga, and through ecological and restoration science.

NGĀTI HAUĀ MAHI TRUST

The original nursery for Ngāti Hauā Mahi Trust, Morrinsville nursery. Photo: Ngāti Hauā Mahi Trust

Mangateparu nursery. Photo: Ngāti Hauā Mahi Trust

Hautapu nursery. Photo: Ngāti Hauā Mahi Trust

RESILIENCE LESSON #2

Whakapapa is important. Growing and planting locally eco-sourced native plant is key to strengthening the whakapapa of our repo and ngahere within Ngāti Hauā and connecting to our people.

RESTORATION IN THE AFTERMATH OF THE NATIONAL LOCKDOWN
TĀNGATA ME TE TAIAO

Tiaki manaakitia te tāngata,
tiaki manaakitia te taiao

Caring for the people,
caring for the environment

Ngāti Hauā Mahi Trust kaimahi are led by Ngāti Hauā tribal members. Since 2012, the Trust has employed 50 people either full time, part time, or casual. Many have gone on to have successful careers in their chosen professions. The year 2020 was proving to be another successful year, with contracts for several wetland and riparian restoration projects about to get under way for the planting season. In the Waikato, the lead up to this planting season coincided with the lockdown period over March of last year, meaning we had approximately 150,000 plants 'shovel ready' when we were instructed to walk away and stay home.

At no stage did we ever question the need and benefit for going into a lockdown. But, while nurseries like ours can cope with a small pause in operations, worries about the duration of the lockdown began to cause headaches for our senior managers and the stakeholders with whom we worked. There were concerns about the survival of our plants when we had to weigh up the cost of maintaining plants while people were focussed on saving lives and not contracting COVID-19. Thank goodness, **maintaining plants was an approved essential service** by Te Manatū Whakahiato Ora (Ministry of Primary Industries) and a few of us were able to work. Strict COVID practices were adhered to: 'Work in isolation or in your whānau (home bubble) when onsite, and no tamariki or kaumātua. Only touch the native plant species you were assigned to work with, only use your assigned Personal Protective Equipment (PPE), wash your hands, and stay home if sick'.

Unfortunately, **planting plants was not an approved essential service**, which meant our kaimahi were not allowed to travel to the restoration sites. There were also concerns about maintaining wages for our kaimahi in the absence of receiving business income. But perhaps the most important concern was the impact of having to disconnect our people – even if only temporarily – from the health and well-being benefits they receive working within our taiao and with their nursery whānau.

Kaimahi with their work truck at Mangateparu nursery.
Photo: Ngāti Hauā Mahi Trust

Kaitiaki in training, tamariki of Ngāti Hauā working in the nursery, Morrinsville. Photo: Ngati Hauā Mahi Trust

Planting plants in the ground is a magical experience. There is the obvious benefit to the environment in the reinstatement of indigenous flora (plants) that once cloaked the whenua and the restoration of valuable habitat for our indigenous fauna (birds, fish, and insects). However, we often take for granted the positive influences planting can have on the health and well-being of people. Among our own kaimahi, we witness increased self-esteem and confidence as they learn about the indigenous plants and ecosystems with which their tūpuna once interacted. Being witness to the transformation of kaimahi as they reconnect to te taiao is such a proud feeling. They have pride – that we as whānau feel as well – when they complete a task or action for the first time. As they continue learning about their environment, reconnecting their whakapapa to the whenua, their knowledge about themselves as a people also grows.

Their role as seed collectors, propagators, and planters is broader than that – they are actively practising kaitiakitanga – walking the talk – and providing strong leadership in the promotion of better practices and actions for our whenua. Contributing to mātauranga a-iwi and strengthening kaitiakitanga for Ngāti Hauā. Restoration of repo (as well as the ngahere (forests), wai (rivers and streams), and moana (oceans), for that matter), therefore, is also the restoration of ourselves. It was for these reasons, that we were concerned about the possible impacts if all of that was taken away from them.

Restoration planting at Pukemoremore Wetland. Photo: Ngāti Hauā Mahi Trust

We need not have worried. Among the most valuable gifts that can be enhanced in a COVID-changing world is foresight, inspired by hindsight. This happens to be something our tūpuna passed onto us through our tikanga (cultural practices), kōrero tāwhito (oral traditions), and ngā taonga tuku iho o ngā tūpuna (cultural heritage). Without foresight, we may not have been able to navigate the loneliness and isolation that came with lockdown. Witnessing nature undisturbed by human interference for those eight weeks and imagining the future world that our restoration projects were ensuring, allowed many of us to admire, reflect on, and reenergise for the time when we would be permitted outside our 2 km neighbourhood lockdown boundaries to begin a new cycle of seed collection, propagation, and planting.

RESILIENCE LESSON #3

Keep your eye on the prize – life may throw challenges, but if you keep focused on your end goal, you won't be so overwhelmed by what is currently happening.

A mokopuna of Ngāti Hauā planting a mānuka (NZ teatree) seedling at Pukemoremore Wetland. Photo: Ngāti Hauā Mahi Trust

A FINAL NOTE

Most of our readers in Aotearoa will know how it all panned out over the year following lockdown. For our nursery and others in the industry, we were supported back into mahi fairly quickly, with the reenergising of environmental-focused kaupapa (themes) and resourcing. We also believe that part of our ability to hit-the-ground-running was linked to an existing plan – Ngā Puna o Mangaonua ki Mangaone Ecological Enhancement Project. This 21-year programme of restoration action is focused on two culturally important puna (streams) – Mangaone and Mangaonua – and funded by the Waikato River Clean Up Trust administered by the Waikato River Authority. Complementing this plan was the development of our own monitoring framework, the Ngāti Hauā Wetland Mauri Framework. Both these important developments were inspired by our 'lessons of resilience', although we didn't fully appreciate that until we experienced the lockdown and the challenges it presented.

To help build your own resilience we recommend:

- **Kōrero with your whānau, kaumātua, and communities** to build a picture of what your traditional rohe looked like, and the resources, landscapes, and species that you might wish to see returned (if applicable) or enhanced.
- **Visit these places together as a whānau, to touch, feel, and smell it.** You can only give 100% to something when you know what it looks like and what the dream for it could be.
- **Map those spaces, and then put that map on the wall where you can see it** – if you keep looking at it, you can keep imagining and visualising the future for the environment and your people.
- **Build a plan** – it is important to write things down on paper so that it is recorded for those who might come later. Make sure the plan is easy to understand and is communicated in a way that makes sense to your kaimahi, whānau, and community.
- **Use time wisely to keep adding to the kete (toolkit) of your kaimahi, whānau, and community.** This might include bringing in experts, both Māori and non-Māori, working in the wetland restoration field; reading new research and approaches; and socialising and talking to others working in the industry, including site visits to other rohe to talk to their marae, hapū, and iwi.

RESILIENCE LESSON #4

The seeds you gather and nurture today, will grow into the trees that will eventually form the canopy that shelters you tomorrow. Remember where you have come from – what that feels and looks like. So that you may know where you are headed – what tomorrow should feel and look like.

Community planting day at Mangaonua Wetland. Photo: Ngāti Hauā Mahi Trust

GATHERING AND NURTURING THE SEEDS OF KNOWLEDGE
THE WETLAND MAURI FRAMEWORK

Nā Waikohu Keelan

Ngā awa itiiti e pā ana ki te wai o Waikato, ko ngā uaua o tō tātou awa. Tō tātou awa he manawa

All the little streams and rain that flow into the Waikato River are like the veins of the body. The River is the heart

– Sir Robert Mahuta (Waikato)

In 2018, Ngāti Hauā Mahi Trust formalised a research partnership with Manaaki Whenua – Landcare Research to co-develop a Wetland Mauri Framework to support wetland restoration within the Mangaonua and Mangaone Stream Catchments. This project was funded and supported by the Biological Heritage National Science Challenge, SSIF Resilient Wetlands programme – Manaaki Whenua, and the Waikato River Authority.

The Mangaonua and Mangaone Stream Catchments are located south-east of Hamilton City, Waikato region. The head-waters of the Mangaonua catchment originates between the Te Miro, Rūrū, and Maungakawa ranges and runs through to the main stem and gullies of the Te Puna o Mangaonua where it meets Te Puna o Mangaharakeke. The main stems of the Mangaone catchment originate behind Cambridge, then flow into Te Tupuna Awa o Waikato at Riverlea (Fig. 3).

Waikohu Keelan with the completed report for the Ngāti Hauā Wetland Mauri Framework. Photo: Ngāti Hauā Mahi Trust

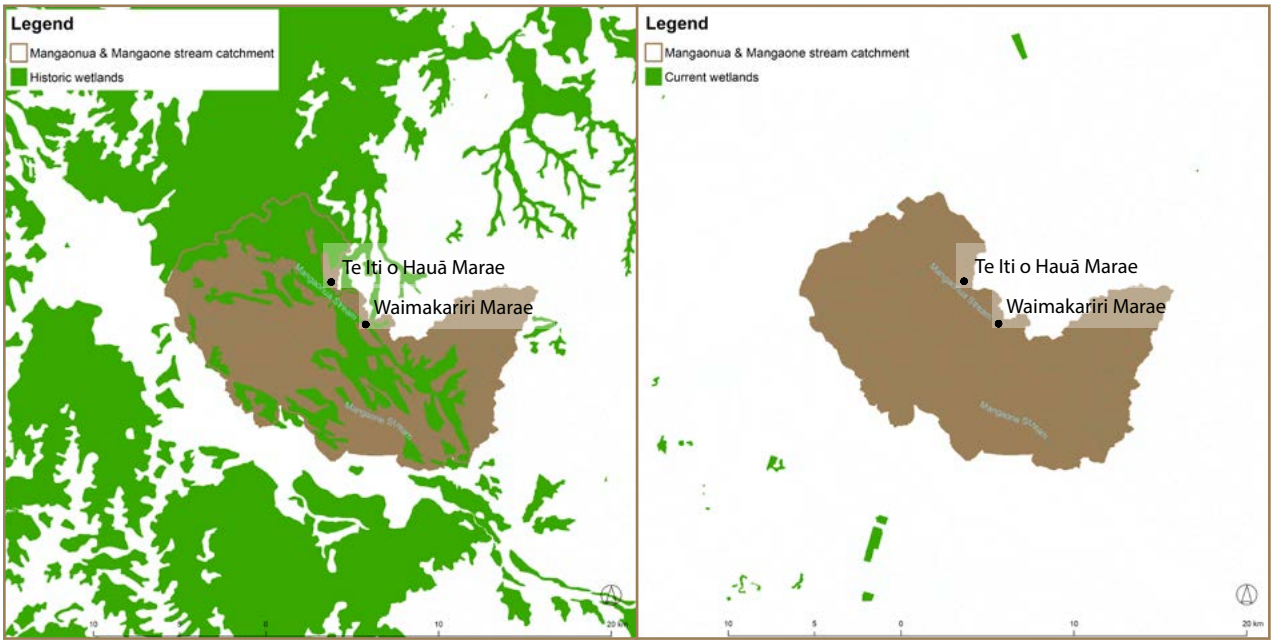


Figure 3. Maps of wetland historic (1840) and current (2008) extent (represented in green) in the Mangaonua and Mangaone stream catchments, Waikato. Te Iti o Hauā and Waimakariri Marae are located along Te Puna o Mangaonua. Adapted from Ausseil et al. 2008, Manaaki Whenua – Landcare Research

MAURI

Manawa mai te mauri nuku, manawa ai te mauri rangi. Ko te mauri kai au, nō Tuawhakarere. Ka pakaru mai te pō, ka tākiri mai ko te ata, ka kōrihi te manu.

Tihei mauri ora!

Mauri is described as the life essence of all living things, from people on the marae to the tuna (freshwater eels) in the awa, and the tūi in the kōwhai tree. All things naturally occurring in our world – awa, moana, ngahere, and maunga – have mauri. Mauri can be seen, felt, heard, and sensed as an indicator of the health and well-being of our taiao. Since the early 19th Century, we have lost 91% of wetlands throughout the Waikato region. As a consequence, the mauri of our remaining repo has depleted immensely. As kaitiaki and mana whenua (Indigenous people with primary rights and responsibilities over an area) working in environmental restoration, enhancing mauri became our focus. As we wanted to understand and measure mauri, we sought to develop the **Ngāti Hauā Wetland Restoration Mauri Framework**, which aligned with our aspirations to restore te mauri o te awa, te repo, te whenua o Ngāti Hauā.

The partnership with Manaaki Whenua supported an internship to build capacity and support a research career pathway. I was able to work alongside project leaders Yvonne Taura (Ngāti Hauā) and Mahuru Wilcox (Ngāti Ranginui, Ngāti Awa), kairangahau and freshwater wetland ecologists based at Manaaki Whenua. My internship was initially a little intimidating, as I was welcomed by learned and esteemed scientists including pedologists (soil scientists), lab and field technicians, social scientists, and kairangahau Māori (Māori researchers). I felt like a baby īnanga (whitebait) in the great ocean. I found them all inspiring as they shared their research passions, which made for an encouraging workspace. They were conscious of the state of the world, which meant the organisation was committed to making the world a better place, and that resonated well with me.

Restoration planting at Mangaonua Wetland. Photo: Ngāti Hauā Mahi Trust

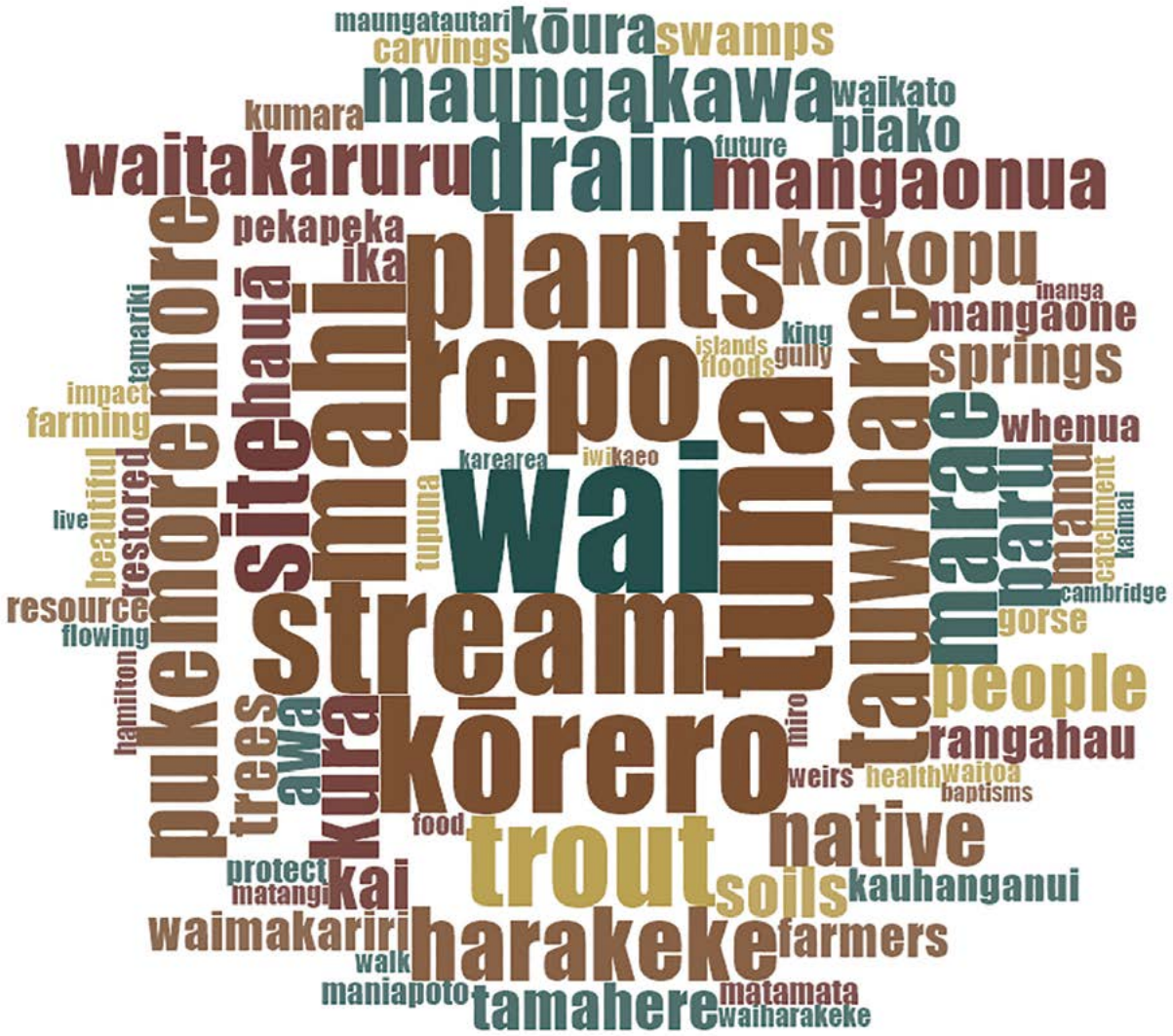


Figure 4: Values (shown in a word cloud) important to one of the whānau interviewed. The words 'repo', 'wai', and 'tuna' are most frequently used by this whānau member. Photo: Ngati Hauā Mahi Trust

DEVELOPING THE FRAMEWORK

It was important for the Trust to ensure the values and priorities of whānau of our affiliated marae – Waimakariri (Cambridge) and Te Iti o Hauā Marae (Tauwhare) – guided the process. My role, as research assistant, was to identify and organize whānau interviewees from each marae and kaitiaki from Ngāti Hauā. As mana whenua and kaitiaki of Te Puna o Mangaonua, they have lived on the whenua for generations and share a close relationship with the awa. The interviews were amazing learning experiences that were a privilege for me to sit in. Whānau shared kōrero about their experiences with Te Puna o Mangaonua, how they would drink from their awa, swim in their awa, be baptized in their awa, and, most important, how they used their awa for mahinga kai (cultivated foods) (Fig. 4). It was obvious that our whānau felt a deep sense of loss in not being able to do these activities today. Many talked about their issues with restricted access to their awa and the concerns they have with the degraded state of Te Puna o Mangaonua.

THE FRAMEWORK

Our whānau guided us in identifying four key themes of our framework: **Wai – Te Hauora o Te Wai, Whakapapa – Te Hauora o Te Tāngata, Mahi – Te Hauora o Te Taiao, and Mahinga Kai.** Mahinga Kai was the topic most discussed by our whānau, who shared that the most important aspect of the mauri of the environment as they understood it was the environment's ability to support and sustain life.

The conceptual illustration of the Ngāti Hauā Wetland Mauri Framework (Fig. 5) includes the four key themes, connected to the important values identified by the whānau. The holistic concept of interconnectedness between the key themes and values was maintained by using a circular design. The koru, linked and unfurling in different directions, highlights the importance of all themes and values. No one theme or values is ranked as having more importance than the other. It is symbolic of the important roles each living element has for the health and well-being of our environment and for each other, which is exemplified in this whakatauki:

Ki te kore a Rakahore, ka kore a Rakataura

**Without the pull of Rakataura's current,
the pebbles of Rakahore won't turn**

NEXT STEPS

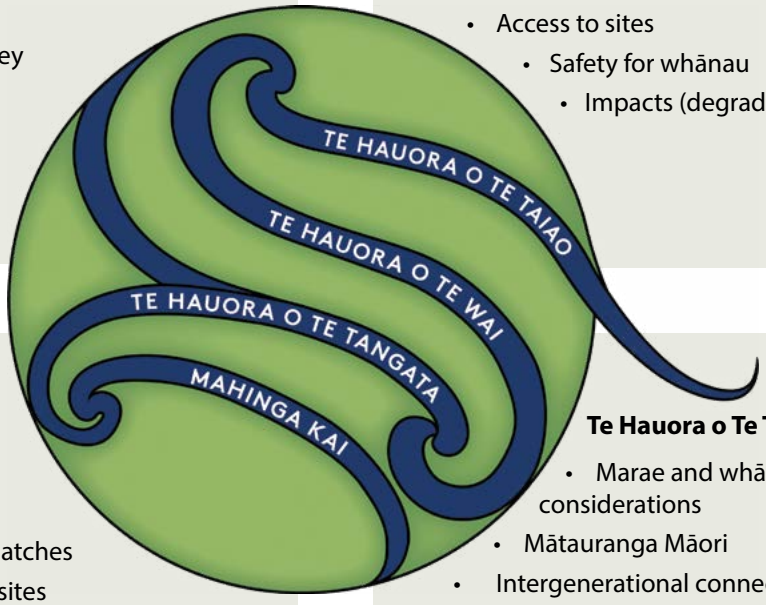
This framework can be used as a foundation for the development of a practical wetland monitoring tool for future projects undertaken throughout the Mangaonua and Mangaone Stream Catchment. After this experience, I feel inspired to pursue a career in research, and to collect and share information that will benefit the world. Yvonne and Mahuru were supportive, encouraging, and most of all inspiring. By the end of my internship, I wanted to be a learned individual like Yvonne, Mahuru, and the kaimahi at Manaaki Whenua.

Te Hauora o Te Taiao

- Restore wāhi tapu and wāhi taonga
- Aspirations acknowledged in restoration
- Collaboration with key partners
- Capacity building among whānau
- Kōrero as a whānau

Te Hauora o Te Wai

- Water quality
- Water quantity
- Access to sites
- Safety for whānau
- Impacts (degradation, etc.)



Mahinga Kai

- Restore tuna stocks
- Restore kōura stocks
- Restore watercress patches
- Access to gathering sites
- Intergenerational connection
- Impacts (degradation, etc.)

Te Hauora o Te Tāngata

- Marae and whānau considerations
- Mātauranga Māori
- Intergenerational connection
- Tikanga revival
- Restore taonga
- Capacity building among whānau
- Impacts (pests, etc.)

Figure 5: Conceptual illustration of Ngāti Hauā Wetland Mauri Framework including themes and values identified by the whānau. Illustration: Weka Pene

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Ausseil AG, Gerbeaux P, Chadderton WL, Stephens T, Brown D, Leathwick J 2008. *Wetland ecosystems of national importance for biodiversity: Criteria, methods and candidate list of nationally important inland wetlands.* Landcare Research Contract Report LC0708/158. Lincoln, New Zealand: Landcare Research.

Ngāti Hauā Iwi Trust 2018. *Te Rautaki Tāmata Ao Turoa o Hauā – Ngāti Hauā Environmental Management Plan.* Morrinsville, New Zealand: Ngāti Hauā Iwi Trust. 106 p. https://ngatihauaiwitrust.co.nz/publications/trust-documents

Peters M, Clarkson B 2010. *Wetland Restoration: A Handbook for New Zealand Freshwater Systems.* Lincoln, New Zealand: Manaaki Whenua Press. https://www.landcareresearch.co.nz/publications/wetland-restoration

Taura Y, Wilcox M, Thompson K, Keelan W 2019. *Ngāti Hauā Wetland Mauri Framework.* Contract Report: LC3598. Hamilton, New Zealand: Manaaki Whenua – Landcare Research. 45 p. https://ngatihauaiwitrust.co.nz/ngati-haua-wetland-mauri-framework-2019

Useful websites

Ngāti Hauā Mahi Trust

Ākina Foundation
https://www.youtube.com/watch?v=6ZTlo9OfXa8

National Recognition Te Puni Kōkiri Maori 2019 NZ Biosecurity Award
https://www.youtube.com/watch?v=7lqVptr83zo

Ngāti Hauā Iwi Trust
https://ngatihauaiwitrust.co.nz

Pokapū Akoranga Pūtaiao – Science Learning Hub
https://www.sciencelearn.org.nz/videos/1928-ngati-haua-mahi-trust

Rural Delivery
https://www.youtube.com/watch?v=gCaYKkzwbqU

Waikato River Authority – Waikato River Clean Up Trust
https://waikatoriver.org.nz/funding-applications-2021

Contact details for Keri Thompson

Email: keri.thompson@nhmt.org.nz

3.
WHEN HANDS HEAR THE LANDSCAPE SPEAK
RECONCILING TE REO O TE REPO AND LANDSCAPE DESIGN

CHERI VAN SCHRAVENDIJK-GOODMAN
(TE ATIHAUNUI A PĀPĀRANGI, NGĀTI APA,
NGĀTI RANGI), KATRINA CHRISTISON (TIDY GARDENS)

ILLUSTRATIONS BY MONICA PETERS

Inā kei te mōhio koe ko wai koe, i anga mai i hea, kei te mōhio koe kei te anga atu ki hea

If you know who you are and where you are from, then you will know where you are going

We would like to express our thanks to Monica Peters for her stunning illustrations that help visualise our different wetland systems. We also would like to thank the many people who have inspired us on our landscaping journeys: our whānau, teachers, mentors, colourful clients, design colleagues, and peers. Most important, the plants and spaces we love to work in, be inspired by, and hopefully, continue to 'hear' loudly with our hands.

– Ngā mihi, nā Cheri māua ko Katrina

Previous page: Repo in a pot – designed and implemented by Cheri at the Hamilton Botanical Gardens, Waikato. Photo: Cheri van Schravendijk-Goodman

'How can the indigenous landscape become manifest in the city? ... through the expression of the design that we have cause to question; What has come before? What is lost? Where are we now? What does this mean?'

– Bela Hinemoa Te Ngaro Po Grimsdale (Te Ātiawa, Ngāti Raukawa, Ngāti Toa)[1]

Consider taking a walk across our modern-day urban landscapes. Every day we are greeted with straight lines of concrete, steel, glass and timber buildings, marked tar-seal roads, concrete, or gravel-covered pathways. We sit under strategically placed trees in the heat of the summer sun (usually exotic trees like oaks; *Quercus* spp.), or lie on the vast stretches of (usually) carefully manicured lawn in parks, reserves or along river and lake edges. Aotearoa New Zealand wasn't always like this. To try and imagine anything beyond our idea of 'greenspaces' as inspired by and manifest in the urban environment, can be difficult when 'control of nature' is all we know – and when the influences we see come from over half a world away.

[1] Grimsdale 2018

Picturesque Garden at the Hamilton Botanical Gardens, Waikato. This stunning garden explores the beauty of unclipped fields on the banks of the Waikato River. Photo: Cheri van Schravendijk-Goodman

Take the idea of a lawn, for example. Lawns didn't exist until after colonisation (post-1840), when European settlers introduced their colonial concepts of clipped, manicured, formal gardens set among 'wild landscapes' created with trees and shrubs to frame the green spaces. 'Grass-covered fields' observed by the first non-Māori botanist arrivals to Aotearoa, were not monocultural grass lawns. Instead, uneven swards of tallish native grasses, with erect, or drooping seedheads, graced our repo (wetlands) and associated habitats. Of special mention are:

- the sweet smelling kāretu (*Hierochloe redolens)* and *Microlaena* spp.
- the clumps of swamp millet (*Isachne globosa*) found in peatlands, swamps, and along waterways
- the diverse and stunning toetoe (*Austroderia* spp.) found across Aotearoa in almost all ecosystems – from high in the mountains, to the edges of repo (swamps), to the dunes
- the versatile tussocks (*Chionochloa* spp.) at higher elevations and latitudes – those masses of coppery-reds or silvery-yellows that grace many postcards from Aotearoa.

Then there are the sedges – the 'cutty grasses' such as pūrekireki and pūrei (*Carex secta*, *C. virgata*), *C. gaudichaudiana*, and rautahi (*C. geminata*) that we find along the fringes of waterways. Most New Zealanders do not realise how many of these grassy-type plants we have, and the diversity is beautifully overwhelming. However, none of these fit the concept of a lawn, despite representing the pre-colonial landscape that our tūpuna (ancestors) were familiar with. Yet, here we are, with our lovingly maintained patchworks of trimmed green, from the mountains to the sea.

This sounds like a love letter to our native grasses and sedges – and to a degree, it is. The lawn is a good metaphor for highlighting the impacts we have on nature, and the impacts that nature, in turn, has on us, both as landscape designers, and as an appreciative audience. Most of us have only ever known the clipped lawns as we see them today – anything beyond this is difficult to conceive.

Without realising it, in conditioning our environment to behave a certain way, 'clipped-nature' has conditioned us to believe that this is the only way it should be. So, we tolerate the hard edges of tar seal, concrete, steel, and timber, provided we can continue to accommodate the manicured and strategically placed trees and gardens – and lawns – within it. Sadly, in doing so, we erase the historical and identity-rich picture that lies beneath it. So, yes, while we are fond of our native grasses and sedges, it's the story of repo beneath the lawn and concrete that pulls on the heartstrings – and is the reason why we chose to write this story.

Kāretu (*Hierochloe redolens*).
Photo: Cheri van Schravendijk-Goodman

A reserve in central Whanganui City, North Island – this used to be part of a very large swamp and fen wetland well used by tangata whenua. This is also part of the Whanganui River floodplain. Now it is concrete, paved, manicured lawns, and strategically placed exotic trees.
Photo: Cheri van Schravendijk-Goodman

REACTIVATING REPO ON COLONISED LANDSCAPES

We are landscape designers. We play with design to suit the needs and wants of our clients. At the same time, we are trying to bring an energy and movement to a space that is seasonally, architecturally, and culturally diverse enough to generate year-long interest. We do this through colour, plant forms, and their natural movements and placement, including contrasting the softness of plants, against harder landscaping like paving. Wetland plants in this regard provide architecturally interesting variations in height, and texture into gardens (Fig. 1 and Table 1).

As design students, an important skill we learn is landscape. We are invited to test our understanding of the spaces we see, and then to think about the parts we can't understand – the layers that underlie an urban space. Archaeologists and anthropologists know this area of work well because they are trained to carefully pull the human layers apart and to make sense of them. It is the role of scientists to describe the historic plants, megafauna, microorganisms, rocks, and minerals that make up the layers that we can't see. Comparatively, landscape designers don't always have the benefit of being able to look at the same layers. Instead, we rely on the best available information, while also drawing on our experience, creative training, limitless imaginations, and sometimes, our gut instinct.

Increasingly, part of this kete (toolkit) of important information gathering is in speaking with tangata whenua (Indigenous people of the land) to help shape and inspire designs (refer to Te Aranga Principles to learn more about this key approach for urban design). Discussions like this are informed by hundreds of years of occupation and interactions by Indigenous peoples with those spaces.

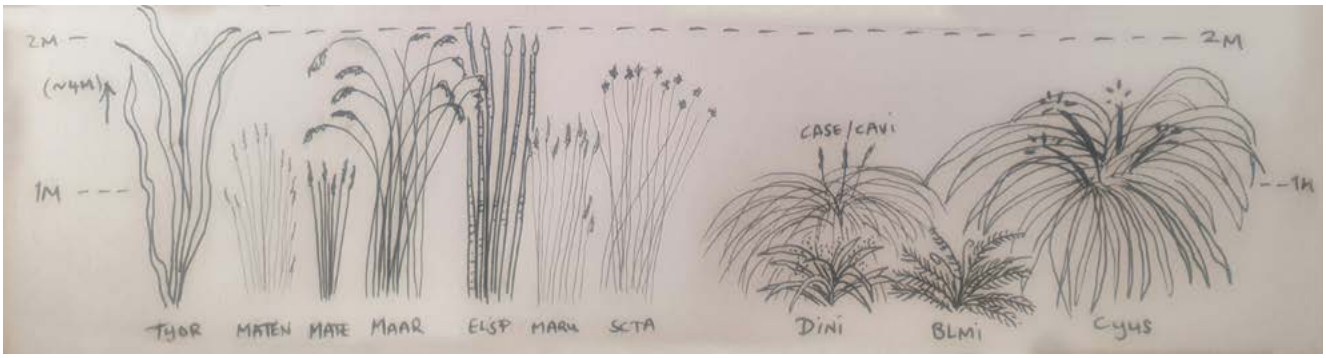


Figure 1. A sketch showing clients the heights and forms of some native wetland rushes and sedges as part of a planting design for a subdevelopment. Illustration: Cheri van Schravendijk-Goodman

Table 1. Plants in figure 1 found in peat, fen, and swamps of the Waikato

CODE in image	Waikato name	Common name	Latin name
TYOR	Raupō	Raupō	*Typha orientalis*
MATEN	Wīwī	Sedge	*Machaerina tenax*
MATE		Sedge	*Machaerina teretifolia*
MAAR		Jointed twig rush	*Machaerina articulata*
ELSP	Ngāwhā, kuta	Giant spike sedge	*Eleocharis sphacelata*
MARU	Wīwī	Soft twig rush	*Machaerina rubiginosa*
SCTA		Soft stem bulrush	*Schoenoplectus tabermontanii*
CASE/CAVI	Pūrekireki, pūrei	Sedge	*Carex secta, C. virgata*
DINI	Tūrutu	Swamp dianella, swamp blueberry	*Dianella haematica*
BLMI	Kiokio	Swamp kiokio	*Blechnum minus*
CYUS	Ūpoko-ā-tangata	Giant umbrella sedge	*Cyperus ustulatus*

TE ARANGA PRINCIPLES

In 2006, Māori practitioners working within the fields of resource management, architecture, urban planning, and landscape design gathered together to develop a draft National Māori Cultural Landscape Strategy. Seven 'Te Aranga Principles' were developed and named after Te Aranga Marae, Flaxmere, Hastings, where they were formulated.

'The key objective of the Principles is to enhance the protection, reinstatement, development and articulation of Mana Whenua cultural landscapes enabling all of us (Mana Whenua, Mātāwaka, Tauiwi, and Manuhiri) to connect to and deepen our 'sense of place.'

The principles are outlined and we strongly recommend that landscape designers and other practitioners seek to implement them meaningfully within the urban space.

Rangatiratanga – the right to exercise authority and self-determination within one's own hapū and iwi realm

Kaitiakitanga – managing and conserving the environment as part of a reciprocal relationship, based on the Māori world view that humans are part of the natural world

Manaakitanga – the ethic of holistic hospitality whereby mana whenua have inherited obligations to be the best hosts they can be

Wairuatanga – the immutable spiritual connection between people and their environments

Kotahitanga – unity, cohesion, and collaboration

Whanaungatanga – a relationship through shared experiences and working together which provides people with a sense of belonging

Mātauranga – Māori and mana whenua knowledge and understanding

A large number of important cultural sites identified by hapū (sub-tribes) and iwi (tribes) across the motu (country) were within or adjacent to repo; in particular, key places where many whānau (families) and hapū congregated seasonally. Sadly, these were among the first natural areas that were targeted following colonisation, resulting in the drainage of large tracts of repo to support urban development, farming, and industry; particularly in our larger cities like Auckland, Hamilton, Wellington, and Christchurch. The challenge rests in the level of attention we pay to those landscapes when we are tasked with designing. The next challenge lies in the implementation – is it realistic to bring those landscapes back, or are there other ways we can represent them?

Pātaka at Te Parapara – a garden inspired by the traditional māra kai (food gardens) that were once found around the area where the Hamilton Botanical Gardens are now located. Native plantings surround Te Parapara. Photo: Cheri van Schravendijk-Goodman

'The language of landscape is our native language..... The language of landscape is a habit of mind'

– Anne W Spirn (1998)[2]

As landscape designers, exploring the return of landscapes can generate some of the most exciting opportunities for re-surfacing the narratives, and physical nature of these spaces. One way to do this is through the recreation of wetlands for stormwater management, like the St Kilda subdivision in Cambridge, Waikato. There is a catch – **we must always do our homework**. Not all wetlands are created equal, and not all plants used in these recreations – particularly in stormwater wetland design – are necessarily the right choice for that space. If we are to commit to allowing a landscape to sing, talk, and dance with us, we must do our homework on what the 'choir' used to sound like, and the form of the 'dancers' that once shimmied across the surface. We provide some examples of this diversity and we recommend that our colleagues use the illustrations and Te Aranga Principles as inspiration.

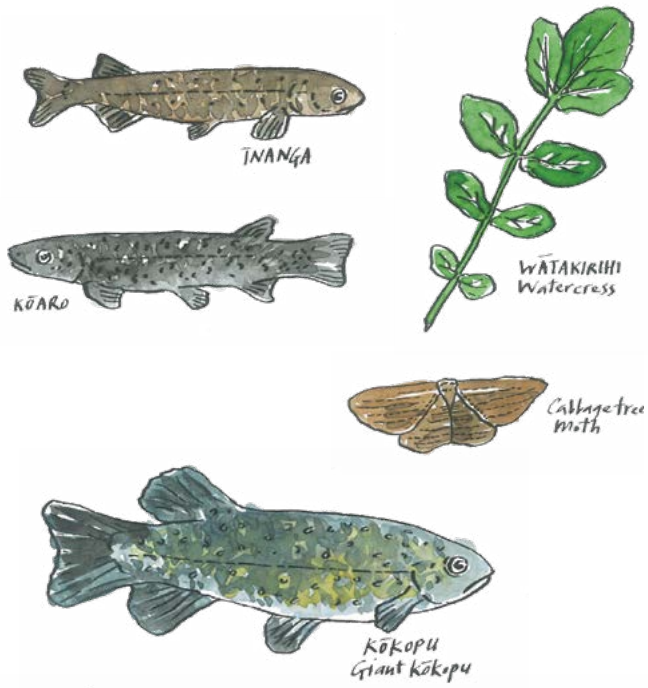
[2] Menzies 2017

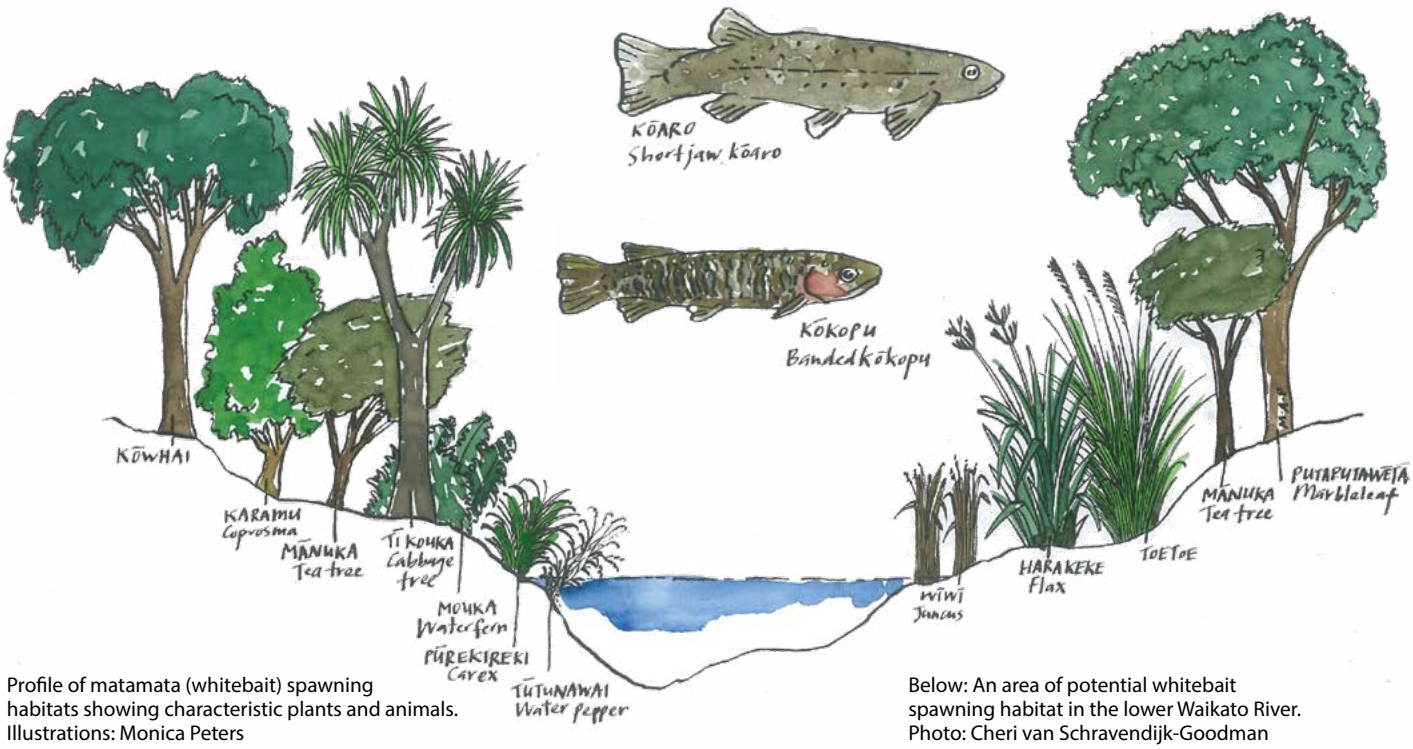
WEAVING MĀTAURANGA AND DESIGN

MATAMATA SPAWNING HABITAT

Matamata spawning habitat illustration is unique to Te Puuaha o Waikato (Port Waikato), and provides an example of how working with tangata whenua, and acknowledging and respecting their local knowledge can enhance planting plans; both from a restoration and landscape design perspective. Here, mātauranga highlights interconnections across the plant life. As all good designers know, a garden is about getting the right balance in layering and texture. When we pay attention to the narratives of the local people, we open ourselves to beautiful insights about how those layers can be aesthetically pleasing, as well as ecologically practical. In this example, incorporating these plants into urban tributaries can enhance important spawning habitat for matamata (īnanga, īnaka; *Galaxias masculatus*), and adding wātakirihi (watercress; *Nasturtium* spp.) supports cultural practices.

Check: Chapter 5.5: Matamata – eating with our tūpuna





Profile of matamata (whitebait) spawning habitats showing characteristic plants and animals. Illustrations: Monica Peters

Below: An area of potential whitebait spawning habitat in the lower Waikato River. Photo: Cheri van Schravendijk-Goodman

OUR WETLAND LANDSCAPES

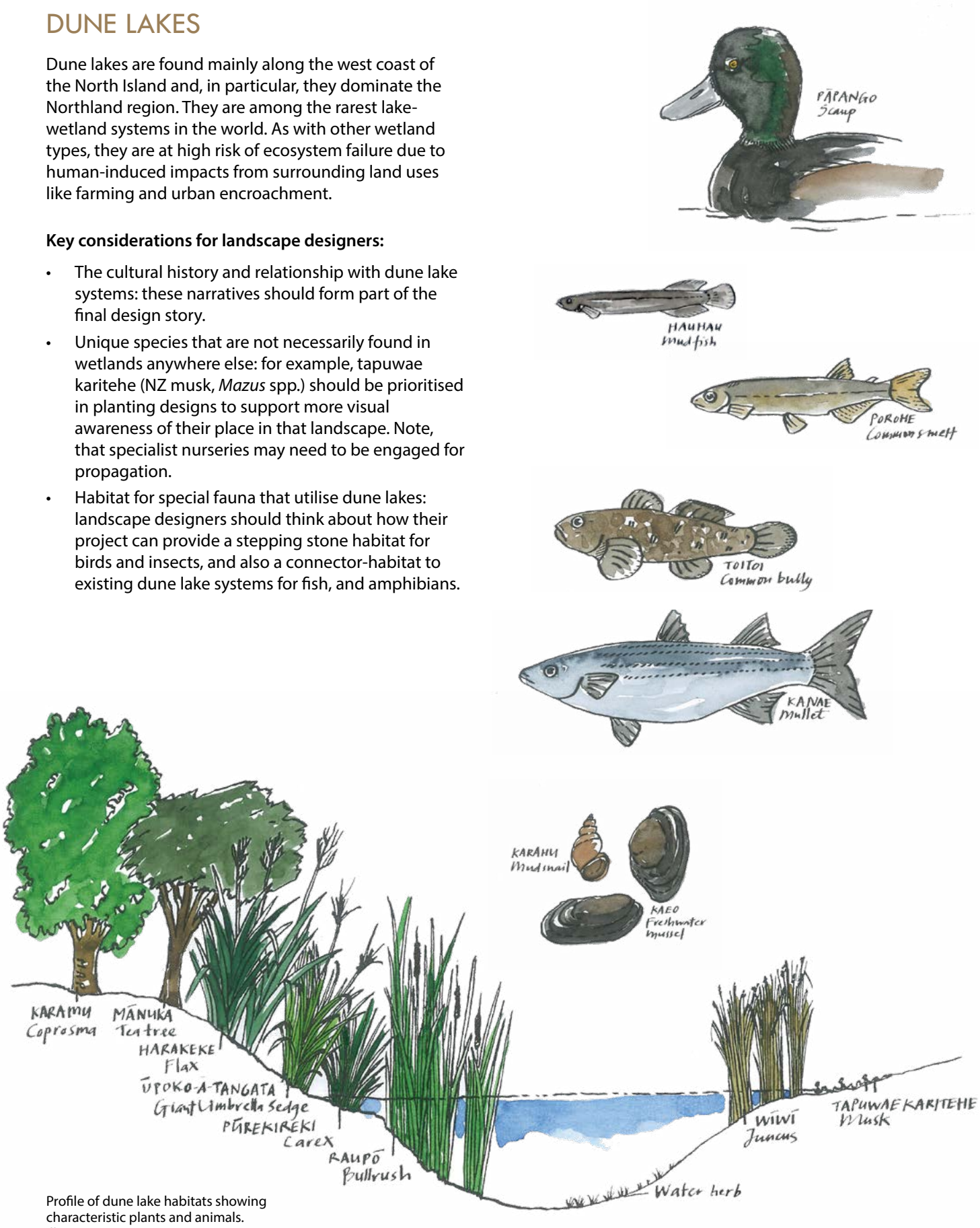
Illustrations by Monica Peters

DUNE LAKES

Dune lakes are found mainly along the west coast of the North Island and, in particular, they dominate the Northland region. They are among the rarest lake-wetland systems in the world. As with other wetland types, they are at high risk of ecosystem failure due to human-induced impacts from surrounding land uses like farming and urban encroachment.

Key considerations for landscape designers:

- The cultural history and relationship with dune lake systems: these narratives should form part of the final design story.
- Unique species that are not necessarily found in wetlands anywhere else: for example, tapuwae karitehe (NZ musk, *Mazus* spp.) should be prioritised in planting designs to support more visual awareness of their place in that landscape. Note, that specialist nurseries may need to be engaged for propagation.
- Habitat for special fauna that utilise dune lakes: landscape designers should think about how their project can provide a stepping stone habitat for birds and insects, and also a connector-habitat to existing dune lake systems for fish, and amphibians.



Profile of dune lake habitats showing characteristic plants and animals. Illustrations: Monica Peters

ESTUARIES

Estuaries are impressive systems where freshwater and marine merge, resulting in unique interactions between some distinctive flora and fauna. Yet they can often be the most underappreciated and overlooked systems, particularly where they are adjacent to urban environments. Estuaries were historically often targeted for industry, with resultant damage generated through heavy metal pollution, and tributary channelisation for faster water movement.

Key considerations for landscape designers:

- Estuaries are systems to accentuate 'vistas', because many of the plants are short. This allows you to play with levels at the ground plane to frame and enhance 'big sky' views.
- From a landscape design point-of-view, vast expanses of harakeke, rushes, and sedges can be used to tell estuarine stories in a simple and beautiful way. The restiad, oīoī (*Apodasmia similis*), which commonly grows in estuaries, is rapidly growing in popularity for design.
- Interesting plants like ureure (*Salicornia quinqueflora*) and pānakenake (*Lobelia angulata*) can create stunning groundcover mosaics. With careful planning, these plants could also be incorporated into planting designs within a town centre.

Landscaped estuarine habitat along the beach in Wellington City. In the background is the Waitangi Park Wetland landscape project where hundreds of salt marsh rushes were reintroduced into this urban centre. Photo: Cheri van Schravendijk-Goodman

A salt marsh with ureure and oioi at Paihia, Bay of Islands. Photo: Cheri van Schravendijk-Goodman

Profile of estuary habitats showing characteristic plants and animals. Illustrations: Monica Peters

GUMLANDS

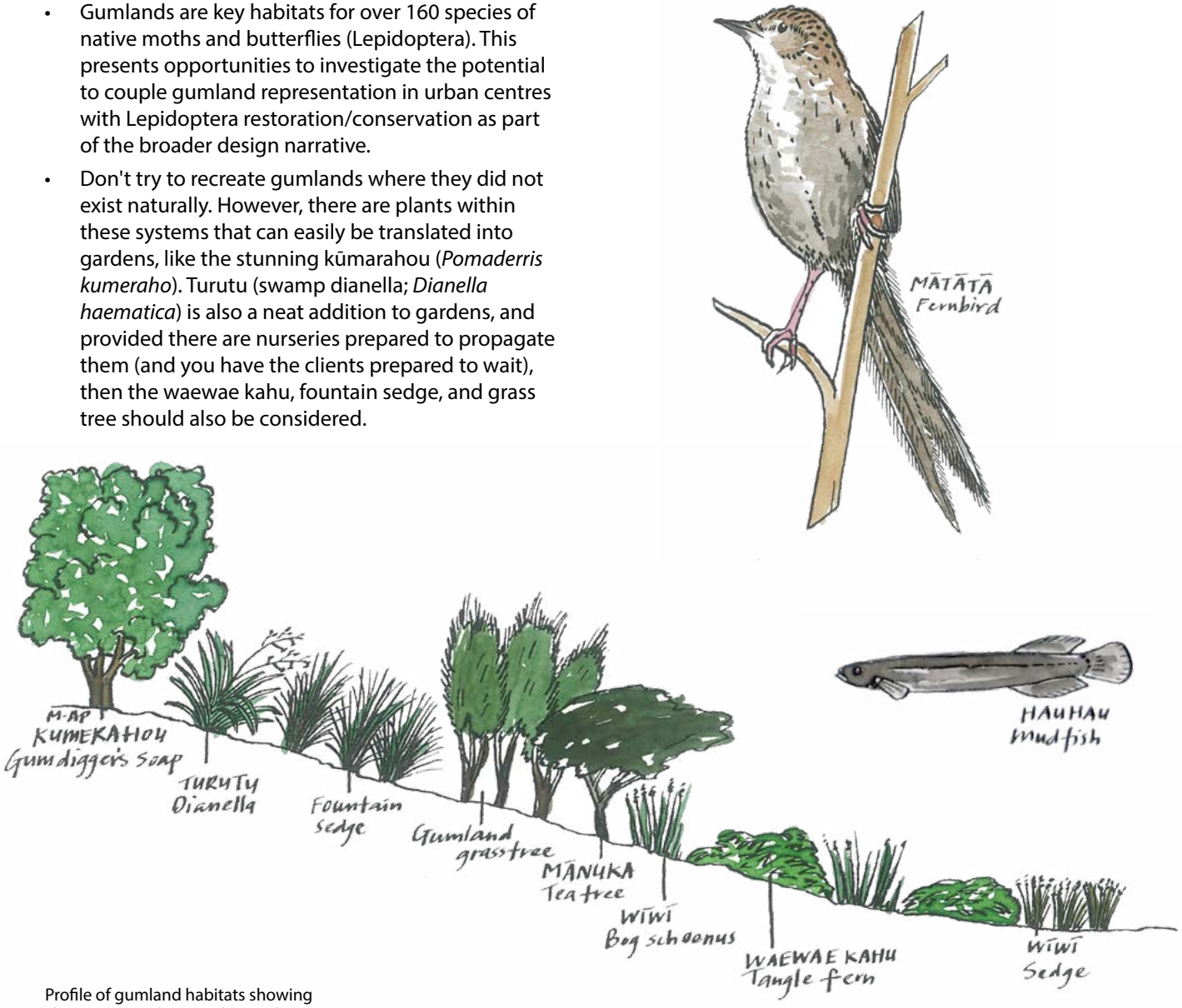
Gumlands are often referred to as heathlands in Aotearoa because they are similar in appearance to those in Europe. Few realise they are actually a wetland type – as evidenced by the influence of seasonal saturation on their ecology – and usually associated with ancient kauri (*Agathis australis*) forests and fossilised gum deposits.

Considered critically endangered systems, greatly reduced due to kauri gum extraction and conversion to farmland, gumlands are unique as they occupy very infertile soils, and are characterised by low growing heath shrubs, sedges, and ferns. Some of the more interesting and unique plants found on gumlands are the waewae kahu (tangle fern; *Gleichenia dicarpa*), fountain sedge (*Lepidosperma neozelandicum*), and gumland grass tree (*Dracophyllum lessonianum*).

Waewae kahu, tangle fern. Photo: © Neil Fitzgerald

Key considerations for landscape designers:

- Gumlands are key habitats for over 160 species of native moths and butterflies (Lepidoptera). This presents opportunities to investigate the potential to couple gumland representation in urban centres with Lepidoptera restoration/conservation as part of the broader design narrative.
- Don't try to recreate gumlands where they did not exist naturally. However, there are plants within these systems that can easily be translated into gardens, like the stunning kūmarahou (*Pomaderris kumeraho*). Turutu (swamp dianella; *Dianella haematica*) is also a neat addition to gardens, and provided there are nurseries prepared to propagate them (and you have the clients prepared to wait), then the waewae kahu, fountain sedge, and grass tree should also be considered.



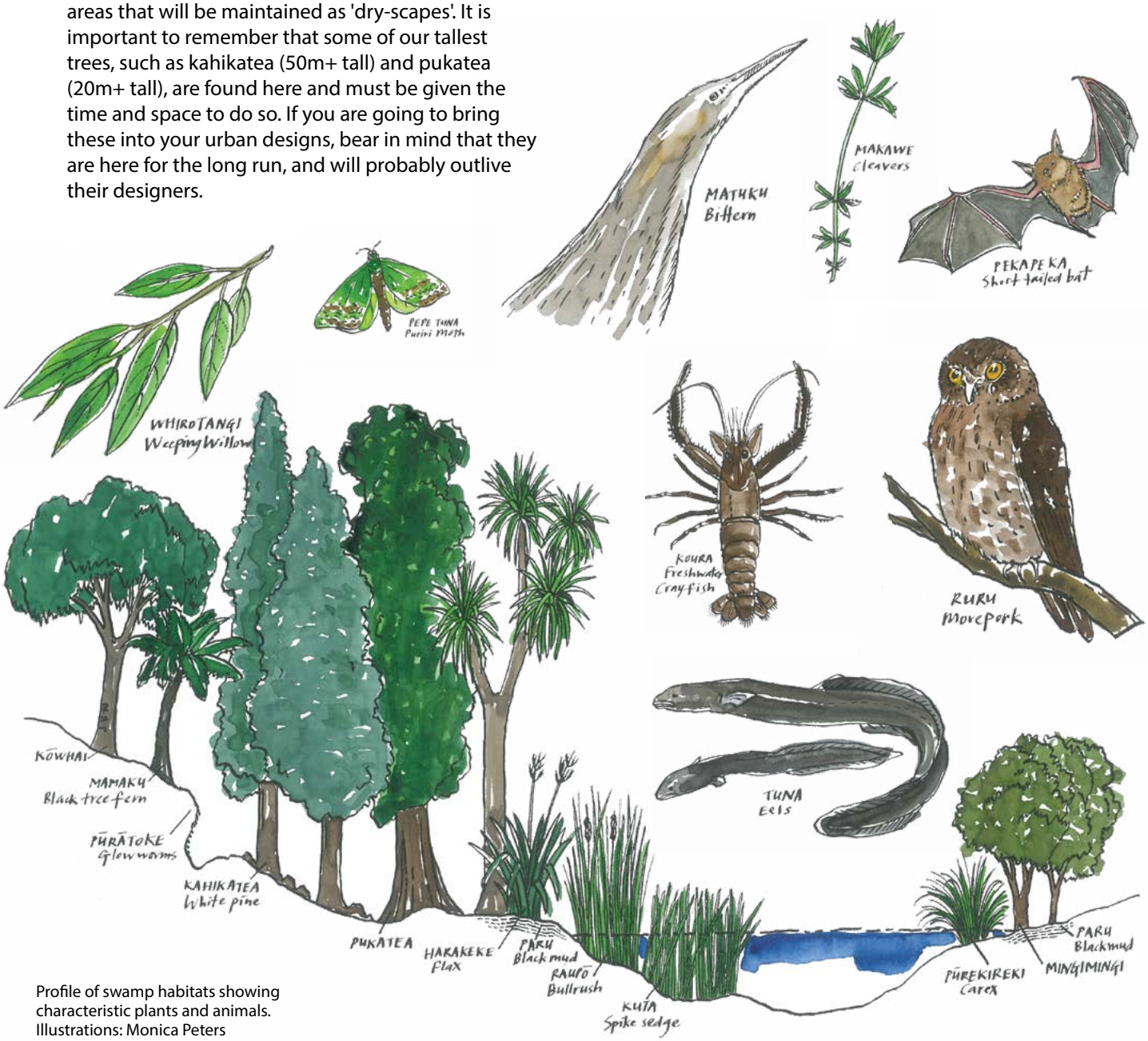
Profile of gumland habitats showing characteristic plants and animals. Illustrations: Monica Peters

SWAMPS

Swamps are most easily recognised by the average New Zealander. They are found across the motu, and have suffered some of the highest levels of conversion and decline. The exceptional features of swamps are the stands of kahikatea (*Dacrycarpus dacrydioides*), pukatea (*Laurelia novae-zelandiae*) or maire tawake (swamp maire; *Syzygium maire*) forests that border them. These majestic stands are located within the most diverse and fertile repo and were also the trees most utilised by our tūpuna.

Key considerations for landscape designers:

- Bear in mind that a swamp feature will be a habitat, not just for aesthetics. Do your homework about the fauna, so that you can design appropriately to support them; and to get client (and community) support for the design intent.
- Swamps are wet systems – they are not suitable for areas that will be maintained as 'dry-scapes'. It is important to remember that some of our tallest trees, such as kahikatea (50m+ tall) and pukatea (20m+ tall), are found here and must be given the time and space to do so. If you are going to bring these into your urban designs, bear in mind that they are here for the long run, and will probably outlive their designers.
- Some swamps have hidden gems like native climbers, e.g. kiekie (*Freycinetia banksia*) or native jasmine (*Parsonsia heterophylla*). The ground can also offer surprises, like ferns, e.g. maidenhair (*Adiantum* spp), and pukupuku (*Doodia media*). Herbs like native watercress (*Rorippa* spp.) and nāhui (*Alternanthera nahui*) can make stunning additions around ponds or water features.
- Work closely with tangata whenua to explore their relationships with swamps both pre- and post-colonisation. You might be surprised by the cultural value given to some exotic plants as well, which will not necessarily impede wetland restoration, and also form an important part of a broader landscape narrative. Note that two such plants feature in the illustration, based on dialogue from Te Puuaha – whirotangi (weeping willow, *Salix babylonica*) and makawe (cleavers, *Galium aparine*).



Profile of swamp habitats showing characteristic plants and animals. Illustrations: Monica Peters

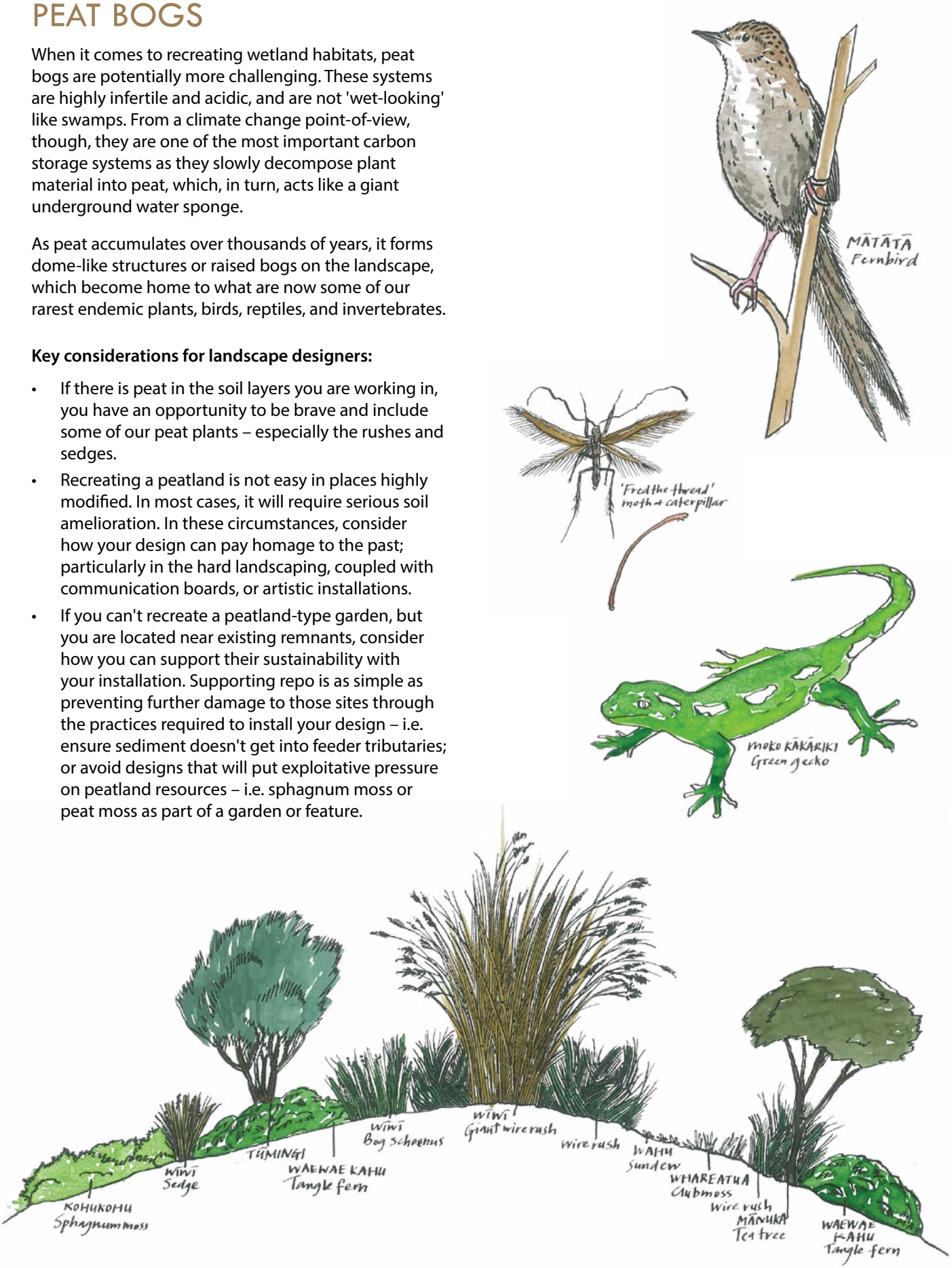
PEAT BOGS

When it comes to recreating wetland habitats, peat bogs are potentially more challenging. These systems are highly infertile and acidic, and are not 'wet-looking' like swamps. From a climate change point-of-view, though, they are one of the most important carbon storage systems as they slowly decompose plant material into peat, which, in turn, acts like a giant underground water sponge.

As peat accumulates over thousands of years, it forms dome-like structures or raised bogs on the landscape, which become home to what are now some of our rarest endemic plants, birds, reptiles, and invertebrates.

Key considerations for landscape designers:

- If there is peat in the soil layers you are working in, you have an opportunity to be brave and include some of our peat plants – especially the rushes and sedges.
- Recreating a peatland is not easy in places highly modified. In most cases, it will require serious soil amelioration. In these circumstances, consider how your design can pay homage to the past; particularly in the hard landscaping, coupled with communication boards, or artistic installations.
- If you can't recreate a peatland-type garden, but you are located near existing remnants, consider how you can support their sustainability with your installation. Supporting repo is as simple as preventing further damage to those sites through the practices required to install your design – i.e. ensure sediment doesn't get into feeder tributaries; or avoid designs that will put exploitative pressure on peatland resources – i.e. sphagnum moss or peat moss as part of a garden or feature.



Profile of peat bog habitats showing characteristic plants and animals.
Illustrations: Monica Peters

WE COME BACK FULL CIRCLE TO LAWNS

At the beginning of this chapter, we began with the clipped lawn and the influence of Europe on our obsession with 'controlling the wild'. In an interesting turn of events there is now a growing movement in Europe to move away from the classic strip mowing, to 'wilder lawns' with native grasses and flowers to increase wildlife habitat. In Aotearoa, a similar movement is growing, and some of our wetland plants have been identified as suitable species for 'no mow lawns'. We have outlined them in table2.

Piripiri growing on the Otago coastline. Photo: Katrina Christison

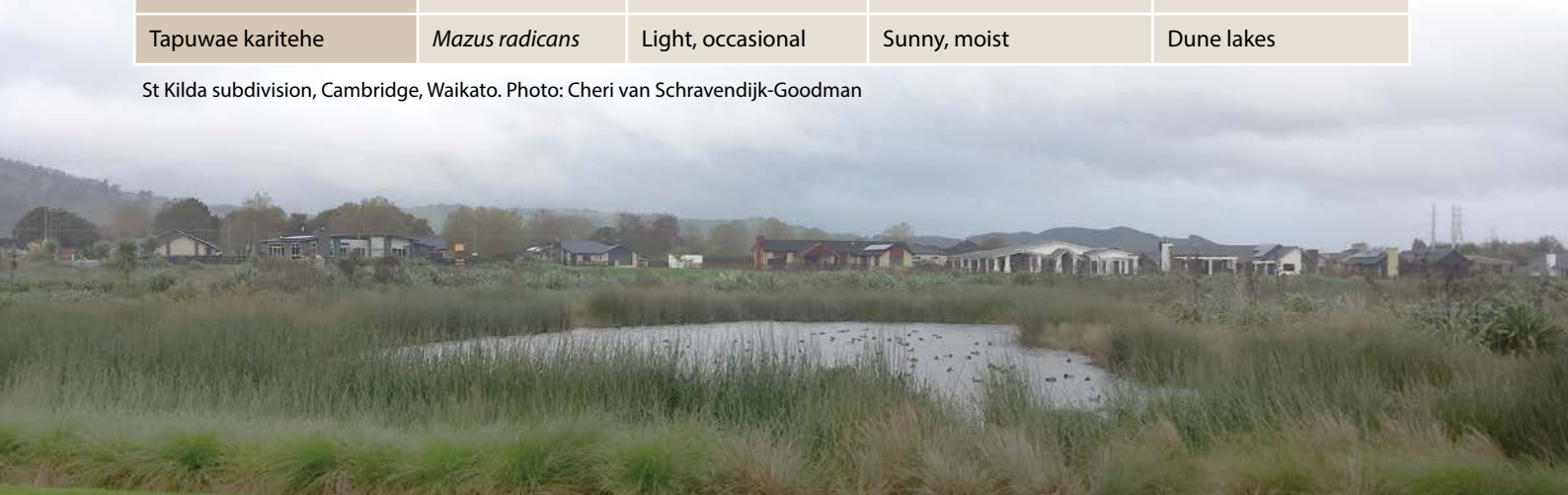
Pānakenake (white flower) growing among violets. Photo: Cheri van Schravendijk-Goodman

Remuremu and a popular landscape variety of piripiri (*Acaena inermis purpurea*). Photo: Cheri van Schravendijk-Goodman

Table 2. Wetland groundcovers suitable for 'no mow' lawns

Māori or common name	Botanical name	Foot traffic tolerance	Growing conditions	Wetland type
Little hard fern	*Blechnum penna-marina*	Light	Sun or semi-shade	Alpine bogs and fens
Pānakenake	*Lobelia angulata*	Light	Sun or semi-shade, moist	Swamps
Piripiri	*Acaena inermis*	Light to moderate	Sun, semi-shade, moist	Ephemeral wetlands – turf plant
Remuremu	*Selliera radicans*	Moderate to heavy	Sun or light shade, moist	Estuaries – turf plant
Shore cotula	*Leptinella dioica*	Moderate	Damp, well-drained soil in sun or semi-shade	Coastal wetlands and salt marshes
Tapuwae karitehe	*Mazus radicans*	Light, occasional	Sunny, moist	Dune lakes

St Kilda subdivision, Cambridge, Waikato. Photo: Cheri van Schravendijk-Goodman



FINAL THOUGHTS

Always do your homework – making assumptions based only on what we see, limits creativity when we overlook what was, and what could be. Agencies like Te Papa Atawhai (Department of Conservation) and regional councils can provide information about historic wetland coverage. Information about soils, hydrology, and historic vegetation is also available to inform planting lists to suit the wetland types that once existed there.

Talk to the locals – local marae, hapū, and iwi have centuries of experience and interaction with the landscapes within which you might be looking to design. Tangata whenua can provide insights into specific areas and species, and their experiences can provide a richness to the final design narrative.

Learn the local names for plants and other species – there are a several lists available that can provide 'Māori and common names', but they may not necessarily resonate with tangata whenua from the area you are working in. As local dialect can tell us a lot about specific species, as well as the people and the environment, it becomes more meaningful for implementing the design.

Reintroducing our native plants takes time – research the appropriate people and nurseries who are prepared to propagate the native species in which you might be interested. This is particularly important when dealing with endemic or very rare plants. There are few specialist nurseries left in Aotearoa, but we desperately need them if we are going to be serious about embracing the return of our special plants and landscapes. The only way to encourage their resurgence is to give nurseries a reason to keep operating; and to build the confidence and patience in your clients to allow the time needed to wait for the seedlings to grow.

Be courageous in your use of our natives – if it wasn't for the growing interest to include our native species within landscape design, they might have become extinct. Plants like the kākābeak (*Clianthus* spp.) and mikoikoi (*Libertia* spp.) are becoming rare in the wild. Encouraging their adoption in the private garden gives them an opportunity to grab the attention of plant lovers, and, we hope, to increase their populations. We can also do this for our wetland plants.

Finally, have fun!

Native swamp plants including mamaku and nikau (which feature on swamp forest edges in the lower Waikato) are incorporated into a themed garden with exotic trees at the Auckland Botanical Garden. Photo: Cheri van Schravendijk-Goodman

Te Repo o Aoteaora – wetland habitats, and native flora and fauna handouts.

Lists of all species illustrated for the wetland landscapes in this chapter.

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Awatere S, Pauling C, Rolleston S, Hoskins R, Wixon K 2008. *Tu Whare Ora – Building capacity for Māori driven design in sustainable settlement development*. Prepared for Nga Pae o te Māramatanga. Landcare Research Contract Report: LC0809/039. Hamilton, New Zealand: Landcare Research

Awatere S, Harmsworth G, Rolleston S, Pauling C 2013. *Kaitiakitanga o ngā ngahere pōhatu: Kaitiakitanga of urban settlements*. In: Jojola T, Natcher D, Walker R 2013. Reclaiming indigenous planning. Montreal, Quebec: McGill-Queens University Press. Pp 236–259

Mahuta R, van Schravendijk-Goodman C, Baker C 2017. *Chapter 5.5: Matamata – eating with our tūpuna*. In: Taura Y, van Schravendijk-Goodman C, Clarkson B eds. 2017. *Te Reo o Te Repo – The Voice of the Wetland: Connections, understanding and learnings of our wetlands*. Hamilton, New Zealand: Manaaki Whenua – Landcare Research and Waikato Raupatu River Trust. Pp. 107–117. https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/5_5_Fauna_Matamata.pdf

Park G 2006. *Theatre Country: Essays on Landscape and Whenua*. Wellington, New Zealand: Victoria University Press.

Useful websites

About our wetlands
https://www.landcareresearch.co.nz/publications/naturally-uncommon-ecosystems/wetlands

Creating a lawn alternative with native plants
https://www.treesforcanterbury.org.nz/planting-trees-and-shrubs/creating-a-lawn-alternative-with-native-plants

Ngā Tipu o Aotearoa – New Zealand Plants
https://nzflora.landcareresearch.co.nz

Te Aranga Principles
http://www.aucklanddesignmanual.co.nz/design-subjects/maori-design/te_aranga_principles#/design-subjects/maori-design/te_aranga_principles/guidance/about/core_m%C4%81ori_values

What does Māori architecture look like today?
https://thespinoff.co.nz/atea/07-01-2020/what-does-maori-architecture-look-like-today

Tuia Pito Ora – NZILA

Grimsdale B 2018. The pathway to lost land – te haerenga ki te whenua i ngaro ki te po. Visioning landscape's that speak Māori
https://nzila.co.nz/news/2018/11/visioning-landscapes-that-speak-maori

Menzies D 2017. Assessing the Māori cultural landscape.
https://www.buildingbetter.nz/publications/urban_wellbeing/Menzies_2017_cultural_landscape.pdf

Paul J 2017. Exploring Te Aranga Design Principles in Tāmaki.
https://www.buildingbetter.nz/publications/urban_wellbeing/Paul_2017_exploring_te_aranga_design_principles.pdf

Daylighting of tributaries and wetland spaces in urban centres

Freshwater Blog
https://freshwaterblog.net/2014/07/08/daylighting-urban-rivers

Landezine
http://landezine.com/index.php/2016/10/waitangi2

Spotlight on Māori designers and advisors

Christine Morehu (Waikato)
https://nz.linkedin.com/in/chrissy-morehu-0ba544126
https://issuu.com/christinemorehu/docs/christine_morehu_portfolio_30032021_-_portrait_a4

Nga Aho
https://ngaaho.maori.nz/index.php?m=2

Contact details for Cheri van Schravendijk-Goodman

Email: cheri@swampfrog.co.nz

SECTION TWO

CULTURAL RESOURCES

4.
NGĀ RONGOĀ O NGĀ REPO A WETLAND PERSPECTIVE

ROBERT PA ROPATA MCGOWAN

Ka ora te whenua, ka ora te tāngata

If you heal the land, you heal the people

Kīngi Tāwhiao Te Wherowhero (Waikato)

In pre-European Aotearoa New Zealand, repo (wetlands) were considered taonga (culturally important) and played a key role in people's lives as a major and reliable source of kai (food). Tuna (freshwater eels), kōura (freshwater crayfish), and many other indigenous fish species, as well as various bird species that lived and nested in and around lakes and wetlands were readily available. Native plant species such as raupō (bulrush), tī kouka (cabbage tree), and various berries and seeds provided sustenance, especially in times of scarcity. Repo provided building materials – raupō and toetoe for roofing and insulation, and harakeke (NZ flax) and kuta (giant spike sedge) for weaving, as well as paru (swamp mud) valued by weavers for dyeing properties. When needed, repo also provided rongoā (medicine) for treating wounds and injuries and the various sicknesses that afflicted people then.

Much changed when colonial settlers took control of the landscape in the early 19th century. Repo were no longer valued as taonga but instead natural resources to be developed. The new settlers brought other resources to grow and harvest, such as domestic animals (sheep, pigs, goats, and poultry) for agriculture and crops (including wheat, potatoes, maize, carrots, etc.), and it was no longer vital to rely on repo for the necessities they provided. The old way of living quietly disappeared.

Only 10% of repo throughout Aotearoa now remains, and many of these are far from pristine. Even where they remain it is difficult to access the kai, building and weaving materials, and rongoā they contain, particularly when repo are situated in reserves and on private or landlocked areas.

This chapter focuses on repo in the 21st century. They are still very important, but their place in the landscape and the services they provide are quite different. Most land is now farmed or cropped and now must cope with the extremes that climate change may bring.

Whānau Māori still look to repo to provide rongoā; in fact, for much of the motu (country), they are one of the few places where people can find the rākau rongoā (medicinal plants) they need for rongoā.

The main purpose of rākau rongoā used for rongoā is to heal the whenua. That is something to be kept firmly in mind when considering rongoā, including those that might be found in a repo. The knowledge of rongoā, however, has faded, along with the disappearance of many of the rākau rongoā that were once used. The challenge is to reclaim that knowledge, as people work to restore the resources the whenua (land) once provided.

A Raupō hut, location unknown 1905. Photo: Auckland Libraries Heritage Collections 2-V612, photographer H E Vaile

Previous page: Wetland restoration, Waimea inlet, Tasman Bay. Photo: Kathryn Brownlie

REPO HAVE MANY WAYS OF HEALING THE WHENUA

In these days of intensive farming, repo are of special importance. Their role in absorbing nutrients and toxins from adjacent waterbodies and associated catchments, makes it safer for all the life that belongs there. The past was very different. The pre-European landscape didn't have animals that polluted the land with their waste, as is the case with many of the domestic animals introduced to our landscapes since settlement. Nor were chemicals, such as fertilisers, used to optimise the productivity of the land. These are issues that should be considered when it comes to the use of rongoā.

Repo also mitigate the effects of flooding events by trapping debris and retaining silt and mud. These materials enrich the soils around the edge of the repo and provide habitat for a rich diversity of species, including many of the plant species sought for rongoā. At the same time, repo retain water and give it time to drain through the soils to feed the aquifers that feed puna (freshwater springs), which in turn allow life to thrive. Owing to repo drainage over the last 150 years and the poor state of remaining repo, many puna have disappeared, along with the whole network of native plants and animals they sustained.

Makomako, wineberry. Photo: Te Kawa Robb

Table 1. Native species introduced in this chapter

Plant or animal (Māori name and common name)	Scientific/ botanical name
Hangehange | NZ Privet	*Geniostoma ligustrifolium*
Karamū | Coprosma	*Coprosma robusta*
Kawakawa	*Piper excelsum*
Koromiko | Hebe	*Veronica salicifolia, V. stricta*
Māhoe | Whiteywood	*Melicytus ramiflorus*
Maire tawake, waiwaka | Swamp maire	*Syzgium maire*
Makaka | Marsh/saltmarsh ribbonwood	*Plagianthus divaricatus*
Makomako | Wineberry	*Aristotelia serrata*
Mamaku | Black tree fern	*Cyathea medullaris*
Mātātā | NZ Fernbird	*Megalurus punctatus*
Mingimingi	*Coprosma propinqua*
Patē, patetē | Seven finger	*Schefflera digitata*
Ponga I Silver fern	*Cyathea dealbata*
Pukatea	*Laurelia novae-zelandiae*
Putaputawētā, kaiwētā | Marbleleaf	*Carpodetus serratus*
Raupō I Bulrush	*Typha orientalis*
Raurēkau, manono, kanono, kawariki	*Coprosma grandifolia*
Swamp daisy	*Olearia solandri*
Tī kōuka I Cabbage tree	*Cordyline australis*
Tuna I Freshwater eels	*Anguilla* spp.
Tutu, tūpākihi	*Coriaria* spp.
Whekī | Rough tree fern	*Dicksonia squarrosa*

Pate/patetē, seven finger.
Photo: Jamie Watson

Pukatea. Photo: Beverley Clarkson

Tutu, tūpākihi, *Coriaria arborea*.
Photo: Beverley Clarkson

Table 2. Native species featured in other chapters of *Te Reo o Te Repo – The Voice of the Wetland* (2017)

Plant or animal (Māori name and common name)	Scientific/ botanical name	Chapter references
Harakeke I NZ flax	*Phormium tenax*	4.3 Harakeke – weaving our people together 7.2 Waitaki restoration Poster 3. Taonga classifications and species
Kahikatea	*Dacrycarpus dacrydioides*	Poster 3. Taonga classifications and species
Korimako | Bellbird	*Anthornis melanura*	5.3 Ruru – he tangi na te ruru – conversations in the night
Kōura | Freshwater crayfish	*Paranephrops* spp.	5.2 Kōura – the ancient survivor Poster 3. Taonga classifications and species
Kōwhai	*Sophora* spp.	5.5 Matamata – eating with our tūpuna
Kuta, ngawha, paopao I Giant spike sedge	*Eleocharis sphacelata*	4.2 Kuta – the giant of freshwater habits
Mānuka | Teatree	*Leptospermum scoparium*	Poster 3. Taonga classifications and species
Matipo, mapou	*Myrsine australis*	Pamphlet – Raakau preservation technique
Matuku | Australasian bittern	*Botaurus poiciloptilus*	3 Toreparu Wetland – a research partnership journey 7.3 He whenua ora – Te Hākari Dune Wetland
Ponga | Silver fern	*Cyathea dealbata*	3 Toreparu Wetland – a research partnership journey
Pūriri moth	*Aenetus virescens*	5.3 Ruru – he tangi na te ruru – conversations in the night
Ruru | Morepork	*Ninox novaeseelandia*	5.3 Ruru – he tangi na te ruru – conversations in the night
Toetoe	*Austroderia* spp.	Poster 3. Taonga classifications and species
Tūī	*Prosthemadera novaeseelandiae*	5.3 Ruru – he tangi na te ruru – conversations in the night
Wētā	*Rhapidophoridae, Anostostomatidae* families	Poster 3. Taonga classifications and species

Kareaotahi is a small peat lake that is being enhanced by a community restoration group. Lake Cameron, Waipā District, Waikato.
Photo: Abby Davidson

REPO AS A SOURCE OF RONGOĀ

Repo are becoming increasingly important to whānau (family) who use rongoā Māori. In many places throughout Aotearoa, particularly in the urban centres where many people live, they are among the few places where rākau rongoā can still be found. This will increasingly become the case as landowners fence off their waterways and wetlands to help address urgent water-quality problems. Restoration plantings have led to little patches of new native bush where once very little remained. Many of the species used in these plantings are important as rongoā, although it is likely that few people engaged in wetland restoration are aware of the plants' medicinal properties.

Tūī feeding from a kōwhai tree. Photo: Manaaki Whenua

Some important points

1. **The key role of rākau rongoā is not to heal us, the people, but to heal the whenua. We have to stop always putting ourselves in the centre of the picture.**

   We need to consider all the other life that belongs there. In Te Ao Māori, rākau rongoā are all whānau, descendants of Tāne Mahuta (God of the forests and birds), and that includes us; and in that whānau we are pōtiki (the last-born child of Tāne Mahuta). To put ourselves and our needs ahead of te taiao (natural world) is against tikanga (cultural values and practices) and causes an imbalance that affects the whole living world.

2. **Rākau rongoā are for the most part found on the regenerating fringe of the ngahere.**

   Their role is to help recreate the environment needed for the whenua to recover and, in time, to thrive. If you take special note of which plants establish first, and where, you will gain an insight into how they may help us as rongoā. Plants like koromiko (hebe), makomako (wineberry), mānuka (NZ tea tree), and tutu come up quickly after a fire or flood and cover the land to stop it from drying out and blowing away. This in turn establishes the environment that will help other slower growing and more permanent species to establish. These first plants are quickly followed by karamū (coprosma), swamp mingimingi, matipo, and many other species. If it is damp enough, mamaku and wheki will quickly appear, or in drier landscapes other tree ferns such as mamaku (black tree fern) and ponga (silver fern) will grow. Once there is sufficient shade, kawakawa, raurēkau, patetē (seven finger), and hangehange (NZ privet) may start to establish.

   Similar processes occur in a repo: the rushes and sedges that first appear capture soil and build up the land so that shrubs and trees can follow if conditions are suitable.

   - This only happens naturally if there is a seed source nearby, and enough of the right bird species to bring the seed. Much of the whenua has lost the power to heal itself. There is little or no local seed source, and the birds that spread the seed have vanished. Even worse, plants like harakeke and kōwhai rely on birds such as tūī and korimako to pollinate their flowers. If these birds are absent from the environment, pollination may not be effective, and less seed will be produced to help the land recover.
   - To make rongoā available again, much more than just planting trees must be done. We particularly need to look after the birds, which means taking care of animal pests that kill them, such as stoats, ferrets, and feral cats (among others). We must also work hard to control weed species. Trees like crack willow (*Salix fragilis*) and grey willow (*S. cinerea*) will take over the fringes of repo and exclude most native plants, including those used for rongoā. The whenua has been hurt so much that in many cases it cannot be restored unless we help. That's our special role as Tane's potiki.

   Fast-growing, early successional plant species quickly form a protective fringe around the edge of the ngahere (bush). These plant species are usually the ones chosen for restoration projects, both because they are easy to propagate and grow, and have an ability to draw nutrients from the soil. In a wetland situation a range of more wet-tolerant plants will be included: trees like tī kouka, harakeke, swamp mingimingi, and various sedges and rushes, to be followed later with pukatea, māhoe, patetē, swamp maire, and other species that require shade to establish.

   Always keep remembering the main role of rākau rongoā is to restore and heal the community of species that makes a healthy wetland community. Planting them enables the birds and invertebrates to return as they all play important roles in sustaining the health of the repo and all the species that belong there.

- A lot of chemicals are used in modern day agriculture and horticulture (e.g. fertilisers and sprays), and they can be harmful to human health. Sprays and chemicals are also used the clear the weedy vegetation as part of the restoration work, especially at the beginning. As they often remain in the soil, taking time to break down and become safe, the chemicals can be absorbed by the plants that grow there, and make them unsafe to be used as rongoā. A great example of this is explained in chapter 4.1 Wātakirihi – te huakita o te wātakirihi – bacterial quality of watercress.

3. **We need to restore the natural biodiversity of repo, not just plants and trees.**

   Restoration plantings too often include only a few species, the ones that are easiest and cheapest to source, grow, and plant. This means the previous diversity of that whenua is often not restored, even if the riparian areas are well planted. Diversity is needed for the health of the whenua. For one thing, birds need it; the whenua should provide a continuous food supply throughout the whole year, as well as suitable and safe places to nest. Kairongoā (rongoā practitioners) remind us that sometimes the effectiveness of a rongoā may depend on the environment in which it is growing, and what it is growing with. We need to restore the networks, the world of connections that the whenua needs to be well and healthy, not just to plant trees and plants around repo to cover the fringes.

Increasingly, restored wetlands are places where whānau look to find their rongoā. But the rongoā from which we benefit most may not be the leaves and branches we prepare for ourselves; many people find even greater healing for themselves in helping to heal the whenua. This connects us to its mauri (life force), and is a greater source of healing than any rongoā wairākau (rongoā tea) – that healing reaches the deepest part of us.

Raurēkau. Photo: Te Kawa Robb

But there is a need to be wary! Rākau rongoā growing in highly modified environments may not be safe to use as rongoā.

Harakeke (NZ flax), raupō (bulrush) and pūrekireki (swamp sedge) thrive at Otauria Wetland, Hannah's Bay, Rotorua. Raupō shows typical winter dieback. Photo: Beverley Clarkson

HOW TO RE-INTRODUCE RĀKAU RONGOĀ INTO THE REPO

The key is to work towards creating a welcoming environment for all the whānau (plants, animals and birds) of that whenua – not just for ourselves and our needs, but for the whole whānau of Tāne.

The first question to ask is: what does the whenua need to be well and healthy?

If we plant to heal the whenua, and the wai (freshwater) that gives it life, we will find the healing we need. The wellness of people depends on the wellness of the whenua and its wai. Water treated with chlorine and/or other treatments may be safe to drink, but it is not nearly as good as pure water straight from the whenua. Usually the land needs lots of healing before its water is safe to drink. We need to ask the whenua where we should start, rather than rely only on our own knowledge and the expertise of the people who advise us. In all cases, ensure that you source plant species appropriate for your rohe (region) – double check with your kaumatua (elders) and other members of the whānau with expertise, visit other repo nearby, and also look into historical plant records that also give some clues as to the landscape in and around your repo.

1. **Focus especially on plant species that clean and heal the water.**

   A research project led by ESR (Te Whare Manaaki Tangata, Taiao hoki) based in Lake Waikare (Waikato Region) and Lake Wairarapa (Wellington Region) has demonstrated that mānuka has a special ability to remove pathogens from ground waters. These trials involve the participation of mana whenua (Indigenous people with primary rights and responsibilities) of these lakes to maintain and monitor the sites and build capability among the whānau. Raupō is good at absorbing toxins, as the dense stands act as an effective purifier. These stands function as barriers, restricting water flow and allowing sediments to drop out of the water column. Raupō roots provide habitat for microbes (microscopic organisms) that breakdown organic wastes, neutralising their toxicity. Raupō is being used in constructed wetland sites, specifically chosen for water purification purposes. A good guide of successful restoration is to look for native fish. If these fish start to come back it is a sure sign we are beginning to succeed.

Mātātā, NZ fernbird. Photo: © Oscar Thomas

2. **Plant trees for native manu.**

   Manu (birds) rely on established habitat for kai and roosting. Native tree species such as karamū, swamp mingimingi, and makomako produce lots of berries, as well as being hosts for a range of insect species that supplement the birds' diet. Plant a range of species to ensure there is a food supply for birds throughout the whole year. Kahikatea are very important fruiting trees in repo. They may take some years to mature and fruit but once established they hold their fruit well into winter. Mānuka and putaputawētā are important for pūriri moths and wētā, which then feed ruru (morepork). Once these trees are well established the birds are more likely to stay and nest.

3. **The birds also need secure nesting sites.**

   Makaka and some of the swamp daisies like *Olearia solandri* have dense vegetation that make it hard for stoats and rats to penetrate. The raupō, rushes, and sedges provide shelter for the very shy and special wetland manu such as the matuku (Australasian bittern), the mātātā (fernbird), and other species that have disappeared from much of the motu. When these manu return, we know the mauri of the repo is reviving.

4. **Add any rākau rongoā that might be missing.**

   More than likely, most are already part of the mix, but some rākau need some protection and are best planted once initial trees are established. Kawakawa grows best with some shade, especially if it is to be used for rongoā, and raurekau is most often found in the subcanopy, under the other trees. Once the initial plantings have become established, it is time to infill plant with species that need some protection to grow, especially those that we might need as rongoā.

HARVESTING RONGOĀ
BEST NOT TO HURRY!

We must always ask the whenua before we start to harvest. If we harvest too soon after planting not only may we hurt or even kill the trees, but we may also miss out on much of the rongoā. Rongoā is not simply the preparation of the right leaves and branches, the place where the trees grow, and what other species they grow with are also very important. So too are the season and time of day. All of these factors affect rongoā.

We need to give our rākau rongoā time to settle into the whenua and make the connections that enable them to thrive. We must keep reminding ourselves that the main purpose of rākau rongoā is to heal the whenua and all the life that belongs there – they are not there just for our benefit. If we keep looking after our plantings and visiting them regularly, we will know when they are ready to give us rongoā.

We must always approach the whenua as healers not as harvesters. We share what it provides, not as owners but as part of the whānau, as pōtiki.

Ka ora te whenua, ka ora te tāngata

If you heal the land, you heal the people

This whakataukī gives us the guideline we must always follow. Caring for the whenua is the key to our own health and well-being. This applies particularly to ngā repo; they are truly the "kidneys of the whenua".

Focusing only on our own health, harvesting rongoā when we need it, and ignoring it for the rest of the time will at best bring only short-term benefits. Our own physical ailments and limitations are not our greatest source of concern. Rather, we need to look to the hurting within us, our insecurities, our loss of the connections we need to be well, the paru that contaminates our minds and our hearts and stops us from seeing clearly and knowing how to care for ourselves and the world around us.

In going to a repo, **let's not just look for the plants we need for rongoā, rather look for how the repo heals the whenua and cleans the wai** – it does that by healing connections and sharing life. **If we can learn that lesson we are on the road to good health.**

Dense stand of raupō reedland showing typical winter dieback Waihi Scenic Reserve, South Taupō Wetland. Photo: Yvonne Taura

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Clarkson B 2010. Chapter 13. Monitoring. In: Peters M, Clarkson B ed. *Wetland restoration. A handbook for New Zealand freshwater systems*. Lincoln, New Zealand: Manaaki Whenua Press, Landcare Research. Pp. 242–261. https://www.landcareresearch.co.nz/__data/assets/pdf_file/0014/41423/Chp_13_Monitoring_2012.pd

Gines MG, Robinson B, Prosse J, Esperschurtz J, Mishra M, Horswell J 2017. *Manuka planting for water quality.* Water New Zealand Issue 202. Pp. 63–66. https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=3046

McGowan R 2019. *Tiwaiwaka – healing the mauri of the whenua. Ka ora te whenua, ka ora te tangata.* Tauranga, New Zealand.

Te Reo o Te Repo – The Voice of the Wetland

Harmsworth G. *Poster 3. Taonga classifications and species.* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/Poster_taonga_classification_and_species.pdf

Kapa M. *Chapter 4.2. Kuta – the giant of freshwater habitats.* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/4_2_Flora_Kuta.pdf

Kusabs I. *Chapter 5.2. Kōura – the ancient survivor.* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/5_2_Fauna_Koura.pdf

Mahuta R, van Schravendijk-Goodman C, Paki H. *Chapter 5.3. Ruru – he tangi na te ruru – conversations in the night.* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/5_3_Fauna_Ruru.pdf

Mahuta R, van Schravendijk-Goodman C, Baker C. *Chapter 5.5. Matamata – eating with our tūpuna* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/5_5_Fauna_Matamata.pdf

Robb M, Thomson T. *Chapter 3. Toreparu Wetland – a research partnership journey.* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/3_Toreparu_Wetland.pdf

Scheele S. *Chapter 4.3. Harakeke – weaving people together.* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/4_3_Flora_Harakeke.pdf

Smith H. *Chapter 7.3. Hei Whenua Ora – Te Hākari Dune Wetland.* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/7_3_Hei_Whenua_Ora.pdf

Taura Y. *Pamphlet – Raakau preservation technique.* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/7_1_Rakau_Preservation.pdf

Tipa G, Nelson K, Home M, Tipa M. *Chapter 7.2. Waitaki restoration.* https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/7_2_Waitaki_Restoration.pdf

Useful websites

Pa Ropata McGowan

Queen's Service Medal 2020 – For services to Māori and conservation
https://www.nzherald.co.nz/bay-of-plenty-times/news/article.cfm?c_d=1503343&objectid=12335710

Loder Cup Award Winner 2018
https://www.doc.govt.nz/news/events/awards/loder-cup-award/2018-winner

Te Ahi Kaa
https://www.rnz.co.nz/national/programmes/teahikaa/audio/201792503/rob-mcgowan-rongoa-practitioner

Waka Huia
https://www.youtube.com/watch?v=-MOtY38Shfk

Pokapū Akoranga Pūtaiao – Science Learning Hub
Healing repo
https://www.sciencelearn.org.nz/videos/2017-healing-repo

Raupō
https://www.landcareresearch.co.nz/science/plants-animals-fungi/plants/ethnobotany/weaving-plants/information-sheets/raupo

Rongoā and repo
https://www.sciencelearn.org.nz/videos/2016-rongoa-and-repo

Tiwaiwaka
https://www.tiwaiwaka.nz

Contact details for Pa Ropata McGowan

Email: rmcgowan@doc.govt.nz

5.
TE REO O TE REPO
THE LANGUAGE OF THE SWAMP

HĒMI WHAANGA (NGĀTI KAHUNGUNU, NGĀI TAHU),
TOM ROA (WAIKATO, NGĀTI MANIAPOTO)
TE PUA WĀNANGA KI TE AO – TE WHARE WĀNANGA O WAIKATO

'Ki te hiki au i tōku wae i tēnei whenua, ka moanatia i muri i a au, pūrekireki wīwī māna tātou hei huti ake ki uta, ko Te Atua tōku piringa, ka puta ka ora.'

'If I were to lift my foot (of influence) from this land, it would be flooded (by unwelcome influences). The pūrekireki sedge grass will be a sanctuary for us from the swamps, and as God is my refuge, I will survive.'

Kīngi Tāwhiao (Waikato)

It is 'by language that the Māori are able to know the will and mind and power of the Gods … [It has] a life force, a power, and a living vitality. Language has a spirit and also a mauri (that gives it its unique structure and function).' [1]

The name 'repo' is a term that many of us are familiar with for describing a wetland or swamp – it is also the term that is used in the title of this wetland series: *Te Reo o Te Repo – The Voice of the Wetland.*

[1] Barlow, 1991: 112

The language and kōrero (narratives) we use to describe our relationship with this water system has its origins in our mātai tuarangi (cosmology), whakapapa (genealogy), and understanding of te reo (language). Te reo is often described as a vehicle that carries our whakapapa, tikanga (customs), hītori (history), pūrākau (mythology), waiata (songs), karakia (prayers), mātauranga (knowledge), whakaaro (thoughts and ideas), tūmanako (hopes, dreams, and desires), and whakararu (frustrations and anger). Language constantly changes and evolves over time. We consider language as tapu (sacred) because of its connection to ngā atua (founding elements) as it was gifted to our tūpuna (ancestors) by ngā atua.

Paru (mud rich in iron salts, valued mud for black dye in weaving) in the lower Waikato River, Waikato. Photo: © Swampfrog Environmental

Previous page: Pūrekireki, *Carex secta*, at Lake Kanohirua, Te Uruwera. Photo: © Neil Fitzgerald

Māori have always interacted and had a close connection with oceans and waterways, from our journey from Hawaiki (ancient homeland) to the time we transitioned from iwi moana (people of the ocean) to tangata whenua (people of the land). When our tūpuna came to Aotearoa New Zealand, they encountered a landscape of floral, faunal, and geographical diversity whose richness was matched only by its unfamiliarity. As we observed and interacted with new land- and seascapes and the various species that occupied these environments, our language and naming practices evolved. Our mātauranga of the waterways – awa (rivers and streams), roto (lakes), repo (wetlands and swamps) systems grew over time and was methodically imbedded and incorporated across our oral traditions in whakapapa, pūrākau, waiata, karakia, mōteatea (laments), whakataukī (proverbs), and interwoven into our practices and beliefs. This connection and relationship between these water systems and people in the environment are described as the principle of 'ki uta ki tai' (to the mountains to the sea).

In this chapter we talk about some of the features of our language and the various ways we describe this relationship with repo from the origin of kupu (words) and whakapapa. Also, how this mātauranga was embedded in many of the names and places scattered throughout the land- and seascape.

The native water spider (*Dolomedes* spp.) found in swamps, is well camouflaged against the autumn leaves.
Photo: © Swampfrog Environmental

At poukai, gathering mātauranga Māori about wetland birds. Ngā Tai e Rua Mārae, Tuakau, Waikato. Photo: © Swampfrog Environmental

THE ORIGIN OF REPO

There are various versions describing the origin of repo; and many of them centre around ngā atua wāhine (founding female elements) and the important role in their creation. In particular, narratives point to ngā atua wāhine such as the three depicted in the following images:

Ngā atua wāhine o ngā repo – Goddess Series.
Illustrations: Te Kura Ormsby

***Wai-nui-ātea*: The Clear Mighty Waters**

***Para-whenua-mea*: The Muddy Soil of Mother Earth**

One version describes the time following the separation of ***Ranginui*** (Sky Father) and ***Papatūānuku*** (Earth Mother). When ***Tāne*** (God of the forests and birds) separated his father and mother he set about providing means for his mother to be protected and cared for. One of those means was the great forest of ***Tāne*** and repo plays an extremely important part in Te Waonui a Tāne (forest mythology). In this account, Tāne created the repo as the kidneys for ***Papatūānuku***, acting as a natural cleansing mechanism for her body. These were named ***Ngā Whatukuhu o Papatūānuku***, the kidneys of Earth Mother.

In terms of the whakapapa of repo there are various versions. Many of these whakapapa accounts describe the relationship between the numerous atua and various water systems. One version by Tupai Whakarongo Tarawhare – the last tohunga (expert) from the Tokitoki Whare Wānanga in Tūranganui-a-Kiwa, Gisborne (North Island) – includes a description of the whakapapa of repo in an oriori (lullaby) he composed for Te Whakataha-ki-te-rangi (the child of Tu-rere-i-ao and Ana Taka-waerea).

In this oriori, ***Wai-nui-ātea*** is the tupuna of inland waters – awa, roto, repo:

- ***Rangi*** (Sky Father) married his second wife ***Wai-nui-ātea*** (Clear Mighty Waters), and their union created ***Te Moana-nui a Kiwa*** (Great Ocean of Kiwa).
- ***Te Moana-nui a Kiwa*** married ***Para-whenua-mea*** (Muddy Soil of Mother Earth), and their union created ***Moana-nui*** (Mighty Ocean), ***Moana-roa*** (Open Seas), and ngā repo ***Tū-i-te-repo*** (Oozy Swamp)***, Tu-i-te-wao*** (Oozy Forest Swamp), and ***Tū-te-hemo-rere*** (Oozy Putrid Swamp). ***Rangi-tahuri*** is known as the originator of whītau (harakeke fibre).

HE ORIORI MŌ TE WHAKATAHA-KI-TE-RANGI

Ka noho Wai-nui-ātea, ka noho i ā Rangi,
The Mighty Waters did abide with the Sky Father,

Puta mai ki waho rā Moana-nui a Kiwa;
And unto them was born the Great Ocean of Kiwa;

Ka maringi kei raro ko Para-whenua-mea,
Poured down here below was the Muddy Soil of Mother Earth,

Nā Moana-nui, e, nā Moana-roa, e.
Begotten, too, by the Mighty Ocean were the Open Seas.

Nā Tū-i-te-repo, nā Tū-i-te-wao,
The Oozy Swamp, the Oozy Forest Swamp,

Nā Tū-te-hemo-rere, nāna Rangi-tahuri;
Oozy Putrid Swamp begat Rangi-tahuri;

Nāna te whītau, ka roia hei kaka,
She grew the flax from which cloaks were woven,

Ka mahana i ahau.
That now keep me warm.

Lines 20-27 of song number 234: He oriori mō Te Whakataha-ki-te-rangi, Apirana Ngata (2006)

In an explanation to clarify some of the links contained in the oriori, Hēnare Ruru (Rangatira (chief) of Te Whānau o Taupara, Te Aitanga-a-Māhaki, Tairāwhiti – Gisborne) provided the following whakapapa of ngā atua (Fig. 1) which outlines the connection between ***Rangi*** and ***Wainui-ātea*** to the primary water bodies of ***Moana-nui, Moana-roa, Moana-pōtango, Moana-hakere, Tū-i-te-repo, Tū-i-te-wao,*** and ***Tū-i-te-hemo-rere***.[2] This version omits ***Te Moana-nui a Kiwa*** and ***Para-whenua-mea*** but it is exactly the same as the version collected by Edward Treagar (19th Century surveyor, linguist and writer) from Wiremu Wī Pere (19th Century politician from Te Aitanga-a-Māhaki and Rongowhakaata, Tairāwhiti):[3]

Figure 1. A version of repo whakapapa as told by Hēnare Ruru[2]

In other versions, ***Te Moana-nui a Kiwa*** and ***Para-whenua-mea*** created ***Moana*** (Ocean) and ***Wai*** (Water). In this example, ***Kiwa*** is also described as the father of ***Onepū*** (sand) and ***Te Parahua*** (fresh alluvial deposit).

In a version from the Waikato region (North Island), ***Tangaroa*** (God of the oceans) had three wives:

- ***Hine-i-te-huhi*** – the union with Tangaroa descend repo
- ***Hine-Moana*** – the union with Tangaroa descend roto and awa
- ***Ikatere*** – the union with Tangaroa descend ika (fish)[4]

A version from Te Waipounamu (South Island) notes that ***Hine-i-te-huhi*** and ***Hine-i-te-repo*** are the personified versions of swamps. ***Hine-tū-repo*** one of the wives of ***Māui*** (Polynesian demigod), was ravished by ***Tuna*** or ***Puhi***, personified form of the eel.[5]

Other versions credit ***Hine-Moana*** with creating all the species of the moana, including tuangi (cockles), kina (sea urchins), ngōiro (eels), kanakana (lamprey), kanae (mullet), tāmure (snapper), gurnard, hapuku (groper), haku (kingfish), kahawai, tarakihi and the wheke (octopus). Together with ***Kiwa***, ***Hine-moana*** birthed ***Rakahore*** (Rocks), ***Taumata*** (Stones), and eight other children (refer to Hirini Moko Mead (Māori anthropologist)).[6]

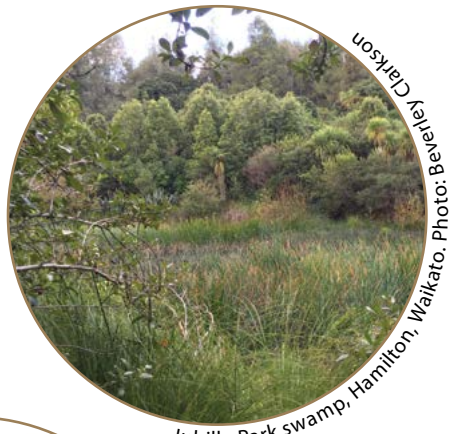
And finally, Aroha Yates-Smith (Māori academic) notes that ***Hine-o-te-repo*** is a sister of ***Māui*** and a kaitiaki (guardian) of swampland, and ***Hine-Moana*** is the personified form of the ocean, daughter of ***Hinerauwhārangi***, as well as the second wife of ***Kiwa***.[7]

What is important to note with these few examples is the diversity of stories relating to the origins of these water systems. Each has its own kōrero and whakapapa to describe the relationship to these important waterways – awa, roto, repo.

[2] Ngata & Jones, 2006: 222
[3] Tregar, 1898: 113
[4] Hopkins, 2018: 658
[5] Best, 1982: 327
[6] Mead, 2003: 344
[7] Yates Smith, 1998: 253

TE REO: THE ORIGIN OF WORDS FOR DESCRIBING A WETLAND, SWAMP, BOG OR MARSH

Te Reo o Te Repo (the language of the swamp) is a language that describes our intimate relationship with both land- and seascapes. Mātauranga regarding repo has been built over millennia of interactions, and this knowledge was integrated into our oral traditions, practices and beliefs, and immortalised in the names, places, and stories.



Jubille Park swamp, Hamilton, Waikato. Photo: Beverley Clarkson

Waipapa mire, Pureora, Waikato. Photo: Beverley Clarkson

Mangaiti Gully swamp, Hamilton, Waikato. Photo: Beverley Clarkson

The term 'repo' in te reo Māori has various meanings. One meaning refers to repo as a 'swamp, bog, marsh (noun)', another means 'dirt, dust (noun)'. Another description provides a clue to its origins in Polynesia. In some of the many Pacific languages the term 'repo' and its various spellings refer to 'dirt, dirty and earth' (Table 1).

Table 1. Word search for *repo 'dirt, dirty, earth'

Language	Name	Meaning
Rarotongan	Repo	Dirty, soiled, foul; dirt, muck, mud; to shit
Pukapuka	Lepo	Mud, wet taro bed
Penrhyn	Repo	Dirt, filth; soil; excrement, faeces; to be dirty; to evacuate
Tuamotu	Repo	Dirt
Rapanui	Repo/Rapo	Clay
Hawaiian	Lepo	Dirt, earth, ground; dirty, soiled

Pollex is a comparative dictionary of Polynesian languages.
Ref: Greenhill, Clark, & Biggs, 2020

Another name that many of these languages have for a swampy area is the word 'huhi' or 'husi; fusi; uwi; vuci' (depending on how you spell it in the various islands) (Table 2). In many of these examples, 'huhi' is used to describe a swampy area that is used for cultivating taro (*Colocasia esculenta*), the starchy root crop with edible leaves. The word hūhi is also another name we have in te reo Māori for wetland or swamp.

Table 2. Word search for *swamp

Language	Name	Meaning
Fijian	Vuci/Levu	Swamp
Nuguria	Huhi	Swampy area where swamp taro is cultivated, taro gardens
Nukuoro	Husi	Swamp, taro bog
Pukapuka	Uwi	Taro swamp
Samoan	Tau/Fusi	Swamp, marsh; piece of swamp
Rennellese	Husi	Swamp, especially wet-land taro patch

Pollex is a comparative dictionary of Polynesian languages.
Ref: Greenhill, Clark, & Biggs, 2020

We also have many other names in te reo Māori, as described in Table 3.

Table 3. General names in te reo Māori for describing a wetland, swamp, bog or marsh

Name	Description
Hawai	(adjective) shallow of a lagoon or swamp
Hīwai	(noun) open water in a swamp
Hū	(noun) mud, swamp, mire, quagmire
Kōrepo	(noun) shallow swamp
Kōreporepo	(adjective) swampy
Kūkūwai	(noun) wet, swampy land
Mātā/mātātā	(noun) deep swamp
Mato	(noun) deep swamp, deep valley
Monoku	(noun) wet
Ngae, ngaengae, ngahengahe	(noun) swamp
Ngaeki	(noun) swamp
Oru	(adjective) boggy
Papawheki	(adjective) firm, solid (of a swamp with a good bottom)
Paru	(noun) mud
Pipīwai	(adjective) damp, humid, swampy
Po(w)haru	(adjective) soft, boggy, sodden
Poharu/ pōharuharu	(noun) bog, mud, quagmire
Pūrekireki	(noun) tufts of sedge in a swamp
Rawa, rarawa	(noun) swamp
Rei	(noun) swampy ground, peat
Repo	(noun) swamp, bog, marsh
Reporepo	(noun) swamp, marsh
	(adjective) be swampy, marshy
Roto	(noun) bog, swamp
Tāpokopoko	(noun) bogginess, bog
U(w)hi	(noun) covering (applied to vegetation in a swamp, etc.)
Wairepo	(noun) swamp waters, bog, marsh
Waro	(noun) deep swamp, deep hole, pit
Wharu	(noun) mud, quagmire, bog, mire

There is also a group of words that describe different types of activities and states associated with wetlands and swamps (Table 4).

For example:

- Describing moving and movement: kautū (to wade), po(w)haru (to sink, be stuck), and tapoko; tāpokopoko (to sink, get bogged down; soft, boggy).
- Describing methods used to catch food in repo: rami, rapu, takahi (to catch eels in marshy places by feeling for them with the hands).
- Describing how repo move when you walk on them: ngaere (to oscillate, quake, shake, tremble (as a bog)).

Table 4. General names in te reo Māori for describing activities

Name	Description
Kautū	(verb) to wade
Ngaere	(verb) to oscillate, quake, shake, tremble (as a bog)
Ngapu	(verb) to oscillate or undulate, as swampy ground
Po(w)haru	(verb) to sink, be stuck (into mud, bog etc.)
Rami	(verb) to catch eels in marshy places by feeling for them with the hands
Rapu	(verb) to catch eels by feeling for them with the hands in marshy places
Takahi	(verb) to catch eels by feeling for them with the feet in marshy places
Tapoko; tāpokopoko	(verb) to sink (into mud, etc.), get bogged down
	(adjective) soft, boggy

These examples highlight the connection Māori have to our Polynesian origins, including the variety of names we have, and the different types of activities and ways of describing a wetland, swamp, bog or marsh. There are also many examples of place names, land features and kōrero that have a direct link to repo, for example, Pūrekireki Marae in Pirongia (Waikato, North Island).

PŪREKIREKI MARAE PIRONGIA, WAIKATO

Pūrekireki Marae takes its name from a tongikura by Kīngi Tāwhiao (Waikato):

'Ki te hiki au i tōku wae i tēnei whenua, ka moanatia i muri i a au, pūrekireki wīwī māna tātou hei huti ake ki uta, ko Te Atua tōku piringa, ka puta ka ora.'

'If I were to lift my foot (of influence) from this land, it would be flooded (by unwelcome influences). The pūrekireki sedge grass will be a sanctuary for us from the swamps, and as God is my refuge, I will survive.'

Marutehiakina whare tupuna, Pūrekireki Marae, Pirongia, Waikato.
Photo: Supplied by Tom Roa

The pūrekireki (*Carex secta*) is a grass-like sedge that grows in swamplands. When crossing swamps you can stand on 'pūrekireki' to prevent sinking into the muds of the swamp, thanks to the 'trunk-like' mass they form at their bases from their dead and dying leaves. Ducks also use the protection offered by pūrekireki for their nests and resting places.

'Stand on the pūrekireki and you don't sink!'

Pūrekireki, *Carex secta*, at Lake Kanohirua, Te Uruwera.
Photo: © Neil Fitzgerald

The Waikato region was invaded by the Colonial Forces in 1863, and by 1864 Kīngi Tāwhiao (the Māori King 1860–1894) and his people were expelled from their tribal lands and took refuge primarily with their Ngāti Maniapoto (Waikato-Waitomo region) whanaunga (family relatives). This is what became known as the King Country. With that expulsion, Kīngi Tāwhiao and Ngāti Maniapoto rangatira (chiefs) established the aukati (a boundary marking a prohibited area) – an area from Kāwhia on the West Coast, across to Cambridge via Pirongia, southward to Taupō, across to Mōkau on the West Coast back to Kāwhia. For two decades from 1864, only those who were friendly to the Kīngitanga (Māori King Movement) were permitted into this rohe (area). Surveyors and non-Māori settlers who entered the King Country uninvited were expelled, were warned of dire consequences, and some were even executed after persistent infraction. In composing this tongikura (prophetic saying Tainui dialect), Kīngi Tāwhiao was stating that if he removed his protection as Kīngi Māori from this rohe, it would be flooded by non-Māori settlers. The pūrekireki would therefore, be a sanctuary in the swamp where mana Māori motuhake (self-determination) would hold.

CONSIDERATIONS FOR DEVELOPING WETLAND KNOWLEDGE

As highlighted earlier in the chapter, Te Reo o Te Repo describes our intimate relationship with culturally important land- and seascapes. For many iwi Māori, it is becoming all the more important to regenerate and continue to use our distinctive mita (dialects) to prevent the imbedded observations, knowledge, whakapapa, and narratives from disappearing.

Some considerations when considering your journey with *Te Reo o Te Repo – The Language of the Swamp*:

1. **Kōrero with your kaumātua (elders) and key whānau (family) members about the ways your people describe waterway systems** – awa, roto and repo, as well as whenua (land). Remember that language is expressed as much in our whakairo (carving), raranga (weaving), and waiata as it is in kōrero.
2. **Learn and record your unique names for the native plant and animal species found around your repo and associated landscapes.** Many of the Māori names used for species are currently based on a generalised dialect, which means localised experiences and understanding of those species and places can be diluted or overwhelmed by the mita of other iwi (tribes).
3. **Whakataukī (proverbs) are a koha (gift) from our tūpuna to help guide us in our activities and decisions.** Considering that the modern world we live in is highly modified and very different from our tūpuna, we mustn't be afraid to create our own whakataukī based on our learning in wetland restoration, for example, to be shared with our mokopuna (descendants). These form important kete mātauranga (baskets of knowledge) that help to facilitate and enhance growth in the way we speak about, to, and with our repo.

Harakeke (NZ flax), raupō (bulrush) and pūrekireki (swamp sedge) thrive at Otauria Wetland, Hannah's Bay, Rotorua. Raupō shows typical winter dieback. Photo: Beverley Clarkson

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Atua wāhine and whakapapa

Barlow C 1991. *Tikanga Whakaaro: key concepts in Māori culture.* Auckland, New Zealand: Oxford University Press.

Best E 1982. *Māori religion and mythology: Part 2*. Wellington, New Zealand: Government Printer.

Hopkins A 2018. *Classifying the mauri of wai in the Matahuru Awa in North Waikato.* New Zealand Journal of Marine and Freshwater Research 52(4): 657–665. DOI: 10.1080/00288330.2018.1536670

Mead HM 2003. *Tikanga Māori – living by Māori values.* Wellington, New Zealand: Huia Publishers.

Ngata A, Jones PTH 2006. *Nga Mōteatea – the songs. Vol. 3.* Auckland, New Zealand: Auckland University Press.

Treagar E 1898. *Kiwa the navigator (collected from Wi Pere), by Edward Tregear*. Journal of the Polynesian Society 7(2): 111–113.

Yates-Smith A 1998. *Hine! e Hine! Rediscovering the feminine in Māori spirituality.* Unpublished PhD thesis, Hamilton, New Zealand: University of Waikato.

Further information

Greenhill SJ, Clark R, Biggs B 2020. Pollex. https://pollex.shh.mpg.de

Robertson N 2019. *Para-whenua-mea – Muddy-soil-of-Mother-Earth. Personifications of water in Te Ao Māori (the Māori world).* In: Halter R, Walthard C 2019. *Cultural spaces and design: prospects of design education.* Basel, Switzerland: LIBRUM Publishers & Editors LLC. https://openrepository.aut.ac.nz/bitstream/handle/10292/13030/2019-10-06_CSD-Book-and-cover_small.pdf?sequence=5&isAllowed=y

Contact details for Dr Hēmi Whaanga

Email: hemi.whaanga@waikato.ac.nz

6.
PULLING NATURE BACK FROM THE BRINK
INTERWEAVING CULTURE, SCIENCE, POETRY AND *SPORADANTHUS*

JULIAN WILLIAMS (NGAATI MAKIRANGI),
BEVERLEY CLARKSON (MANAAKI WHENUA),
CORINNE WATTS (MANAAKI WHENUA),
ROBERT HOARE (MANAAKI WHENUA)

Ki te kotahi te kaakaho ka whati, ki te kaapuia e kore e whati

When reeds stand alone they are vulnerable, but together they are unbreakable

Kiingi Taawhiao (Waikato)

It's difficult to imagine the impact that the potential loss of *Sporadanthus ferrugineus* would have had on the overall health and well-being of Te Awa o Waikato, particularly in the eastern and more southern areas of the lower catchment. For this reason, we want to mihi to our tupuna awa. We also acknowledge the hapuu of the lower Waikato who suffered immeasurable losses to their practices and environmental knowledge as a result of this plant and its associated ecosystems almost being completely decimated. We cannot turn back time, but we can do our best to better facilitate the reinvigoration of memory and connection. We hope this chapter provides renewed interest and support of this valuable peatland taonga.

– Ngaa mihi, naa Julian maatou ko Beverley, ko Corinne, ko Robert

SPORADANTHUS: THE PLANT THAT WAS AND THEN ALMOST WASN'T

If you've ever had the chance to wander through Lake Rotopiko, a peat lake located in the Waikato region, you may be in awe of the stunning remnant kahikatea (*Dacrycarpus dacrydioides*) stands, or of the swathes of sphagnum moss interspersed with obscure native grasses like swamp millet (*Isachne globosa*). As well, there are slowly expanding dense swards of tall, rush-like plants called *Sporadanthus ferrugineus,* also known as bamboo rush, giant wire rush, or cane rush.

Previous page: *Sporadanthus ferrugineus*, Kopuatai Peat Dome, Waikato. Photo: Beverley Clarkson

Sporadanthus ferrugineus population at Lake Rotopiko, Waikato. Photo: Beverley Clarkson

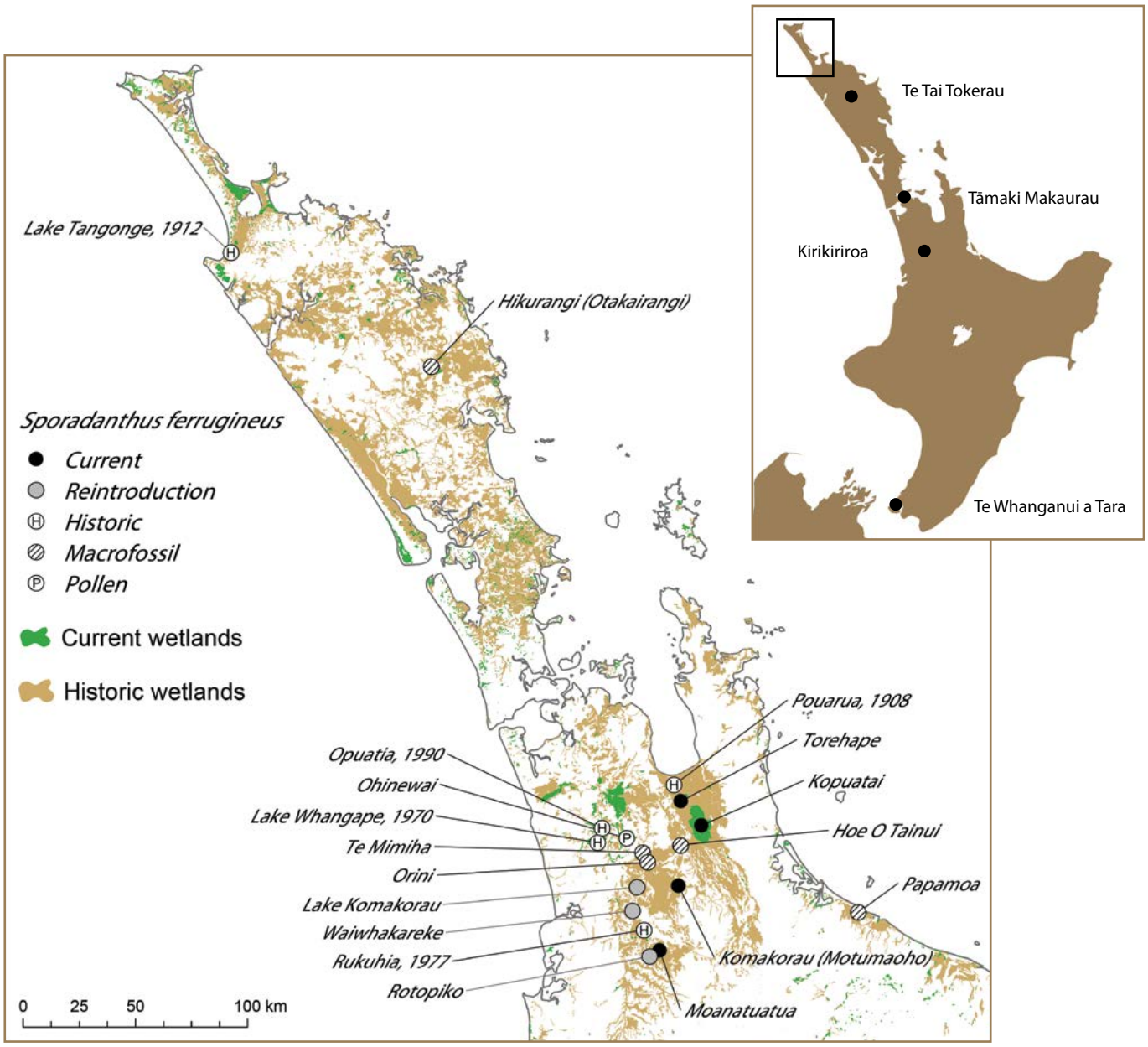


Figure 1. Map of historic (1840) and current (2008) records of *Sporadanthus ferrugineus* in New Zealand.
Adapted from de Lange et al. 1999, Manaaki Whenua – Landcare Research

Sporadanthus ferrugineus once dominated more than 100,000 ha of northern North Island (Fig.1), including the Waikato region from Ohinewai – Hoe o Tainui – Pouarua in the north, to Moanatuatua in the south. With such a large expanse of this unique plant featured across the Waikato peatscapes, it would have been well known – at least to local hapuu (sub-tribes) and whaanau (families). However, there's a familiar sad tone to the story of *Sporadanthus*, as there is for a number of our indigenous and endemic wetland plant species.

Late 19th Century, in the wake of Raupatu (land confiscation throughout the Waikato) suffered by Waikato peoples, *Sporadanthus* rapidly disappeared from the landscape following extensive wetland draining and agricultural conversion. Today, little more than 3000 ha – only a fraction of the original extent (3%) now remains. It is currently listed as a threatened species – at risk and relict – by the Department of Conservation, which means it is confined to very few fragments, all in the Waikato region.

Along with the loss of *Sporadanthus*, potentially a huge body of knowledge, including the ingoa (names), whakapapa (connections), and tikanga (customary values and practices) associated with the plant seem to have also disappeared. We have not been able to locate any maatauranga (knowledge) about *Sporadanthus* or the traditional relationship with hau kaainga (local people). Such is the sad reality of native plant species loss – when they disappear, ecosystems steadily disappear, whakapapa is fractured, and the kaumaatua (elders) who remembered it eventually pass away.

COLLABORATIVE EFFORT TO BUILD KNOWLEDGE OF A DECLINING PLANT

This chapter is a collaboration between a diverse range of people with an interest in *Sporadanthus* and its valuable ecosystem. Our team comprises tangata whenua affiliated with the traditional lands and natural resources with historic *Sporadanthus*-dominated peatlands; ecologists who have studied the unique wetland ecosystem including plants and invertebrates; a scientist with a particular fondness for poems, and a very special skinny caterpillar.

In coming together, we do so as woven strands of a kete (harakeke basket) or even as a kaakahu (a form of cloak woven from the fibres of harakeke) to surround, protect, and enhance the little understanding we have of this intriguing plant. We use the best available knowledge, tools and experience at our collective disposal to share this message. As a result, we share everything we know in this chapter – cultural memories and clues; scientific and technical information; imagery; experience of our experimental plots and monitoring in the Waikato, and even poetry.

We have only just started to 'weave this kaakahu'. We hope that our readers and next generation of indigenous knowledge holders, orators and scientists – along with our fellow non-Maaori scientists and poets – will keep building on, and eventually help us complete this precious garment of a plant that 'almost wasn't'.

Sporadanthus ferrugineus also known as bamboo rush, giant wire rush, or cane rush. Photo: Beverley Clarkson

HE AHA TE INGOA I TUKU IHO O TE TAONGA NEI? REDISCOVERING PIECES OF THE JIGSAW PUZZLE OF WAIKATO PEATLANDS

Sporadanthus ferrugineus is a remarkable plant from raised peat bogs in northern Aotearoa New Zealand – it survives solely in ultra-low nutrient rainwater, instead of nutrient-rich ground water (like most other plants). Early botanists commented on its immense abundance in the Waikato, as it stretched to the horizon in a smooth waving field of brown tasselly tops – the description of the scientific name *ferrugineus* (rust-coloured) refers to.

There have been previous names for *Sporadanthus ferrugineus* in the botanical literature: *Calorophus* sp., *Lepyrodia traversii*, and *Sporadanthus traversii*. Originally, the North Island species was thought to be the same as *Sporadanthus traversii*, which is widespread in bogs on Rekohu Chatham Island. However, in 1999, taxonomic and ecological investigations revealed two distinct species, each endemic (confined) to these botanical regions. This means that instead of one larger population of the same species spread across two locations, we have two smaller but separate populations of related plants. This difference is important to ensure the two species are not mixed in restoration projects, thus maintaining ecological integrity of each population.

Through a mix of historical records, maps of wetland extent and land use changes over time, pollen analyses, and study of wetland ecology and processes, we can start to assemble a rough picture of what has and is happening to *Sporadanthus*. These tools allow us to quantify impacts to the plants and restoration success which, when combined, can be used to build plans and strategies to enhance the health and well-being of *Sporadanthus*-dominated wetlands. However, there are elements within the wider narrative of *Sporadanthus* and peat wetland systems that are not as easy to measure; such as the human component.

Sporadanthus ferrugineus rust coloured flower heads (tassels). Photo: Beverley Clarkson

The interactions between human communities, species and ecosystems are important for understanding the wider wetland story. However, these stories usually only start at European settlement in the early 19th Century, resulting in centuries long gaps in knowledge. Recognising these gaps enables us to understand the profound cultural and ecological disruption resulting from European settlement. Events like the large-scale Raupatu throughout the Waikato facilitated the suppression of knowledge, until, in some cases, it was then 'lost'.

The impact of lost land and lost cultural knowledge is hard to measure. It is difficult to put a number or data set to something when we are not sure where the actual start point was. These are some of the realities that we now face in wetland restoration: we are not just trying to physically restore these valuable ecosystems, but also to find ways to restore knowledge that, although 'lost' at the moment, is just (we hope), waiting for the right trigger to help it resurface.

Slowly, but increasingly, the traditional names and descriptions given to native plant species by hapuu and iwi, are valued as more than just a name. Embedded within these names are narratives describing anything from the origin of the species, to its wider whakapapa and ecology, its use by the hau kaainga, and events or people that it may be associated with. In researching *Sporadanthus,* we quickly discovered that its names, as understood by Waikato peoples, are difficult to locate. Finding a name may not seem that important, but when the narratives embedded in the name of the species as discussed, its absence raises questions:

- What are we (Maaori and non-Maaori) losing in our understanding of plant species, and even peatlands, by not knowing its names as given by tuupuna?
- How can we bring back its names?
- But more importantly, who should be tasked with reviving plant species names given by tuupuna?

We conclude that a plant's name can only be revealed to its people when it wants to. We wish to share our experiences in the meantime to provide some background for interested whaanau.

Throughout the wetland handbook series, contributors have used the general name of 'wiiwii', which is a kupu Maaori (Maaori word) we recognise for encompassing several rushes and rush-like plants, typical of wetlands throughout the motu (country). However, we cannot say for certain that this is a name that should necessarily continue to be used to describe *Sporadanthus* within Te Ao Maaori or botany.

Examples of other rushes referred to as wiiwii by hau kaainga include:

- *Juncus* species, e.g. our native species such as *Juncus pallidus* and *J. edgariae*; but note that our people do use the same name to refer to exotic species;
- Sometimes oioi *(Apodasmia similis*) can also be referred to as wiiwii;
- *Machaerina* species, e.g. *M. articulata* (*Machaerina* was formerly known as *Baumea*).

In our investigations, we have come across two additional names for *Sporadanthus*: whatipuu and kaho, but the original sources have not been verified and we are also unsure about the dialectal origins.

Juncus edgariae. Photo: Beverley Clarkson

Oioi. Photo: Beverley Clarkson

Machaerina articulata. Photo: Beverley Clarkson

Whatipuu could well refer to the visual display of the vegetation type in the landscape, reflecting the vast brown fields of robust, flexible stems swaying in the wind. 'Whati' might refer to the way the plants bend or move. It could also be in the context of 'break', given *Sporadanthus*, as a member of the jointed 'rush' family (Restionaceae), has stems which break easily at the joints, especially when dry. The 'puu' might refer to their clumping growth form, or could be related to the sound of the stem breaking. With whatipuu in mind, it is possible that the plant could have been useful for thatching, or packing and insulation of whare, similar to the uses of raupoo (*Typha orientalis*).

Kaho can refer to the description of the horizontal batten of tukutuku panels (ornamental lattice-work seen in meeting houses), and so tends to be associated more with the culms of toetoe (*Austroderia* spp.). Toetoe have a very similar tussock-like growth form to *Sporadanthus*, and, considering the depth of observational skills and botanical knowledge of our tuupuna, it is possible the name could have been used as a descriptor, or as part of a traditional classification system.

As highlighted here, however, the challenges of losing plant species – even if we find them again – generate a larger set of complications for our understanding of wetlands, especially when key knowledge systems like those of tangata whenua (Indigenous people) are missing in the broader picture.

Sporadanthus ferrugineus flower head and jointed stems. Photo: Beverley Clarkson

Toetoe. Photo: © Neil Fitzgerald

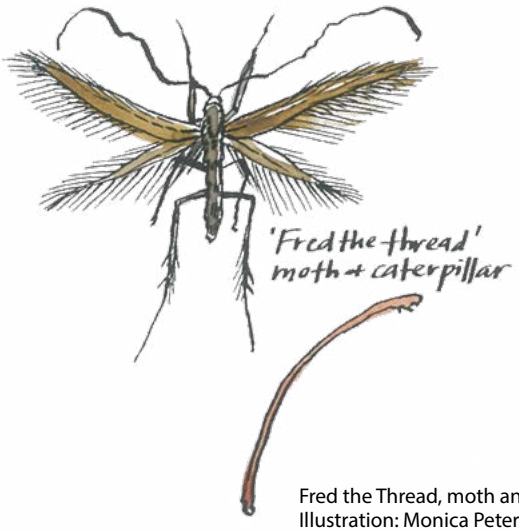
Monitoring reconstructed populations of *Sporadanthus ferrugineus* at Lake Rotopiko, Waipaa district. Photo: Supplied by Beverley Clarkson

HOW *SPORADANTHUS* PEATLANDS ARE BEING RESTORED IN THE WAIKATO AND FINDING 'FRED THE THREAD'

This next section outlines how we are developing our scientific knowledge of *Sporadanthus* and explores the caterpillar/moth associated with it. There are three sites where populations of *Sporadanthus* were reintroduced as part of wider lake catchment restoration initiatives. Sites are adjacent to Lake Rotopiko (Waipaa district), Lake Komakorau (Waikato district) and in the Waiwhakareke Natural Heritage Park (Hamilton city). All reintroductions occurred between 2006 and 2008 using young *Sporadanthus* plants sourced from a peat mine at Torehape on the Hauraki Plains (Fig.1).

One of the unique features of *Sporadanthus* is that it's home to 'Fred the Thread' (*Houdinia flexilissima*), an endemic moth whose larvae are reputed to be the world's skinniest (i.e. thread-like) caterpillar. The moth is also classified as threatened - just as its host plant is. The caterpillar is found only inside *Sporadanthus* stems and in no other plants. 'Fred' is now apparently well-established and thriving at all three reintroduced population sites, indicating the larvae would have been translocated inside the original *Sporadanthus* plants sourced from the peat mine.

Propagation of *Sporadanthus* through sowing seed or transplanting young plants is relatively easy, enabling re-establishment in areas where it once grew, and also for constructing new populations for cultural or educational purposes. Lake Komakorau, Waikato. Photo: Beverley Clarkson



Fred the Thread, moth and caterpillar. Illustration: Monica Peters

Once upon a peatland – Memories of Fred

The story of Fred's discovery begins with the research relationship between researcher Corinne Watts and the plant *Sporadanthus*. While studying the stems at Torehape Peat Dome (Hauraki District) in 2003, Corinne chanced upon squiggly lines decorating the stems and wondered which artist might be responsible. Opening up stem after stem, she discovered amazingly thin, long thread-like larvae (caterpillars) of a reddish orange colour, and the legend of **'Fred the Thread'** was born. Fred has no legs, but he does have a hinged head-capsule that allow him to eat his way along the inside the *Sporadanthus* stem.

No entomologist (a person who studies insects) could work out to what type of insect the Fred larvae belonged. Lepidopterists (a person who studies butterflies and moths) thought they were Coleoptera (beetles); coleopterists (a person who studies beetles) thought they were Diptera (flies); and no dipterists (a person who studies flies) could be found to comment. Eventually Corinne and a lepidopterist colleague, Robert Hoare, reared the larva through to adulthood, and lo and behold, they were indeed moths (Lepidoptera)!

'Fred the Thread' was named *Houdinia flexilissima* – after its remarkable escape from the tight confines of the *Sporadanthus* stem (named after the Great Harry Houdini, escape artist and magician of the late 19th century), and its very thin flexible larva.

FRED THE THREAD

A poem by Robert Hoare

I have a friend (his name is Fred)
He's thinner than a cotton thread
His colour is an orange-red
He doesn't feed on jam or bread
But *Sporadanthus* stems instead.
Such narrow tunnels must he tread
He needs a hinge inside his head
To give his jaws the room to shred
The food that is his home and bed
And stop himself from dropping dead.

Now when our friend is fully fed
And knows the time has come to shed
His final skin, a sense of dread
Begins to filter into Fred:
How fast, he thinks, the time has sped!
And what a sheltered life he's led!
He hopes he'll have some outdoor cred
And won't be thought of as inbred.
He sloughs his skin from A to Zed
And there's a pupa in his stead!

Three weeks have passed, and it's incred-
ible to see the adult Fred,
A mothy person born and bred
To look like that on which he's fed.
He shows an admirable ded-
…ication to his art, his sed-
…entary posture leaving ed-
…ucated mothmen ruby-red,
The effort of locating Fred
Causing a rush of blood to head
Resulting in potential med-
…ical emergency and bed
With cooling drink and favourite ted*
Until delirium has fled.

To summarize, he's Fred the Thread,
He's red and has a hingèd head
His head is used to shred his bed,
His bed's the food on which he's fed,
His bed is red and I am led
To think the redness of the Fred
Reflects the bedness of the red
I mean the redness of the bed
The bed he shreddeth with his head
Until the Fred is fully fed
And sheds the skin he has to shed
To flee the bed that must be fled
To lead the life that must be led
To woo the wife that must be wed
To father further Freds of Thread.
Then Fred can smile and drop down dead.
I've said the things I wanted said.

*teddy bear

Fred the Thread is thought to be the world's thinnest caterpillar with a width of up to only 0.9 mm! The caterpillar, pupa and body of the moth are all a distinctive pinkish orange colour, similar to the culms of the *Sporadanthus* stems. The caterpillars hatch from small oval eggs into the stem creating star-shaped or squiggly lines as they feed and the moths rest along the length of the stems. Photos: Birgit Rhode, Manaaki Whenua and © Neil Fitzgerald

WHAT WE CAN DO TO HELP BUILD OUR KNOWLEDGE OF OUR PEATLANDS, AND PLANTS LIKE *SPORADANTHUS*

- **Investigate old maps to see what kinds of wetlands may have existed around your marae, papakaainga, and wider rohe**

  Maps of past and present wetland extent (area) and types can be sourced from Manaaki Whenua, Taihoro Nukurangi (NIWA), Te Papa Atawhai (Department of Conservation), or your local councils. Be sure to ask for maps or information that can help you identify the wetland types. This information is important for understanding the different, and often unique kinds of plants, birds, insects or fish that live in those places, and will also help with gathering your own maatauranga about them.

- **Gather images of the plants, fish and animals associated with the wetland types found in your areas – especially the rare/uncommon ones**

  Maaori names of plants and animals (if they can be found) do not always capture regional and local dialects specific to your hapuu. Getting photos will help trigger memories for whaanau and so may help identify the names and tikanga associated with those species. If possible, try to get live samples of plants from your local nursery to help make the connection more real.

- **Koorero with kaumaatua (elders) and whaanau about the types of spaces that used to exist around your marae**

  When you are able to get the props mentioned above – maps, images, and real plants, dedicate some time to sit down with your whaanau and kaumaatua to talk through what your local environment used to look like. Be sure to talk about the smells, the sounds, as well as the things seen. Our senses can tell us a lot about what was going on, including the abundance of life found in those places, and also give clues as to what you might want to investigate further as a whaanau.

HELPFUL GLOSSARY

Understanding the terminology

Coleoptera – the order (group) of insects known as beetles; this is the largest order of animals on earth

Coleopterist – a person who studies or collects beetles

Diptera – a large order (group) of two-winged insects, also known as true flies; includes mosquitoes

Dipterist – a person who studies or collects true flies, including mosquitoes

Entomologist – a person who studies or collects insects

Larva – juvenile form of insect, e.g. caterpillar. Plural is larvae

Lepidoptera – the order (group) of insects that includes butterflies and moths

Lepidopterist – a person who studies or collects butterflies and moths

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Clarkson BR 1997. *Vegetation recovery following fire in two Waikato peatlands at Whangamarino and Moanatuatua.* New Zealand Journal of Botany 35: 167–179.

Clarkson BR 2002. Swamps, fens and bogs. In: Clarkson BD, Merrett M, Downs T eds *Botany of Waikato.* Hamilton, New Zealand: Waikato Botanical Society. Pp. 47–55.

Clarkson BR, Schipper LA, Clarkson BD 2004. *Vegetation and peat characteristics of restiad bogs on Chatham Island (Rēkohu), New Zealand.* New Zealand Journal of Botany 42: 293–312

Clarkson BR, Schipper LA, Lehmann A 2004. *Vegetation and peat characteristics in the development of lowland restiad peat bogs, North Island, New Zealand*. Wetlands 24: 133–151.

Clarkson BR, Peters M 2010: Revegetation. Chapter 10 In Peters M, Clarkson BR, *Wetland restoration: a handbook for New Zealand freshwater systems.* Lincoln, New Zealand: Manaaki Whenua Press. Pp. 155–184.

Clarkson BR 2018. *New Zealand Restiad Bogs.* In: Finlayson C, Milton G, Prentice R, Davidson N (eds) The Wetland Book, Springer, Dordrecht. https://doi.org/10.1007/978-94-007-4001-3_222

Clarkson BR, Cave VM, Watts CH, Thornburrow D, Fitzgerald NB 2020. *Effects of lowered water table and agricultural practices on a remnant restiad bog over four decades*. Mires and Peat, 26, 19, 13 pp. https://doi.org/10.19189/MaP.2019.OMB.StA.1876

de Lange PJ, Heenan PB, Clarkson BD, Clarkson BR 1999. *Taxonomy, ecology, and conservation of Sporadanthus in New Zealand.* New Zealand Journal of Botany 37: 413–431.

Haenfling C, Newnham R, Rees A, Jara I, Homes A, Clarkson B 2016. *Holocene history of a raised bog, northern New Zealand, based on plant cuticles.* The Holocene 27(2): 309–314.

Hoare R, Dugdale JD, Watts CH 2006. *The world's thinnest caterpillar? A new genus and species of Coleophoridae s.l. (Lepidoptera) from Sporadanthus ferrugineus (Restionaceae), a threatened New Zealand plant*. Invertebrate Systematics 20: 571–583.

Neilson K, Hodges M, Williams J, Bradly N 2018. *Waikato and Wāipa River restoration strategy – Volume 1: Report and references.* Waikato Regional Council Report 2018/08. Hamilton, New Zealand: Waikato Regional Council. https://www.waikatoregion.govt.nz/services/publications/tr201808

Peters MA, Clarkson BR 2008. *Recreating rare restiad wetlands in the Waikato*. Poster. NZ Landcare Trust. https://www.landcare.org.nz/file/recreating-restiad-wetlands

Wagstaff SJ, Clarkson BR 2012. *Systematics and ecology of the Australasian genus Empodisma (Restionaceae) and description of a new species from peatlands in northern New Zealand*. Phytokeys 13: 39 79. https://doi.org/10.3897/phytokeys.13.3259

Watts C, Clarkson B, Cave V, Thornburrow D, Thorpe S 2020. *Invertebrate communities in a modified isolated raised bog compared to an intact raised bog in New Zealand*. Mires and Peat, 26, 20, 12 pp. https://doi.org/10.19189/MaP.2019.MEH.StA.1879

Watts C, Thornburrow D, Clarkson B, Dean S 2013. *Distribution and abundance of a threatened stem-boring moth, Houdinia flexilissima, (Lepidoptera: Batrachedridae) in New Zealand peat bogs.* Journal of Research on the Lepidoptera 46: 81–89.

Waikato-Tainui Te Kauhanganui Inc 2013. *Tai Timu Tai Pari Tai Ao: Waikato-Tainui Environmental Plan.* Hamilton, New Zealand: Waikato-Tainui Te Kauhanganui Inc. 268 p.

Wehi PM, Brownstein G, Morgan-Richards M 2020. *Indigenous plant naming and experimentation reveal a plant-insect relationship in New Zealand forests.* Conservation Science and Practice, 2(10). https://doi.org/10.1111/csp2.282

Useful Websites

Find out more about Fred the Thread
Fred the Thread – A poem

https://www.sciencelearn.org.nz/videos/752-fred-the-thread

https://www.rnz.co.nz/national/programmes/afternoons/audio/201823458/critter-of-the-week-fred-the-thread

https://www.abc.net.au/science/news/stories/2006/1767096.htm

Lake Rotopiko – The Serpentine Lakes complex
https://www.wetlandtrust.org.nz/wp-content/uploads/2019/10/Rotopiko-Brochure-Jul-2013.pdf

Wetlands in the Waikato
https://www.wetlandtrust.org.nz/wp-content/uploads/2018/11/Waikato_wetlands_to_visit.pdf

Wetlands and tuna – A story that needs telling
https://tuna.conference.maori.nz/assets/Uploads/ba6ab0208a/Cheri-van-Schravendijk-Goodman.pdf

WhenuaViz – Whenua Māori Visualisation Tool
https://whenuaviz.landcareresearch.co.nz

Contact details for Dr Beverley Clarkson

Email: clarksonb@landcareresearch.co.nz

7.
KEI KONEI TONU TE MAIRE TAWAKE
KEEPING THE KETE FULL FOR THE ULTIMATE SWAMP TREE

RANGI MAHUTA (WAIKATO),
CHERI VAN SCHRAVENDIJK-GOODMAN
(TE ATIHAUNUI A PAAPAARANGI,
NGAATI APA, NGAATI RANGI),
ANTOINETTE VAN DER WEERDEN (WINTEC)

Maa te rongo, ka moohio;
maa te moohio, ka maarama;
maa te maarama, ka maatau;
maa te maatau, ka ora

Through awareness comes wisdom;
through wisdom comes understanding;
through understanding comes knowledge;
through knowledge comes well-being

We would like to express our thanks to Graeme Atkins (Ngaati Porou) and the whaanau from the myrtle rust and East Coast native plant groups who provide constant injections of inspiration and knowledge to the myrtle rust and native plant protection space. Their determination and passion keep our valued Myrtaceae (myrtle) family on the national radar. Many thanks also to our colleagues from Te Tira Whakamaataki (Maaori Biosecurity Network), Dr Melanie Mark-Shadbolt, Alby Marsh, and Dr Nick Waipara, for supporting whaanau in pursuing aspirations for our taonga species. Thanks also to our whaanau at the coal face – we see you fighting the big fight, and we recognise and tautoko the valuable contributions you all make to protecting our taonga. Ngaa mihi nui ki a koutou.

– Ngaa mihi, naa Rangi maatou ko Cheri, ko Antoinette

Sketch of maire tawake from John Buchanan (1860s) a botanist and botanical artist.
Photo: © Auckland War Memorial Museum Tamaki Paenga Hira

Previous page: Mature maire tawake, Cambridge, Waikato region. Photo: Karen Denyer

As the authors of this chapter, we each have memories of when we first learned about maire tawake – also known as maire tawhake, tuhuhi, waiwaka, and whaawhaakou (swamp maire; *Syzygium maire*). Despite it having featured in the diets of our tuupuna (ancestors), many New Zealanders are not aware of this tree or of its importance in the thousands of hectares of swamp forest that once covered many parts of Te-Ika-a-Maaui (North Island of Aotearoa) and the top of Te Wai Pounamu (South Island of Aotearoa) (Fig. 1).

It's the typical story of wetlands in the mid-19th Century, being drained and converted either to farming or large settlements, which leads to species declining or becoming locally extinct. Over time, because they're no longer in sight, people stop talking about these species. They stop using or referring to them, and finally, they are forgotten. If maire tawake had not reappeared on our radar – the reasons being diverse – we might have continued to remain oblivious. We are no longer oblivious!

This chapter aims to share the best information we can find about this remarkable tree, as our contribution to the kete (baskets) of knowledge. As with many rare species throughout Aotearoa New Zealand, there are gaps in our mātauranga (knowledge), but we try to give prompts for whaanau (families) to help trigger 're-memorying' of our swamp tree and the landscapes that it did – and indeed still does – inhabit. Most important, this is about making sure the kete of our mokopuna (grandchildren) and their mokopuna are never emptied again.

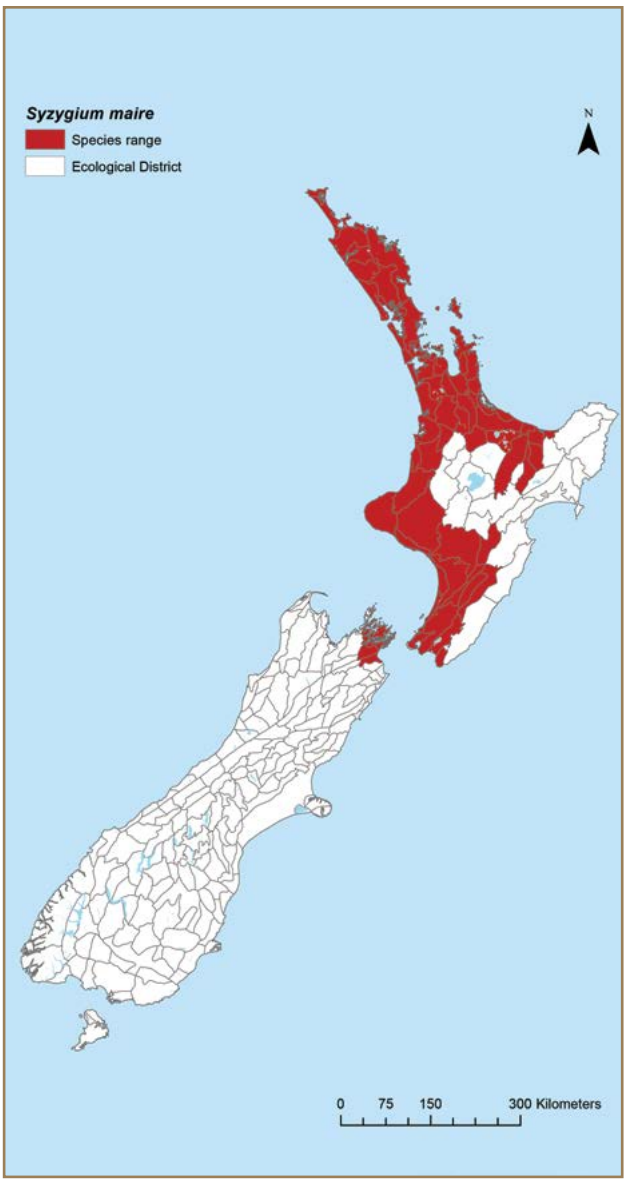


Figure 1. Map of the presence of maire tawake (*Syzygium maire*) in Ecological Districts in Aotearoa New Zealand. Adapted from Wiser et al. 2017, Manaaki Whenua – Landcare Research

Maire tawake seedling.
Photo: Cheri van Schravendijk-Goodman

THE ULTIMATE SWAMP TREE

Maire tawake is an endemic species (only found in Aotearoa) and is one of the very few native trees that can live very happily in a repo (swamp). Next to the familiar kahikatea (*Dacrycarpus dacrydioides*) and pukatea (*Laurelia novae-zelandiae*), maire tawake is the ultimate swamp tree because it has the following key features:

- **A root system that can handle being covered in water.** Maire tawake does this through the development of pneumatophores – aerial roots that appear like bunches of short straws at the base of the tree when in flooded areas. These grow up over the water surface and when waterlogged, the tips of the aerial roots become spongy, and 'breathe in' oxygen that is unavailable in the waterlogged root zone.
- **A flower that stands out among the others to attract insect and bird pollinators.** Maire tawake flowers have bright white stamens (thin filaments appearing above the flower) creating a bristly appearance. These flowers appear in bundles of up to 20 individual flowers, sitting at the ends of branches and making them appear like snow across the tree from November to July. Scientifically, maire tawake belongs to the Myrtaceae family, like poohutukawa (*Metrosideros excelsa*) and raataa (Northern raataa; *M. robusta* and Southern raataa; *M. umbellata*), which all have very similar flowers.
- **A bright red, fleshy fruit that looks tasty to disperser birds.** One of the most obvious bird visitors to a swamp forest is the native kereruu (*Hemiphaga novaeseelandiae*), which can travel up to 65 km a day. As kereruu love to munch on the fruit of kahikatea, it makes sense that maire tawake, a swampy counterpart, would evolve a means to attract kereruu and other birds to eat their fruits and carry the seeds away to another site. Maire tawake is not wholly dependent on our birds, though – the seeds also germinate readily without the assistance of moving through the digestive tract of a bird.
- And most important of all, ***you need swamps – and lots of them.***

The fact that maire tawake has evolved so successfully in waterlogged soils of swampy environments has also contributed to its decline. As swamps have been drained across the motu (country), maire tawake also disappeared across several culturally and ecologically important landscapes. More recently, a new threat has pushed maire tawake even closer to the brink of extinction – a fungal pathogen known as **myrtle rust** (*Austropuccinia psidii*).

Breathing roots of maire tawake. Photo: Bruce Clarkson

White flowers of maire tawake. Photo: Bruce Clarkson

Bright red, fleshy fruit of maire tawake. Photo: Bruce Clarkson

Our tuupuna were on to something! Recent nutritional investigations specifically highlight the high antioxidant value of the maire tawake berries as being up to 18 times that of the famed 'superfood', blueberries (*Vaccinium corymbosum*).

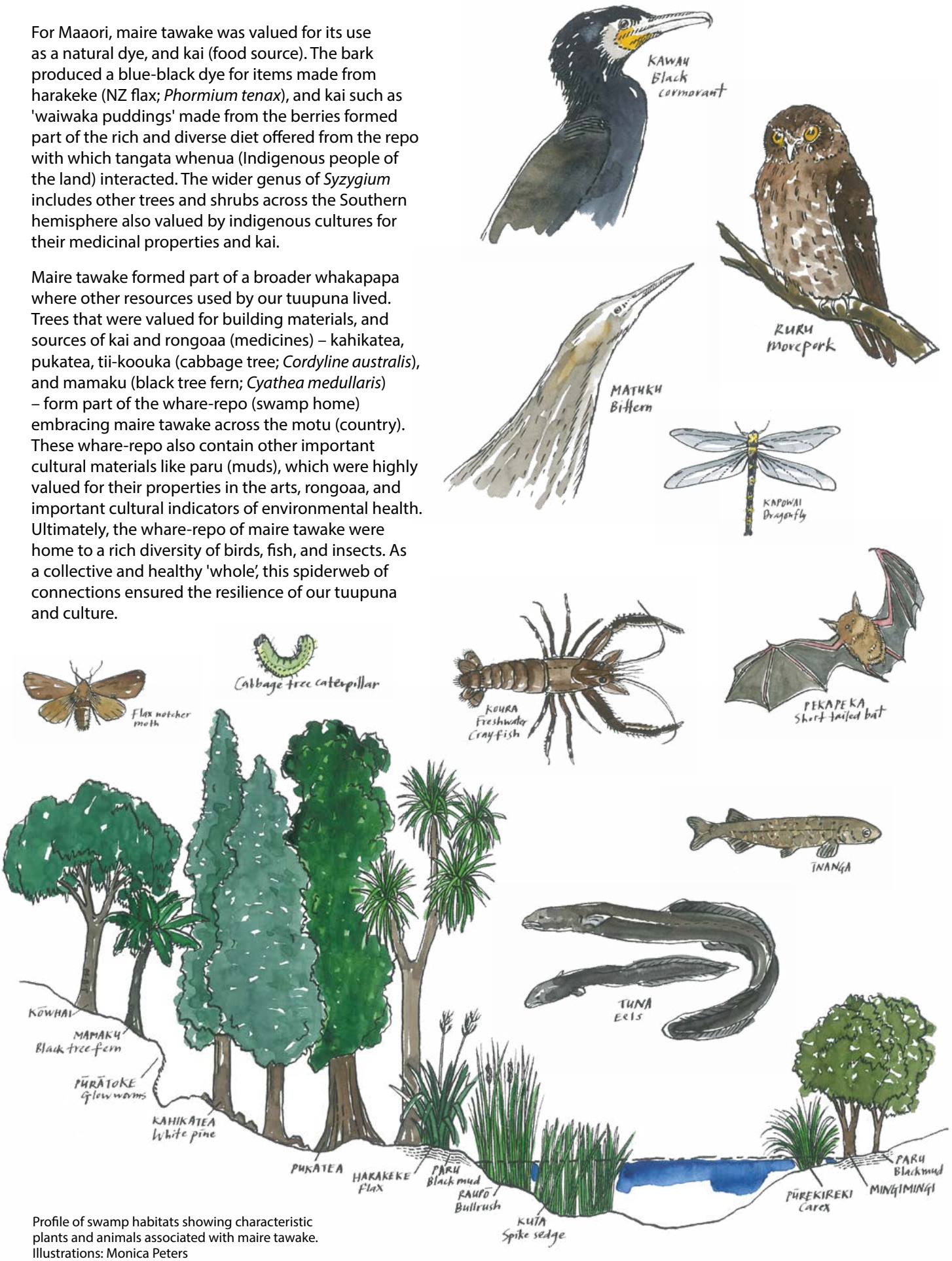
MAIRE TAWAKE ARE STILL HERE
RE-EDUCATING OUR EYES

As noted earlier, the major decline in maire tawake populations following colonisation resulted in its disappearance from the wider national community. Persistent attempts to keep propagating and promoting maire tawake populations diminished. Only a handful of native plant nurseries, wetland ecologists, conservation rangers, and communities (including hapuu (sub tribes) and iwi (tribes)) still had remnant populations and recognised the significant value of the tree. As a result, for many New Zealanders, knowing what the tree looks like – its form, leaves, trunk – is a distant memory. We need to retrain our eyes to see the bigger picture and the place of maire tawake in it.

Can you see it? A maire tawake sapling in a wetland-themed garden, Auckland Botanical Gardens, Auckland.
Photo: Cheri van Schravendijk-Goodman.

For Maaori, maire tawake was valued for its use as a natural dye, and kai (food source). The bark produced a blue-black dye for items made from harakeke (NZ flax; *Phormium tenax*), and kai such as 'waiwaka puddings' made from the berries formed part of the rich and diverse diet offered from the repo with which tangata whenua (Indigenous people of the land) interacted. The wider genus of *Syzygium* includes other trees and shrubs across the Southern hemisphere also valued by indigenous cultures for their medicinal properties and kai.

Maire tawake formed part of a broader whakapapa where other resources used by our tuupuna lived. Trees that were valued for building materials, and sources of kai and rongoaa (medicines) – kahikatea, pukatea, tii-koouka (cabbage tree; *Cordyline australis*), and mamaku (black tree fern; *Cyathea medullaris*) – form part of the whare-repo (swamp home) embracing maire tawake across the motu (country). These whare-repo also contain other important cultural materials like paru (muds), which were highly valued for their properties in the arts, rongoaa, and important cultural indicators of environmental health. Ultimately, the whare-repo of maire tawake were home to a rich diversity of birds, fish, and insects. As a collective and healthy 'whole', this spiderweb of connections ensured the resilience of our tuupuna and culture.



Profile of swamp habitats showing characteristic plants and animals associated with maire tawake. Illustrations: Monica Peters

SYZYGIUM MAIRE WHAT'S IN A SCIENTIFIC NAME?

While the use and recognition of kupu Maaori (Maaori terms) for native plants and animals are increasing, globally, all living organisms on Earth are given a scientific name, based on the Latin language. This classification system provides consistency in communication about flora and fauna across scientific communities. Living organisms are categorised into a **Genus** – the first part of the scientific name, and a **Species** – the second part of the scientific name, based on shared characteristics or traits such as physical appearance. For maire tawake, *Syzygium* is the **genus**; and *maire* is the **species**. Of interest, the species name is a kupu Maaori (indigenous word), deviating from the typical reliance upon Latin as the descriptor language, and highlighting the uniqueness of maire tawake compared with other *Syzygium* species in Australasia.

The name Syzygium comes from the Greek word syzygos, meaning 'paired'. Syz means 'with', and zygon refers to 'yoke' or 'embryo'. Together, it means a 'union of two'. Syzygium therefore refers to the paired leaves and branches of maire tawake that sit opposite each other at the node (Fig. 2). Before this classification (1979), the genus of maire tawake was Eugenia – named after a prince in Savoy, France, in the 18th century.

Importantly, the use of kupu Maaori by our tuupuna also provided a valid means of classification and understanding of the natural world (and sometimes a form of understanding whakapapa (connections)). For over a century, however, this indigenous nomenclature was largely disregarded by non-Maaori (post-colonisation). More recently, studies and papers by

Figure 2. Bright green new growth clearly showing the way pairs of leaves grow out of the stem opposite each other. This growth pattern is echoed across all plants in the genus Syzygium. Photo: Cheri van Schravendijk-Goodman

Maaori and Indigenous authors and academics have successfully argued for their recognition and value for a more 'whole-istic'and informed understanding of the world.

Fully understanding what our kupu mean in relation to trees like maire tawake is an area that deserves more discussion with our people at the flax roots. Better understanding of traditional classification systems could help support restoration and protection of these valued trees. The 'Want to learn more' section provides resources to help discussions with your kaumaatua (elders) and whaanau about any unique names and understanding of whakapapa.

A review of ingoa raakau (tree names from the Maaori language) in an online Maaori dictionary highlights the importance of understanding local dialects, and how names are applied to our species through a Maaori worldview. Table 1 demonstrates the dialectical differences of maire species. Note that we cannot say with confidence where these names are more commonly used, hence the importance of always talking to hau kaainga (home people) to find the correct name used in each rohe (tribal region).

Table 1. Maaori names for swamp maire

Maaori name referring to multiple species	Maaori name of individual species with dialectical differences	Common name	Scientific name
Maire	Maire kootae, maire roororo	Narrow-leaved maire	*Nestegis montana*
	Maire raunui	Black Maire	*Nestegis cunninghamii*
	Maire rauriki	White maire	*Nestegis lanceolata*
	Maire taiki	NZ sandalwood	*Mida salicifolia*
	Maire tawake, maire tawhake, tuhuhi, waiwaka	Swamp maire	*Syzygium maire*
Puka	Maire tawake, maire tawhake, tuhuhi, waiwaka	Swamp maire	*Syzygium maire*
	Pohuehue	Large-leaved Muehlenbeckia	*Muehlenbeckia australis*
	Puka, akapuka	Shining broadleaf	*Griselinia lucida*
	Puka, pukanui		*Meryta sinclairii*
Whaawhaakou	Maire tawake, maire tawhake, tuhuhi, waiwaka	Swamp maire	*Syzygium maire*
	Taawari	Taawari	*Ixerba brexioides*

MYRTLE RUST
WHAT CAN THAT MEAN FOR RESILIENCE OF MAIRE TAWAKE?

In May 2017, myrtle rust was first discovered decimating poohutukawa forests on Raoul Island (Kermadec Islands) and was traced to nurseries in Kerikeri (Northland) and Taranaki where it possibly was wind-blown across from Australia (although it is hard to pinpoint where it first landed on the mainland). Attention focused very quickly on maire tawake and its Myrtaceae cousins, and by mid-2021, the true severity of the impact of myrtle rust on the native Myrtaceae trees was realised. This was particularly evident on the East Coast of the North Island, where mature ramarama (*Lophomyrtus bullata*) were found dead or dying by the local hapuu monitoring team. Myrtle rust was also found on infected maire tawake in Auckland and its susceptibility to the fungal pathogen, along with the susceptibility of ramarama and rohutu (*L. obcordata*), caught media attention.

Myrtle rust attacks the new growth, flowers, and fruit of an infected plant. By knocking out the reproductive system (the flowers and fruit), the fungal pathogen limits the potential of an individual tree to send its offspring and genetic material into the world. It also means the tree may 'suffer from starvation'. As trees rely on their leaves for photosynthesis, and thus, food production, their ability to produce energy declines as their leaves age and fall away. These trees may not be able to produce new leaves due to myrtle rust infection, then they (and affiliated Indigenous peoples and anxious caretakers) are essentially caught in a waiting game for when infected trees will finally expire. Because of this risk, the conservation status of our plants become a major concern.

Before May 2017, the conservation status of maire tawake was '**Not Threatened**'. With the presence of myrtle rust, by 2018, its status had changed to '**Threatened – Nationally Critical**'.

As a result of historical habitat clearance, and the recent myrtle rust incursion, maire tawake – along with ramarama and rohutu – now sits in the same category as rare and threatened native wetland birds like the matuku (Australasian bittern; *Botaurus poiciloptilus*) and paarera (grey duck; *Anas superciliosa*).

Myrtle rust infection on the underside of a ramarama leaf, showing the distinctive bright yellow spores, found on Mount Karioi summit, Waikato. Photo: Scott Bartlam

Myrtle family species native to Aotearoa. Photo: Science Learning Hub

There are 37 native myrtles in Aotearoa, including poohutukawa (*Metrosideros excelsa*), maanuka (*Leptospermum scoparium*), kaanuka (*Kunzea ericoides*), raataa (*Metrosideros umbellata*), maire tawake (*Syzygium maire*), and ramarama (*Lophomyrtus bullata*).

IS IT ALL DOOM AND GLOOM?

At no stage should we underestimate the risk myrtle rust poses to the Myrtaceae family. The surveillance and monitoring mahi (work) of the hapuu from the East Coast, Northland, and Taranaki (North Island) has guaranteed the devastation of myrtle rust remains in our consciousness. More important, we should not continue the 'myrtle rust amnesia' that followed the 2018 announcement from the Ministry for Primary Industries (MPI) about the government's move away from eradication to long-term management. However, it is important to remember that not all trees in the Myrtaceae family will succumb to myrtle rust, and that there may be a form of natural resilience, just as we humans build a resilience to the common cold or flu. Cutting down every tree that shows an infection does not allow this resilience to occur, although not cutting down every tree puts other, more susceptible trees at risk.

How do we re-establish maire tawake in repo with areas of myrtle rust infections – particularly in regions like Auckland and Waikato where huge tracts of wetlands have been drained, and less than 5% remain in some areas?

This issue isn't easily resolved, but such considerations have influenced a large programme of work being led by Ngaa Raakau Taketake – Saving our Iconic Trees, which focuses on resilience for Myrtaceae species. There are some actions we, as taangata tiaki (guardians) of our trees and repo, can take to empower our communities to respond to myrtle rust:

1. **Talk to kaumaatua, whaanau and others in your community about the plants, fish, and birds that used to be and are still in your repo.** Be sure to record your practices associated with those species as they might provide clues for their restoration and monitoring from within your worldview.

2. **Collect information about where your repo used to be and map them** – do you have some remnants still in your rohe that could be restored or buffered? Is maire tawake a tree that could be returned?

3. **Identify whaanau or community members** who have either the skills or the passion you need to lead native plant restoration.

4. **Consider the roles needed as taangata tiaki in biosecurity monitoring and surveillance.** While myrtle rust is a serious plant disease impacting the Myrtaceae family in Aotearoa, there are other pathogens on the horizon. The more eyes we have on the ground searching for unusual activity in our repo and ngahere (forests), the better.

5. **Consider other options for supporting our native species** – particularly those that are at risk like maire tawake. Seed banking – collecting, curating, and storing seeds – is one way to protect the whakapapa of our repo and ngahere. While the seeds of many native trees can be easily stored in banks with the appropriate training, others like maire tawake with 'fleshy fruits' might require more specialist storage and technical skills. Te Tira Whakamaataki (Maaori Biosecurity Network) can provide some guidance and further information on seed banking.

6. **Once you have planned your priorities, seek the advice and guidance of people who can help you:**
   - Kaimahi (staff) at Te Tira Whakamaataki and rangers at Te Papa Atawhai (Department of Conservation) can provide guidance, advocacy, and connection
   - Scientists at Crown Research Institutes like Rangahau Ahumaara Kai (Plant and Food Research), SCION, and Manaaki Whenua – Landcare Research can provide advice about maire tawake and restoration efforts in the light of myrtle rust
   - The natural heritage teams at Te Kaunihera aa rohe (district and regional councils) and advisors at botanical gardens such as the Auckland Botanic Gardens, and Ōtari Native Botanic Gardens, Wellington, can help with better understanding of seed collection, propagation, and maintenance.

Previous page: The trunk of mature maire tawake, Waikato region.
Photo: Karen Denyer

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Clarkson WM 2014. *Waiwaka: Taranaki's forgotten swamp tree*. New Plymouth, New Zealand.

Gould KS, Thodey K, Philpott M, Ferguson LR 2006. *Antioxidant activities of extracts from traditional Maaori food plants*. New Zealand Journal of Botany, 44(1): 1–4.

Pond W 1997. *The land with all the woods and waters. Rangahaua National Theme U*. Unpublished report for Waitangi Tribunal.
https://www.bing.com/search?q=Pond%2CW+(1997).+The+Land+with+all+the+Woods+and+Waters&cvid=76a3f57fca364a8d94a05a5d6034a4f4&aqs=edge..69i57.1305j0j4&FORM=ANAB01&PC=ASTS

Teulon DAJ, Alipia TT, Ropata HT, Green JM, Viljanen- Rollinson SLH, Cromey MG, Arthur K, MacDiarmid RM, Waipara NW, Marsh AT 2015. *Threat of myrtle rust to Maaori taonga plant species in New Zealand.* New Zealand Plant Protection 68: 66–75.

van der Walt K, Kemp P, Sofkova-Bobcheva S, Burritt D, Nagarajan J 2020. *Seed Development, germination, and storage behaviour of Syzygium maire (Myrtaceae), a threatened endemic New Zealand tree.* New Zealand Journal of Botany 59(2): 198–216.

Wiser SK, Cooper JA, Arnst EA, Richardson SJ 2017. *Mapping of native Myrtaceae species in New Zealand*. Manaaki Whenua – Landcare Research Contract Report LC3065 for the Department of Conservation.

Wotton DB, Ladley JJ 2008. *Fruit size preference in the New Zealand pigeon (Hemiphage novaeseelandiae).* Austral Ecology 33(3): 341–437.

Useful websites

Antioxidants
https://nutritionfoundation.org.nz/nutrition-facts/nutrition-a-z/Antioxidants

App for identifying Myrtaceae (trees and shrubs susceptible to myrtle rust)
https://bioheritage.nz/need-help-to-identify-a-myrtle-theres-an-app-for-that

Botanical Gardens

Auckland Botanic Gardens, Auckland
https://www.aucklandbotanicgardens.co.nz

Ōtari Native Botanic Gardens, Wellington
https://wellingtongardens.nz/our-gardens/otari-wiltons-bush

Maire species
https://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=maire

Maaori TV – Myrtle rust devastates native rākau on the East Coast
https://www.youtube.com/watch?v=Y8QxuMFaRhY

Myrtle rust
https://www.myrtlerust.org.nz

Ngaa Raakau Taketake – Saving our Iconic Trees programme
https://bioheritage.nz/research/saving-our-iconic-trees

Science Learning Hub – Pokapuu Akoranga Puutaiao
https://www.sciencelearn.org.nz/resources/2650-myrtle-rust

Te mara reo – Information about maire tawake
http://www.temarareo.org/TMR-Oriwa.html

Te Papa Atawhai – Department of Conservation

Myrtle rust work on Raoul Island, Kermedec Islands
https://www.doc.govt.nz/nature/pests-and-threats/diseases/myrtle-rust/our-work-on-raoul-island

Te Tira Whakamaataki – Māori Biosecurity
https://ttw.nz

The race against myrtle rust
https://www.youtube.com/watch?v=TDv7pzrM3Ps

Contact details for Cheri van Schravendijk-Goodman

Email: Cheri@swampfrog.co.nz

8. RESTORING AND ENHANCING TUNA

ERINA WATENE-RAWIRI (WAIKATO, MANIAPOTO, NGAAI TE RANGI – TAIHORO NUKURANGI)

Kua ngaro te kai, kua ngaro te taangata

As the kai is lost, so too are the people

Kia ora taatou, this article builds on many projects completed over several years by many people. In particular, I would like to acknowledge: Taroi Rawiri, Dr Jacques Boubee, Dr Erica Williams, Waikato-Tainui, Waahi Whaanui Trust, Genesis Energy, Waikato-Tainui College for Research and Development, Waikato River Authority, Taihoro Nukurangi (NIWA), and all the many iwi partners I have had the priviledge of working with over the years.

– Ngaa mihi, naa Erina

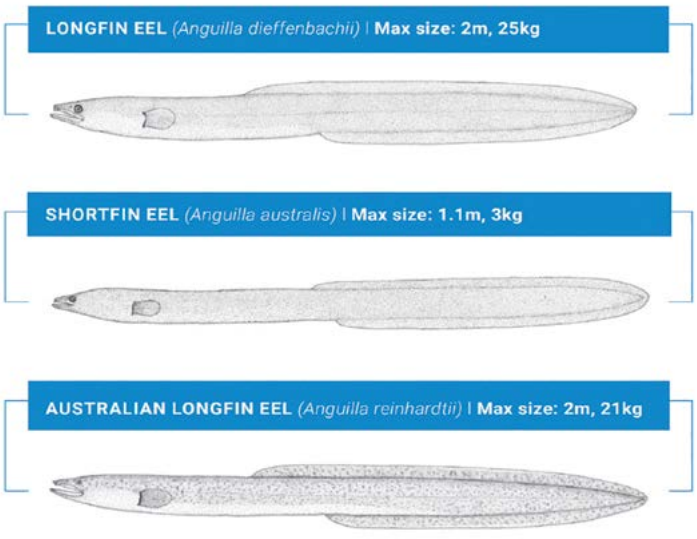


Figure 1. Three tuna species found in Aotearoa, species, maximum size and weight. Photo: NIWA

Tuna or freshwater eels are remarkable fish. Worldwide, there are 18 recognised species, three of which are found in Aotearoa New Zealand (Fig. 1): the endemic longfin eel (*Anguilla dieffenbachii*); the shortfin eel (*A. australis*); and a more recent arrival, the Australian longfin eel (*A. reinhardtii*). These tuna are generally longer lived and slower growing than many other species around the world; longfin tuna in particular, has been recorded as living up to 80 years, whilst the shortfin tuna lives between 15 and 30 years. In terms of their size: longfin tuna reach 2m in length and weigh up to 25kg, shortfin tuna reach a maximum length of 1.1m and weight of 3kg.

Longfin tuna. Photo: Erina Watene-Rawiri

Previous page: Tuna in a net. Photo: Erina Watene-Rawiri

He ua ki te poo, he tuna ki te ao

Rain at night, eels in the morning[1]

This whakataukii reflects ecological understanding by describing the movement of tuna across the whenua (land) during rain as they move to spawn.

Kaitiaki is a pou carved by Johnson Taoho (Ngaati Whaawhaakia), the carving symbolises how tuna populations sustained the people of Raahui Pookeka. Photo: Erina Watene-Rawiri

Tuna were highly valued by Maaori in pre-European times, as shown by their prevalence in place names, whakataukii (proverbs), puuraakau (legends), waiata (songs), and mahi toi (artwork). The importance of tuna for many hapuu (sub-tribes) and iwi (tribes) cannot be underestimated. Tuna are connected to Maaori through whakapapa (geneaology). In some cases, the identity and mana of hapuu and iwi, and access to tuna are intertwined. Due to their abundance, the relative ease with which they were caught, and their high nutrient values, they provided an important source of fat and protein, and in many cases were essential for the survival of Maaori communities. Tuna were so highly regarded that inter-tribal wars were often fought over access to tuna fishing grounds.

Kua kaheko te tuna i roto i aku ringaringa

The eel has slipped through my hands[2]

This whakataukii recognises the morphological characteristics of the slippery skin of a tuna and its status as a prized food to represent a loss where something worthwhile has slipped away.

Although the term 'tuna' is a common name to refer to these valued species, there are distinctive names used among different hapuu and iwi that also reference different stages in their lifecycles. Table 1 provides some examples, but this is not an exhaustive list. For those seeking to work with Maaori, it is important that the unique dialect and science of each hapuu and iwi regarding their tuna maatauranga (knowledge) are acknowledged where appropriate and agreed upon.

Table 1. Some examples of Maaori names for tuna

Maaori name	Possible species
Ika paewai	Longfin, shortfin
Paewai	Longfin, shortfin
Paraharaha	Longfin
Puhi	Shortfin
Rino, ringo	Shortfin
Tuna	Longfin, shortfin, Australian longfin
Tuna pahu	Longfin
Tuna tuoro	Longfin

[1] Mead & Grove, 2001: 305

[2] Mead & Grove, 2001: 131

Maaori knowledge, or maatauranga Maaori, was acquired over many generations. Maaori gained extensive hapuu and iwi specific maatauranga of tuna, which extended well beyond catching tuna for survival. This involved in-depth maatauranga acquired from observation and experience, including understanding the relationship between environmental parameters (rainfall) and life cycle, migration patterns, preferred habitats, and development of sustainable harvesting techniques, as well as preparation, cooking and preservation methods, fisheries conservation practices, traditional names, and relationships with astronomy such as maramataka (Maaori lunar calendar).

Me te raparapa tuna

Like eels split open for drying[3]

This whakataukii outlines a preparation technique where tuna is split and hung on a stick in the sun to dry.

An example of knowledge gained from observation and experience is evident in the following quote:

'Long before the question had begun to interest European Scientists the Maaoris knew that the eels went to sea to spawn, and they had a regular lore built up about their times and manner of migration. So accurate was their knowledge that they could tell to a day when the migrations would commence, and on what nights they would be running…'

– McDonald[4]

Tuna have a complex lifecycle and are diadromous, which means that they spend part of their life in the ocean and part in freshwater (Fig. 2). This is supported by narratives from hapuu and iwi that highlight the depth of understanding that our tuupuna (ancestors) had about this as well as other aspects of tuna ecology.

[3] Mead & Grove, 2001: 305
[4] Best, 1986: 100

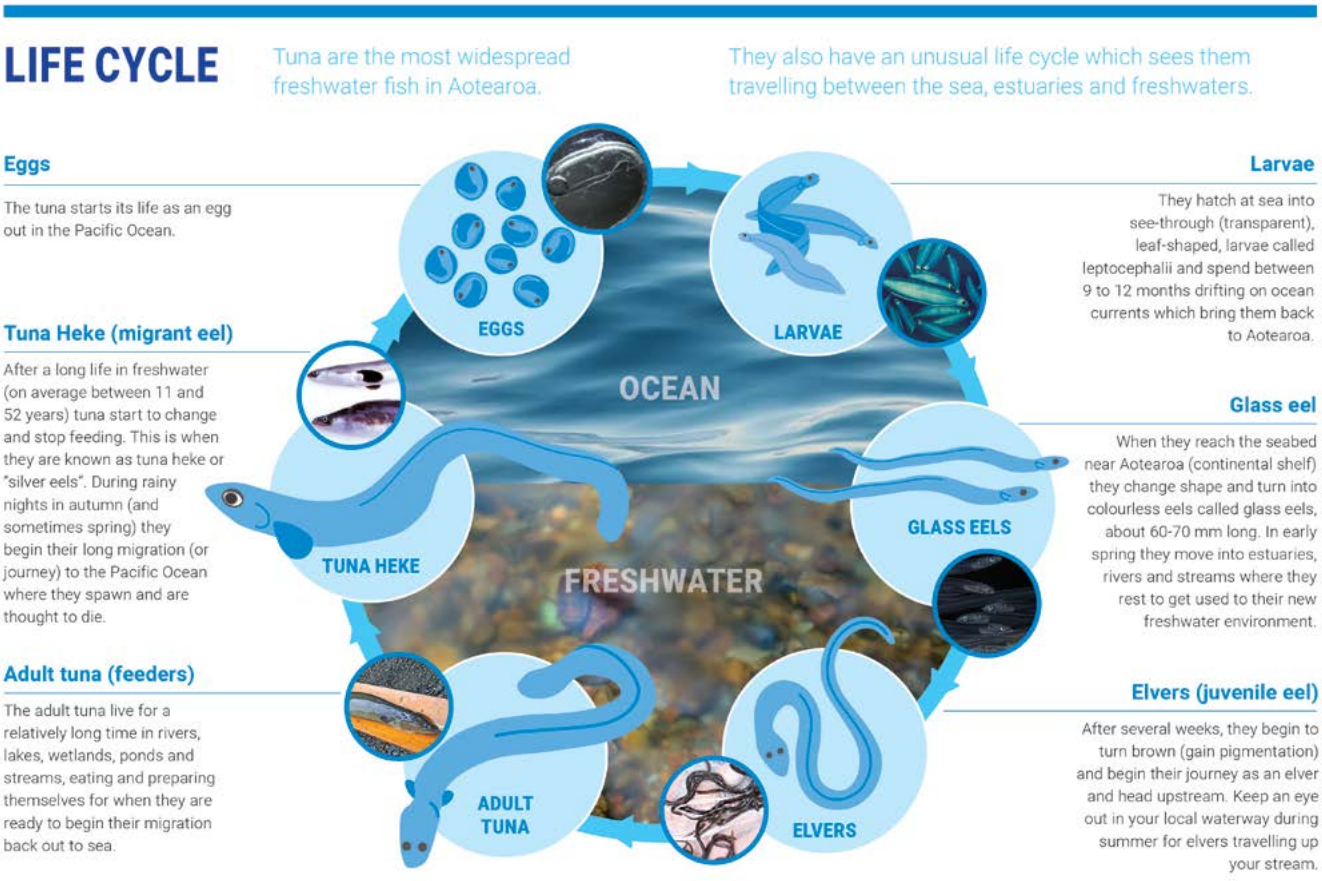


Figure 2. Tuna lifecycle. Illustration: Aarti Wadhwa, NIWA

TUNA – AA TAATOU TAONGA

Tuna are found in all sorts of freshwater habitats including awa (rivers and streams) and repo (wetlands). They like to hide in the mud, or under banks, rocks, boulders, and weeds. As tuna are the top predator in these freshwater systems, they are opportunistic feeders and will eat pretty much anything they can catch and fit in their mouths. Younger and smaller tuna eat aquatic invertebrates (such as small insect larvae, snails, midges, and crustaceans), small fish under 10 cm (such as smelt (*Retropinna retropinna*) and bullies (*Gobiomophus* spp.)), and worms and other small insects. Older and larger tuna can eat larger prey over 25 cm in length such as giant kookopu (*Galaxias argenteus*), koura (freshwater crayfish; *Paranephrops* spp.), other tuna, and even small birds, and rats!

Me te whata raparapa tuna e iri ana te tutu

The tutu berries are hanging like split eels[5]

This whakataukii outlines a preparation technique where tuna is split and hung on a stick in the sun to dry.

Taroi Rawiri preparing a shortfin tuna for smoking.
Photo: Erina Watene-Rawiri

RESTORATION AND ENHANCEMENT

Tuna have experienced many challenges to their survival over the last 200 years. Early exploration and trade resulted in destruction of many Maaori tuna weirs. Large areas of lowland wetland were progressively drained, and less than 10% of all wetlands that were present when Europeans arrived in Aotearoa now remain. Hydro-electric dams were constructed, along with other barriers such as flood pumps, which block access to upstream habitat and kill tuna that pass through the turbines. Beginning in the 1930s, extermination campaigns were waged against tuna for two decades, during which hundreds of thousands of tuna were deliberately destroyed to protect trout. Then in the 1960s, the commercial eel fishing industry developed, and large quantities of eels have been harvested by commercial fishers ever since.

Unsurprisingly, tuna are now no longer as abundant as they once were, and longfin tuna are currently classified by Te Papa Atawhai (DOC) as '**At risk – Declining**', which is the same threatened species status as the brown kiwi (*Apteryx mantelli*), a beloved national icon. Shortfin tuna are classified as '**Not Threatened**'.

This decline in tuna populations is of great concern to Maaori, a sentiment expressed by many, including Dr Pita Sharples, former Maaori Party Co-Leader:

'Any threat to the eels are a threat to the identity and mana of the hapuu and iwi who have a responsibility to protect them… It is outrageous that people are still catching them for profit.'[6]

– Dr Pita Sharples (Ngaati Kahungunu, Ngaai Te Kikiri o Rangi, Ngaati Paahauwera)

Our work in this field has highlighted that the decline in tuna populations is driving an urgent exploration of tangible restoration, enhancement, and protection solutions. Some of the potential solutions include making legislative changes to fisheries management (e.g. bylaws that limit catch numbers and weight limits), identifying and implementing fish passage solutions to improve connectivity, selective harvesting (i.e. releasing breeding female tuna), shelving commercial quota, and restoring habitat.

[5] Mead & Grove, 2001: 131
[6] Parliamentary Commissioner for the Environment, 2013

CASE STUDY

DEVELOPING TANGIBLE RESTORATION OPTIONS FOR TUNA

CONSTRUCTED TUNA PONDS FOR HABITAT AND ENHANCEMENT

In the Waikato region, tuna are considered a taonga (culturally important species) by iwi. They are treated as such because they sustain the Waikato way of life, both physically and spiritually. In the physical sense, the fisheries provided a plentiful, reliable, and respected food source essential for the tribe. The Waikato-Tainui Iwi Environmental Management Plan - *Tai Pari Tai Tumu Tai Ao*, highlights the restoration of taonga fish and shellfish species and the ability to provide these taonga as food in reasonable amounts to manuwhiri (visitors) as critical markers of Waikato-Tainui mana and status. The ability to provide these taonga species confirms the tribe's proficiency in manaaki taangata (hospitality of the people) or the practice of generosity and reciprocity. The abundance of food and other resources that were traditionally available to Waikato-Tainui within its tribal rohe (region) are well known throughout the motu (country), as demonstrated by the following quote:

'… the Waikato River, with its tributaries, was the most celebrated in New Zealand for its paa tuna and the quantities of eels found there, right away from the mouth up to the Huka Falls, near Lake Taupoo, above which none are found. The Mangataawhiri, the Maramarua, the Whangamarino, the Mangawara, the Waipaa, the Awaroa, the Opuatia, and the two lakes Waikare and Whangapee, all in middle Waikato, were famed for their eels… '

– Downes[7]

For traditional fishers, the decline in tuna availability has caused concern about the fishery, and also about the intergenerational exchange of fishery information and knowledge among the people the fishery. To start addressing this, we worked in partnership with Waikato-Tainui and Genesis Energy to explore options to create habitat for tuna.

Waiharakeke Stream ford, Utakura River catchment, Northland. The ford is 1.5m high and restricts the ability of elvers to reach habitats upstream. Photo: © NIWA

Scientists have found that small ponds can contain greater biomass (CPUE) of tuna compared with larger water bodies. In addition, tuna favour these habitats if they are able to access them freely, i.e. there are no barriers like dams, flood gates, flood pumps, fords or perched culverts preventing them moving up or down stream.

Based on that information, we thought that building more tuna ponds and creating more habitat within the lower Waikato River system would benefit local tuna populations. In the spirit of action-based research – using the best available knowledge (maatauranga and science) at the time – we created some tuna ponds in Raahui Pookeka (Huntly, Waikato), on private land located between Lake Waahi and the Waikato River (Fig.3).

Before any digging of ponds begins, it is important to check consent and planning requirements for your region.

To construct the tuna habitat pond, we checked consent requirements under the Resource Management Act 1991 (RMA 1991) and District Plans to ensure we had the right planning permissions for managing risk to the environment, and also to ensure appropriate health and safety, particularly during construction. In our case, after discussion with staff at the regional and district councils, our habitat was considered to be within the permitted activity rules for our region. We had selected a site on private land owned by one of the project partners (Genesis Energy), and checked the hydrology to ensure the pond would be viable. The earthworks to create the tuna pond were completed in less than a week.

[7] Downes, 1918: 296–297

Figure 3. Ponds located near Lake Waahi and the Waikato River, Raahui Pookeka, Waikato.
Source: Manaaki Whenua – Landcare Research

Diggers preparing one of the tuna ponds, Raahui Pookeka. Photo: Erina Watene-Rawiri

Six weeks after the construction phase, we set some fyke nets (type of fish net) to monitor fish numbers. The beginning of winter (June) was not the optimal time for monitoring, but we were still interested in testing the responses of the tuna to the new habitat. We caught more than 106 shortfin eels in the new tuna pond, which was amazing and unexpected.

Three years after construction, with the wetland plants and trees more established, the pond was re-surveyed as part of a wider catchment-scale tuna monitoring programme. Our catch numbers had almost doubled, with 205 shortfin eels captured, spanning a wide range of sizes. This pond provided the largest catch of 34 eels (per net on each night, also referred to as CPUE or catch per unit effort) across the whole monitoring programme, which involved 10 sites across the Waipaa and Waikato River catchment. The early indications highlight that the tuna ponds are indeed beneficial for our taonga, that they have relatively high catch rates, and that they can support small, medium, and large tuna. Based on these observations, we continue to advocate for the creation of tuna ponds and to monitor and evaluate their medium- to long-term success. Our next steps involve looking specifically at growth rates and the length of time tuna stay in the ponds.

Naau i whakatakoto i too hiinaki i te wai taawawarua anei te waituhi ka taha

You set your eel-pot during the main flood, after the first freshet had passed and therefore missed the descending eels[18]

This whakataukii makes clear that effective actions must be carried out at the right time.

A view of the pond 3-years after installation and plantings. Photo: Erina Watene-Rawiri

Constructed tuna habitat in Raahui Pookeka, Waikato. Photo: Erina Watene-Rawiri

The tuna pond was fenced off, and the margins were planted with a mix of indigenous wetland plant species and trees (Table 2).

Table 2. Examples of the indigenous plant species used at the restoration site

Maaori name	Botanical name
Harakeke	*Phormium tenax*
Houhere	*Hoheria sexstylosa*
Karamuu	*Coprosma robusta*
Kuta	*Eleocharis sphacelata*
Maanuka	*Leptospermum scoparium*
Pukatea	*Laurelia novae-zealandiae*
Puurekireki, puurei	*Carex secta, C. virgata*
Tii koouka	*Cordyline australis*
Toetoe	*Austroderia fulvida*

More than just places for tuna

The co-benefits of tuna ponds like these are potentially endless: they are important living classrooms to teach our rangatahi (youth) about tuna; they could be used as potential harvesting locations for tuna (providing tuna outside the ponds increasing opportunities to migrate and spawn); or they could be turned into tuna reserves.

Finally, while the tuna ponds were developed out of a desire to create more tuna habitat, there were other obvious benefits. Bird species like kotare (kingfisher; *Todiramphus sanctus*), swans (*Cygnus atratus*), and ducks (*Anas* spp.) now also utilise the habitat, along with other native fish species, including smelt and bullies. The wetland plants and trees are maturing and can potentially be harvested to support other cultural practices.

[8] Mead & Grove, 2001: 305

Longfin tuna in stream. Photo: Erina Watene-Rawiri

HOW DO WE RESTORE MAATAURANGA OF TUNA?

Key actions we can take to increase our understanding of tuna based on our collective maatauranga follow.

1. **Koorero (speak) with local kaumaatua (elders) and other whaanau (family) members about their memories and current interactions with tuna:**
   - Record where, when, and how tuna were harvested.
   - Identify how those populations and harvesting practices have changed.
   - **What may have caused population decline?** The cause may need to be addressed first, before any new populations can be reintroduced to the area, e.g. restoring bankside vegetation, building tuna ponds, or reducing introduced aquatic weeds and the abundance of pest fish (if present).

2. **Consider the ecology and environmental whakapapa (connection) of the system to understand better:**
   - The best areas to restore tuna. Consider sites that have good water quality, overhanging vegetation, instream woody debris, and stream bed materials suited to the tributary and each species of tuna. Note of caution here – please do not try to change the natural stream bed material to suit the species you want!
   - Examine adjacent land use and how you can mitigate any adverse impacts, e.g. fencing to exclude livestock access – tuna love undercut banks and lots of woody debris.
   - Benefits (if any) for other organisms – (kooura (freshwater crayfish), kookopu (*Galaxias* spp.), matamata (whitebait), porohe (smelt)) and aquatic invertebrates (caddisflies, mayflies, stoneflies, snails, limpets).
   - An aquatic survey (e.g. Stream Health Monitoring and Assessment Kit – SHMAK) of what is there now is a good way to build a baseline to help monitor changes over time.

Two longfin females. Photo: © NIWA

3. **Building a monitoring and restoration framework:**
   - **What are the practices associated with harvest and have these changed?** Also consider whether kaumaatua and whaanau have any thoughts on why practices may have changed (if they have).
   - **What are the local names (if any) for tuna, and what other species are they connected to (whakapapa)?** This is key to building a bigger, more holistic picture of connections and associated health and well-being of the whole system, e.g. insects, birds, other fish, and plants. Depending on what the natural system looks like in your area, this might also include shellfish species and molluscs like snails.
   - **Where to monitor?** Identify your own monitoring areas based on what you have learnt from your people. Think about where the populations of tuna were and where they are now. Note that some whaanau may not wish to share the exact location of their harvesting areas, so consider instead asking if the populations have decreased and disappeared, and if there are any changes to the habitat, or adjacent land use they feel may be affecting tuna populations.
   - **Who to talk to?** Talk to scientists and other communities with additional experience in tuna ecology and restoration, and work with them to help build a restoration framework that best meets the needs of your local community.

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Ausseil AG, Gerbeaux P, Chadderton WL, Stephens T, Brown D, Leathwick J 2008. *Wetland ecosystems of national importance for biodiversity: Criteria, methods and candidate list of nationally important inland wetlands*. Landcare Research Contract Report LC0708/158.

Ashwell BY 1878. *Recollections of a Waikato missionary.* Auckland, New Zealand: Church Printer. 25 p.

Best E 1986. *Fishing methods and devices of the Maaori.* Dominion Museum bulletin no. 12, Wellington, New Zealand: Government Printer. 264 p.

Downes TW 1918. *Notes on eels and eel-weirs (tuna and paa-tuna)*. Transactions and Proceedings of the NZ Institute 50: 296–316.

Dunn NR, Allibone RM, Closs GP, Crow SK, David BO, Goodman JM, Griffiths MH, Jack DC, Ling N, Waters JM, Rolfe JR 2018. *Conservation status of New Zealand freshwater fishes, 2017*. Wellington, New Zealand: Department of Conversation. 11 p.

Grove N 1981. *Ngaa peepeha a ngaa tiipuna*. Wellington, New Zealand: Department of Maori Studies, Victoria University of Wellington.

Hamilton A 1908. *Fishing and sea-foods of the ancient Maaori.* Dominium Museum Bulletin No. 2. Wellington, New Zealand: Government Printer. 73 p.

Jellyman D 2012. *The status of longfin eels in New Zealand – an overview of stocks and harvest*. NIWA Client Report CHC2012–006. Christchurch, New Zealand: National Institute of Water and Atmospheric Research.

Mead SM, Grove N 2001. *Ngaa peepeha a ngaa tiipuna: the sayings of the ancestors*. Wellington, New Zealand: Victoria University Press.

McDowall RM 1990. *New Zealand freshwater fishes: a natural history and guide*. Wellington, New Zealand: Heinemann Reed MAF Publishing Group. 553 p.

New Zealand Government 1991. *Resource Management Act 1991*. Wellington, New Zealand: NZ Government.

Parkyn S, Collier K, Clapcott J, David B, Davies-Colley R, Matheson F, Quinn J, Shaw W, Storey R 2010. *The restoration indicator toolkit: Indicators for monitoring the ecological success of stream restoration.* Hamilton, New Zealand: National Institute of Water and Atmospheric Research. 134 p.

Parliamentary Commissioner for the Environment 2013. *On a pathway to extinction? An investigation into the status and management of longfin eel.* Wellington, New Zealand: Parliamentary Commissioner for the Environment. 95 p.

Parliamentary Commissioner for the Environment 2014. *Update report on a pathway to extinction? An investigation into the status and management of longfin eel.* Wellington, New Zealand: Parliamentary Commissioner for the Environment. 11 p.

Roberts M, Norman W, Minhinnick N, Wihongi D, Kirkwood C 1995. *Kaitiakitanga: Maaori perspectives on conservation*. Pacific Conservation Biology 2: 7–20.

Waikato-Tainui Te Kauhanganui Inc. 2013. *Waikato-Tainui Environmental Plan: our plan, our environment, our future – Tai Tumu, Tai Pari, Tai Ao*. Hamilton, New Zealand: Waikato-Tainui Te Kauhaunganui Incorporated.

Watene-Rawiri E, Murchie A, Williams E 2018. *Manaaki Tuna Community Monitoring Programme 2018 Survey Results.* NIWA Client Report 2018361HN prepared for Waikato-Tainui College for Research and Development. Hamilton, New Zealand: National Institute of Water and Atmospheric Research.

Whaanga H, Wehi P, Cox M, Roa T, Kusabs I 2018. *Maaori oral traditions record and convey indigenous knowledge of marine and freshwater resources.* New Zealand Journal of Marine and Freshwater Research 52(4): 487–496. DOI: 10.1080/00288330.2018.1488749

Williams E, Zernack A, Boubée J, Watene-Rawiri E 2019. *New Zealand tuna (freshwater eels): Maaori-driven management practices–past, present and future.* In: *Eels Biology, Monitoring, Management, Culture and Exploitation*: Proceedings of the First International Eel Science Symposium. Great Easton, UK: 5m Books Ltd. Pp 210–217.

Williams EK, Watene-Rawiri EM, Tipa GT 2018. *Empowering indigenous community engagement and approaches in lake restoration: an Aotearoa New Zealand perspective.* In: Hamilton D, Collier K, Quinn J, Howard-Williams C eds *Lake restoration handbook: A New Zealand perspective*. New York, US: Springer.

Williams E, Crow S, Murchie A, Tipa G, Egan E, Kitson J, Clearwater S, Fenwick M 2017. U*nderstanding taonga freshwater fish populations in Aotearoa New Zealand*. Prepared for Te Wai Maaori Trust by the National Institute of Water and Atmospheric Research. NIWA Client Report 2017326HN. Wellington, New Zealand: National Institute of Water and Atmospheric Research.

Useful websites

NIWA

Stream Health Monitoring and Assessment Kit (SHMAK)
https://niwa.co.nz/freshwater/management-tools/water-quality-tools/stream-health-monitoring-and-assessment-kit

Taonga species series: Tuna
https://niwa.co.nz/te-kuwaha/tuna

Tuna information resource
https://niwa.co.nz/te-kuwaha/tools-and-resources/tuna-information-resource

Tuna: Barriers to migration
https://niwa.co.nz/te-k%C5%ABwaha/tuna-information-resource/pressures-on-new-zealand-populations/tuna-barriers-to-migration

Tuna: What does science tell us about New Zealand eels?
https://niwa.co.nz/sites/niwa.co.nz/files/Taonga%20Species_Tuna%20LOW%20RES.pdf

Educational Resources

Science Learning Hub – Pokapuu Akoranga Puutaiao

Ngaa ika taketake wai maaori – Tuna
https://www.sciencelearn.org.nz/videos/1808-tuna

Tuna working with glass eels
https://www.sciencelearn.org.nz/resources/423-tuna-working-with-glass-eels

Conservation volunteers NZ
https://conservationvolunteers.co.nz/tamariki-for-tuna-longfin-eel-educational-resources

Waikato-Tainui – Waikato River Fisheries Bylaws
https://gazette.govt.nz/notice/id/2014-go1266

http://www.legislation.govt.nz/regulation/public/2011/0294/latest/DLM3930995.html

Puuraakau

He reo too te kaainga – if our tuna habitat could speak, what would it say?
https://www.bing.com/videos/search?q=he+reo+to+te+kainga+-+if+our+tuna+habitat+could+speak

Tuna restoration in the Waikato
https://waikatoriver.org.nz/wp-content/uploads/2018/12/Restoring-Tuna-a-guide-for-the-Waikato-and-Waipaa-River-Catchment-2016.pdf

Contact details for Erina Watene-Rawiri

Email: erina.watene-rawiri@niwa.co.nz

9.
THE WETLAND PADDLERS OF AOTEAROA DUCKS, SWANS AND GREBES

CHERI VAN SCHRAVENDIJK-GOODMAN
(TE ATIHAUNUI A PĀPĀRANGI, NGĀTI RANGI, NGĀTI APA), BRENDA GREENE

Ko te pārera e rakiraki ana, ko te pārera e koēkoē ana

The calls of the duck – rakiraki, koēkoē

Che Wilson (Ngāti Rangi)

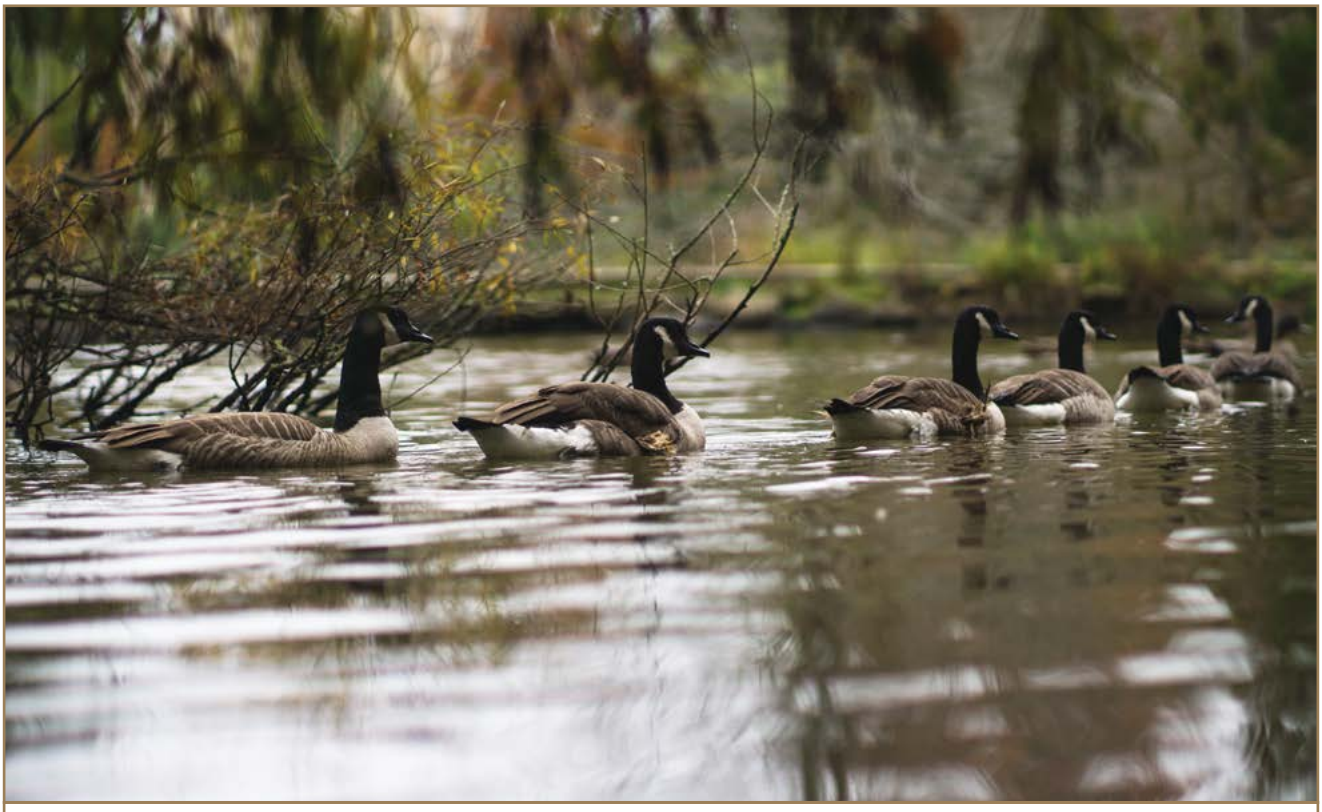
We wish to thank Che Wilson (Ngāti Rangi), John Innes (Manaaki Whenua – Landcare Research), and all of the photographers who gave permission to use their images – Athena Rhodes, Bartek Wypych, Eddie van Uden, Neil Fitzgerald, Oscar Thomas and Raewyn Adams, NZ Birds Online, Te Papa Atawhai (Department of Conservation). A special thanks to tāngata tiaki from Te Tai Tokerau (Northland) who inspired us to give some attention to the pāpango and weweia.

– Ngā mihi, nā Cheri māua ko Brenda

MANU HAUORA, REPO HAUORA

There is something about ducks paddling on a repo (wetland), roto and moana (lake), awa (river), and hāpua (lagoon). Their graceful and deliberate moves give many of us a sense of calm, as they appear to float effortlessly across the water surface. If their honks and quacks were absent in those spaces, it would feel odd. They are the sights we take for granted but would notice if they were no longer present.

Previous page: Female pūtangitangi (paradise shelduck). Photo: © Neil Fitzgerald



Canada geese swimming in a row. Photo: © Athena Rhodes

Kawau paka, little shag. Photo: © Athena Rhodes

Matuku, Australasian bittern. Photo: © Oscar Thomas

Kahu, Australasian harrier. Photo: © Oscar Thomas

Kotoreke, marsh crake. Photo: © Oscar Thomas

Once upon a time, before European colonisation took hold during the 19th century, our tūpuna (ancestors) would have been lucky enough to see a very different set of birdlife: at least seven species of native duck, a black swan, and one or two grebe species. A truly healthy repo would also have included shoreline birds such as: matuku (Australasian bittern), matuku-moana (white-faced grey heron), kōtuku (white heron), kōtuku-ngutupāpā (royal spoonbill), pūweto (spotless crake), and kotoreke/koitareke (marsh crake). Kawau (native cormorants, shags), kahu (Australasian harrier), ruru (morepork), and kōtare (kingfisher) would have flown above and around these waterbodies. However, in modern times, such diversity is a distant memory.

Today, the most common water birds we see are the introduced mallard (*Anas platyrhynchos*), white or mute swan (*Cygnus olor*), and Canada goose (*Branta canadensis*) all brought to Aotearoa by the early settlers from Europe during the late 1880s. It is not unusual to also see large, white male greylag geese (*Anser anser*), a feral goose introduced from Europe, with their grey-speckled female companions. Their presence is usually announced with a series of wild hissing noises targeted at unsuspecting humans venturing into their territory – not to mention the large deposits they tend to leave in their wake.

Ka hauora ngā manu,
ka hauora ngā repo

When the birds are healthy,
the wetlands are healthy

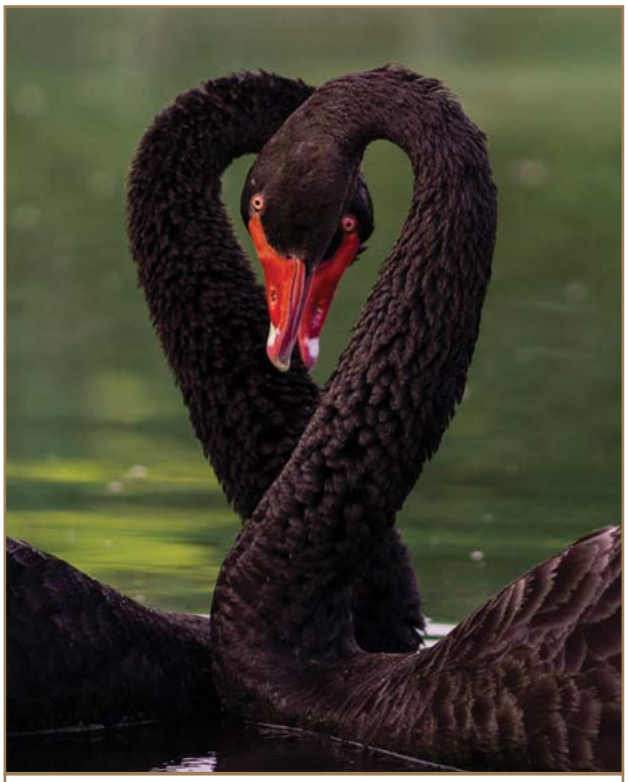
INTRODUCING OUR NATIVE WETLAND PADDLERS

An often under-appreciated reality is that Aotearoa has eleven species of native wetland paddlers: eight ducks, one swan (*Anatidae*), and two grebes (*Podicipedidae*) (Table 1). Of the eight duck species, seven are found in various swamp and estuarine wetlands, while the other, the kuruwhengi (Northern shoveler) migrates here as an occasional visitor from the Northern Hemisphere.

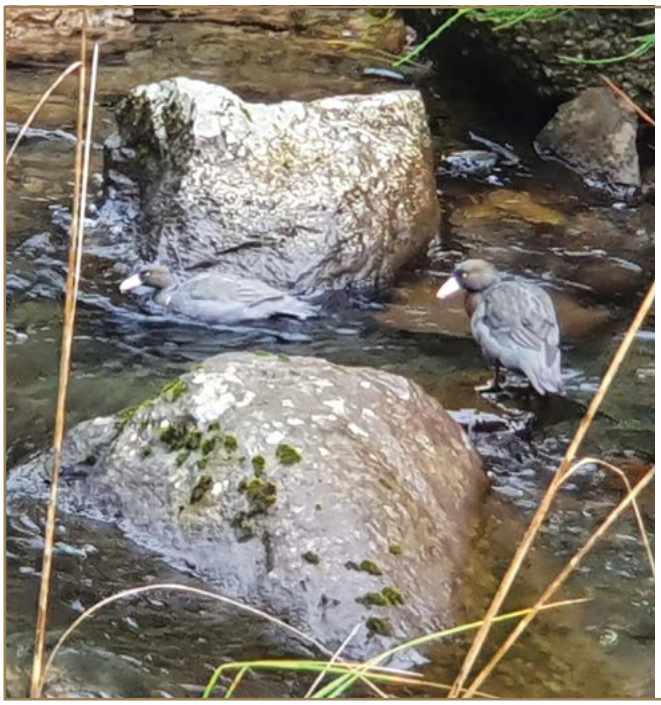
The ninth wetland paddler is the native black swan (or wāna, wani, kakīānau). Archaeological finds in the middens and hangi pits of early Polynesian ancestors show that *Cygnus sumerensis,* a larger ancestor of our modern day native black swan, was an important part of their diets. Referred to as *pouwa* by tangata whenua (Indigenous people) of Rēkohu (Chatham Islands), this bird had disappeared by the time European settlers arrived to Aotearoa during the early 19th century. This suggests that hunting by our tūpuna had tipped the balance towards their extinction. The black swan has since been reintroduced by early European settlers and has re-established naturally throughout Aotearoa from Australia.

The remaining two of the eleven paddlers, are the unique aquatic birds from the grebe whānau (family) – the pūteketeke (Australasian crested grebe) and the weweia (New Zealand dabchick). The former is found mainly on South Island lakes and the latter mainly on North Island lakes.

Repo throughout the motu (country) were once home to this entire diverse collection of native water birds. Now, all but the pūtangitangi and wāna have declined due to habitat modification and loss, introduced vertebrate and mammalian predators, hunting, and competition from other aquatic and land-based (terrestrial) species. Part of the toolkit for helping these water birds into the future is about raising awareness about them and their place in repo – as well as reviving our historical connections to them.



Wāna (black swans) courting. Photo: © Athena Rhodes

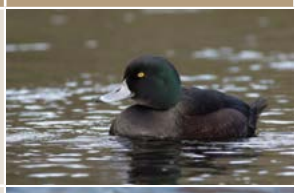
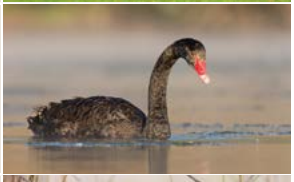
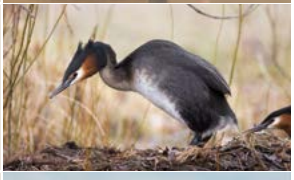
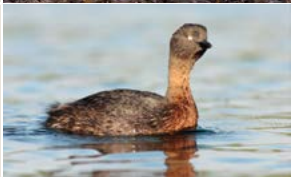


THE WHITEWATER PADDLER – WHIO

The whio (blue duck, *Hymenolaimus malacorhynchos*), is named after the whistle made by the male. Once found in all fast flowing, clean rivers from the mountains to the sea, it is now only found in forested headwaters and tributaries. The whio is endemic to Aotearoa and is nationally vulnerable. While this chapter will look at the native species found living only around repo, for those still lucky enough to have a good selection of native ducks and suitable habitat, we have also included websites about whio at the end of the chapter.

Whio (blue duck) pair.
Photo: Cheri van Schravendijk-Goodman

Table 1. Meet the paddlers – native water birds found in wetlands

Māori name	Common name	Scientific name	NZ & Conservation Status*	Image
Pāpango Matapōuri Raipo Titīpōrangi	New Zealand Scaup, diving duck NZ's rubber duckie	*Aythya novaeseelandiae*	Endemic Not threatened Photo: © Neil Fitzgerald	
Pārera	Grey duck	*Anas superciliosa*	Native Nationally critical Photo: © Neil Fitzgerald	
Pāteke	Brown teal	*Anas chlorotis*	Endemic Recovering Photo: © Neil Fitzgerald	
Tētē Tētē moroiti	Grey teal	*Anas gracilis*	Native Not Threatened Photo: © Neil Fitzgerald	
Kuruwhengi	Australasian shoveler	*Anas rhynchotis*	Native Not Threatened Photo: © Oscar Thomas	
	Northern shoveler	*Anas clypeata*	Native Vagrant Photo: © Oscar Thomas	
Pūtangitangi Pūtakitaki Pari	Paradise shelduck	*Tadorna variegata*	Endemic Not threatened Photo: © Oscar Thomas	
Wāna Wani Kakīānau	Black swan	*Cygnus atratus*	Native Not threatened Photo: © Neil Fitzgerald	
Pūteketeke Kāha Kāmana	Australasian crested grebe	*Podiceps cristatus*	Native Nationally vulnerable Photo: © Neil Fitzgerald	
Weweia Taihoropī Taratimoho Totokipio	New Zealand dabchick	*Poliocephalus rufopectus*	Endemic Recovering Photo: © Neil Fitzgerald	

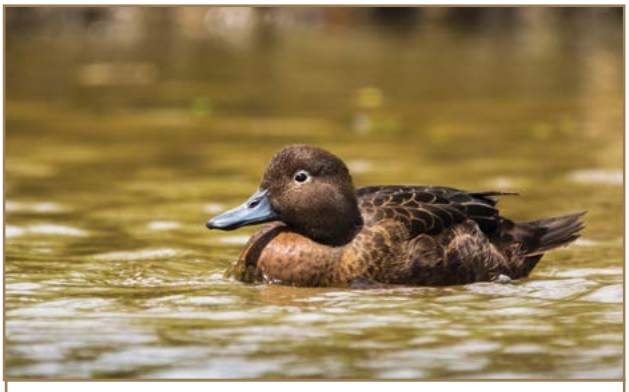
* Information sourced from www.nzbirdsonline.org.nz

Pāpango (New Zealand scaup) adult female with her chicks. Photo: © Athena Rhodes

Kia ora and G'day mate – where our water birds came from and their status today

Many of our native water bird species originally flew here from Australia. Some arrived many centuries ago and others more recently, such as pāpango (New Zealand scaup), pārera (grey duck), kuruwhengi (Australasian shoveler), pūtangitangi (paradise shelduck), wāna (black swan), and pūteketeke (Australasian crested grebe). Tētē (grey teal) look pretty much the same in both countries. As all of these birds have established here by themselves (i.e. no human-assisted introductions), they are considered native to Aotearoa. Note that these birds were in Aotearoa prior to the arrival of our tūpuna.

The tētē, pūtangitangi and wāna, have increased in number as the area of agricultural land in Aotearoa has increased. Sadly, the pārera, pāteke (brown teal) and pūteketeke are in trouble and deserve some attention. Changes in the way we manage our land have tipped the balance in favour of our generalist species. These water birds have better adapted to the open pastures associated with agriculture, while our birds that have more specialised food and habitat needs, are declining. This means the more impacted our repo and freshwater systems become (by drainage, pollution, and weed and pest infestations), the more our unique and specialist species will suffer.



Pāteke, brown teal. Photo: © Oscar Thomas

OUR RELATIONSHIPS WITH WATER BIRDS

As for all native and taonga (treasured) species, there is always a whakapapa (connection) that describes their genealogy and position in our world. For some hapū (subtribes) and iwi (tribes), our ducks are personified through a tupuna known as Moe-Tahuna – a reference also to the way they rest on the banks of lakes, and other freshwater and estuarine waterbodies. This is only one narrative, and it is likely that other hapū and iwi have additional unique accounts of the whakapapa of these native ducks, swans and grebes.

The broad regional diversity of ingoa Māori (traditional names) suggests a wide historical distribution of these water birds. Of the names recorded, however, not all are recognised by all hapū and iwi. We can only assume there was a wealth of in-depth knowledge about these water birds, how they interacted with each other, and their wider freshwater and estuarine environments. Sadly, locating this knowledge is difficult.

Much of our oral history has not been recorded, and existing recordings may only focus on specific hapū and iwi, thus overlooking narratives from elsewhere in Aotearoa. With the loss of kaumātua (elders) who hold the mātauranga (knowledge) in our communities, narratives become more difficult to source, requiring concentrated efforts to regather and piece information back together. Today, as the populations of rare water birds decline across the motu, we risk forever losing our connections to, and mātauranga about, these birds. The importance of their place within the wider whakapapa of our roto, awa, and hāpua, and their associated repo, has never been more real.

A lot of the published historical information about our relationship with native ducks focuses on their harvest. Pārera, pāteke and pūtangitangi were important, and kuruwhengi (specifically the Australasian shoveler) and the weweia were also mentioned. More recently, shared kōrero (conversations) includes references to historical harvests of duck and swan eggs. Interwoven into harvesting were sustainable practices such as rāhui (temporary prohibition) that ensured populations were managed. Traditional responsibilities of hapū and iwi towards natural resources were, and still remain, wider than utility (use) – they also included taking care of the natural resource to ensure sustainability for future generations. Our wetland paddlers are no exception in this regard.

RAILS, HERONS, AND PADDLERS
WETLAND BIRD DIVERSITY AS INDICATORS OF HEALTHY WHENUA AND WAI

Tangata whenua throughout Aotearoa have long focussed on the holistic management of catchments and freshwater systems, rather than on specific individual species or wetlands. All repo are part of the landscape sequence between whenua (land) and wai (freshwater) and provide important clues as to the health and wellbeing of the entire system.

Nationally, over 90% of repo throughout the motu have been drained in the last 150 years. As repo act like the kidneys of a freshwater system, declines in bird populations warn us that our waterways are no longer healthy enough to sustain populations or our practices associated with them. Repo, therefore, are like a chapter in the bigger story about the landscape. When we experience connections to, and harvest, from healthy land and waterways can we see the full story. Only then can we really appreciate how the many parts of the system need to work together to achieve full health and wellbeing.

Realistically, our paddlers alone cannot confirm if a wetland system is doing well. The entire whakapapa of these water birds (along with plants, fish, and insects) is needed. The montage below illustrates a story of what a healthy whenua-repo-wai landscape should look like when viewed through the lens of greater wetland bird diversity. Across whenua, repo, and wai we have:

- rails, such as the pūweto (spotless crake, *Porzana tabuensis*), along the banks and swampy edges
- herons, such as the matuku (Australasian bittern, *Botaurus poiciloptilus*) and kotuku (white heron, *Ardea modesta*), which also interact within repo that lie between the spaces of whenua and wai
- pāpango and pārera in the shallows close to shore
- weweia floating serenely on open water
- cormorants, such as the kawau (*Phalacrocorax carbo*) drying their wings near the shore.

Healthy whenua-repo-wai landscape as highlighted by greater wetland bird diversity. Montage created with permission from photographers. Ōkārito Lagoon, West Coast, South Island, with oīoī (*Apodasmia similis*) in the background, matuku and kotuku © Eddie van Uden. Added: pūweto © Bartek Wypych; pāpango, pārera, weweia © Neil Fitzgerald; and juvenile kawau © Raewyn Adams.

Water bird behaviours as indicators for presence of kai

Although there are no currently known published accounts of tūpuna observations of the behaviour of our ducks, it is likely that they were good tohu (environmental indicators of change) of seasonal, weather, and tidal changes, as well as of the presence of other kai (food sources). Table 2 outlines how the feeding behaviours of these wetland birds may have provided additional environmental cues for our tūpuna. The reality in different rohe (regions), however, would need to be confirmed with kaumātua, whānau, hapū, and iwi 'at place'.

Tētē, grey teal. Photo: © Neil Fitzgerald

Historic and current management regimes for native ducks in Aotearoa

Historically, sustainable practices such as rāhui and whakatipua (regeneration periods) were woven into harvesting practices. Traditional responsibilities of hapū and iwi included taking care of the natural resource as well as the spiritual dimensions and ensuring these connected future generations to a secure food source. Associated activities included the intergenerational exchange of reo me ona tikanga (language and practices) and mātauranga, agreeing on the harvest of other mahinga kai (cultivated foods), and guidance of the timing of harvest following traditional maramataka (traditional lunar calendars).

Despite the strong relationships between tangata whenua and our water birds, their management is no longer under traditional hapū and iwi authority. Their management instead sits with two key organisations: Te Papa Atawhai (Department of Conservation – DOC) and Fish and Game New Zealand. DOC manages all native species under key legislation such as the Conservation Act 1987 and the Wildlife Act 1953. Pārera, pūtangitangi, and wāna can be hunted during duck shooting season. Permits for hunting these ducks, along with bag limits for each species, are managed by Fish and Game under the Wildlife Act 1953. Today, pāteke, pāpango (New Zealand scaup), tētē (grey teal), and whio (blue duck) are the only ducks that are protected by law and cannot be hunted.

Table 2. Feeding behaviours of native wetland birds and environmental patterns

Food source	Wetland-water landscape	Environmental patterns potentially indicated by wetland bird behaviour	Water bird
Shellfish: Tuangi (cockles), kākahi and kāeo (freshwater mussels) on shorelines of estuaries and rivers Kōura (freshwater crayfish)	Estuarine wetlands, lagoons Freshwater wetlands and river systems recognised as being sources of kākahi kāeo and kōura	Feeding indicates availability of shellfish and locations of kōura. Abundance of bird populations indicates food source availability and suitable habitat for local bird communities. Can also indicate a healthy habitat if food sources are abundant	Pāteke and tētē
Fish	Most wetland types where water sources (both estuarine and freshwater) connect	Possible indicator of increased fish activity and spawning	Pūteketeke and weweia
Seed heads and new plant shoots	Most wetland types and riparian margins of water systems like rivers, lakes and lagoons	Possible indicator of the availability of plant materials for harvest, nesting and raising young chicks	Pārera, pāteke, pūtangitangi, and wāna

The difference between pārera and mallard ducks – green speculum = pārera; blue–purple = mallard. Photo: © Raewyn Adams

THE SAD STORY OF THE PĀRERA – ON THE BRINK?

There are many sad stories about our native water bird species. However, these can often be tempered with hopeful tales of reintroductions, successful breeding programmes, robust predator control, and wetland habitat restoration. There remains one sad tale, however, where all these elements of 'hope'are challenged – and that is the story of the pārera (grey duck, *Anas superciliosa*).

Like our tūpuna, the European settlers had a penchant for hunting waterfowl. And so, along with introducing their pasture grasses, domestic stock, and trees, they also brought with them their own ducks for hunting, namely, the mallard (*A. platyrhynchos*). Acclimatisation Societies, established by European colonists during the 1860s, introduced a range of new species into Aotearoa and lobbied for control of hunting in the country. This allowed European-style regulations and hunting methods to be established and removed the management of duck harvest by tangata whenua along with the mātauranga accumulated over hundreds of years of pārera interactions.

Pārera and mallards share similarities in plumage (as seen in the image above) and behaviours. As the number of mallards increased, the competition and crossbreeding with pārera also increased. This has caused a huge decline in the population of pārera compared to the mallards. By the 1950s, pārera made up less than 45% of the total population of mallards, hybrids, and pure pārera. By the 1980s, this was less than 10%. Pure-bred pārera is now considered one of the rarest water birds we have. As pārera flock with the mallard they still remain on the list of species that can be hunted during duck shooting season.

As a bird with nationally critical status – more endangered than whio (blue duck) – we are witnessing a native duck slowly heading towards extinction. What we do about that is a question for all of us to ponder, as there are no easy answers. If anything, this challenge at least deserves to be discussed more among our communities.

MONITORING AND RETURNING OUR WETLAND PADDLERS

Long-term observations and monitoring were natural activities for our tūpuna. Mātauranga is just as relevant today and can help deepen our collective understanding of our natural resources, especially our birdlife, in our respective rohe.

Key actions we can take to build our understanding of our paddlers based on our collective mātauranga:

1. **Kōrero with kaumātua and key whānau members about their memories of our ducks, swans, and grebes.**

- **Are they aware of any whakataukī or kōrero about these paddlers?**

  Whakataukī (proverbs) provide key guidance and life learning about a particular take (issue) or kaupapa (topic). They also provide important clues to the observations made by our tūpuna and their interactions with native wildlife and wetlands. Whakataukī from your hapū and iwi can help build an important cultural picture about:

  - the presence of the different birds in the rohe throughout the year
  - the different types of interactions between the hapū and iwi and the birds (both historically and currently).

- **What are your local names for these paddlers?**

  If the names in this chapter are not the same for your hapū and iwi, it is important you record those names and the whakapapa of the names. This ensures the protection of your mita (dialect) and that restoration of your birds is relevant to your wetland-scape and mātauranga.

- **What do these paddlers look or sound like?**

  Our senses are very good at detecting changes, provided we pay attention and know what to look for. Recording these sensory changes is just as important as collecting scientific data about our paddlers. This information can provide clues to their health as well as the health of wetland habitats:

  - A change in colour and size might suggest that species of water birds have changed. This can be linked to environmental changes and human influences. If you can, share the photos of the different water birds in this book and see if your kaumātua and whānau recognise any.
  - A change in sound might indicate changes in population size (louder if many, quieter if less), or changes in the timing of breeding cycles. Many of our water birds have distinctive calls during breeding, and some also put on incredible displays as males compete for females. This can also cause a bit of noise! Table 3 illustrates the months when many of these paddlers are breeding and laying eggs.

Table 3. Breeding season timetable for native wetland birds

Māori name	Common name	Age at fledgling (average)*	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pāpango	New Zealand scaup	75 days old	E									E	E	E
Pārera	Grey duck	65 days old								E	E	E		
Pāteke	Brown teal	55 days old							E	E	E			
Tētē	Grey teal	35 days old												
Kuruwhengi	Australasian shoveler	56 days old										E	E	
	Northern shoveler	Data deficient – travels to the Northern Hemisphere, and records are low in Aotearoa												
Pūtangitangi	Paradise shelduck	60 days old								E	E	E		
Wāna	Black swan	90 days old							E	E	E	E	E	
Pūteketeke	Australasian crested grebe	Data deficient	E	E	E						E	E	E	E
Weweia	New Zealand dabchick	35 days old	E	E	E			E	E	E	E	E	E	E

Information sourced from www.nzbirdsonline.org.nz and relevant at the time of writing

Periods of breeding are indicated by the filled in months. Egg-laying periods (if known) are marked with 'E'inside the breeding timetable.

* Age at fledgling is the average time it takes for a chick to reach fledgling (i.e. preparing to leave the nest). Only the eggs of pārera, pūtangitangi, and wāna can be harvested with a permit.

- **Where are/were these paddlers found and why do/did whānau seek them out?**

  Places where these wetland birds might have been/are found can indicate their whakapapa as well as their relationship to other plants and animals. It is also important to consider any associated practices or observations of the birds as tohu, especially if their behaviour told our people something useful about other mahinga kai.

- **Can whānau remember if paddlers were found in certain areas of the rohe, or near any particular trees or plants?**

  Again, this can help increase overall understanding about the habitat and whakapapa of wetland birds. Many of our ducks and grebes use specific plants to build nests, or provide material for their nests. Some, such as pūtangitangi and tētē, like to nest in tree hollows or holes. Pūteketeke and weweia, on the other hand, like to build nests that float.

  There are many other occasions where kaumātua or whānau may have seen these water birds. People often make important observations unintentionally. These observations may seem insignificant at the time but can often provide an indication of the health of the wider ecological system. Noticing the presence of absence of our wetland birds in certain areas can provide clues about patterns and other cultural indicators (e.g. the fish, plants, and invertebrates they eat) that could also be monitored over time.

Weweia (New Zealand dabchick) in floating nest.
Photo: Dick Veitch CC-BY © DOC

Tētē (grey teal) nest in tree hollow. Photo: John Kendrick
CC-BY © DOC

2. **Some key points for wetland restoration to support our paddlers**

- **Animal/vertebrate pest control.**

  Most of these water birds are susceptible to the jaws of a hungry predator (and that includes domestic cats and dogs along with introduced pests such as possums, rats, stoats and wasp nests). It is really important that all wetland restoration projects have very good vertebrate pest control in place to ensure our birds get a decent chance at settling down and raising a whānau.

- **Be clear about the water birds you want to encourage healthy populations of, and what they need in their wetland habitat.**

  While all our birds need water, food, and shelter, not all of them access the same spaces or materials – that's why they can co-exist so well. It is important to do your homework about what each species needs to eat (which means building habitat to support their kai) and where they like to nest. This could be up a tree in a nest box; in the hollows of more mature trees, or inside a clump of sedges or raupō. You can get advice from bird, invertebrate and wetland scientists, DOC, your local Fish and Game Council representatives, and/or organisations like Ducks Unlimited NZ (see website link in reference section).

- **Build a long-term vision for all the paddlers you want to see return – but do it in bite-sized pieces.**

  Trying to save every bird, fish, plant, and insect in your wetlands can be overwhelming. A good idea is to break your vision down into workable chunks. For example, choose a fish, plant (or mix of plants), wetland paddler, and insect that are connected. The insect might feed the fish, which feeds the paddler. And the plant (or mix of plants) might be valuable as nesting material for the paddler, provide shade for the fish, and habitat for the insect. A good idea is to draw this out like a picture, and then work with your whānau experts – and, where necessary, ecological experts – to help you build the appropriate restoration plans. You can then add more pictures with more connected species as you gain experience and confidence.

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Best E 1979. *Forest lore of the Māori*. New York, USA: AMS Press. 503 p. http://nzetc.victoria.ac.nz/tm/scholarly/tei-BesFore-t1-body-d2-d6-d34.html

Best E 1982. *Māori religion and mythology.* Wellington, New Zealand: Government Printer. http://nzetc.victoria.ac.nz/tm/scholarly/tei-Bes02Reli-t1-body-d4-d4-d24.html

Robert M 2013. *Ways of seeing whakapapa.* Sites: A journal of social anthropology and cultural studies, 10(1), 93–120. https://sites.otago.ac.nz/Sites/article/viewFile/236/240

Wright S, Nugent G, Parata H 1995. *Customary management of indigenous species: a Māori perspective.* New Zealand Journal of ecology, 83–86. https://newzealandecology.org/nzje/1968.pdf

Useful websites

Birds NZ (Ornithological Society of NZ)
https://www.birdsnz.org.nz/contact

Department of Conservation
https://www.doc.govt.nz/footer-links/contact-us

Ducks Unlimited NZ
https://www.ducks.org.nz

Fish and Game New Zealand
https://fishandgame.org.nz/about/about-fish-and-game-council/contact

Pārera – Grey duck
https://www.stuff.co.nz/science/107234405/native-grey-ducks-mating-to-extinction

Pouwa – Native black swan
https://royalsocietypublishing.org/doi/full/10.1098/rspb.2017.0876

https://wildfowl.wwt.org.uk/index.php/wildfowl/article/view/264/264

New Zealand Birds Online – Wetland water birds

Adams L 2013. New Zealand scaup, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/new-zealand-scaup

Melville DS 2013. Northern shoveler, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/northern-shoveler

Mills JA 2013. Grey teal, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/grey-teal

O'Donnell CFJ 2013. Australasian crested grebe, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/australasian-crested-grebe

Szabo MJ 2013. New Zealand dabchick, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/new-zealand-dabchick

Williams MJ 2013. Australasian shoveler, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/australasian-shoveler

Williams MJ 2013. Black swan, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/black-swan

Williams MJ 2013. Brown teal, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/brown-teal

Williams MJ 2013. Grey duck, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/grey-duck

Williams MJ 2013. Paradise shelduck, New Zealand Birds Online. http://nzbirdsonline.org.nz/species/paradise-shelduck

The odd duck out

Williams MJ 2013. Blue duck, New Zealand Birds Online.
http://nzbirdsonline.org.nz/species/blue-duck

https://www.doc.govt.nz/get-involved/conservation-education/resources/blue-duck-whio-fun-facts-posters

Moe-Tahuna as part of a cultural monitoring framework

Walker DP 2019. *Toitū te Whenua, Matatū Ana te Wao nui o Tāne: A Cultural Health Monitoring and Assessment Approach for Indigenous New Zealand Forests.* Thesis submitted in partial fulfilment of the requirements for the Degree of Doctor of Philosophy. Canterbury, New Zealand: Lincoln University. https://researcharchive.lincoln.ac.nz/bitstream/handle/10182/11261/Walker%2C%20Dean%20PhD.pdf?sequence=4&isAllowed=y

Photographer credits

All images have been used with permission from respective photographers. You can view the entire collection on their websites.

Athena Rhodes
https://thatgirlinmustard.com

Bartek Wypych
https://www.flickr.com/photos/125337794@N03

Eddie van Uden
http://www.equinoxdesign.co.nz

Neil Fitzgerald
https://www.neilfitzgeraldphoto.co.nz

Oscar Thomas
https://www.flickr.com/photos/kokakola11

Raewyn Adams
http://www.raewyn-adams.nz

Contact details for Brenda Greene

Email: tcgreene@xtra.co.nz

10. TE REO TIPU KAUPAPA MĀORI VIEWS OF MOLECULAR RESEARCH WITH RĀKAU RONGOĀ O NGĀ REPO USED FOR TYPE II DIABETES (T2D)

DR JONNI HAZELINE KOIA (WAIKATO-TAINUI, NGĀTI WHĀTUA)

Ka ora te whenua, ka ora te tāngata

If you heal the land, you heal the people

Kīngi Tāwhiao Te Wherowhero (Waikato)

Ko Taupiri te maunga
Ko Waikato te awa
Ko Pōtatau Te Wherowhero te tāngata
Waikato Taniwharau!
He piko, he taniwha
He piko, he taniwha
Ko Tainui te waka
Ko Ngāti Whāwhākia te hapū
Ko Te Ohaaki, ko Maurea ngā marae
No Rāhui Pōkeka ahau

I would like to acknowledge my whānau especially my husband, tamariki, parents and siblings. With the Lord's hand, none of this would have been made possible.

I would also like to acknowledge Pa Ropata (Robert McGowan) and whaea Marilyn Vreede for your teachings and guidance, Te Kāhui Rongoā Trust for their tautoko and Health Research Council for funding my rangahau. I would also like to acknowledge my academic mentors Prof Peter Shepherd, Prof Vic Arcus, and Prof Linda Tuhiwai Smith.

– Ngā mihi, nā Jonni

Indigenous flora in Aotearoa New Zealand are among the most unique and diverse in the world. A high proportion (70–80%) of indigenous flora is endemic to Aotearoa, and not found anywhere else on earth. Many of these have rongoā medicinal properties that our tūpuna (ancestors) have used for centuries, providing relief for many common illnesses and conditions. As a result, Māori view indigenous flora as taonga (treasure), with associated values and responsibilities related to kaitiakitanga (exercise of guardianship) and rangatiratanga (right to exercise authority). These values especially hold when it comes to their use and sustainability for future generations.

Aongotete wetlands (Bay of Plenty) surrounded by native plants. Photo: Jonni Koia

Previous page: Testing various rākau rongoā extracts on human cell culture (invitro testing). Photo: Jonni Koia

Te Reo Tipu comes from the understanding that rākau rongoā (Māori medicinal plants) have a unique voice. We understand rākau rōngoā has an intelligence of its own, and quite often can speak to you, teach, guide and protect you. If you mahi (work) with our rākau rōngoā long enough, you will develop a sense of this. The primary role of rākau rōngoā is to nurture and heal the whenua (land), often appearing at the fringes of land that has been damaged. As pōtiki (the youngest child of Tāne Mahuta), it is our responsibility to take care of our rākau rongoā and guide how it is used. Te Reo Tipu is, therefore, about understanding the role rākau rongoā has for healing Papatūānuku (Earth mother) and the importance of acknowledging Tāne Mahuta (God of the forests and birds) for the gift given.

Repo (wetlands) are well recognised by Māori and non-Māori for their role as rākau rongoā for the whenua and wai (freshwater). They are often referred to as the 'kidneys' of the natural world for their ability to cleanse and filter harmful pollutants from surrounding catchments before they reach our waterways. Coastal and riparian repo can buffer the whenua from rough wave action and flooding. Around the edges of our repo – tucked among the swamp forests, or where the repo graduate to dry land – are valuable rākau rongoā. They are not only important for the treatment of serious human ailments, but also for maintaining structural habitat surrounding repo and wai systems. In their own right, rākau rongoā can act as important tohu (indicators) of ecosystem or habitat changes, supporting the observable and delicate balances between whenua and wai.

My mahi with four of these rākau rongoā – karamū (*Coprosma robusta*), kūmarahou (*Pomaderris kumeraho*), mamaku (*Cyathea medullaris*), and kawakawa (*Piper excelsum*) – is explored further in this chapter. These rākau rongoā could potentially play a role in treating Type II diabetes (T2D), one of the more serious afflictions affecting a large number of our people.

Whakapapa o Te Reo Tipu

The name Te Reo Tipu was given by whaea Marilyn Vreede, a Trustee member of Te Kāhui Rongoā Trust from Whanganui. I approached her to name my rangahau (research).

It is important to me that our kaumātua (elders) are given the opportunity to fulfil their role as kaitiaki – keepers of the knowledge – and that they are actively engaged and involved in all aspects of my rangahau. This is how I believe our rongoā will be protected. My kaumātua inform Te Reo Tipu in a way that the rongoā would want and no doubt expect. Along with my kāhui kaumātua (elder committee), I am also establishing a kāhui rangatahi (youth committee) to provide interms of succession for my rangahau. Our rangatahi also have amazing foresight for the future of our rongoā.

Key mentors in my rangahau – whaea Marilyn Vreede and Pa McGowan. Photos: Lewis Gardiner (top) and Jonni Koia (bottom)

Rongoā Māori is about holistic healing and connection of a person to their wairua and restoration of mauri to Papatūānuku.

Many of our people take a holistic view: they believe that if they can restore mauri (life force) or connection with Papatūānuku, Earth Mother, this will allow them to restore their connection to their whakapapa (genealogy) and with themselves. The balance in their journey towards healing and good health is then restored.

Disease is a social issue before it becomes a health issue. Homelessness, loneliness, domestic violence, or relationship incidences are all social issues that can lead to disease. When people are lonely, they can eat too much or nothing at all. This leads to obesity or weight loss that impacts on their health. The current decline of Māori health is in many cases, due to the disconnection our People have to their whenua, including our repo.

Rongoā is more than just plant compounds that have certain medicinal effects on human physiology, as is the case with many modern medicines. Appropriate use of rongoā also supports and stimulates organs like the liver, kidney, and pancreas to heal themselves. Inspired and guided by this knowledge, many kairongoā (rongoā practitioner) use rongoā blends, in which each rongoā complements the other.

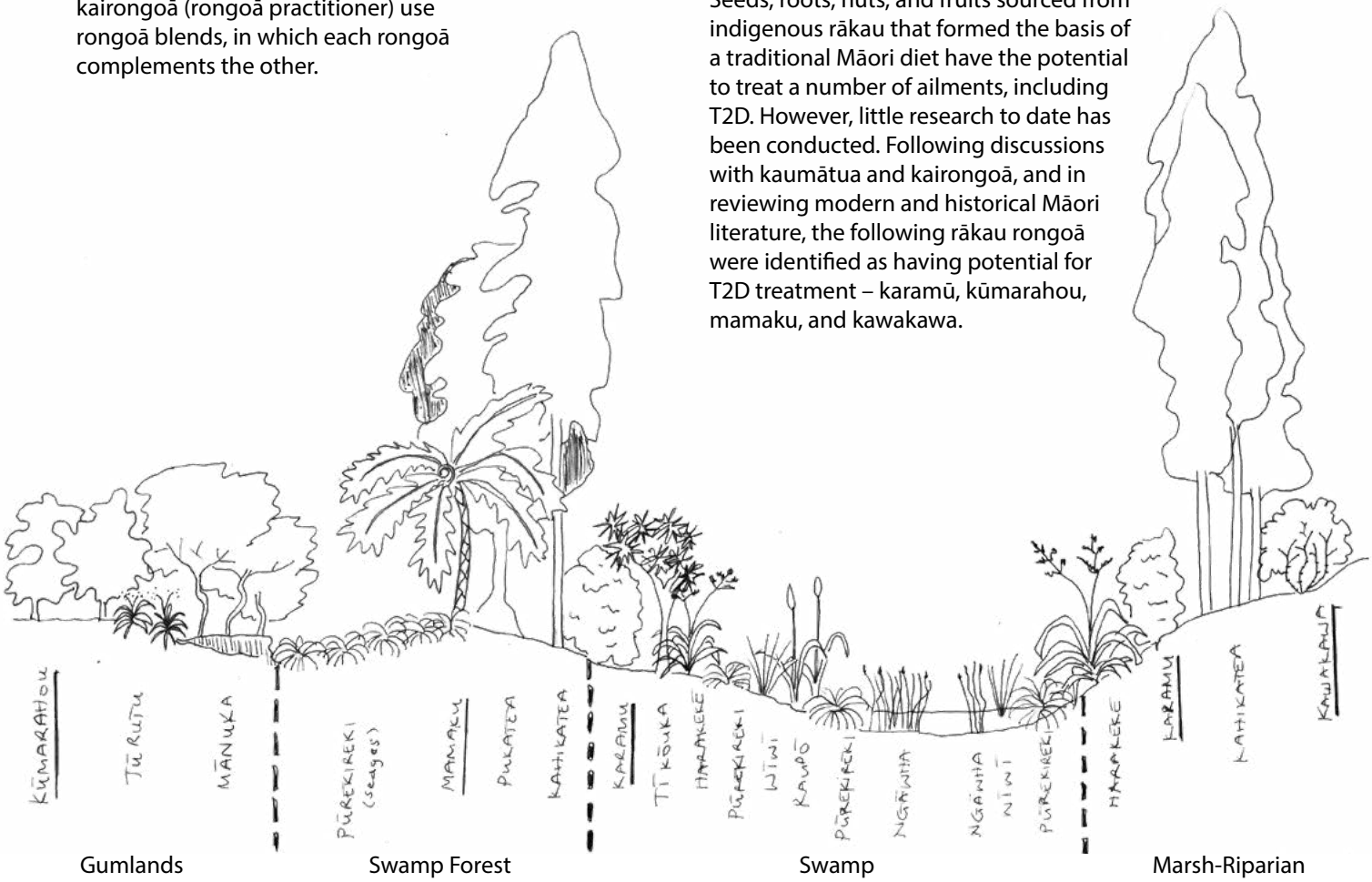
Karamū.
Photo: © Jon Sullivan

Mamaku.
Photo: © Jon Sullivan

Kawakawa.
Photo: © Jon Sullivan

Kūmarahou.
Photo: © Tony Foster

Seeds, roots, nuts, and fruits sourced from indigenous rākau that formed the basis of a traditional Māori diet have the potential to treat a number of ailments, including T2D. However, little research to date has been conducted. Following discussions with kaumātua and kairongoā, and in reviewing modern and historical Māori literature, the following rākau rongoā were identified as having potential for T2D treatment – karamū, kūmarahou, mamaku, and kawakawa.



Gumlands Swamp Forest Swamp Marsh-Riparian

The different wetland types where the four rongoā rākau can be found. (NB: these wetland types and their associated plant species are not found everywhere. Some, like Gumlands for example, are unique to the upper North Island. Illustration: Cheri van Schravendijk-Goodman

Table 1. Rākau rongoā identified as effective treatment for Type II Diabetes (T2D)

Plant	Potential medicinal properties of interest to this rangahau	Other traditional uses	Whakapapa – where does it grow	Compatible plants it grows with in wetland environments (some examples)
Karamū *Coprosma robusta*	• Blood sugar stabilisation • Treatments related to inflammation and obesity • Anti-tumour and antioxidant properties	• Used as kai, the mature berries can be eaten • Leaves used to make tea and as part of rituals • Bark used as a dye	• Found in both the North and South Island • Common in coastal, and lowland forests, within shrublands, and open sites including swamp forests	• Kahikatea (*Dacrycarpus dacrydioides*) • Pūrekireki, pūrei (*Carex virgata, C. geminata, C. secta)* • Harakeke (*Phormium tenax*) • Mingimingi (*Coprosma propinqua*) • Tī kōuka (*Cordyline australis*) • Toetoe (*Austroderia* spp.)
Kūmarahou *Pomaderris kumeraho*	• Treatment of respiratory (lung) conditions • Treatment of sores, wounds, rashes and skin irritations • Anti-tumour and anti-oxidant properties	• Used like a soap • Flowering period noted as a tohu – as observed in the maramataka (planting and fishing calendar) for māra kai (vegetable gardens)	• Only found in the North Island • Coastal to lowland habitats • Often found on roadside banks or in shrublands, but occasionally seen in forests • Prefers full sun and nutrient poor soils	**NB:** Kūmarahou does not like wet feet, but can be found on the drier, higher areas around swamp forests, in gumlands, or margins of valley bottom wetlands: • Mānuka (*Leptospermum scoparium*) • Kānuka (*Kunzea ericoides*) • Swamp turutu (*Dianella haematica*) • Wīwī (*Gahnia, Machaerina, Schoenus* spp.)
Mamaku *Cyathea medullaris*	• Nurtures, soothes and heals Papatūānuku when damaged • Parts of the plant used for inflammations, boils, and sores	• Used as kai, the young fronds can be eaten • Construction of rua-kumara (kumara storage pits) • Used by some as a musical instrument (Jew's Harp)	• Found both in the North and South Island • Can adapt to a variety of conditions but tends to prefer damp soils, wetland margins, and on frost free hillsides	• Kahikatea • Pukatea (*Laurelia novae-zelandiae*) • Nīkau (*Rhopalostylis sapida*) • Kōwhai (*Sophora* spp.) • Patetē (*Schefflera digitata*) • Māhoe (*Melicytus ramiflorus*) • Hoheria (*Hoheria* spp.)
Kawakawa *Piper excelsum*	• A universal rongoā used for a range of ailments	• Used as kai, the orange fruits are sweet and the seeds are peppery • Worn by some iwi as a head wreath during tangihanga (funeral)	• Found in both the North and South Islands, but more common in the North Island • Prefers semi-shaded areas within free draining, moist soil • Very shade tolerant, but will not tolerate frost	**NB:** Kawakawa doesn't like wet feet, but can be found on the drier edges of swamp forests and along waterways with: • Kahikatea • Pukatea • Kōwhai • Māhoe • Kōtukutuku (*Fuchsia excorticata*) • Hoheria • Mamaku

MY JOURNEY AS A KAIRONGOĀ AND MOLECULAR SCIENTIST

'Harvesting rākau rongoā involves considering the needs of others, ensuring sustainability, being gentle with footprints, harvesting the east side of the plant by hand, never harvesting in the rain, and harvesting leaves during the growing season.'

– Dr Jonni Koia

Dr Jonni in the laboratory preparing freeze dried wairākau extracts at various concentrations before invitro testing. Photo: Jonni Koia

Maōri studying and working within the contemporary scientific realm walk an interesting line. We are trained to maintain a certain structure in the way we are expected to conduct ourselves as scientists, but, at the same time, we also work hard to hold fast to who we are as individuals, and our unique identity as Maōri.

I prepare rongoā wairākau (rongoā tea) in my home for my whānau, and so, as a **kairongoā**, I personally seek to strengthen my connections with the rongoā when I visit the ngahere (forest). Key lessons that I have learned:

- Always take the opportunity to connect with Papatūānuku and give thanks to Tāne Mahuta (God of the forests and birds) for our rongoā.
- Allow the time to connect, and listen to what our rongoā are trying to teach and say to you. Sometimes its 'Ae, come here', sometimes its 'Kao, go over there', and sometimes its 'Kao, go home and come back another time.'
- Turuki Whakataha, which means to set any personal issues aside when entering the ngahere to connect with rongoā. I feel this is really important, as it allows the mind and wairua (spirit) to be clear. It is always important to understand that the role of rongoā is to heal Papatūānuku and for us as pōtiki to be responsible in our use of rongoā.

As a **molecular scientist**, the major challenge remains in the identification and confirmation of active anti-diabetic rākau rongoā extracts to support its potential as a treatment of T2D. A major objection raised by mainstream health providers is the lack of scientific and clinical research (in their opinion) to support the use of rākau rongoā. This generates a resistance to the acceptance of rākau rongoā in the community.

Scientific research to counter these negative attitudes towards our rongoā mātauranga can require both extraction of material from the plants, and testing on human cell lines and animals to gather the data and information required. As a scientist, I want to ensure robust testing methods. But, more importantly, as Māori, I also expect that robust cultural practices are also followed. Building on traditional kaupapa Māori methods, I also apply the same process to my mahi in the lab:

- Applying tikanga Māori (customary values and practices) and karakia (prayer) before harvesting.
- Returning any unused material back to Papatūānuku. In my lab, it is forbidden to discard unused plant material to waste or down the drain.
- When undertaking testing of rākau rongoā on animals, apply the appropriate tikanga that respects both the rongoā and the animal. Our practices such as karakia are especially important when an animal may need to be euthanised. This is a reality for this type of mahi as we try to enhance our understanding of treatment effects in both humans and across nature.
- It is also important to be aware that human cell lines in this type of research come from individuals. Each has given consent before their deaths for their cells to be used for research purposes. I always karakia before any cell culture screening is performed to ensure all involved are kept safe, and, more importantly, to acknowledge the deceased person who donated their cells. I teach all my students this very important step.

Bottles of wairākau made from kūmarahou, karamū, kawakawa, and mamaku. Photo: Jonni Koia

Kawakawa tincture soaking. Photo: Jamie Watson

Dried tātarāmoa (bush lawyer) stored in jars at home. Photo: Jonni Koia

WHAT CAN WE DO TO SUPPORT THE PROTECTION AND ENHANCEMENT OF MĀTAURANGA ABOUT OUR VALUED RONGOĀ?

Mātauranga Māori is about places, the people connected to those places, and our interactions with the whenua over many generations – it is a knowledge of the land from the people who belong to the land. It is knowledge Māori have accumulated by living on the whenua, working with the whenua, and harvesting from the whenua, while all the time listening, watching, and caring to ensure that they can continue to survive. Mainstream research (both within medicine and environmental restoration) increasingly recognises the value of our ancient knowledge, and the solutions that sit within this knowledge to solve modern-day challenges. **However, as decisions relating to our valued species and our communities adapt and grow to better incorporate mātauranga, so too does the risk of their exploitation and misinterpretation.**

The restoration of our environment is very tightly connected to discussions about our community health and well-being – especially when talking about our rongoā. Our rākau rongoā and their associated plant whakapapa often form important components of restoration planting lists, even though they may not be identified as such. As whānau become more involved in projects (including research into our native flora and fauna), it is important to ensure such projects are framed and implemented in a way that best supports your own aspirations for rehabilitating, or re-creating those spaces where your cultural practices can be supported and sustained. The mahi should be done in a way that does not compromise the integrity of the values important to you, your whānau, hapū (sub-tribe), and iwi (tribe).

Below are some key considerations to ensure your mātauranga is best supported in repo restoration, especially where rākau rongoā are concerned:

1. If you or your whānau are considering a repo restoration project, or have been approached to participate in one, it is important first, **to get a good understanding of the drivers or purpose for the project.** You are within your rights to ask project managers for the time needed for whānau to wrap their heads around a project, and for them to give you the best available information to help you reach a decision.

2. **Ensure there is sufficient time** for you all to wānanga (discuss) the ideas behind a proposal. This puts into practice your rangatiratanga, and is an important process for building your own picture of what you all wish your future to look like.

3. To help build your future picture, it is important to **acknowledge what your past picture looked like.** One idea for wānanga is to choose a time in your history, and think about the following:

    - **What did your cultural landscape look like at that time?**
      Talk to your kaumātua and wider whānau about the plants, ecosystem types, animals (fish, birds, insects) that used to be in your rohe (region), especially regarding the specific project area.
    - **How did your tūpuna interact with that cultural landscape?**
      Think about your practices related to harvest of kai (including historic practices such as birding [the observation of birds in their natural habitat]), collection of rongoā, materials for weaving, dyeing, carving, and building. Also, consider areas of cultural significance, such as the areas occupied by your kaitiaki (guardians), important spaces for spawning of valued fish species, and nesting/roosting areas of valued birds.

      Consider what the maramataka (planting and fishing calendar) of those interactions looked like. This is especially important for times of whakatipua (regeneration) needed by valued species, in particular, rongoā and weaving plants often more at risk of being overexploited without the correct tikanga.
    - **Can you still interact with your traditional cultural landscape in the present day?**
      If not, what needs to be returned to support those practices again? And, then the most difficult question: Is it achievable to bring all that back? Or are there compromises that need to be made? If so, what are they? What are your bottom-lines/non-negotiables?
    - And finally, **what processes need to be put in place to ensure the sustainability of those resources into the future, including your associated practices?**
      Restoration does not necessarily mean that the site won't be impacted again in the future. Investigate what options there are for formal protections to be put on the land (e.g. covenants, especially if not Māori-owned). Include in those covenants, protection for your access, use, and management of those resources for the sustenance of your practices.

      Also, consider how your mātauranga in relation to the project can be guaranteed the protection you expect. Your mātauranga is your own, and you have the right to ensure that the use of that mātauranga does not occur to the detriment of your people, your cultural landscapes, and the valued resources within.

4. **Rākau rongoā are important for all repo restoration projects**, not only as a means of ensuring cultural practices are sustained for present and future generations, but also because of the role they play in healing the whenua and wai.

    - Spend time with your kaumātua, whānau, hapū, and iwi to better understand the rākau rongoā that were recognised in your rohe. Spend time talking about **which plants appear first, and which plants come after them.**
    - This information is important for **building plant lists**, particularly if some plants are needed to first build the 'whare-ngahere' (forest house) that supports those more sensitive plants and animals that appear later. Good examples of whare-ngahere building and kōhanga plants are tutu, mānuka and kānuka, kōwhai, harakeke, and karamū and mamaku (two of the rākau rongoā discussed in this chapter). Be sure you first check with your mātauranga experts that these plants are appropriate for your rohe.

Next page: Enjoying whānau time in the ngahere while collecting rākau rongoā. The huge buttress roots of pukatea provide a natural playground for tamariki. Yarndley's Bush, Te Awamutu, Waikato. Photo: Jonni Koia

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Dawson J, Lucas R 2011. *New Zealand's native trees*. Nelson, New Zealand: Craig Potton. 576 p.

Koia JH 2016. *Te Reo Tipu – bittersweet quest for anti-diabetic rongoā rākau used for type II diabetes mellitus*. Wellington, New Zealand: Health Research Council.

Koia JH, Shepherd P 2020. *The potential of anti-diabetic rākau rongoā (Māori herbal medicine) used to treat Type II Diabetes Mellitus (T2DM) Mate Huka: A review.* Frontiers in Pharmacology 11:935. doi: 10.3389/fphar.2020.00935 https://www.frontiersin.org/articles/10.3389/fphar.2020.00935/full

Riley M 1994. *Māori healing and herbal*. Paraparaumu, New Zealand: Viking Sevenseas NZ. 528 p.

Useful websites

Additional information about the incorporation of rākau rongoā into gardens http://www.o2landscapes.com/pages/pp-pomaderris.php; http://www.o2landscapes.com/pages/pp-coprosma.php; http://www.o2landscapes.com/pages/pp-cyathea.php

Contact details for Dr Jonni Koia

Email: jonni.koia@aut.ac.nz

SECTION THREE

MĀTAURANGA MĀORI

11.
TUIA NGĀ REPO ME NGĀ TĀNGATA RECONNECTING COMMUNITIES WITH THEIR WETLANDS

YVONNE TAURA (NGATI HAUĀ, NGĀTI TŪWHARETOA, NGĀI TE RANGI, NGĀTI RANGINUI, NGĀTI UENUKU), PAULINE WAITI (TE RARAWA), CATHY BUNTTING (POKAPŪ AKORANGA PŪTAIAO)

Ka pū te ruha, ka hao te rangatahi

When the old net is cast aside, the new net goes fishing

Tuia ngā repo me ngā tāngata – reconnecting communities with their wetlands was funded by the New Zealand Government's Unlocking Curious Minds initiative, and supported by Manaaki Whenua – Landcare Research (Strategic Science Investment Funding for Crown Research Institutes) and the University of Waikato. We acknowledge the support and contributions from:

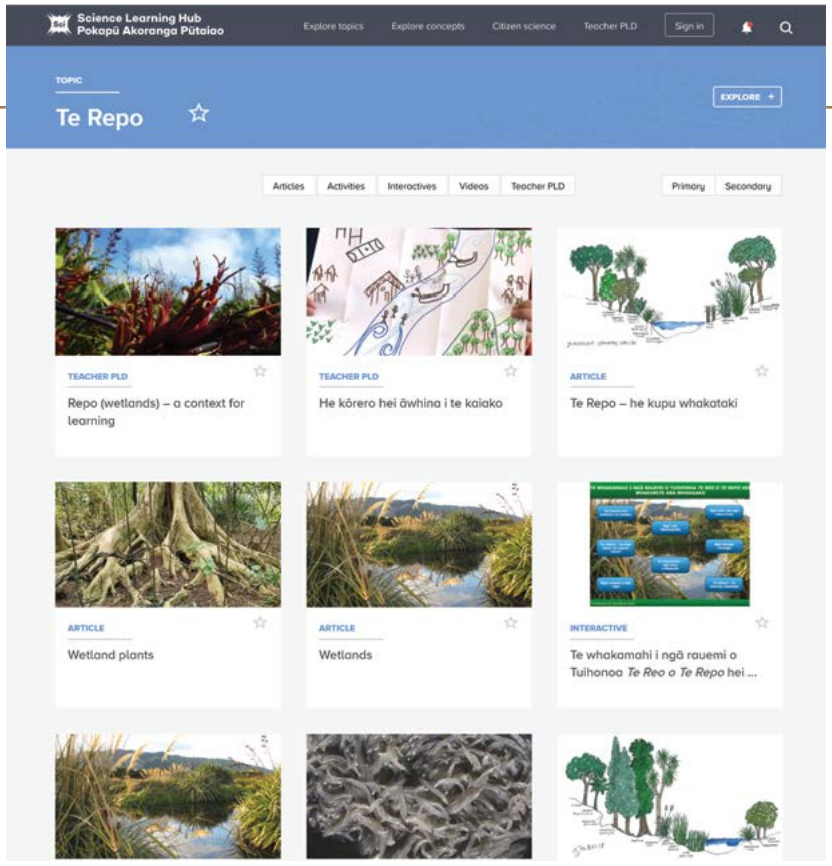
The co-editors of the *Te Reo o Te Repo* cultural wetland handbook series – Cheri van Schravendijk-Goodman (Te Atihaunui a Pāpārangi, Ngāti Apa, Ngāti Rangi) and Dr Beverley Clarkson (Manaaki Whenua). The Science Learning Hub team – Andrea Soanes, Greta Dromgool, Angela Schipper, Rachel Douglas, Tom Goulter, Vanya Bootham, and Mary Bennett. Translator and linguist Hēni Jacob (Ngāti Raukawa).

The tumuaki, kaiako, and tauira from Te Kura Kaupapa Māori o Te Kōtuku (Tāmaki Makarau), Te Kura Kaupapa Māori o Whakarewa i te reo ki Tūwharetoa (Taupō), Te Kura o Tuahiwi (Ōtautahi), Te Wharekura o Arowhenua (Waihōpai), and Te Kura Kaupapa Māori o Ōtepoti (Ōtepoti).

The kaitiaki and kairangahau Māori who supported our kaupapa of creating bilingual resources for kura to promote wetland topics such as ngā tohu mō ngā rawa ā-iwi – kōura, matamata, ruru, kuta, and harakeke; rongoā Māori; iwi-led dune wetland restoration; and willow control effects on terrestrial invertebrates (insects) and aquatic inverterbrates (zooplankton).

Those who feature in the video clips – Robert Ropata Pa McGowan (Ngā Whenua Rāhui), Shannon Te Huia (Ngāti Maniapoto, Ngāti Raukawa – Puniū River Care Inc.), Dr Shaun Awatere (Ngāti Porou – Manaaki Whenua), and Dr Ian Kusabs (Te Arawa, Ngāti Tūwharetoa).

– Ngā mihi, nā Yvonne mātou ko Pauline, ko Cathy



Tuihonoa Te Reo o Te Repo features exclusively on the Science Learning Hub website. Photo: Science Learning Hub

Previous page: Tauira from Taupiri School helping to restore their local Whangamaire Wetland, Waikato. Photo: Manaaki Whenua

When *Te Reo o Te Repo – The Voice of the Wetland* handbook was conceived, the main focus for the editors was to create a resource that centred on our whānau (families) voices in wetland restoration at the marae (Māori social and cultural centres), hapū (sub-tribes), and iwi (tribes) levels. After the handbook was published (2017), the editors became increasingly aware of the different rōpū (groups) interested in science research that facilitated connections between Māori and their repo (wetlands), in understanding cultural resources, and in learning from case studies for wetland monitoring and restoration. Councils and community groups, learning institutions, and kura (schools) expressed interest in increasing engagement with science in partnership with mātauranga Māori (Māori knowledge).

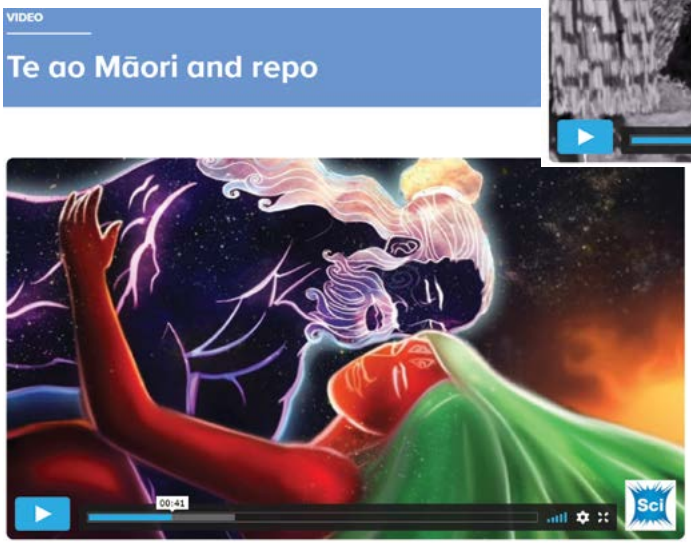
At the same time, the team at the Science Learning Hub (Hub) was actively seeking opportunities to collaborate with Māori and showcase mātauranga Māori as a vital component of ecosystem research throughout Aotearoa New Zealand. The Hub is an extensive digital resource that connects the science and education sectors, making science and pūtaiao within Aotearoa more visible and accessible to kaiako (teachers), tauira (students), and whānau (local communities). The small team of resource developers, science educators, education researchers, and web specialists do this by creating bespoke multimedia resources that act as 'windows'into the world and people of science.

When people come together around a shared kaupapa, the impact can be significant. For us, this is the story of *Tuihonoa Te Reo o Te Repo*: the creation of rich multimedia resources in te reo Māori (Māori language) and English that unpack the learnings shared in the *Te Reo o Te Repo – The Voice of the Wetland* handbook series.

A SHARED KAUPAPA

A shared kaupapa was established from a kapu tī (cup of tea – engagement) between Yvonne (lead researcher, Manaaki Whenua) and Greta Dromgool (teacher professional learning development (PLD) facilitator, Science Learning Hub). Yvonne wanted to include wetland resources for tamariki (children) within the *Te Reo o Te Repo* cultural wetland handbook series and Greta was interested in increasing pūtaiao and mātauranga Māori understanding on the Hub website. What came about from this hui (meeting) was a proposal to collaborate, and bring together a multi-disciplinary team of skilled science educators, kaiako, kaitiaki (guardians), kairangahau Māori (researchers), and whakamāori (translator), to create *Tuihonoa Te Reo o Te Repo*.

Our aim was to support learning about wetland ecology and showcase connections to wetland restoration as a way of increasing kaiako and tauira engagement with science in partnership with mātauranga Māori, that is, mātauranga pūtaiao (Māori-informed knowledge of the natural world). We focused our efforts on working with kura kaupapa Māori (Māori-medium schools) in rural locations throughout Aotearoa, collaborating with them to develop educational resources that would support them to become effective kaitiaki of their repo.



Screenshots of video clips from *Tuihonoa Te Reo o Te Repo* site. Photos: Science Learning Hub

TUIHONOA TE REO O TE REPO

Tuihonoa Te Reo o Te Repo – the suite of rauemi tuihono (online resources) – includes over 30 articles (including 24 in te reo Māori) illustrating Māori-led wetland research, teaching and learning guides for the classroom, interactive image maps to navigate the site, and a collection of short video clips featuring key wetland experts – kaitiaki and kairangahau Māori who supported the development of these resources.

The resources draw extensively on chapters within the *Te Reo o Te Repo* cultural wetland handbook series, but are written specifically for kaiako and teachers, and tauira and students. They promote wetland topics such as ngā tohu mō ngā rawa ā-iwi (cultural indicators) – kōura (freshwater crayfish; *Paranephrops* spp.), matamata (whitebait; *Galaxias* spp.), ruru (morepork; *Ninox novaeseelandiae*), kuta (giant spike sedge; *Eleocharis sphacelata*), and harakeke (NZ flax; *Phormium tenax*); rongoā Māori; iwi-led dune wetland restoration; and willow control effects on terrestrial invertebrates (insects) and aquatic invertebrates (zooplankton).

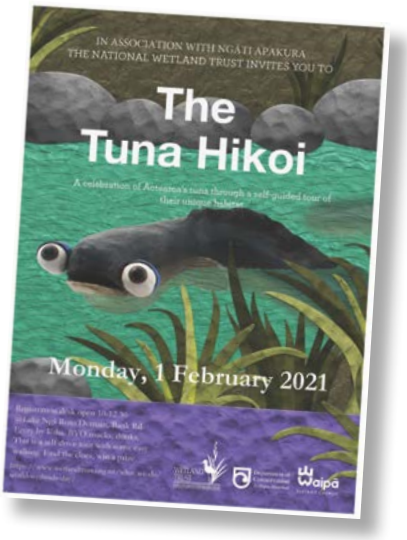
One priority of *Tuihonoa Te Reo o Te Repo* was to create wetland resources that privileged mātauranga pūtaiao within a mātauranga Māori framework.

'Importantly, these resources privilege mātauranga Māori, 'ngā kōrero tuku iho', in mātauranga pūtaiao. Kaiako are able to teach pūtaiao within a mātauranga Māori framework, and therefore continue to privilege 'ngā kōrero tuku iho o ngā tūpuna', and from there engage in the appropriate science. In other words, Tuihonoa Te Reo o Te Repo are embedded with mātauranga Māori, and then other knowledge is added as required. Which is the opposite to how science is usually taught, where western ideas are privileged. These rauemi flip that around, and represent a re-thinking of teaching pūtaiao and science in kura throughout Aotearoa.'

– Pauline Waiti

Lead researcher Yvonne Taura and the Hub team – Greta Dromgool, Angela Schipper, and Cathy Buntting, and scientist Louis Schipper at the launch of *Tuihonoa Te Reo o Te Repo*. Photo: National Wetland Trust

Tuihonoa Te Reo o Te Repo was officially launched on 1 February 2021, World Wetlands Day, and celebrated as part of a community event *Te Tuna Haerenga – The great mystery eel tour*, at Lake Ngā Roto, Ōhaupō, organised by the National Wetland Trust. The resources can be freely accessed from the Science Learning Hub website: https://www.sciencelearn.org.nz/topics/te-repo



Te Tuna Haerenga – The great mystery eel tour, World Wetlands Day Event 2021. Photo: National Wetland Trust

Tamariki interacting with science experiments at the launch of *Tuihonoa Te Reo o Te Repo*. Photo: Science Learning Hub

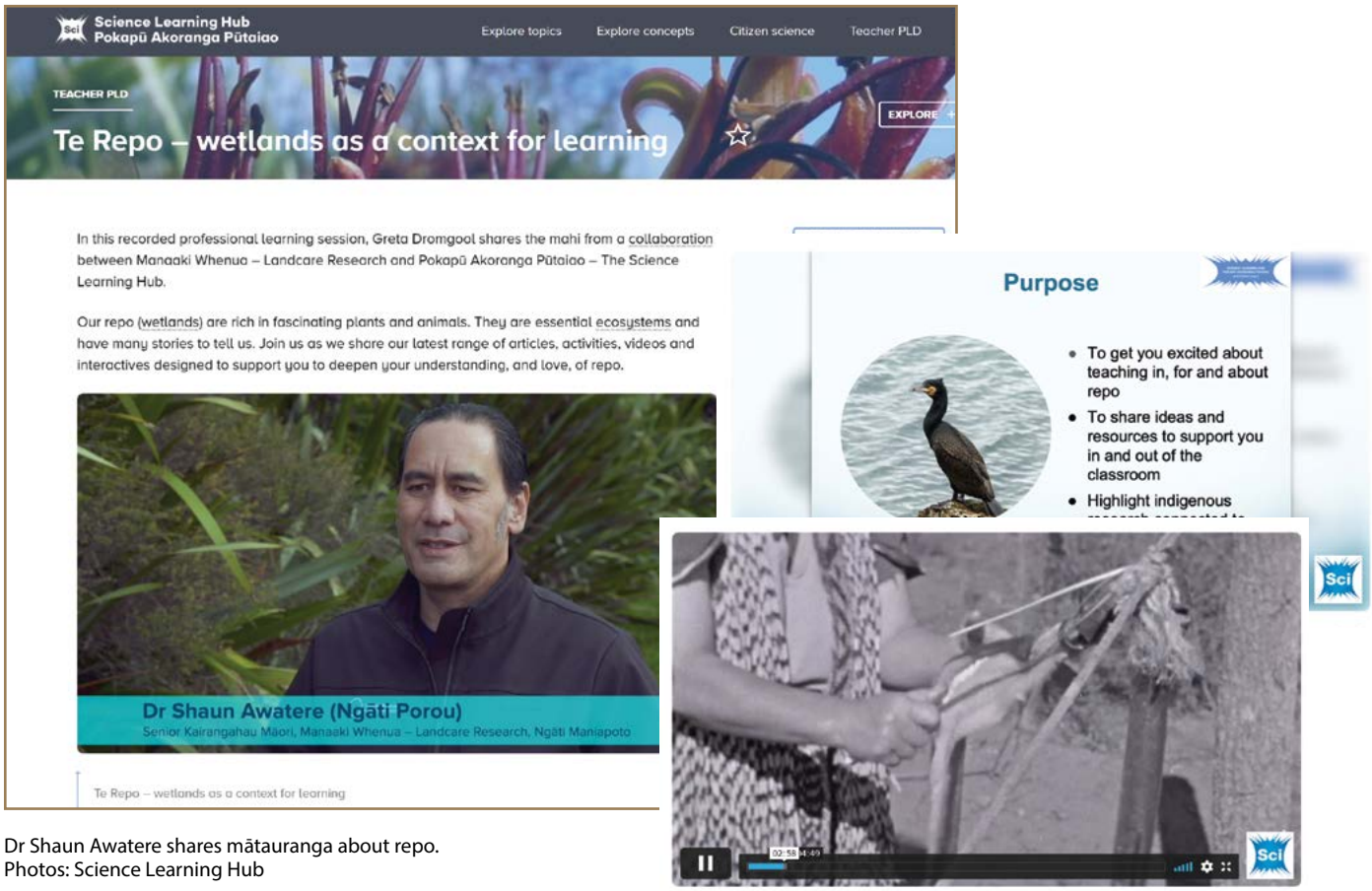
MĀTAURANGA PŪTAIAO AND SCIENCE

The context for re-thinking the knowledge important for tauira Māori and all students in Aotearoa New Zealand

In 2018, the New Zealand Government began an extensive review of the senior secondary school qualification, the National Certificate of Educational Achievement (NCEA). One of the recommendations accepted as a result of this review was ***He mana ōrite mō te mātauranga Māori***. This means that, in the context of school education, Māori knowledge has value alongside other knowledges. This means that mātauranga Māori needs to sit alongside the body of knowledge called science, and for tauira Māori, mātauranga Māori can in fact be privileged, explored, and understood before engaging with science. This calls for a re-thinking of the ways that the subjects 'pūtaiao' and 'science' are framed in teaching and learning in kura and schools throughout Aotearoa.

The term **mātauranga Māori** is a relatively new term (from the early 1990s) and is used to encapsulate the essence of Te Ao Māori, required to describe a Māori world view. It is often referred to as *'ngā kōrero tuku iho o ngā tūpuna'*, the knowledge handed down by our kaumātua and tūpuna, and is a living knowledge system, recording Māori experiences and engagements of and in the world through whānau, hapū, and iwi relationships with the environment, past, present and future. These experiences are recorded in whānau, hapū, and iwi pūrākau, waiata, haka, raranga, whakairo, whakataukī, oriori and so on. For tauira, developing ideas about and understandings of concepts such as whakapapa, kaitiakitanga, whanaungatanga, and ways of interacting with te taiao, such as maramataka, will inform their ways of thinking, practice and decision-making about te taiao for present and future generations. These are then based on the ideas and understandings of past generations. Mātauranga Māori is the essence of our unique identification as Māori.

Mātauranga pūtaiao is described as mātauranga Māori-informed understandings of Te Ao Tūroa, the natural world. It sits alongside the western science knowledge system. Both knowledge systems are valued; however, mātauranga pūtaiao is privileged for tauira Māori as it represents the knowledge that gave our tūpuna the ability to successfully maintain their tino rangatiratanga over thousands of years as a people with a distinct set of values, beliefs, and understandings informing their many and varied relationships with te taiao, Te Ao Tūroa. Mātauranga pūtaiao helps tauira to access science knowledge to complement their mātauranga Māori and understanding, building their knowledge and understanding of their world.



Dr Shaun Awatere shares mātauranga about repo.
Photos: Science Learning Hub

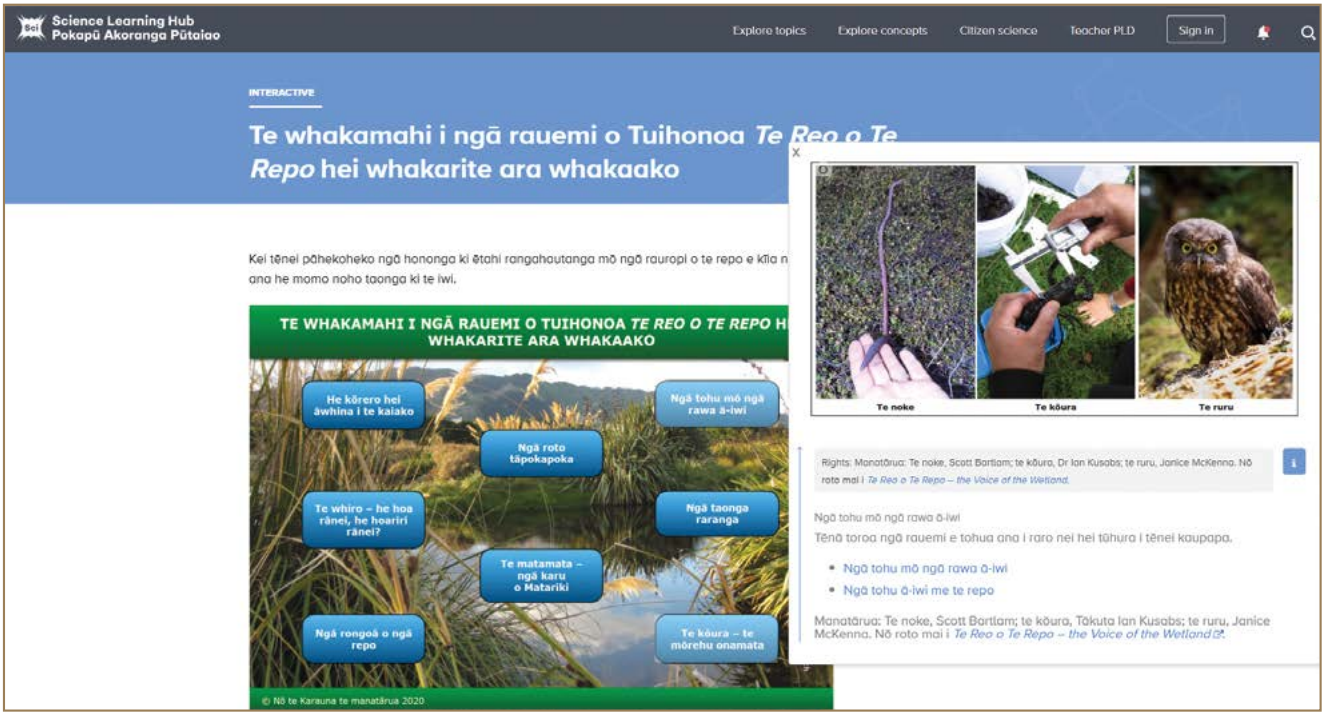
TRANSFORMING MĀTAURANGA PŪTAIAO AND SCIENCE

Our first action after securing funding support was to invite five kura kaupapa Māori from across Aotearoa to introduce and trial drafts of the online resources. These kura were located close to local repo and were considering or already undertaking repo restoration projects: Te Kura Kaupapa Māori o Te Kōtuku (Tāmaki Makarau – Auckland), Te Kura Kaupapa Māori o Whakarewa i te reo ki Tūwharetoa (Taupō), Te Kura o Tuahiwi (Ōtautahi – Christchurch), Te Wharekura o Arowhenua (Waihōpai – Invercargill), and Te Kura Kaupapa Māori o Ōtepoti (Ōtepoti – Dunedin).

The next action was to host a 1-day wānanga (workshop) with key kaiako, kaitiaki, and kairangahau Māori. The wānanga laid a strong foundation, provided much needed guidance, and identified key themes that would support the project's ongoing development.

First, whānau identified the need for resources to be written completely in te reo Māori that supported kura kaupapa Māori[1] – kaiako, tamariki, and whānau to learn more about and connect with their local repo, and become confident kaitiaki.

As these resources elevate Māori-centred wetland research and restoration, it was agreed that some of these resources be written only in te reo Māori, privileging mātauranga pūtaiao specifically for kura kaupapa Māori audiences. Other resources are written in English for English-medium audiences.



Interactive pages for te reo Māori and English content in *Tuihonoa Te Reo o Te Repo*. Photos: Science Learning Hub

[1] Tauira and students in Aotearoa New Zealand can attend English-medium, bilingual, or Māori-medium kura and schools.

Robert Pa Ropata McGowan shares mātauranga about repo. Photos: Science Learning Hub and Scottie Productions © Waka Huia

Second, we were reminded that we all need to learn to listen to the whenua (land). Robert Pa Ropata McGowan captured this sentiment powerfully at the end of the wānanga[2]:

*'**How do we heal a wetland?** Well, you ask it. We've got to remember that we can communicate in more ways than just by words. Back in Whanganui [Manawatū region, North Island] running workshops for the river people, I say to them, "You've got to ask the river what she wants you to do." And they say, "Well, how do you talk to a river?" I respond, "The river doesn't speak Māori and doesn't speak English. It speaks river." What we have to do is restore our ability to hear what the land is saying.'*

– Robert Pa Ropata McGowan

Third, whānau emphasised a kaupapa of interconnections: 'restoration'is not just about ecological restoration, it reaches far beyond to cultural, historical, social, and spiritual restoration.

Fourth, ongoing guidance would be required during the project to retain cultural integrity and authenticity – and as a project team we were whole-heartedly committed to this. Most importantly, this included the continued support and generosity of authors from the *Te Reo o Te Repo* cultural wetland handbook series that would feature in *Tuihonoa Te Reo o Te Repo*; the openness of kaiako who continued engaging with us; the expertise of whaea Pauline's leadership as a pūtaiao Māori educator; and the proficiency of whaea Hēni's ability to translate content for a young audience.

The Hub team recognised the privileged space created by this wānanga. One of the team wrote in a reflection at the time:

'Wow, the wānanga has given the mahi [work] such an important, solid grounding. We knew it was going to be an important part of our process, and this was underlined by the care that was taken in identifying who to invite, drafting the invitations, and planning the day. The fact that so many different people turned up to give a day of their time is indicative of the importance of this kaupapa, and also the value that they each attribute to the work we are trying to do through this project. I found huge value in the 'open forum' where everyone was invited to share their connections with their repo – the narratives were all so compelling, and beautifully told! I was especially reminded of the importance of connections – humanity with nature, it all starting with the whenua, the need to listen to whenua. Also that 'restoration' reaches far beyond ecological restoration, to cultural, historical, social and spiritual restoration. That was a powerful insight for me.'

– Science Learning Hub team member

[2] Healing Repo video available on the Science Learning Hub website https://www.sciencelearn.org.nz/videos/2017-healing-repo

HOW DO WE ENGAGE TAUIRA WITH MĀTAURANGA PŪTAIAO IN THEIR AKOMANGA?

The *Te Reo o Te Repo* cultural wetland handbook series provided numerous opportunities for kaiako and tauira to engage in mātauranga pūtaiao in their akomanga (classroom). Engagement with mātauranga Māori facilitates the learning of mātauranga pūtaiao. The case studies chosen from the wetland handbook series provided the opportunity to reclaim mātauranga Māori through restoring our various taiao of Te Ao Tūroa.

One such case study based on the mahi of Dr Ian Kusabs (Te Arawa, Ngāti Tūwharetoa), is kōura, providing tauira with a perfect example of the value of mātauranga Māori for the survival of kōura today. Through engagement with this case study – available on the Science Learning Hub in te reo Māori and English – tauira learn:

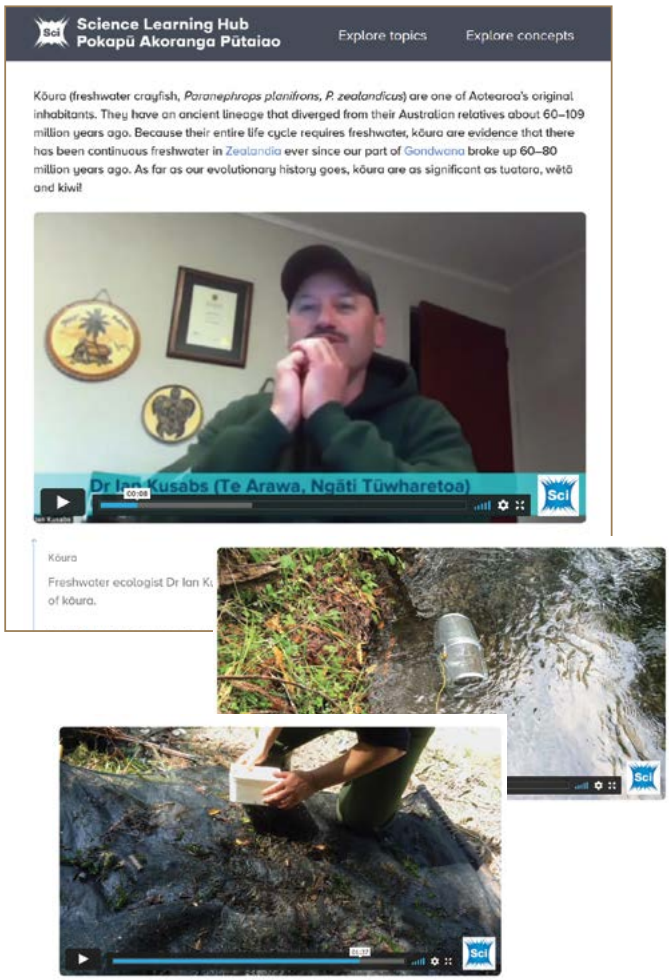
- kōura are also known as kēwai
- there are two species of kōura, each with a scientific name: northern kōura – *P. planifrons* and southern kōura – *P. zealandicus*
- kōura are one of the original inhabitants of Aotearoa; as their entire life cycle requires freshwater, kōura are evidence that there has been continuous freshwater in Zealandia ever since our part of Gondwanaland broke up 60–80 million years ago
- kōura are omnivores, consuming plant and animal species, as well as rotting plant and animal matter
- kōura were and are important kai for our tūpuna, and are considered taonga species
- kōura are an indicator and keystone species; they play an important role in freshwater ecosystems – directly through predation or indirectly by breaking down plant material – and affect other aquatic invertebrates such as insects, crustaceans, molluscs and worms, by cleansing the stream bed of fine silt
- kōura live in different environments, such as streams, rivers, lakes, ponds, and wetlands

Tauira also learn that while information about stream-dwelling kōura is well reported in Aotearoa, information about kōura living in lakes, ponds and wetlands is not reported effectively because of a lack of a successful way of sampling the populations in the lakes, ponds, and wetlands. However, they learn that the use of a traditional Māori method of harvesting kōura, called *tau kōura,* allows for effective sampling in these habitats. The tauira learn that *tau kōura* was, and still is, the method used in the Te Arawa rohe (tribal area) for the Rotorua and Taupō lakes, and is the culmination of 500 years of mātauranga and rangahau (research) that had proved it was superior to other methods, such as pouraka (baited traps), hīnaki (fyke nets), pae pae (dredge nets), and rama (hand nets). Tauira learn how to make and use *tau kōura*, from mātauranga Māori of their tūpuna, and they learn why the method is effective and able to be used in the future, the mātauranga pūtaiao.

Finally, mātauranga Māori and mātauranga pūtaiao with which tauira learn and engage provides the evidence and guidance needed to restore the kōura populations.

In other words, engaging with this case study (as one example), tauira will:

- kōrero with whānau, hapū, and iwi members about the mātauranga Māori learnt
- learn and understand the ecology and environmental whakapapa of the repo system
- draw on their growing understanding to build a monitoring and restoration framework.



Dr Ian Kusabs shares mātauranga and science research about kōura. Photos: Science Learning Hub

HE KŌRERO HEI ĀWHINA I TE KAIAKO
A TEACHING AND LEARNING GUIDE

A teaching and learning guide – ***He kōrero hei āwhina i te kaiako*** – has been designed to support the integration of any or all the case studies into a teaching and learning programme. A series of pātai (questions) has been developed about the following areas of inquiry with any of the case studies:

- te mātauranga o ngā tūpuna – knowledge of ancestors that relates to the natural world
- te mātauranga o ināianei – current knowledge of the natural world
- te mātauranga hei mua atu – future knowledge of the natural world.

By engaging with these pātai, within the context of identified taiao, tauira should be able to develop a plan of what they know and what they need to find out in order to engage with their repo.

He kōrero kōpūtahi

Ahakoa kei ngā whānau, ngā hāpu me ngā iwi te nuinga atu o ngā mātauranga Māori e pupuri ana, he maha tonu ngā kōrero e wātea ana hei toro i ngā puna tōtika, pēnei i ēnei:

- Te Repo – he kupu whakataki
- Kaupapa Mātauranga Māori
- Kauhaurangi PLD – ko Ahorangi Hēmi Whaanga te kaikauhau
- Kauhaurangi PLD – he rauemi mō te mātauranga me te Ao Kōiora
- Kauhaurangi PLD – ko Ahorangi Rangi Matamua e matapaki ana i te noho puiaki mai o te reo Māori

He whakamihi

He mea tuhi ngā kōrero āwhina nei e Pauline Waiti.

He kōrero hei āwhina i te kaiako – a teaching and learning guide. Photos: Science Learning Hub

FROM WĀNANGA TO ZUI
THE IMPACT OF COVID-19

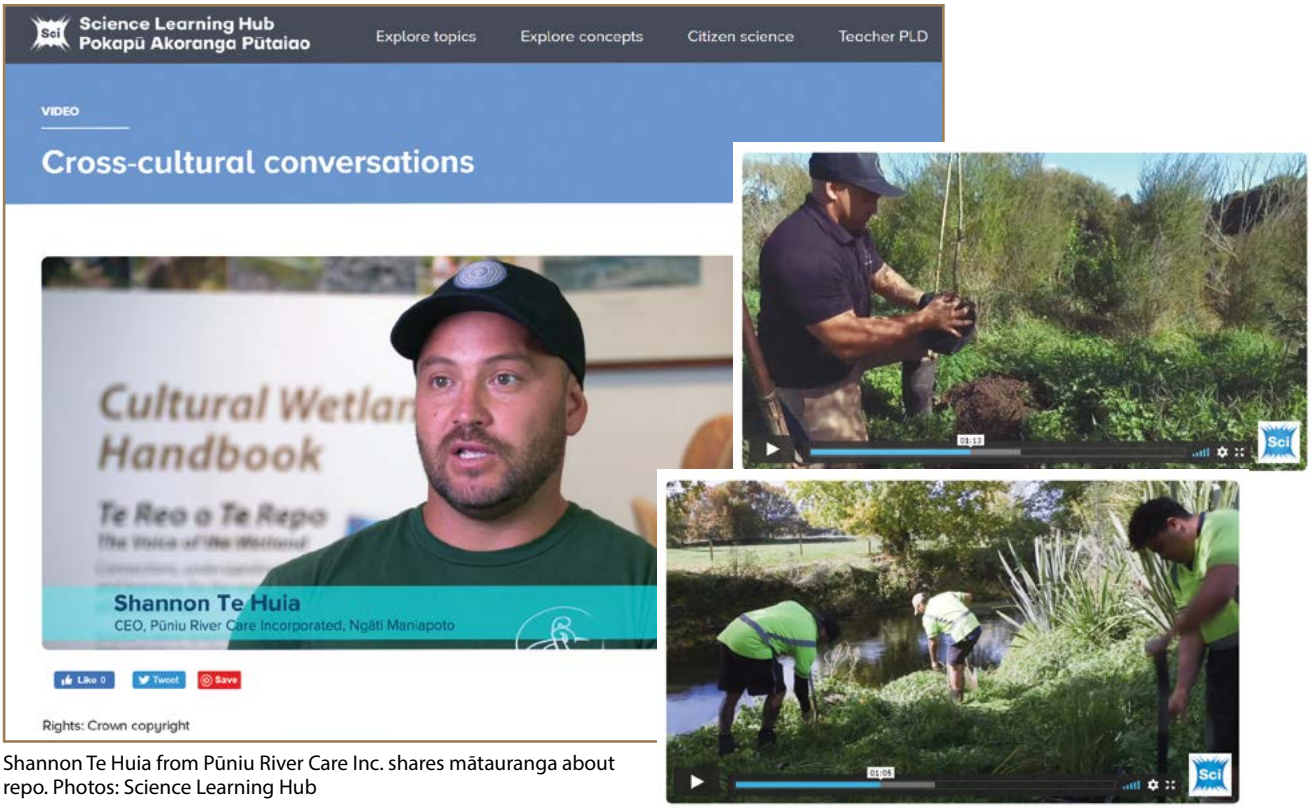
To ensure *Tuihonoa Te Reo o Te Repo* would resonate with kaiako and tauira, our original intention was to introduce and trial drafts of the online resources at wānanga with five kura across Aotearoa – from Tāmaki Makarau to Ōtepoti. The purpose of these wānanga was to visit each kura and their repo, as well as to connect with a local repo expert (kaitiaki or kairangahau) in order to maximise intergenerational ako (reciprocal learning). Ongoing engagement between these kura and the team would be supported through online forums, drawing on the experience of the Hub team in building communities of practice to support ongoing learning.

The entire world felt the impacts of the COVID-19 global pandemic, and Aotearoa was not immune to the health and economic risks. As we set into rāhui (lockdown) between March and April 2020, with the ongoing possibilities of further rāhui, and the continual effects of domestic travel restrictions, the project team had to make some hard decisions. It was with heavy but hopeful hearts that we shifted from engaging kanohi ki te kanohi (face to face) to 'zui'– hui hosted via Zoom video conferencing. While this meant we were no longer able to engage directly with kura at their tūrangawaewae (place of belonging through kinship), a safe space was created where participating kaiako of each kura could meet, connect, and support each other in their kaupapa of wetland restoration. This connection between kaiako from different kura was a valuable outcome. Cost savings from reduced travel were re-directed towards the development of additional online resources.

Throughout the year we held zui with our participating kaiako. These zui created space for whakawhanaungatanga (establishing relationships), sharing experiences about their engagements with their local repo, and introducing the draft resources to receive feedback.

'One thing I am grateful for is to have some language to explain why it [pūtaiao] is important. Many of the things that I'm teaching the children, I was taught as a young child, but to have language to explain what I know in my heart because I'm not very good at communicating. We've become so urban and disconnected from the land ..... it's not dangerous to go in the garden or get a bit damp. It's nice to have rain on your face. Thank you for expressing in words what I know in my heart.'

– Helen Ruston (Kaiako, Te Kura Kaupapa Māori o Te Kotuku)



Shannon Te Huia from Pūniu River Care Inc. shares mātauranga about repo. Photos: Science Learning Hub

When we were ready to publish *Tuihonoa Te Reo o Te Repo* we held an online 'soft launch', attended by kaiako, kaitiaki, and karangahau who supported the project. The zui launch provided an opportunity for supporters to reflect on and celebrate the publication of the resources, and to look ahead to future possibilities.

'We've got resources! Oh, so I'm just about ready to cry because seeing it all come together…. having those rauemi on the Pokapū – oh my gosh, this is definitely my PLD presentation for the rest of the school at the end of the year. We've got 3 days planning and this is definitely going to be a foundation.'

– Tiahuia Kawe-Small (Tumuaki Tuarua, Te Wharekura o Arowhenua)

'I think it's important to spark an interest in looking after our wetlands within our school children, because this is so important for the long-term survival of our wetlands. The hope is that kura will essentially be inspired to become kaitiaki for their wetlands, and also that the children might consider science, or even wetlands, as a potential career choice.'

– Bev Clarkson (Manaaki Whenua)

'One of the most exciting things is being able to give a megaphone to our peoples' relationships with their wetlands.'

– Cheri van Schravendijk-Goodman (Te Atihaunui a Pāpārangi, Ngāti Apa, Ngāti Rangi)

Co-editors of the *Te Reo o Te Repo – The Voice of the Wetland* handbook series, Beverley Clarkson, Cheri van Schravendijk-Goodman, and Yvonne Taura, being filmed for the *Tuihonoa Te Reo o Te Repo* video clips. Photo: Science Learning Hub

GROWING IMPACT

Tuihonoa Te Reo o Te Repo is freely accessible on the Science Learning Hub website. With over 10,000 views between February and June 2021, and national and international interest, the impact of this suite of rauemi tuihono will continue to grow. Our ultimate goal is that *Tuihonoa Te Reo o Te Repo* will support kaiako, tauira, and whānau to access best practice wetland restoration and conservation science protocols that value mātauranga Māori and mātauranga pūtaiao. This, in turn, will empower community action to grow communities, and support wetland restoration.

HELPFUL GLOSSARY

Understanding the terminology

Haka – cultural performance

Kaitiakitanga – exercise of guardianship

Kaumātua – elders

Kura kaupapa Māori – Māori medium schools that follow Māori philosphy in all aspects of the curriculum for tamariki

Maramataka – traditional lunar calendars

Mātauranga pūtaiao – Māori-informed knowledge of the natural world

Ngā kōrero tuku iho – specific knowledge handed down intergenerationally through various cultural practices, and often referred to as ngā kōrero o ngā tūpuna

Ngā kōrero tuku iho o ngā tūpuna – specific knowledge handed down intergenrationally through cultural practices

Ngā tohu mō ngā rawa ā-iwi – native plant and animal indicators that are noticed and valued by whānau, hapū, and iwi who have a relationship with their environment

Oriori – lullaby – song composed on the birth of a chiefly child about their ancestry and tribal history
Pūrākau – traditional stories

Raranga – weaving

Te Ao Tūroa – the natural world

Te mātauranga o ngā tūpuna – specific knowledge of our tūpuna that relates to te ao tūroa

Te mātauranga o ināianei – the current knowledge of te ao tūroa

Te mātauranga hei mua atu – future knowledge of tea ao tūroa

Te taiao – the natural world

Tino rangatiratanga – self-determination, self-government, sovereinty

Tumuaki Tuarua – deputy principle

Tūpuna – ancestors

Waiata – songs

Whakairo – carvings

Whakataukī – proverb, significant saying

Whakapapa – genealogy, lineage, descent

Whakawhanaungatanga – establishing relationships through shared experiences and working together, which provides people with a sense of belonging

Culturally significant plants in wetland. Photo: Monica Peters

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Kusabs I 2017. *Chapter 5.2: Kōura – the ancient survivor.* In: Taura Y, van Schravendijk-Goodman C, Clarkson B eds. 2017. *Te Reo o Te Repo – The Voice of the Wetland: Connections, understanding and learnings of our wetlands.* Hamilton, New Zealand: Manaaki Whenua – Landcare Research and Waikato Raupatu River Trust. Pp. 89–93. https://www.landcareresearch.co.nz/uploads/public/Publications/Te-reo-o-te-repo/5_2_Fauna_Koura.pdf

Moewaka-Barnes H, Henwood W, Murray J, Waiti P, Pomare-Peita M, Bercic S, Chee R, Mitchell M, McCreanor T 2019. *Noho Taiao: reclaiming Māori science with young people*. Global Health Promotion, 26(3), 35–43. https://doi.org/10.1177/1757975919829700

Taura Y, van Schravendijk-Goodman C, Clarkson B eds 2017. *Te Reo o Te Repo – The Voice of the Wetland: Connections, understandings and learnings of our wetlands.* Hamilton, New Zealand: Manaaki Whenua – Landcare Research and Waikato Raupatu River Trust. 201 p. https://www.landcareresearch.co.nz/publications/te-reo-o-te-repo

Taura Y, van Schravendijk-Goodman C, Clarkson B eds 2021. *Te Reo o Te Repo – Kei konei tonu au. The Voice of the Wetland – I am still here.* Hamilton, New Zealand: Manaaki Whenua – Landcare Research. https://www.landcareresearch.co.nz/publications/te-reo-o-te-repo-kei-konei-tonu-au

Useful websites

Pokapū Akoranga Pūtaiao – Science Learning Hub

The Hub Team
https://www.sciencelearn.org.nz/pages/about

Tuihonoa Te Reo o Repo
https://www.sciencelearn.org.nz/topics/te-repo

Teaching and Learning Guides for kaiako

He kōrero hei awhina i te kaiako
https://www.sciencelearn.org.nz/resources/2983-he-korero-hei-awhina-i-te-kaiako

Repo – a context for learning
https://www.sciencelearn.org.nz/resources/3001-repo-wetlands-a-context-for-learning

Te Kōura

Te Kōura – te mōrehu onamata
https://www.sciencelearn.org.nz/resources/2936-te-koura-te-morehu-onamata

Te tau kōura – he tikanga tūturu mō te hopu me te tirotiro kōura
https://www.sciencelearn.org.nz/resources/2937-te-tau-koura-he-tikanga-tuturu-mo-te-hopu-me-te-tirotiro-koura

Te whakaora ake i te kōura
https://www.sciencelearn.org.nz/resources/2938-te-whakaora-ake-i-te-koura

Screenshot credits in video clips

Te ao Māori and repo
https://www.sciencelearn.org.nz/videos/2015-te-ao-maori-and-repo
Photo: Papatūānuku and Ranginui, from the graphic novella Te Orokotimatanga o te Ao, by Rewi Spraggon, and illustrated by Munro Te Whata. Kiwa Digital

Wetlands in Aotearoa
https://www.sciencelearn.org.nz/videos/2013-wetlands-in-aotearoa

Cross-cultural conversations
https://www.sciencelearn.org.nz/videos/2018-cultural-indicators
Photo: Kaimahi of Pūniu River Care Inc. riparian planting. Waikato River Authority

The Ake Ake Model
https://www.sciencelearn.org.nz/videos/244-the-ake-ake-model
Photo: Tauira using the Ake Ake Model framework developed by Lorraine Dixon

Te Tāhuhu o te Mātauranga – Ministry of Education

He mana ōrite mō te mātauranga Māori
https://vimeo.com/336199941

He Hihiri i te Mahara – Curious Minds Funding
https://www.curiousminds.nz

Contact details for Yvonne Taura

Email: tauray@landcareresearch.co.nz

12.
NGĀ ROTO TĀPOKAPOKA – TE HIKU O TE IKA DUNE LAKES RESTORATION

WAIKARERE GREGORY (TE RARAWA, TE AUPŌURI, NGĀTI KAHU, NGĀPUHI, NGĀI TAHU), JOANNE MURRAY (TE RARAWA, NGĀTI HINE, NGĀPUHI), WENDY HENWOOD (TE RARAWA)

Te rākau taumatua, he karahuinga manu

It is said that a tree of many years is a gathering place for many birds

Waihoki, te roto tāpokopoko, he wai whakahuihui, he pūkenga ora

Likewise, a dune lake is like an oasis that brings together and grows life

Anaru Reiper (Te Aupōuri)

He mihi tēnei ki a koutou katoa i āwhina, i tautokohia te mahi nui nei.

Ko koutou tēnā o Te Hiku Iwi Development Trust, Manatū Mō Te Taiao (MfE), Te Papa Atawhai (DOC), Te Kaunihera ā Rohe o Te Taitokerau (Northland Regional Council), Te Aho Tū Roa me Enviroschools (Toimata Foundation), Whāriki Research Group (Te Kunenga ki Pūrehuroa – Massey University), Taihoro Nukurangi (NIWA), ko ngā mema o te rōpū Project Advisory, Sweetwater Farms JV, Northtec, Te Matarau, Rawhitiroa Photography, Reconnecting Northland. Ko ngā mahinga tipu – ko Waikura Landscaping Services, ko Bushland Trust, ko Tuia Maara Whenua, ko Ngāi Takoto ki Waimanoni, ko ngā marae o Te Hiku, ko ngā iwi o Te Aupōuri, Ngāi Takoto, Te Rarawa.

He mihi aroha hoki ki te tini anō o ngā whanaunga, ngā marae, ngā kaitūao, e mahi tahi ana mō te kaupapa nei, kia whai oranga te taiao, a, ko tātou anō te tangata me ngā uri whakaheke. Na, kia tuku iho tonu i ngā taonga maha nō ngā tūpuna.

Nā reira, tēnā koutou, tēnā koutou, tēnā tātou katoa.

– Ngā mihi, nā Waikarere mātou ko Joanne, ko Wendy

ABOUT DUNE LAKES

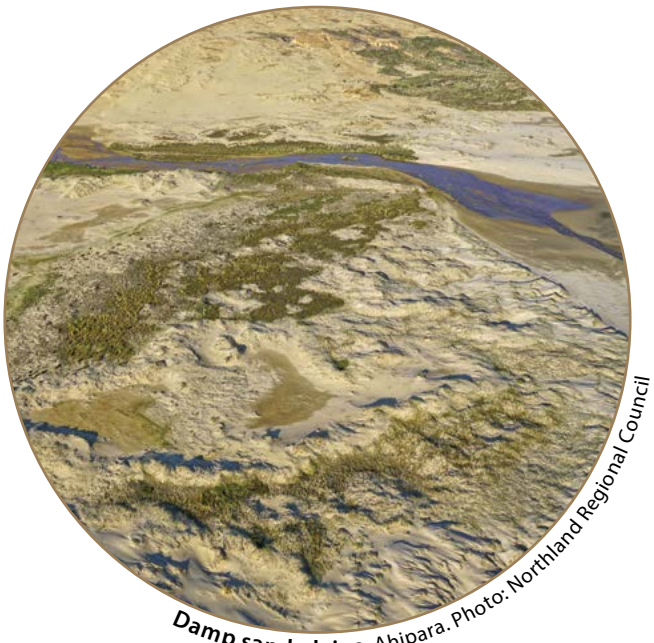
Dune lakes are of regional, national, and international ecological significance. Described as rare and unusual because they are found in few places in the world, dune lakes are formed by the actions of sand, wind, and water in high rainfall regions. Te Tai Tokerau (Northland) Aotearoa New Zealand, has approximately 200 dune lakes greater than 0.5 ha in size. No other region in Aotearoa approaches this number, with indications that Te Tai Tokerau may also top the number of dune lakes internationally. There are six different types of dune lakes and all are quite different, varying in size, depth, water chemistry, and underwater species.

Previous page: Dune slacks, Ahipara.
Photo: Northland Regional Council

Aerial view of Lake Onepū. Photo: © Rawhitiroa Photography

Due to the regularly shifting nature of our coastlines and the variable fertility found in their soils, dune lakes exist alongside examples of some of the most dynamic wetland types, which include palustrine systems like marshes and swamps. Other unique wetland types found around dune systems include:

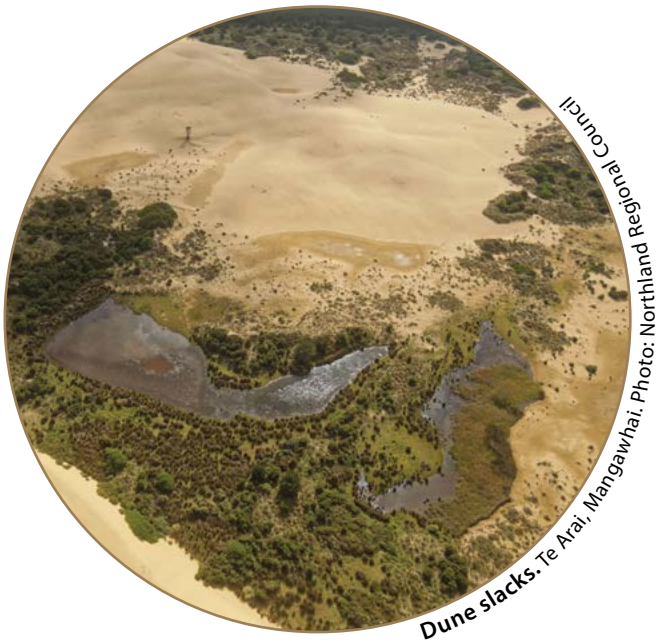
- **Gumlands:** seasonally wet shrublands found only in Northern Aotearoa, concentrated around Kaitaia and Kaikohe. They are more commonly known for the kauri gum (fossilised resin extracted from kauri trees) found in them. Gumlands provide important habitat for native moths and butterflies, in addition to a range of highly threatened and endangered fish, plant, and bird species.



Damp sand plains. Ahipara. Photo: Northland Regional Council

Gumlands. Epakauri, Ahipara. Photo: Northland Regional Council

- **Damp sand plains:** flatter areas of dunes where the wind has gradually removed the sand over many years. Because they have permanent water (above or below the surface), the remaining sand is stabilised, preventing further erosion. In Te Tai Tokerau these were among the first dune wetland types to be converted for human land use and activities, and are some of the most threatened wetland types.
- **Dune slacks:** small depressions between shore dunes or in sandbanks. These were once widespread across the country, including offshore islands like Rakiura (Stewart Island), Southland Aotearoa. Dune slacks (also called dune swales or dune hollows) trap water and nutrients, giving life to some incredible coastal and aquatic plant diversity. Sadly, very few remain in Te Tai Tokerau because of land use intensification.



Dune slacks. Te Arai, Mangawhai. Photo: Northland Regional Council

THE CULTURAL DUNESCAPE OF TE HIKU O TE IKA

TOHU O TE WHENUA, TOHU O TE RANGI, TOHU O TE MOANA

There are approximately 50 dune lakes located in Te Hiku o Te Ika (Fig. 1) and these are of great cultural and environmental significance to the five northern iwi (tribes) of Ngāti Kuri, Te Aupōuri, Ngāti Kahu, Ngāi Takoto, and Te Rarawa. Regarded as taonga (culturally important), they are home to a wide range of species, and are important resources for kai (food); cultural materials such as rongoā Māori (traditional medicine) and raranga (weaving) with kiekie (giegie bush), nīkau, houhere (lacebark); kauri and tōtara for building waka (canoes); kiekie roots for binding; storage for clean water and recreational activities. They also sustain stories that connect to ngā tūpuna (our ancestors). Pūrākau (traditional stories) refer to the lake sites as markers of historical events; of settlements; of tracks that linked hapū (sub-tribes) and iwi; of expressions of whakapapa (connection) to te taiao (natural world); and of tohu (signs) to note and act on – tohu o te whenua (signs from the land), tohu o te rangi (signs from celestial bodies), tohu o te moana (signs from the sea).

Many stories are told of the abundance of kai – lush gardens of taro (root vegetable) thrived on the wet fertile lake edges, with kūmara (sweet potato) further out. Lake Tāngonge is known for its flooding and fluctuations in water levels, and local whānau (families) and hapū would journey to the lake edges to gather kai in season. During the tuna heke (downstream eel migration) and when the karaka (NZ laurel) berries were ripe, locals spent days camped out to gather and process the kai before returning home stocked up for the months ahead.

Mānuka (NZ tea tree) are noted in our stories: they grew alongside waterway banks and were used to replace the kaho (battens) in the bottom of waka. Kaimahi (workers) would bend a mānuka branch into the stream, on returning sometime later they'd pull the branch out and it would be laden with kēwai (freshwater crayfish) ready to be thrown into boiling water for a kai. Mānuka was also used as rākau rongoā (traditional medicinal plant) due to its antiseptic qualities and multitude of health benefits for skin, wounds, bruises, and stomach ailments.

Ka moe a Tāne i a Tawake-toro kia puta ko Mānuka

Tāne married Tawake-toro and begat Mānuka

We continue to acknowledge the importance of whakapapa (genealogy) and the tapu (sacred) nature of the rākau (tree) as we call upon Te Urutapu o Tāne (the sacred realm of Tāne) to bring about wellness to us – te ira tangata (humankind). Mānuka was one of the rākau rongoā included as part of the riparian planting plan around our dune lakes.

Lake Waiparera. Photo: Wendy Henwood

Figure 1. Location of some of the major lakes of Te Hiku, Te Tai Tokerau, Northland. Source: Northland Regional Council

THE STATE OF THE LAKES TODAY

While dune lakes are a key feature of our cultural landscape, they struggle as a result of colonisation and alienation, environmental modification (including wetland drainage), and exploitative land-use practices. The degradation of the once rich, diverse, and productive ecosystems compromises the ecological integrity of entire catchments: water flows radically change, diversity is diminished, species of high cultural and environmental value are depleted and, in some instances, lost. Kaitiakitanga (exercise of guardianship) practices based on profound local knowledge has been eroded with the loss of mātauranga Māori (Māori knowledge) in relation to species, water, and landforms, and their interconnection with the people. Mahinga kai (cultivated foods) have been damaged and food production harmed, undermining the economic, cultural, and spiritual self-sufficiency of Te Hiku communities.

As a result of past action or inaction, the lakes are now nutrient-enriched, with sparse marginal vegetation providing little protection against run-off. Exotic invasive plants and fish are transferred between the lakes by recreational activities via nets and gear. Fish species now include gambusia (mosquito fish) and goldfish, along with pest plants such as hornwort, oxygen weed, and egeria (Brazilian waterweed). Invasive plants choke native species, resulting in frequent toxic blue-green (cyanobacteria) algal blooms that some native fish species cannot survive. Other land-based invasive plants identified include tobacco weed, privet, and elephant grass.

Lake Tāngonge

Lake Tāngonge derives its name from the effect of taro leaves undulating/rippling in the wind. Evidence of rua (storage pits) still exist there today. It once sat in the bowl below what is now Kaitaia, Pukepoto, and the sandhills of the west coast. Draining of the lake occurred in the 1920s as part of a Government settlement scheme to create land for farming. Clearance of bush upstream and changes to land practices create long-standing suffering for mana whenua (Indigenous people with primary rights and responsibilities over an area), due to the loss of kai and resultant lifestyle changes. This has huge long-term impacts on our spiritual and physical health and well-being, disconnecting us from the whenua (land) and wai (water) that is us, and to which we belong.

Draining Lake Tāngonge 1922. Photos: Museum at Te Ahu, Kaitaia

MOTIVATION FOR ACTION

Increasingly, whānau, hapū, and iwi have shown interest in and commitment to kaitiakitanga and learning more about our local environments. The release of the Waitangi Tribunal Wai 262 claim report 2011, and the Te Hiku Treaty Settlements 2015 included two innovative environmental cultural redress mechanisms. These brought a determination to take action and assert rangatiratanga (right to exercise authority) over our whenua, namely, shared governance over:

I. Te-Oneroa-Ā-Tōhē
II. The conservation estate – Te Korowai for enhanced conservation

Te Korowai refers to the cloak of protection provided by Te Hiku iwi as kaitiaki of the whenua and taonga (roto and repo). Mahi (work) underway on Lake Tāngonge also provided guidance for how we could model our restoration plans for other lakes.

Three Te Hiku iwi – Te Aupōuri, Ngāi Takoto, and Te Rarawa, pulled together to start a long-term programme of restoration of the lakes within the rohe.

The aims were to:

I. increase skills and knowledge
II. improve the lake environments in ways that would:
    - uplift the people
    - strengthen iwi cultural connections
    - connect and reconnect whānau with their roto (lake) and repo (wetland) resources
    - demonstrate kaitiakitanga practices and rangatiratanga over our natural resources in the post-settlement era.

The programme is built on the respective iwi mana whenua vision for sustainable community-led restoration of these taonga (treasures). At the same time local skills are built that align with current employment opportunities while strengthening the long-term wellness of the whānau.

Our lakes are home to a wide range of native plants and animals and are among the most threatened and rare aquatic habitats in the world. Species associated with the mauri (life force) of these environments, indicating healthy ecosystems, include those depicted in Table 1 and Figure 2. The surrounding kuta (giant spike sedge) and raupō (bulrush) beds, harvested for raranga materials, are home to many native fish and water birds.

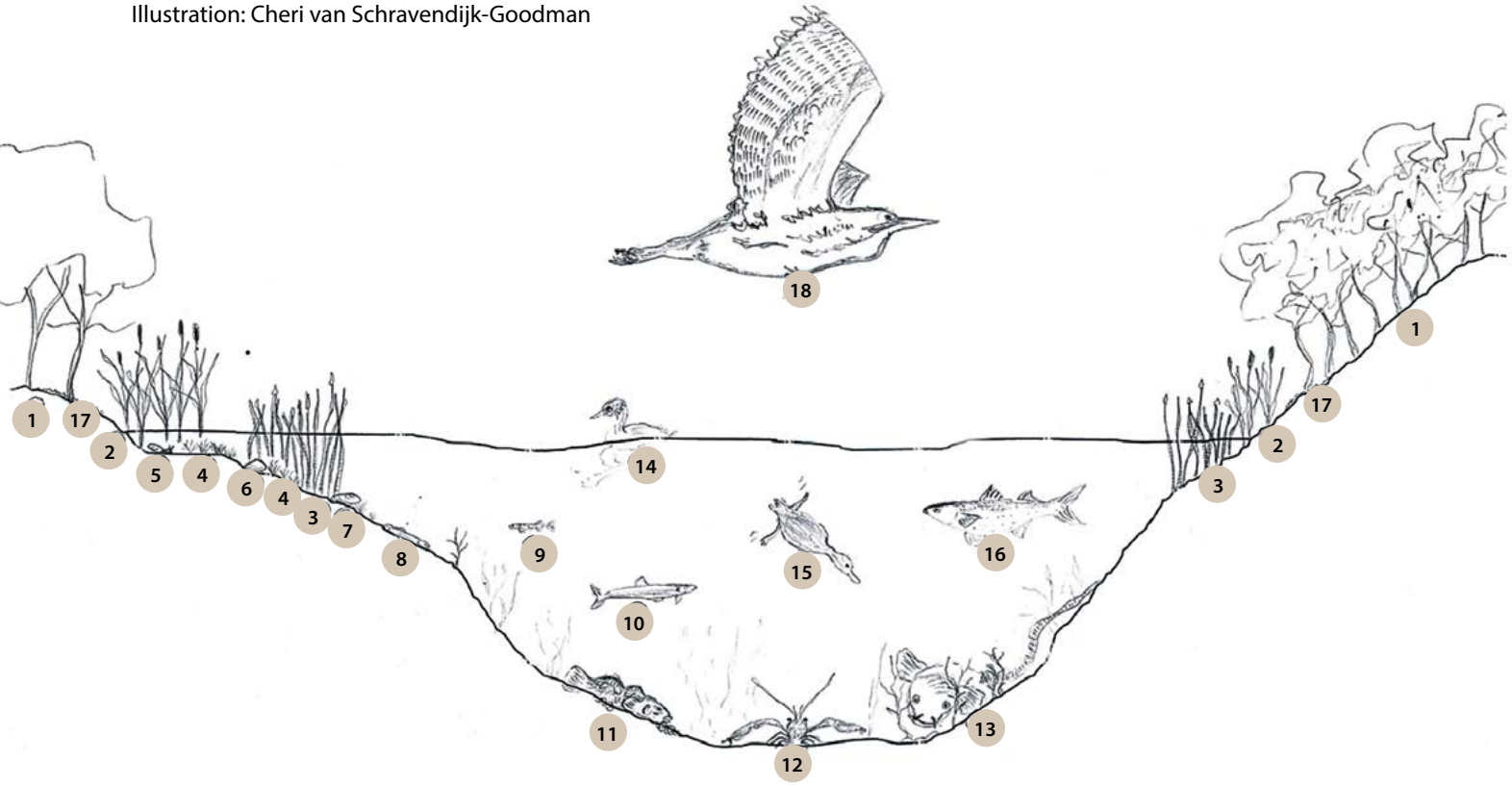
Kaitiakitanga at work – community support for the lake environments, Te Hiku schools planting day, Lake Onepū. Photo: © Rawhitiroa Photography

Table 1. Native plants and animals associated with the mauri of Te Hiku o Te Ika dune lake ecosystems

No.	Species names known to Te Hiku iwi	Common and scientific name	Species Type and Conservation Status
1	Mānuka	*Leptospermum scoparium*	Shrub At risk-declining
2	Raupō	Bulrush, *Typha orientalis*	Wetland plant
3	Kuta	Giant spike sedge, *Eleocharis sphacelata*	Wetland plant
4	**	*Trithuria inconspicua*	Aquatic plant Nationally critical
5	Karahū	Mud snail, *Potamopyrgus* spp.	Mollusc
6	Kōkota	Freshwater pipi, *Chione stutchburyi*	Mollusc
7	Kākahi Torewai	Freshwater mussel, *Hyridella menziesi*	Mollusc
8	Hauhau Waikaka	Black mudfish. *Neochanna diversus*	Fish At risk-declining
9	Īnanga	Dune lake dwarf īnanga, *Galaxias gracilis*	Fish At risk-declining
10	Karawaka	Common smelt, *Retropinna retropinna*	Fish
11	Kōkopu	Common bully, *Gobiomorphus cotidianus*	Fish
12	Kēwai	Freshwater crayfish, *Paranephrops planifrons*	Crustacean Locally rare
13	Tuna	Longfin, shortfin eels, *Anguilla* spp.	Fish Longfin, at risk-declining
14	Taihoropī	NZ dabchick, *Poliocephalus rufopectus*	Waterbird At risk-declining
15	Matapō	NZ scaup, *Aythya novaeseelandiae*	Waterbird At risk-declining
16	Kanae	Grey mullet, *Mugil cephalus*	Fish
17	Tapuwae karitehe	Musk, *Mazus radicans*	Ground plant
18	**Matuku	Australasian bittern, *Botaurus poiciloptilus*	Waterbird Nationally critical

Note: **Species that are classified as having 'Threatened' conservation status

Figure 2. Illustration of native plants and animals associated with the mauri of Te Tai Tokerau dune lake ecosystems.
Illustration: Cheri van Schravendijk-Goodman



OUR APPROACH

Our long-term vision to improve the quality of all Te Hiku lake environments

Three lakes – Onepū, Waiparera, me Te Wai O Tikiahi – were prioritised for restoration. With some funding support, a small group of Te Hiku iwi members set about taking an iwi rangatiratanga (iwi direction, leadership, authority) approach that would make a difference for the people and the environments involved (Fig. 3).

One of our first actions was to restore the ancestral names of the lakes – Onepū (previously known as Bulrush Lake) which is part of Te Ārai dunelands, and Te Wai O Tikiahi (previously known as Split Lake).

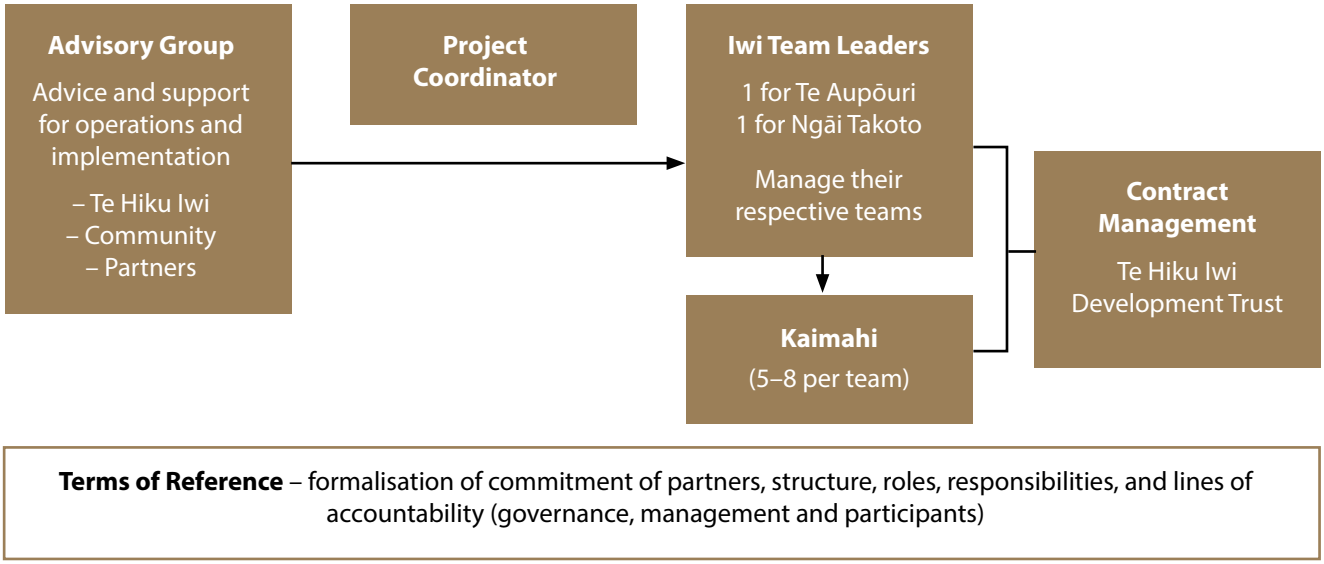


Figure 3. Schematic of Te Hiku iwi project team and structure

Te Wai O Tikiahi. Photo: Wendy Henwood

The project is iwi-led, meaning it is informed by, and supports iwi environmental plans and aspirations. Four interconnected wellbeing pou (pillars) provide a holistic foundation based on shared iwi values and principles (Fig. 4). The environmental focus overarches the framework to ensure the mahi uplifts the people, strengthens iwi cultural identity, and connects whānau with their whenua, roto, and repo – kaitiakitanga in action.

At the core of the plan is building capacity and capability through education, training, and qualifications. It was also a catalyst to prepare a Te Hiku workforce to respond to land-based market needs. The majority of kaimahi recruited had been unemployed for some time. Our programme implemented the following processes:

- Kaimahi enrolled in relevant tertiary studies for 2–3 days per week, and the remaining time involved in hands-on restoration mahi. Studies encouraged whānau to re-engage in learning and to experience the benefit of qualifications that might lead to employment.
- We negotiated fees-free courses to reduce training-related debt for our kaimahi. The project also topped up their income to incentivise and acknowledge their work.
- The majority of kaimahi secured either part-time or full-time employment in local orchards.

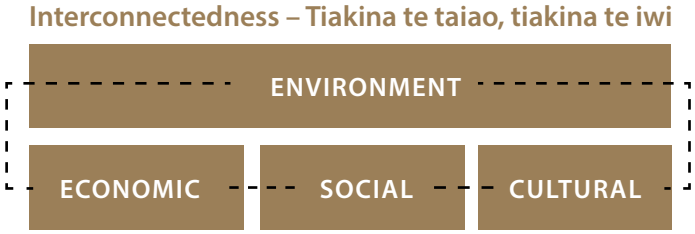


Figure 4. Ngā pou e whā – Four interconnected wellbeing pou

Kaumātua helping out, Te Hiku schools planting day, Lake Onepū. Photo: © Rawhitiroa Photography

Kaitiakitanga at work – community support for the lake environments, Te Hiku schools planting day, Lake Waiparera. Photo: Northern Regional Council

Mahi tahi – Relationships and collaborations

Working together with other groups and projects was key, exposing our kaimahi to a wide range of experiences, expertise, learning, and ideas. In addition to strong mana whenua support and involvement, government agencies, local landowners, local schools, tertiary providers, and community groups also actively participated. Several indigenous and overseas visitors were hosted. Community planting days were also a key feature, with approximately 500 people helping throughout the 2 years. In addition, the team was involved with planting at other Te Hiku lakes and conservation initiatives. This provided valuable sharing, learning, and understanding among people and about places. Although working with a large and diverse group was time consuming and sometimes challenging, it was an essential ingredient of the community project – all had a role to play and added value.

Tamariki participate in tuna monitoring and protection, Lake Onepū. Photo: © Rawhitiroa Photography

Rangatahi taking leadership, Te Hiku schools planting day, Lake Onepū. Photo: © Rawhitiroa Photography

Kaitiakitanga at work – community support for the lake environments, Te Hiku schools planting day, Lake Onepū. Photo: © Rawhitiroa Photography

KEY LEARNINGS

While the aspiration is to use environmental restoration as a catalyst for improving the well-being of Te Hiku, it is unrealistic to expect sustainable outcomes from a 2-year project or from stop-start approaches.

Some issues were challenging and beyond our control:

- Lack of funder understanding of our holistic thinking and the four pou approach
- Short-term funding for long-term issues prevents project development
- Short-term strategies and a lack of appropriate training courses to maintain enthusiasm and purpose led to a degree of kaimahi disengagement. This also hindered building on shared learning to feed into the project.

Whānau getting wet for the tuna survey, Lake Waiparera.
Photo: Wendy Henwood

Whānau ready for the tuna survey, Lake Onepū.
Photo: Wendy Henwood

Key Benefits – Hands-on restoration mahi

Action plans have been developed for each lake. Below are some of the key actions undertaken:

- Nearly 5000 metres of riparian fencing around the three lakes
- Approximately four and a half hectares of the lake margins were planted with a mix of eco-sourced native species – mānuka, kānuka, tī kōuka (cabbage tree), and harakeke (NZ flax) – to create a buffer beside farms and plantation forests
- Fenced and planted areas were the focus for pest animal trapping. Training was sourced locally
- Invasive plant species were identified and removed
- Seasonal monitoring used adaptations of the stream health monitoring and assessment kit (SHMAK) and cultural health indicators (CHI) model. Observation and use of our senses were key monitoring elements to track change over time
- A tuna (freshwater eels) survey was carried out with NIWA in which 236 tuna were caught across the three lakes. Recording data from the catch (weight, length, species, health) gave an indication of abundance and distribution. Twenty-five otolith (ear stone) bones were removed and sent to the laboratory for ageing to provide further information about the state of the fish stock
- Kaimahi development by qualifications and experience gained through the project triggered a new interest in working on and caring for the land.

Tamariki leading water quality monitoring using the water clarity tube from the SHMAK, Lake Onepū.
Photo: © Rawhitiroa Photography

Key Benefits – Local environments as places of learning

- The maramataka Māori (cultural lunar calendar) influenced when we planned and implemented our mahi. This ensured the higher energy days were optimised for learning and the time when the gravitational pull is highest for drawing water from within Papatūānuku (Earth mother) was optimised for planting
- A better understanding of the importance of the dune lake ecosystems, and kaitiakitanga roles and responsibilities, created motivation to participate in environmental restoration. The increased knowledge of local environmental issues, plant species and planting, water quality monitoring, and pest control, was passed on to whānau and communities
- Regular wānanga (workshops) and community planting days were key to connecting mana whenua and the wider community in practical ways. Community groups and agencies were actively involved in all project activities and were crucial to ensuring that the work started through the project would continue
- Some of the schools involved are now including the local lakes in their own curriculum as places of learning and environmental restoration, promoting intergenerational learning opportunities whilst providing student hands-on action, interaction, engagement, connection, and a true sense of kaitiakitanga for their dunes lakes.

Harvesting kuta by the Tuia Māra Whenua Rōpū Rongoā, at Lake Ngatu, Te Hiku. Photo: Joanne Murray

Pāke kuta (cape made of kuta) woven by Kylie Simeon, made from the kuta harvested at Lake Ngatu, Te Hiku.
Photo: © Erica Sinclair Photography

Tamariki leading water quality monitoring using the SHMAK, Lake Onepū. Photo: © Rawhitiroa Photography

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Bergin D, Herbert JW 1998. *Pīngao on coastal dunes: Guidelines for seed collection, propagation and establishment. Coastal Dune Vegetation Network Technical Bulletin 1*. Rotorua, New Zealand: New Zealand Forest Research Institute. 20 p.

Bergin D 1999. *Spinifex on coastal sand dunes: Guidelines for seed collection, propagation and establishment. Coastal Dune Vegetation Network Technical Bulletin 2*. Rotorua, New Zealand: New Zealand Forest Research Institute. 8 p.

Champion PD, Reeves PN 2009. *Factors causing dune ephemeral wetlands to be vulnerable to weed invasion*. DOC Research & Development Series 310. Wellington, New Zealand: Department of Conservation. 53 p.

Hilton M, Macauley U, Henderson R 2000. *Inventory of New Zealand's active dunelands. Science for Conservation 157*. Wellington, New Zealand: Department of Conservation. 35 p.

NIWA 2002. *Stream health monitoring and assessment kit. Stream monitoring manual. Version 2K – A tool for Kaitiaki. Technical report 111-1*. Wellington, New Zealand: National Institute of Water and Atmospheric Research. 190 p.

Tipa G, Tierney L 2006. *A cultural health index for streams and waterways: Indicators for recognising and expressing Māori values*. Wellington, New Zealand: Ministry for the Environment. https://www.mfe.govt.nz/sites/default/files/cultural-health-index-for-streams-and-waterways-tech-report-apr06.pdf

Waitangi Tribunal 2011. *Ko Aotearoa tēnei: A report into claims concerning New Zealand law and policy affecting Māori culture and identity (WAI262)*. Wellington, New Zealand: Waitangi Tribunal. https://waitangitribunal.govt.nz/news/ko-aotearoa-tenei-report-on-the-wai-262-claim-released

Useful websites

Te Hiku Dune Lake Restoration

https://tehikudunelakes.wixsite.com/nga-roto-tapokapoka

https://tehikudunelakes.wixsite.com/nga-roto-tapokapoka/nga-panui-news/hidden-gems-videos-northland-dune-lakes

Te Hiku Treaty Settlement 2015

https://www.govt.nz/treaty-settlement-documents/te-rarawa

Toimata Foundation – Te noho taiao o Te Rarawa

https://youtu.be/Cw3z83tcPUU

About the SHMAK

https://niwa.co.nz/our-science/freshwater/tools/shmak/manual/about-kit

Contact details for Wendy Henwood

Email: tirairaka@outlook.com

13. ME PĒWHEA TE WHAKARAUORA I NGĀ REPO O NGĀTI MANIAPOTO?

NGAHUIA HERANGI (WAIKATO-MANIAPOTO, NGĀTI RAUKAWA KI TE TONGA – KA AWATEA SERVICES LTD), KELLY RATANA (NGĀTI TŪWHARETOA, TE ARAWA – TAIHORO NUKURANGI)

A muri kia mau ki tēnā, kia mau ki te kawau mārō, whanake ake, whanake ake

Therefore, hold fast to the example of the cormorants' unyielding charge, to forever progress onwards and upwards

The project team would like to acknowledge Ngā Tai o Kāwhia, Hauāuru ki Uta and Nehenehenui Regional Management Committees for the opportunity to work alongside them throughout this project. It was an honour and privilege to share and learn together and we sincerely hope that the repo inventory and strategic framework will be a useful tool for directing future restoration efforts for whānau and the wider community.

We also thank Te Wai Māori Trust, Hīkina Whakatutuki (Ministry of Business, Innovation and Employment – MBIE), Maniapoto Māori Trust Board (MMTB), and Taihoro Nukurangi (NIWA) for funding and supporting this project. We acknowledge all of the kaimahi involved from both the MMTB and NIWA for their support and technical guidance during the course of this mahi.

Finally, a special tribute to our tūpuna that were part of this mahi and have since left this world. E ngā rangatira, hoki wairua mai, moe mai rā.

– Ngā mihi, nā Ngahuia māua ko Kelly

'For Maniapoto, wetlands and swamps are highly valued as traditional sources of fisheries and materials.....part of the ancestral landscape.....sources of mahinga kai.....also provide materials and resources for rongoā, raranga and whakairo and were important places to store and preserve taonga.'

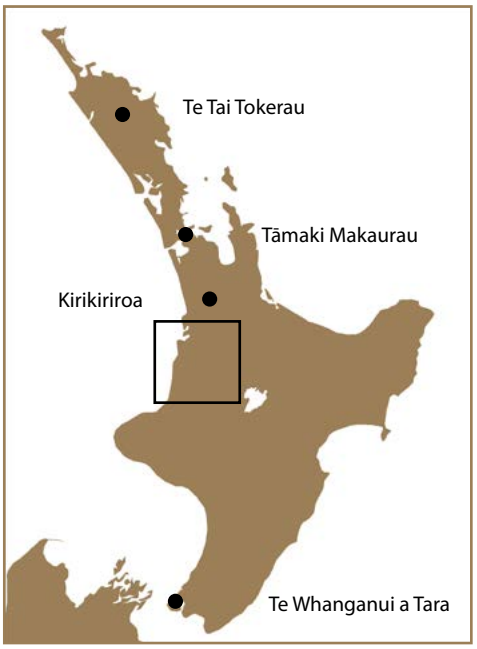
– Ko Tā Maniapoto Mahere Taiao

Previous and current page: Upper Waipa River. Photo: Maniapoto Māori Trust Board

HOW DO WE GO ABOUT RESTORING THE WETLANDS OF NGĀTI MANIAPOTO?

In 2014, the Maniapoto Māori Trust Board (MMTB) and Taihoro Nukurangi (NIWA) collaborated on a project to identify marae (Māori social and cultural centres) aspirations, values, issues, and priorities for the restoration of the Upper Waipā River catchment (Fig. 1). As a result, 53 priority actions were identified. The protection and restoration of repo (wetlands) and puna (freshwater springs) were top priorities, resulting in the formation of these key project objectives:

1. Identify repo and puna, and associated mātauranga (knowledge) within the rohe (region)
2. Develop a strategic framework to prioritise restoration efforts.



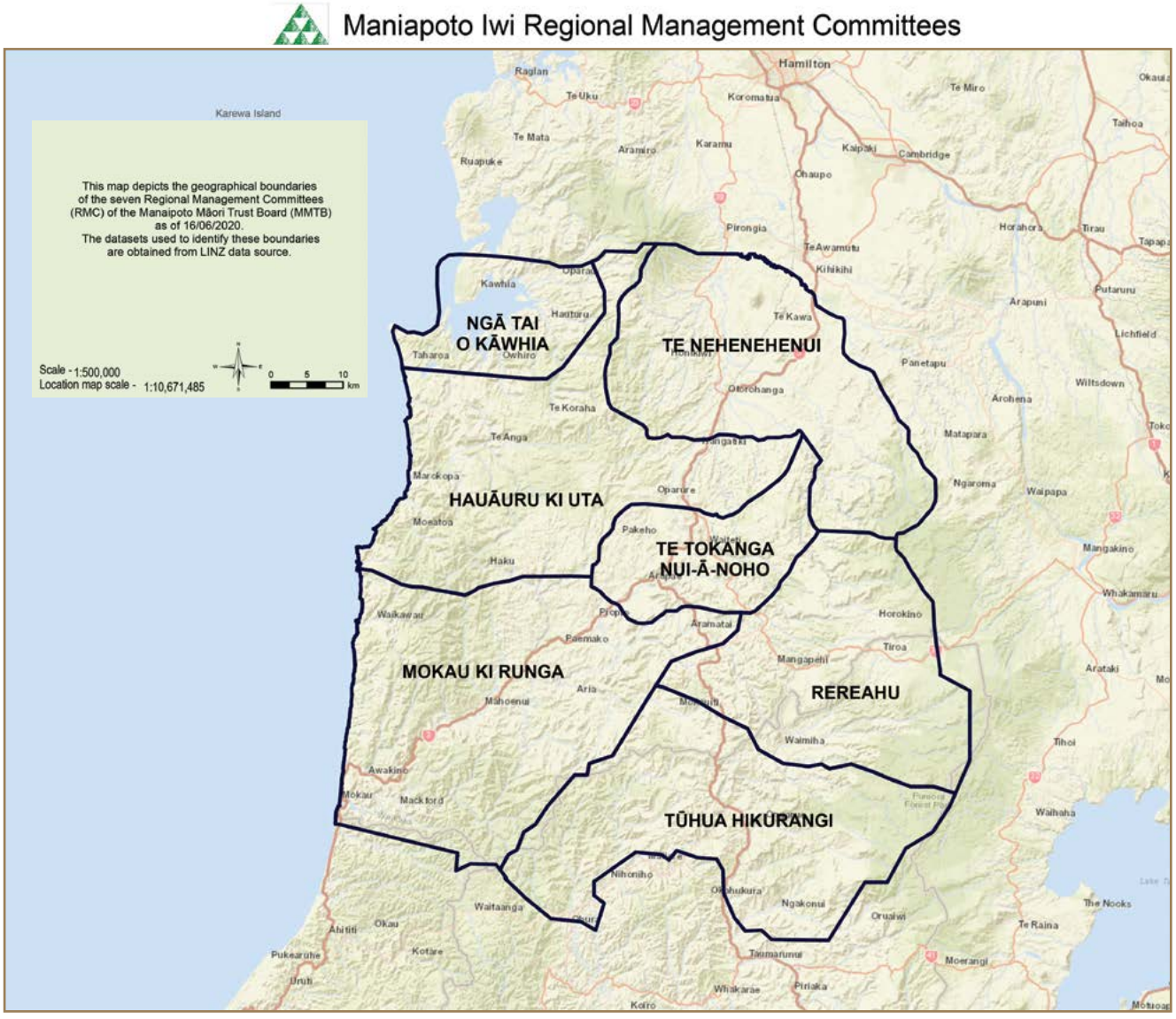


Figure 1. Map of Maniapoto Iwi Regional Management Committee Boundaries 2020. Source: Maniapoto Māori Trust Board

UNDERSTANDING THE CHALLENGES

The restoration of repo and puna requires knowledge regarding their location, size and significance, as well as the desire for restoration to occur.

Repo are increasingly viewed as integral components of the landscape, but in 2008 only 8% remain in the Waikato region, compared with coverage in 1840 (Fig. 2). While restoration and protection of these ecosystems are desperately needed, it can be overwhelming to think about the large amount of mahi (work) needed, often with too little resources available, and limited or no suitable strategies to guide restoration priorities. Furthermore, for many hapū (subtribes) and iwi (tribes), as well as for Maniapoto whānau (families), there was a lack of clear priorities defined by them, using their mātauranga ā-hapū, ā-iwi (iwi and hapū knowledge).

The Ngā Repo o Maniapoto project sought to address these challenges by developing an inventory and a decision-support framework to strengthen the capacity of whānau and the Maniapoto Māori Trust Board to action their restoration priorities.

Whānau checking maps and mātauranga shared.
Photo: Ngahuia Herangi

This map depicts the tribal boundaries of Ngāti Maniapoto for the purpose of its Treaty of Waitangi settlement. This map illustrates the historic (1840) and current (2008) wetland extent within the Ngāti Maniapoto boundaries. Ngāti Maniapoto recognises that there are areas where there are common interests and shared mana with neighbouring iwi that reflect mutual historical association and whakapapa relationships.

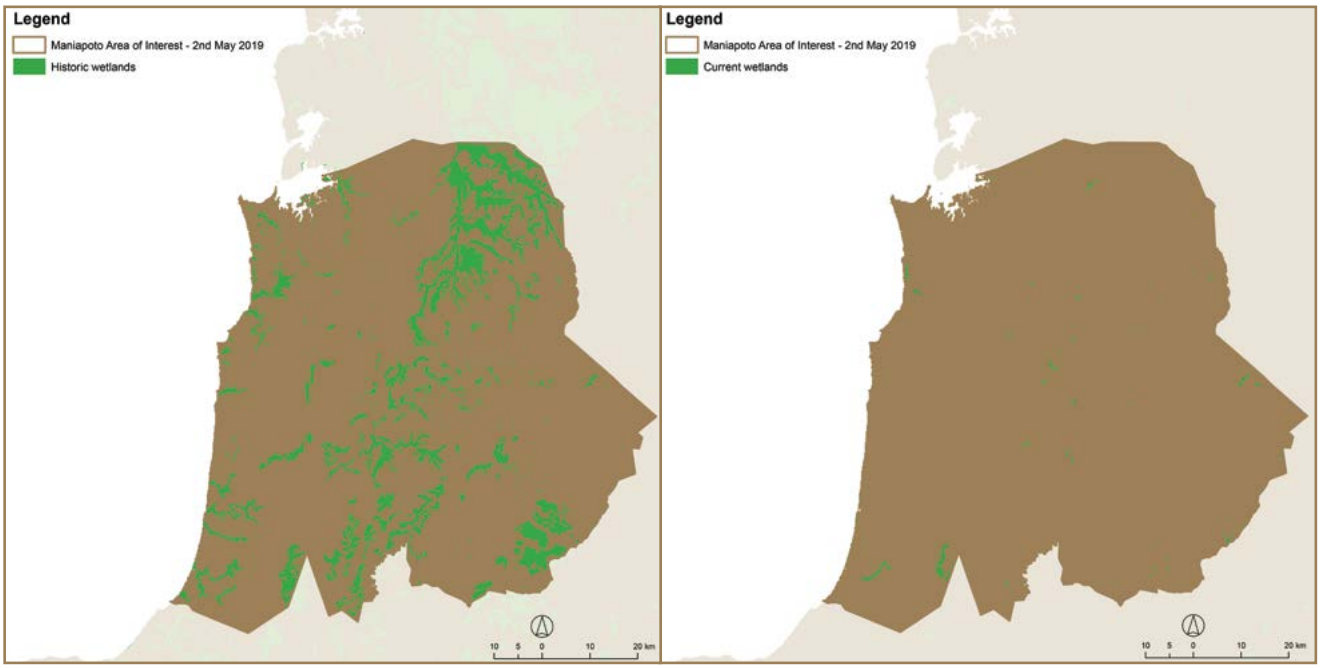


Figure 2. Maps of wetland historic (1840) and current (2008) extent (represented in green) in the Maniapoto tribal rohe, Waikato region. Adapted from Ausseil et al. 2008, Manaaki Whenua – Landcare Research

MEETING THE CHALLENGE
GATHERING OUR MĀTAURANGA

With initial support from Te Wai Māori Trust, MMTB, and NIWA kaimahi (staff) held wānanga (workshops) with whānau from Ngā Tai o Kāwhia Regional Management Committee (RMC) to develop Ngā Repo o Kāwhia.

To gather the necessary mātauranga to guide the mahi, the following techniques were used:

- Interviews were held using a novel mapping technique called 'eBeam', which helped identify repo, puna and mātauranga-ā-hapū associated with repo in the rohe of Maniapoto.
- Through wānanga, a strategic decision support framework was also developed to help whānau prioritise their restoration efforts.

The Vision Mātauranga Capability Fund (VMCF, Ministry of Business, Innovation and Employment – MBIE), enabled us to further refine and improve the process and framework with two further RMCs – Te Nehenehenui and Hauāuru ki Uta.

Throughout the entire project, kaimahi from MMTB and NIWA worked hard to nurture a collaborative relationship. This was established from project set-up through to the ongoing work to action restoration at the priority sites identified. The steps involved are outlined in Figure 3.

Much of the mahi involved in faciliating hui and collecting information was led by MMTB in partnership with their whānau. NIWA provided the support and technical role to collate and map the info, and help develop the final models for repo prioritisation.

From the perspective of our team, this exercise proved an exemplar model for empowering whānau at 'the flax roots', while providing the technical support to help them both lead and meet their expectations for the project outcomes.

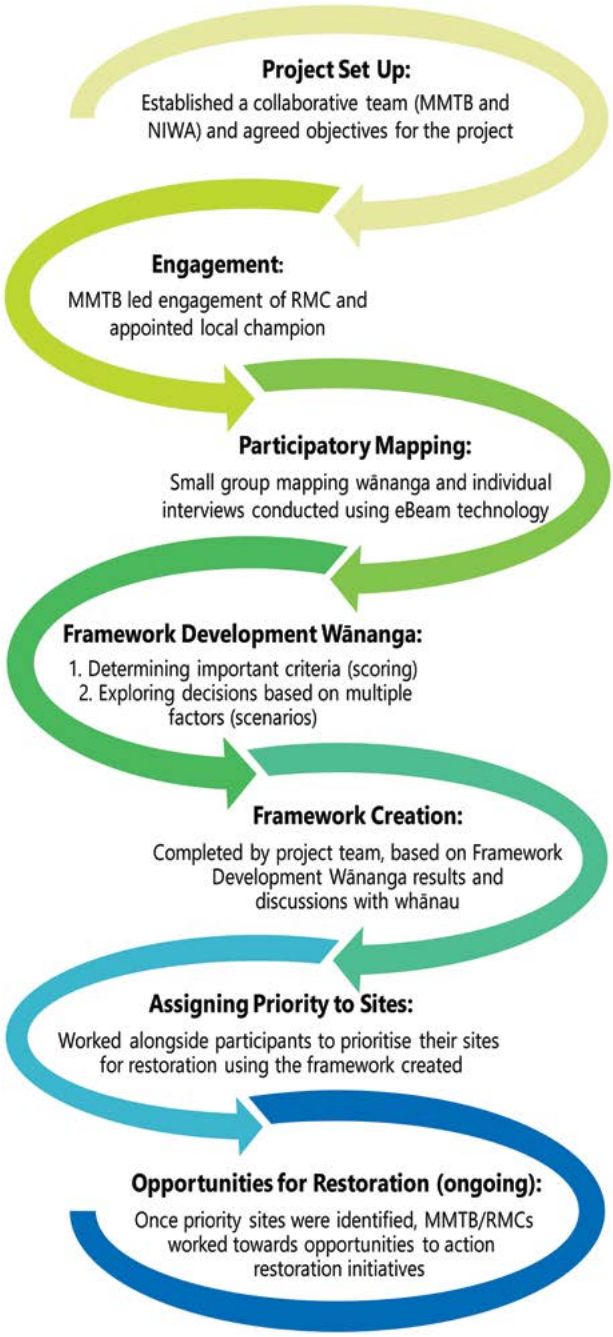


Figure 3. Key steps completed during the project

Interviewing key knowledge holders

The identification of existing repo and puna involved interviewing knowledge holders. During these sessions we asked questions regarding:

- the location of repo and puna
- their size
- their significance (e.g. fisheries, function – gathering kai or collecting paru or raupō, cultural state, or use)
- the desire for restoration to occur at a site
- the feasibility of restoration to be achieved immediately, at a later date, or never (i.e. physical and legal access to the site)

Participatory mapping and data collection

To capture this information we used eBeam technology to aid the participatory mapping method. This provides participants with a map on which to indicate, or 'digitise-as-you-go', location of a repo or puna using a stylus 'pen' (a pen-like mouse that is able to draw on the projected surface), digital screen, and Geographic Information Systems (GIS). Participants draw on the image projected onto the screen using the stylus pen, and digitally capture the location of their sites. This was used in both one-to-one interviews as well as in group mapping sessions (Fig. 4).

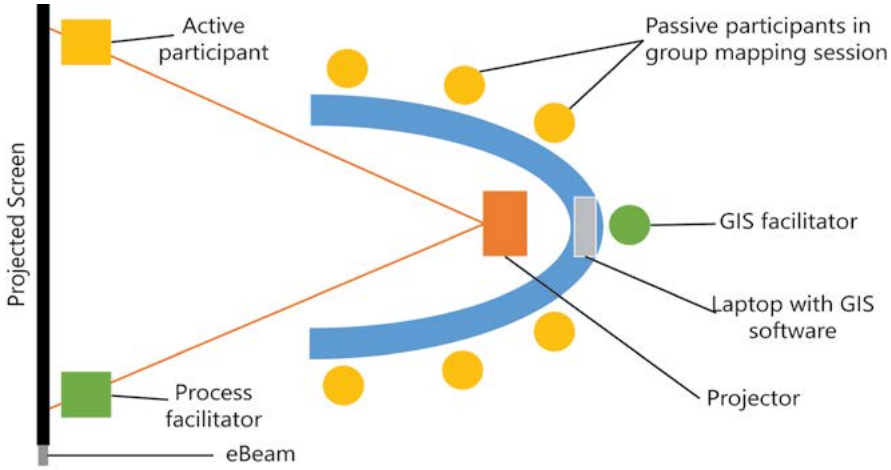
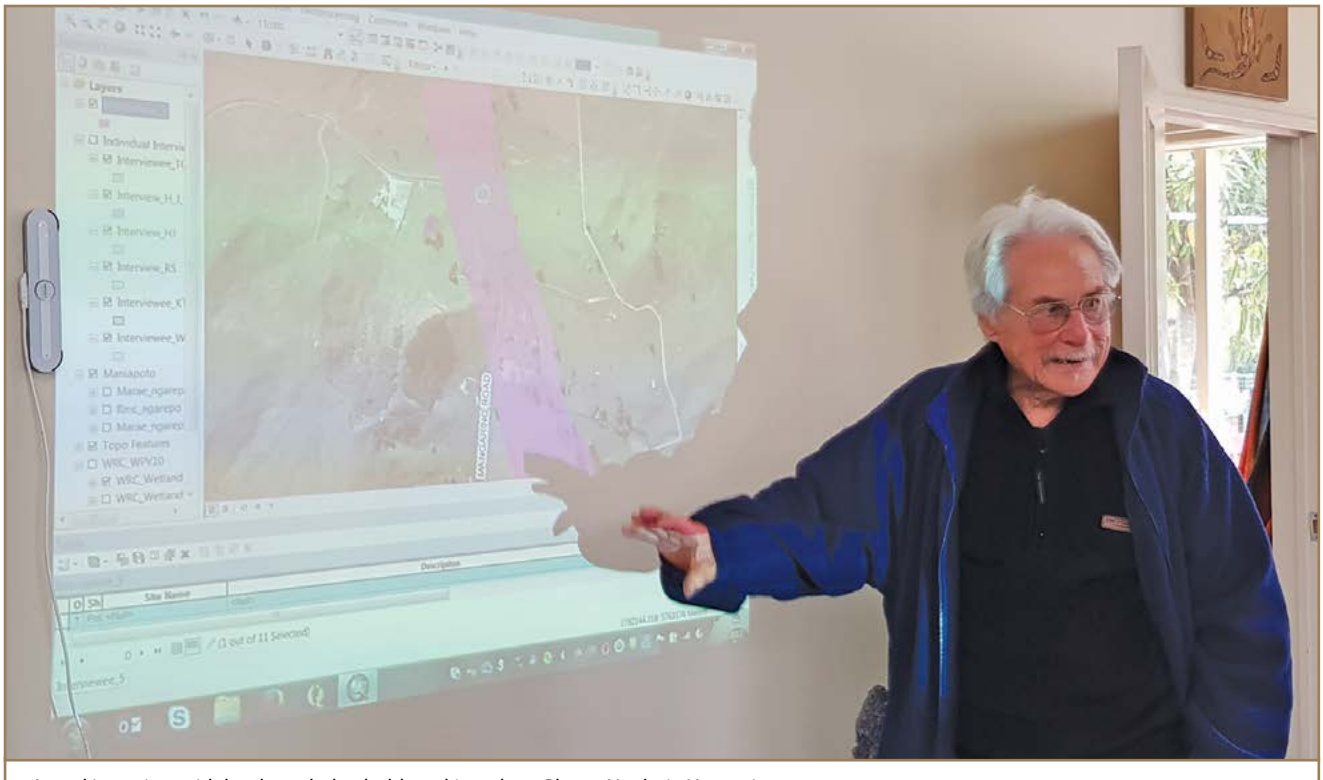


Figure 4. Example of setup for group mapping session



Actual interview with key knowledge holder taking place. Photo: Ngahuia Herangi

RESTORATION FRAMEWORK WĀNANGA

The framework for prioritising restoration efforts was developed through two wānanga using scoring and scenario exercises. These sessions reflected on some of the key aspects considered when whānau were deciding in what order they would like restoration to occur. They also explored key factors that made a site important to them and how they made these decisions. The whakaaro (thoughts) shared in these wānanga formed the basis for developing the framework concept, and eventually a decision-support matrix.

In the framework development wānanga we used a scoring activity with participants from each of the RMC's – Ngā Tai o Kawhia, Te Nehenehenui and Hauāuru ki Uta. Each participant were given 'dots' to allocate towards each value (e.g. kai; mahi; wai), use (e.g. repo for harvesting watercress and tuna (freshwater eels); site where paru (muds used for dying) was found; puna (freshwater spring) used for drinking water), or association (e.g. nil; kōrero hītori (historical associations)), which were then tallied to help inform the prioritisation framework.

Framework development wānanga scoring activity with participants of Ngā Tai o Kāwhia. Photo: Ngahuia Herangi

Framework development wānanga scoring activity with participants of Te Nehenehenui and Hauāuru ki Uta. Photo: Ngahuia Herangi

Developing a decision support matrix

A decision support matrix (see Table 1) is a logical structure for whānau to use when assessing all sites and assigning them to a priority tier (Fig. 5). The aim was to allow for more structure and transparent prioritisation to support restoration decision-making. Four key areas of importance for prioritising were identified: kai, mahi/other, associations, and access.

The matrix was populated with mātauranga shared during interviews and, together with whānau, was used to prioritise sites into one of the four tiers. This resulted in an initial set of priorities, with sites ranging from those to be actioned immediately, to those that required a longer term strategies to complete. In total, 266 sites were captured through interviews with 19 knowledge holders. Sites comprised 104 repo, 86 puna, and 76 other features all mapped using eBeam. Twenty-four taonga species (culturally important) were also identified and documented with each site, including native plants – harakeke (NZ flax) and raupō (bulrush), and fish – kākahi (freshwater mussels) and tuna (freshwater eels) (Fig. 6). This infomation is a huge asset for whānau as they begin restoration of their valued repo and puna.

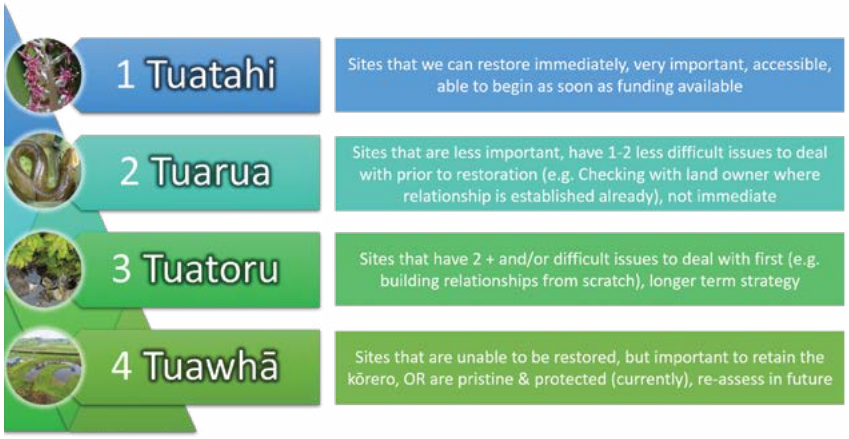


Figure 5. Each site was assessed with whānau and assigned into one of these four priority tiers

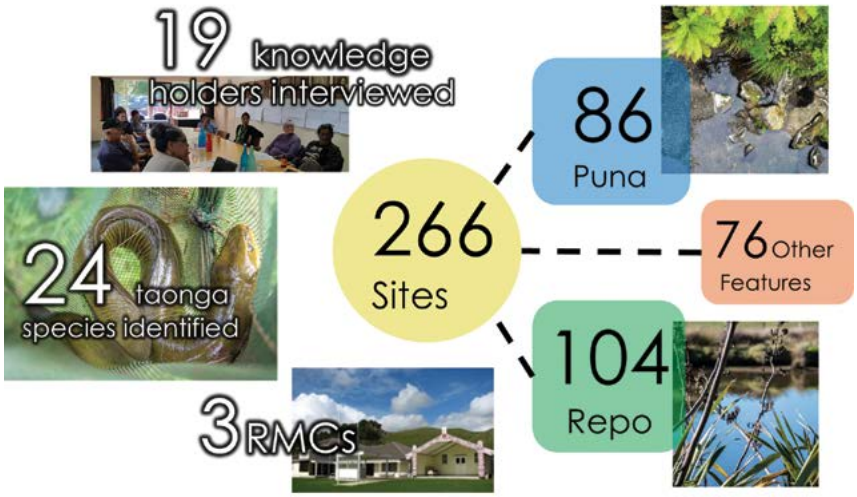


Figure 6. Mapping inventory

Table 1. Decision support matrix developed as a framework to structure mātauranga and help guide the assignment of restoration priorities (red box). This matrix is populated with hypothetical example sites.

						KAI		MAHI/OTHER		ASSOCIATION		ACCESS						
SITE ID	SITE NAME	DESCRIPTION	WHO?	PUNA/REPO/ OTHER?	WAI	MOST IMPORTANT?	OTHER USE?	MOST IMPORTANT?	OTHER USE?	WĀHI TUPUNA?	KŌRERO?	PROPERTY RIGHTS?	RELATIONSHIPS?	PHYSICAL?	MEA MOTUHAKE?	CONDITION?	PRIORITY?	WHY?
1	Te Puna	Puna used for drinking water, also site where patu was found.	JB	Puna	Āe					Kao	Āe	Kao	Aua	Āe		Poor	3	Drinking water site, relationship with owner unknown, also poor condition, not sure if still present.
2	Te Repo	Repo for harvesting watercress, harakeke and tuna. Mānuka branches used for making hīnaki.	JB	Repo	Kao	Tuna, Watercress		Harakeke	Mānuka	Kao	Kao	Āe	Āe	Āe		Ok	1	Important kai and mahi site, accessible through property righ, condition ok, able to improve with restoration efforts.

Repo and puna inventory

Each site mapped as a part of this project added to the growing inventory of repo and puna identified throughout the Maniapoto rohe. The inventory was also checked and verified by whānau throughout our wānanga, allowing time for whānau to amend and ensure accuracy. Sites captured during interviews were stored in a spatial inventory (GIS layer), held by MMTB for exclusive use by the RMC and MMTB (unless otherwise approved by whānau). The inventory can be updated and added to as more interviews are conducted or as more knowledge is documented.

Example communication mechcanism developed for whānau

COMMUNICATING OUR MAHI AND PROTECTING INFORMATION

The project team wanted to ensure whānau were able to walk away from the process confident that they could communicate their mahi and its outcomes to their various committtee, marae hui (meetings), and hapū forums.

We created summary report booklets and large posters about the project, including names of repo and puna. Large maps identifying their sites were given to the whānau and marae as a koha (gift) and acknowledgement of their involvement, knowledge, and energy. We were also careful to create versions that had varying levels of entry – with one version each for the Regional Management Committee, containing all their whakaaro and kōrero (discussion), and separate versions for MMTB and NIWA that contained only information that whānau agreed could be shared publicly.

Whānau checking maps and mātauranga shared. Photo: Ngahuia Herangi

KEY LEARNINGS

Kaitiaki (guardians), mana whenua (Indigenous people with primary rights and responsibilities over an area), and hapū are often the most reliable source of knowledge regarding the location of repo and puna. This is evidenced by 55 different puna being mapped in our project compared with 2 noted on a standard NZ topographic map of the Maniapoto region. This is a significant contribution to the data set to which the RMC's and MMTB now have access.

The way whānau use and physically interact with repo is often the most tangible method through which they can express their values. These are underpinned by concepts such as mauri (life force), whakapapa (geneology), manaakitanga (hospitality), and kaitiakitanga (the exercise of guardianship). Prioritisation of repo for restoration is then driven by the desire to restore a more holistic sense of well-being across all of these values.

Advantages to eBeam as a novel methodology include:

- Interactivity, ability to zoom in and out, and enable or disable different layers of data (e.g. topographic maps, satellite imagery, marae locations) in the interview process.
- The accuracy of capturing shapes (as opposed to points) on the landscape.
- The efficiency of the process. In previous years, hardcopy maps and vivid pens were used, which required transferring and digitising data, a system that compromised the accuracy of the extent of the area.

'This process for restoration of wetlands was more than what we as kaitiaki can physically do for our repo and puna...it's also about restoring connections and, importantly, about restoring people.'

– Participant in wānanga

- Initially, many participants were apprehensive about orientating themselves on the digital maps; however, as the interview progressed, they became more confident. The facilitator often had to guide the mapping, but in all but a few cases participants directed the drawing of shapes, remaining very active and ensuring accuracy.
- Despite initial apprehension, by the end of the process, participants often commented on how much they enjoyed the process.
- Throughout the life of the project the use of eBeam technology (hardware and software) was supplied by NIWA. Since then, MMTB have purchased their own eBeam technology.

Other learnings we also noted included:

- Despite MMTB and NIWA having an established relationship for over 6 years. Regardless, we have an agreement and process for protecting the kōrero and information gathered from the project.
- The strategic restoration framework was seen as a way to structure the kōrero, highlight the collective values of these sites, and support a more transparent whānau priority-setting process.

Framework development wananga scoring activity with participants of Te Nehenehenui and Hauauru ki Uta. Photo: Ngahuia Herangi

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Ausseil AG, Gerbeaux P, Chadderton WL, Stephens T, Brown D, Leathwick J 2008. *Wetland ecosystems of national importance for biodiversity: Criteria, methods and candidate list of nationally important inland wetlands*. Landcare Research Contract Report LC0708/158. Lincoln, New Zealand: Landcare Research.

Levine AS, Feinholz CL 2015. *Participatory GIS to inform coral reef ecosystem management: Mapping human coastal and ocean uses in Hawaii.* Applied Geography 59: 60–69.

Maniapoto Māori Trust Board 2015. *He mahere ika: Maniapoto upper Waipā River fisheries plan*. Te Kuiti, New Zealand: Maniapoto Māori Trust Board.

Maniapoto Māori Trust Board 2016. *Ko tā Maniapoto mahere taiao – Maniapoto Environmental Management Plan*. Te Kuiti, New Zealand: Maniapoto Māori Trust Board.

NOAA 2015. *Guidebook to participatory mapping of ocean uses. Social science tools for coastal programs: 31*. National Oceanic and Atmospheric Administration.

Ratana K, Herangi N, Murray T 2019. *Me pēhea te whakarauora i ngā repo o Ngāti Maniapoto? How do we go about restoring the wetlands of Ngāti Maniapoto?* New Zealand Journal of Ecology 43(3): 1–12.

Tipa G, Williams E, Herangi N, Dalton W, Skipper A, Iti W 2014. *Maniapoto priorities for the restoration of the Waipā River catchment. NIWA Client Report, WEL2015-3.* Hamilton, New Zealand: NIWA.

Useful websites

eBeam technology
https://www.luidia.com/edge

MBIE Vision Mātauranga Capability Fund
https://www.mbie.govt.nz/science-and-technology/science-and-innovation/funding-information-and-opportunities/investment-funds/vmcf

Ngā rauranga mo ngā kaupapa Māori GIS Mahere – Data sources for Māori GIS mapping
https://storymaps.arcgis.com/stories/a62e2ca240ec401785b96a05fbf89eb7

Ngā Repo o Maniapoto
https://waimaori.maori.nz/wai-ora-fund/maniapoto-iwi-trust

Ngā Repo o Maniapoto wetland inventory
https://www.niwa.co.nz/te-k%C5%ABwaha/research-projects/ng%C4%81-repo-o-maniapoto-maniapoto-wetland-inventory

Te Kāhui Manu Hokai (Maori GIS network)
https://www.tekahuimanuhokai.org

Te Wai Māori Trust
https://waimaori.maori.nz

Contact details for Ngahuia Herangi

Email: ngahuia@kaawatea.nz

14.
POUKAWA TE WAIŪ
POUKAWA THE LIFE FORCE

DR ELIZABETH PAKAI (NGĀTI KAHUNGUNU, NGĀTI RANGI, NGĀTI UENUKU)
IN COLLABORATION WITH – TE TUMU PAEROA – JO PLEYDELL (NGĀI TĀMANUHIRI) AND WIRIHANA RAIHANIA (NGĀTI RUAPANI)
ADVISORY TRUSTEES – ROBIN HAPE, RAWIRI HAPUKU, VADELIA WIRIHANA LE GEYT AND TE KURA POHATU (NGĀTI KAHUNGUNU, NGĀI TE WHATUIĀPITI, TE RANGIKOIANAKE)

Ko Kahurānaki te maunga

Ko Poukawa te waiū

Ko Ngāi Te Whatuiāpiti te iwi

ko Te Rangikoianake te hapū

Ko Kahurānaki te marae

Ko Te Hapuku Ika Nui o Te Moana te tangata

E mihi nei, e karanga nei, mo te taonga Moana a Poukawa i waiho ake mai nga tūpuna mo ngā tipuranga e heke mai

Tuatahi, ngā mihi ki ngā mate kua ngaro i te pō a Tama Huata (former Advisory Trustee member). E te rangatira, haere, haere, haere ki te pō, moe mai.

Nā reira te hunga mate ki te hunga mate, te hunga ora ki te hunga ora.

Tēnei te mihi ki a koutou katoa e te whānau o te marae a Kahurānaki rauā ko ngā tangata katoa who assisted with this long-term plan to restore Lake Poukawa to its original state. Many thanks particularly to Revell Wise (retired Te Tumu Paeroa staff member), Craig Erskine (planner), Keith Thompson (wetland ecologist), Garth Miller and Thomas Harrison (former Advisory Trustee members), Jerry Hapuku, and all the kaumātua and kuia who have contributed and shared their whakaaro and memories over the duration of the last several years. Without you this would not be possible. Ngā mihi aroha ki a koutou.

– Ngā mihi, nā mātou Elizabeth, Advisory Trustees

Previous and current page: Lake Poukawa view from the inlet.
Photo: Jonathon Brownrigg

LAKE POUKAWA
POUKAWA TE WAIŪ POUKAWA IS THE LIFE FORCE

Lake Poukawa is a taonga (culturally important) to the people of Te Hauke and the hapū (subtribe), Ngāi Te Rangikoianake, and has shaped the history of the area pre- and post-colonisation. It is the largest lake lying within an ancient peat wetland, in the active tectonic Poukawa Depression (also known as the Poukawa Basin), between the Raukawa and Kaokaoroa Ranges of central Hawke's Bay.

Lake Poukawa is both regionally and nationally significant and is acknowledged for outstanding wildlife values and ecological function. In times past, the lake and the surrounding basin supported multiple pā sites (fortified place) located on the nearby ranges with available kai (food) such as tuna (shortfin eel), īnanga and kōkopu (whitebait), and kākahi (freshwater mussels).

Lake Poukawa maintains populations of several key bird species. These include the nationally endangered matuku (Australasian bittern) and black billed gull, the nationally vulnerable tūturiwhatu (banded dotterel), taranui (Caspian tern), highly valued weweia (NZ dabchick), kuruwhengi (Australasian shoveler), and poaka (pied stilt). There are also fibre resources, primarily harakeke (NZ flax) and raupō (bulrush).

This history and related relationship to the overall water catchment to the Hawke's Bay, has prompted the Hawke's Bay Regional Council (HBRC) to recognise the lake as one of the most important wetland habitats in the region along with Pekapeka Wetland. The Pekapeka Wetland is a 98 hectare wetland reserve located 9 kilometres north of Lake Poukawa, within the Poukawa Basin (Fig. 1).

Weweia, New Zealand dabchick | Kuruwhengi, Australasian shoveler | Poaka, pied stilt. Images taken at Pekapeka Wetland nearby Lake Poukawa. Photo: © John Nelson

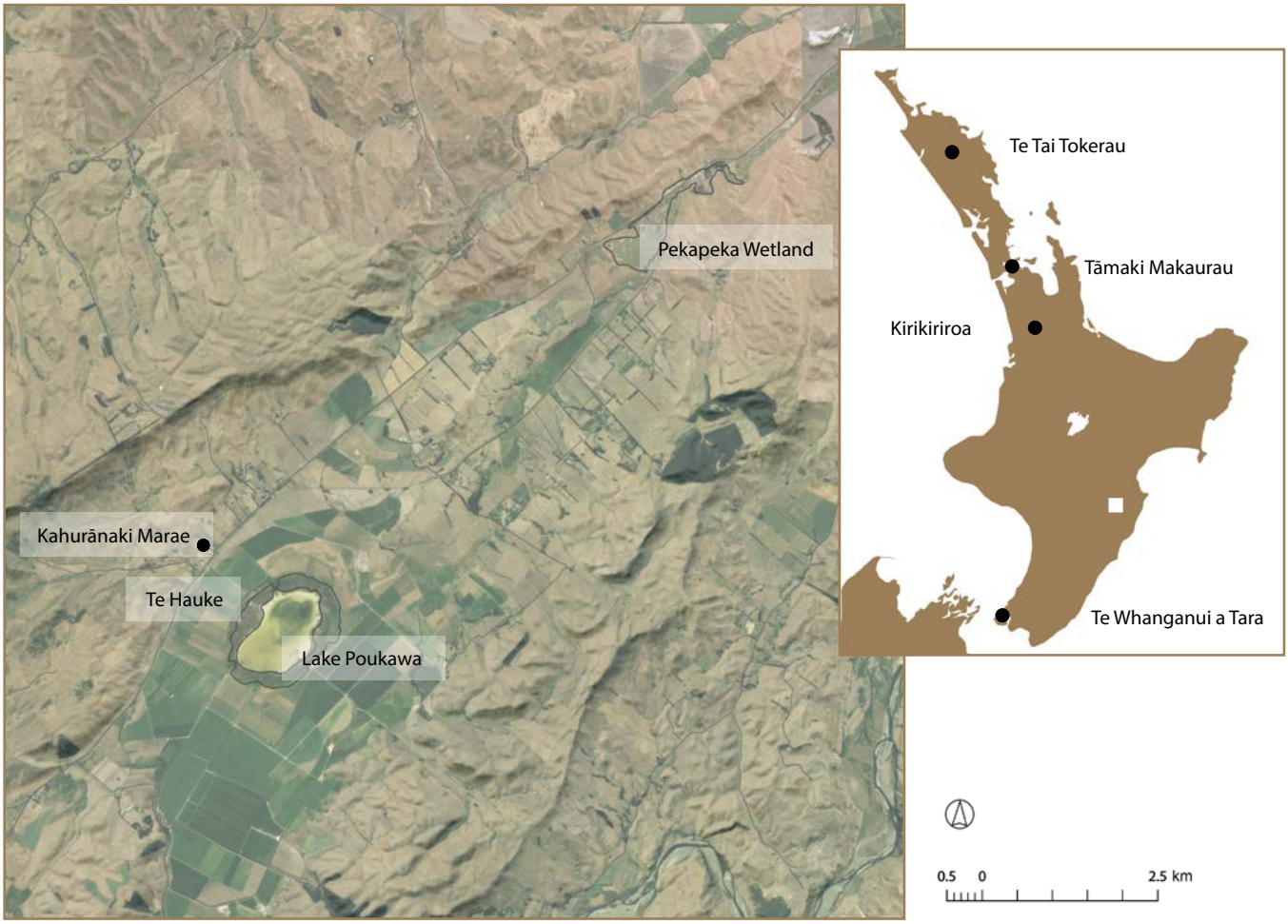


Figure 1. Location of Lake Poukawa, Pekapeka Wetland, and Kahurānaki Marae in Te Hauke, Hawke's Bay region.
Source: Manaaki Whenua – Landcare Research

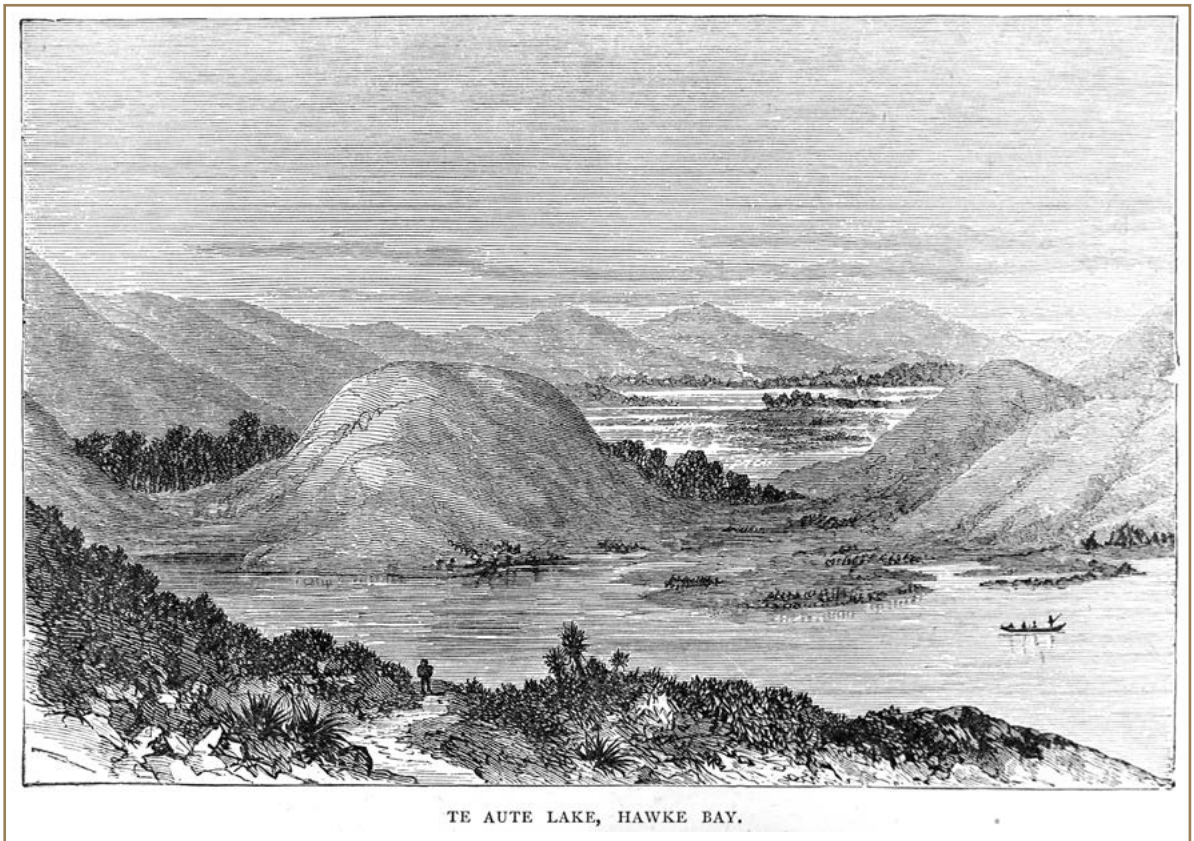
Once part of a huge lake and wetland complex, Lake Poukawa is now a shallow lake and wetland system with a maximum depth of less than one metre. The shallowness is mainly due to the artificial draining of the lake after the 1931 Hawke's Bay earthquake. Over the past 150 years, over 90% of the wetlands in Heretaunga have been lost or severely degraded. With the ever-increasing decline in lake and wetland coverage, many native species of birds, plants, fish, and insects have also been lost locally.

Cultural practices and important landscapes and sites associated with those practices have also been severely impacted, in some cases due to the local disappearance of important species. Tuna fishery is of considerable cultural importance, and from 1966, the lake was declared a non-commercial fishery. This means that until we (Te Tumu Paeroa and the Advisory Trustees) deem the lake and the tuna population 'healthy', no tuna will be taken for commercial purposes, and the tuna take is for customary fishing only.

Our tupuna (ancestor) Te Hapuku, a well-respected and prominent rangatira (chief), helped facilitate land sales in the late 19th century by early European settlers, but with the understanding that the lake would never be drained. His descendants, through the Poukawa 13B Trust, continue to hold fast to his directions by endeavouring to maintain the unique features of the ecosystem.

The Trustees of Poukawa 13B, the landblock within which Lake Poukawa is situated, are committed to ensuring that the state of the lake is restored to what it was when our tūpuna lived around it and within the living memories of many of our kaumātua and kuia (elders). This chapter is the story about the start of our journey in partnership with the Māori Trustee to implement this vision.

Lake Poukawa 1877, as interpreted by WD Blatchley, an artist in the late 19th century.
Photo: Ref: PUBL-0016-23-1. Alexander Turnbull Library, Wellington, New Zealand.



Lake Poukawa 1875-77, as interpreted by CD Barraud, an artist in the late 19th century.
Photo: Ref: PUBL-0016-22. Alexander Turnbull Library, Wellington, New Zealand.

ABOUT POUKAWA 13B AND OUR JOURNEY TOWARDS RESTORATION

Poukawa 13B is a 522.50 hectare block of Māori freehold land and is a taonga to our people. The block is situated along State Highway 2, in rural Te Hauke, 11 km from Hastings (Fig. 1). It is on the western side of the railway line that runs parallel to the State Highway. Poukawa 13B has its own legal and formed access from SH2 across the railway line at Te Hauke. Further formed access runs from SH2 at the southern end of the property.

PLANNING FOR RESTORATION

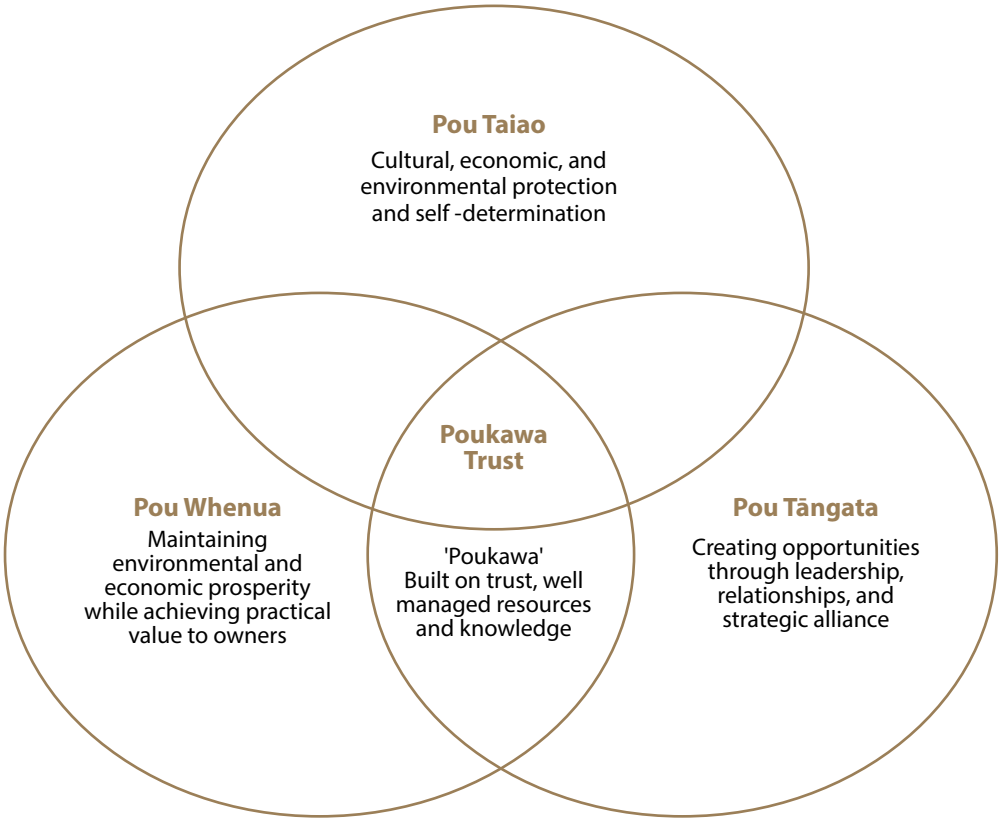
Although the Māori Trustee and Poukawa 13B Advisory Trustees have been working in partnership since 2008, multiple challenges arose as Advisory Trustees changed and the Māori Trustee Office/Te Tumu Paeroa sustained organisational changes. Initial wānanga (workshops) plans were interrupted, and while there is now a definitive strategic plan, this has also been a challenge to implement. However, from 2007/8, with the intervention and support of the Māori Trustee, newly elected Advisory Trustees, have identified many uri (descendants of traditional landowners) to develop a strategic plan. The plan significantly included how uri 'felt' about the lake and the surrounding arable land.

Restoration planning for traditional lands is not a case of simply sitting down and drawing up a plan. With the help of Te Tumu Paeroa and others we have identified many further steps that need to be implemented to drive the vision we all seek. Key steps we have noted and have either put in place or will be implementing over the coming years include:

- **Setting a vision** – where have we come from and what do we want the future to look like for our whenua (land), valued plant and animal species, and our people (including upholding of our tikanga (cultural practices) and kawa (protocols and customs), and sustenance of the tikanga that we value?
- **Developing a communication plan** – how do we keep our shareholders informed so that they can participate meaningfully in the process when and if they want to?
- **Historical information gathering** – based on our mātauranga (knowledge), what is missing, what is still available to us (including practices), and what is the current state or condition?
- **Long-term management** – what information and steps do we need to implement to move towards our vision and recovery of those things we value as described in our historical narratives?

Pekapeka Wetland and boardwalk meandering through the restored wetland. Photo: © John Nelson

POUKAWA TE WAIŪ – THE UNIFYING VISION



Poukawa te Waiū – Poukawa is the life force

Element	Description	Vision	Commentary
Pou Taiao	**Kaitiakitanga** Cultural and environmental protection and restoration	***Cultural and environmental protection and self-determination***	Poukawa the Life Force – The wellbeing of our taonga will be the keystone measure of the unifying vision and integration of all three Pou.
Pou Whenua ↕	**Tiakitanga** Cultural, environmental, and economic integration	***Maintaining environmental and economic prosperity while achieving practical value to owners***	Relationship management and strategic alliances are critical in achieving the right balance between environmental and economic prosperity and the legal; environmental; financial; lease and administration responsibilities of the trust (beyond 2023).
Poukawa Trust	**Rangatiratanga** Trust knowledge and leadership	***The 'Poukawa Brand' built on trust, well managed resources and knowledge***	For the 'Poukawa Brand' to become known as professional operators, the Trust will require good leadership and governance expertise to ensure a smooth transfer of administration and trusteeship from 2023. Ensuring the Trust has the right balance of skills and expertise across all three Pou.
Pou Tāngata	**Manaakitanga** Supported and informed	***Creating opportunities through self-determination***	Creating opportunities for owners to be engaged as kaitiaki and active participants of the Trust. Ensuring transparency of information and communication with owners in the protection of our resources and future of the Trust.

Figure 2. Poukawa Te Waiū – The Unifying Vision (2021) for Lake Poukawa as set by the Trust and Advisory Trustees of Poukawa 13B

COLLABORATING TO IMPLEMENT OUR IDENTIFIED STEPS

1. Setting the vision

The vision and passion were identified over 10 years ago, and the drive for improvements recognised by the plan has quietly simmered away in the background. On establishment, the Advisory Trustees worked with hapū and whānau to identify points of significance, resulting in The Unifying Vision (2010) which was recently been reviewed and updated in 2021, as Poukawa te Waiū – The Unifying Vision (Fig. 2). Research and assistance from individual experts have also helped maintain enthusiasm, with the main objective for improvement of our taonga never far from Trustees' thoughts.

2. Communicating the process and intent

The Advisory Trustees developed a communication plan to identify all shareholders and invited them to have input online with the My Whenua site, located on the Te Tumu Paeroa website.

3. Building our historical information to guide us

The Advisory Trustees wanted to collect and collate as much historical information about Lake Poukawa as possible to build a picture for current and future generations of shareholders/owners. Kaumātua and kuia enjoyed the interaction, were pleased to be included, and felt their memories were valued.

4. Long-term management

As we near the end of lease agreements (2020), we need to ensure that any new negotiated leases are going to advantage shareholders and enable future Trustees and Advisory Trustees to continue building on what the current Trustees have initiated. While we agree that the ultimate goal is to gain overall management of Lake Poukawa, we recognise that this is not possible at this stage. In the interim we continue to monitor water quality, define, and implement restoration activities, identify future land use, and collaborate with shareholders.

The Poukawa 13B Trustees are committed to developing a long-term management plan for Lake Poukawa. A strategic management plan 2020–21 to identify specific areas that the Advisory Trustees would be able to oversee, includes the restoration plan. The need for an overarching management plan has been discussed at some length over the past 5 years and is explained in several documents, such as an Issues and Options Paper (2013) and the Poukawa Lake Indigenous Biodiversity Management Plan (PLIP) Proposal (2017).

Lake Poukawa view from the inlet. Photo: Jonathon Brownrigg

KEY LEARNINGS

'…preparation of a long-term management plan requires a good understanding of the current state of the resource that is to be managed.'

– Keith Thompson

Challenges over the years regarding activities in the catchment with Hawke's Bay Regional Council and the current lessee, have to some degree affected development. To ameliorate this, the Trust engaged Craig Erskine (planner) and Keith Thompson (wetland ecologist) to help address the environmental issues faced by both our people and the lake. These issues included developing responses to resource consent applications for activities that impact on the Trust Lands, and ultimately on the lake. The work that was initially undertaken by both consultants, and then continued by Keith Thompson, has been invaluable. The reports produced for the Trust help clarify what is really happening to the lake. Alongside what we learn from our own mātauranga, baseline studies from scientific and physical research, surveying, and monitoring are also important to the Trustees and support the effective development of a long-term management and restoration plan (Table 1). Working with planners and ecologists are key considerations for other whānau seeking to learn more about their own lands.

Water quality, particularly the impacts of nutrient loading, is critically important to the long-term health and well-being of the lake ecosystem. Until recently, no systematic water studies had been carried out at Lake Poukawa. However, a preliminary survey of lake water quality and main surface water sources was approved and resourced by the Poukawa 13B Advisory Trustees. In December 2018, Hill Laboratories undertook water quality analyses, and technicians from Cawthron Institute identified algal communities present in samples.

NEXT STEPS

Current options for Poukawa 13B Trust that could be useful for shareholders and Advisory Trustees to consider are:

OPTION 1:

Release – Poukawa 13B land would be 'released' from any ongoing rental agreement. This is the ideal option; however, as there have been many changes both within Te Tumu Paeroa and the Advisory Trustees this is not currently a viable option.

OPTION 2:

Develop a Farm Management Plan – This option could be managed in conjunction with Option 3, we believe this option would be manageable under the current structure and overall position of the Trust.

OPTION 3:

Strategic Restoration Plan – This is the preferred option and was voted as the most realistic at this point in our tenure. With this in mind, we advertised for clear expressions of interest and strategic plans for both Poukawa 13B and the lake. We negotiated a contract for a project manager in late October 2019. A decision was made by Te Tumu Paeroa and the Advisory Trustees, to contract Ngāti Pahauwera Development Trust (NPDT), to undertake the work. The plan had to include future land use and management options.

Table 1. Information sources of environmental information about Lake Poukawa and surrounds

Kaupapa	Rationale for the development of Poukawa te Waiū	Information sources: reports, Advisory Trustee workshops, and related Hui-a-Iwi (2008 – current)
Birds (avian fauna)	✓	NZ Fish & Game (2011), Wildlands (2018), HBRC (2019)
Fish populations	✓	NIWA (2009), HBRC (2019)
Hydrology	Partial, gaps	GNS (2011), NIWA (2014), HBRC (2014)
Wetland vegetation ecology	✓	Wildlands (2018), Singers (2015)
Lake algal and aquatic plant ecology	Partial, gaps	NIWA (2009)
Status of vertebrate pests	X	Advice obtained from DOC and HBRC
Water quality	X, gaps	HBRC (2019), Cawthron (2014)
Historical documentation	✓	Te Tumu Paeroa (2013), Wildlands (2018)

Table 2. Culturally important plant species

Structural class	Species names known to Ngāi Te Rangikoeanake	Scientific name
Gymnosperm trees & shrubs	Totara	*Podocarpus totara* var. *totara*
Dicotyledonous trees & shrubs	Swamp coprosma Kānuka Mānuka Mingimingi Ralph's kohuhu Kohuhu Ribbonwood Kōwhai Koromiko	*Coprosma tenuicaulis* *Kunzea robusta* *Leptospermum scoparium var. scoparium* *Leucopogon fasciculatus* *Pittosporum ralphii* *Pittosporum tenuifolium* *Plagianthus regius* subsp. *regius* *Sophora tetraptera, S. microphylla* *Veronica* spp.
Dicotyledonous herbs	Swamp nettle	*Urtica perconfusa*
Dicotyledonous lianes	Pōhue	*Calystegia sepium* subsp. *roseate*
Ferns	Retoretore	*Azolla rubra*
Grasses	Toetoe	*Austroderia fulvida, A. toetoe*
Sedges	Pūrua grass, kukuraho Rautahi Makura, pūrei, pūrekireki, pukio Pūrei Ūpoko-a-tangata Spike sedge Kuta, giant spike sedge Kāpūngāwhā	*Bolboschoenus fluviatilis* *Carex geminata* *Carex secta* *Carex virgata* *Cyperus ustulatus* *Eleocharis acuta* *Eleocharis sphacelata* *Schoenoplectus tabernaemontani*
Monocotyledonous herbs	Kareara Harakeke, NZ flax Manahi Raupō	*Lemna disperma* *Phormium tenax* *Potamogeton cheesemanii* *Typha orientalis*
Monocotyledonous trees & shrubs	Tī kōuka, cabbage tree	*Cordyline australis*

Rautahi. Photo: Beverley Clarkson

Pūrei. Photo: Beverley Clarkson

Upoko-tangata, umbrella sedge.
Photo: Beverley Clarkson

Ngāti Pāhauwera Development Trust

Ngāti Pāhauwera Development Trust are a post-settlement entity that had considerable experience in riparian fencing and planting, and water quality monitoring in the Mohaka rohe (northern Hawke's Bay). NPDT offered their expertise to assist with the restoration of Lake Poukawa. The people of Ngāti Pāhauwera, who NPDT represent, have close whakapapa links to Kahurānaki Marae. NPDT tendered for the work and were successful in supporting the lake restoration planning which is now underway.

Planting

To appropriately restore Lake Poukawa, Ngāti Pāhauwera Development Trust are considering using the Pekapeka Wetland development to identify plant species and follow the approaches outlined in the Wildlands Restoration Plan. The Pekapeka Wetland is a 98 hectare wetland reserve located 9 kilometres north of Lake Poukawa, within the Poukawa Basin.

Some of our taonga plant species integral to future restoration are listed in Table 2.

Drone coverage has helped identify access and the main problem areas of Lake Poukawa. Raupō and willow (grey and crack willow, *Salix* species) have been identified as major areas of work, therefore planting regimes will be prioritised in these areas. Raupō and willow were left to colonise several areas around the lake and effectively became a weed issue. In the initial assessment undertaken by NPDT, it became obvious that raupō would need to be managed and contained, and where possible harvested. Some would also be transferred to other areas of the lake or used by uri for other purposes. Once these raupō and willow areas are controlled, the planting of complementary taonga plant species can take place.

Robin Hape (CEO NPDT), Reka and Jade Joe (kaimahi) standing at the edge of the raupō cropping area, Lake Poukawa.
Photo: Ngāti Pāhauwera Development Trust

Monitoring

Once reliable water quality baseline studies have been undertaken, a monitoring programme can be established to identify changes in the structure and functioning of the wetlands.

Water quality assessments

Hydrology and water quality are the two most important drivers in the functioning of the wetland ecosystem. As far as we know, HBRC has allocated no resources to water quality studies in the 2020–2021 year, and Brownriggs Agriculture Land (current lessee) may not be carrying out water quality studies beyond their consent compliance monitoring programme.

NPDT lead by Rawiri Hapuku (Advisory Trustee) have planted 1500 plants to date; 500 of each tī kōuka (cabbage tree), pūrei and mingimingi.
Photo: Ngāti Pāhauwera Development Trust

Floating Platforms

Access to Lake Poukawa is challenged by a wide margin of mud and raupō that lies between dry land and the lake. This makes it difficult to undertake water testing in the lake. However, HBRC are considering the use of floating platforms to provide safe and easy access to deep water, making it easier to conduct water testing. The platforms are covered in native plantings, which help them blend with the local environment. NPDT partnered with HBRC to successfully implement the floating platforms system in the Putere Lakes (Lakes Rotonuiaha, Rotongaiao and Rotoroa) in Wairoa. NPDT are also interested in using the platforms as work platforms for planting and willow control.

Representatives from HBRC and NPDT standing on a floating platform undertaking water quality testing in one of the Putere Lakes. Photo: Ngāti Pāhauwera Development Trust

UNDERSTANDING TRADITIONAL LAND CONNECTIONS

Before colonisation, land was traditionally communally 'owned', although the concept of 'ownership' did not necessarily mean what it means under a modern (western) economic structure. For many iwi (tribes) and hapū, connection to land is a more powerful concept than possession, as it is the land and its environs that shape who we are as the people of the land – tangata whenua (Indigenous people). From this perspective, it could be understood that it is the whenua that 'owns' us as its descendants and benefactors. It is the responsibility of tangata whenua to adapt to life in a way that ensures resource sustainability. This ensures present and future generations are able to continue a healthy and balanced connection with their whenua. However, colonisation, and the structures associated with possession and control, began to sever that relationship. The division of the land into smaller parcels meant that lands could then be sold or confiscated under colonial law. Consequently, it has been a slow journey for some of our people, requiring much patience and determination to rebalance those impacts.

Questions on succession:

If you or your whānau need to succeed to land after the passing of a tupuna, approach Te Kooti Whenua Māori (the Māori Land Court) for assistance.

ROLE OF THE MĀORI TRUSTEE

The Māori Trustee leads Te Tumu Paeroa, an independent trustee organisation that supports the Māori Trustee to fulfil their role and responsibilities.

The Māori Trustee, with the support of Te Tumu Paeroa, seeks to support and empower whenua Māori owners and trustees in protecting and enhancing whenua Māori. The Poukawa 13B project for Lake Poukawa is one example of this.

Working with Te Tumu Paeroa – what they can offer:

- Te Tumu Paeroa offers services to support whenua Māori owners and trustees regarding land administration. They work with owners to realise opportunities to improve the land and also increase their capability to manage and govern their own whenua.
- Te Tumu Paeroa works with trustees and owners to ensure the terms of the trust order from Te Kooti Whenua Māori are met. All decisions relating to land ownership (including succession) are the function of Te Kooti Whenua Māori.

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

GNS 2011. *Poukawa Basin groundwater model pumping scenarios*. Wellington, New Zealand: Institute of Geological and Nuclear Sciences.

HBRC 2014. *Hawke's Bay Regional Resource Management Plan*. Napier, New Zealand: Hawke's Bay Regional Council.

HBRC 2019. *Outstanding water bodies plan change: selecting a list of outstanding water bodies in Hawke's Bay*. Napier, New Zealand: Hawke's Bay Regional Council.

Knight B, Jiang W 2014. *Use of remote sensing to monitor water quality in Hawke's Bay. Report prepared for Hawke's Bay Regional Council*. Nelson, New Zealand: Cawthron Institute.

NIWA 2009. *The eel (tuna) stocks of Lake Poukawa, Hawke's Bay. Report prepared for Te Ohu Kai Moana Poukawa 13B Trust*. Christchurch, New Zealand: NIWA.

NIWA 2014. *Water resource inventory of Lake Poukawa. Report prepared for Te Tumu Paeroa*. Christchurch, New Zealand: NIWA.

NZ Fish & Game 2011. *Lake Poukawa wetland complex – wildlife values and threats*. Napier, New Zealand: NZ Fish & Game.

R Wise 2017. Revell Wise – the Māori Trustee report to HBRC 2013.

Singers N 2015. *Mapping of Hawke's Bay wetlands. Report prepared for Hawke's Bay Regional Council*. New Zealand: Nicholas Singers Ecological Solutions Ltd.

Te Tumu Paeroa 2013. *Hawke's Bay Regional Council: Change 5 s42A Hearing. Presentation of the Māori Trustee representing Poukawa 13B Trust*. Presentation prepared for Hawke's Bay Regional Council. Napier, New Zealand: Te Tumu Paeroa.

Te Tumu Paeroa 2017. *Poukawa Lake Indigenous Biodiversity Management Plan (PLIP) Proposal 2017. Report prepared for Hawke's Bay Regional Council*. Napier, New Zealand: Te Tumu Paeroa.

Te Tumu Paeroa 2019. *Options Paper (2013) Outline of Poukawa*. Napier, New Zealand: Te Tumu Paeroa.

Thompson K 2013. Management of Lake Poukawa and its wetlands – issues and options. On behalf on the Māori Trustee and Poukawa 13B Trust. Hamilton, New Zealand.

Thompson K 2018. *Water quality in the Lake Poukawa wetland. Report prepared for Te Tumu Paeroa and the Poukawa 13B Trust*. Hamilton, New Zealand.

Wildlands Consultants 2018. O*ptions for the ecological restoration of terrestrial and wetland habitats at Lake Poukawa. Report prepared for Poukawa 13B Trust*. Rotorua, New Zealand: Wildlands Consultants Ltd.

Useful websites

Floating platforms
http://www.gisborneherald.co.nz/environment/20200303/bringing-back-life-to-putere-lakes

NIWA LakeSPI Lake Submerged Plan Indicators
https://lakespi.niwa.co.nz

Te Kooti Whenua Māori
https://maorilandcourt.govt.nz

Te Puni Kōkiri
https://www.tupu.nz

Te Tumu Paeroa
https://www.tetumupaeroa.co.nz

My Whenua
https://www.mywhenua.co.nz

Succession to land
https://www.tetumupaeroa.co.nz/land-owners/succession-to-land

Working with owners to rejuvenate the land
https://www.tetumupaeroa.co.nz/news/working-owners-rejuvenate-land

Te Waiū o Poukawa
https://www.kauwhatareo.govt.nz/en/resource/new-video-2

Contact details for Dr Elizabeth Pakai

Email: pakaiee@xtra.co.nz

15. WHAREKORINO WETLAND ENHANCEMENT PROJECT
ENHANCING A SIGNIFICANT SITE OF PLENTY

TALITHA WANDEN, SHANNON TE HUIA, QUINTON TUNOHO, BRYAN NEWTON (NGĀTI MANIAPOTO, NGĀTI RAUKAWA)

He aha te hua o te whenua, mo te iwi i tēnei ao hurihuri?

What are the fruits of the land for the people in this everchanging world?

Bryan Newton (Ngāti Maniapoto, Ngāti Raukawa)

Previous page: Te Māra Taiohi marae-based native plant nursery. Mangatoatoa Pā, Tokanui, Kihikihi, Waikato. Photo: Pūniu River Care Inc.

Kaimahi undertaking wetland enhancement planting at the base of Maungatautari mountain ranges, Pukeatua, Waikato. Photo: Pūniu River Care Inc.

Acknowledgement must first be given to Te Awa o Pūniu and its surrounding mauri and taonga, which this kaupapa strives to protect and preserve.

Kei warewaretia tō mātou whakaohooho tō mātou kaitiaki – Te Awa o Pūniu – me tōna katoa ō runga, ō roto hoki, me ngā tūpuna e tāwharau nei i a ia.

KO AU KO TE AWA, KO TE AWA KO AU

Our kaumātua, kuia and tūpuna who supported Shannon Te Huia and gave Pūniu River Care Inc (PRC) the opportunity to utilise a small patch of land at Mangatoatoa Pā to grow the first harvest: Reuben and Phylis Te Huia, Jock Roa, Harrold Maniapoto, Valerie Ingley, Bryan Newton, Derek and Moe Roberts, and Hone Hughes.

Our four pā and papakāinga of Te Awa o Pūniu: Mangatoatoa, Rāwhitiroa, Aotearoa and Whakamārama.

Acknowledgements to all our funders throughout the years who have helped support and encourage the growth of PRC – Te Kaunihera ā Rohe o Waikato (Waikato Regional Council), Waikato River Authority, Manatū mō te Taiao (Ministry for the Environment), Momentum Waikato, Waikato-Tainui, Te Papa Atawhai (Department of Conservation), Mercury Energy, Whaingaroa Harbour Care, Waipa District Council, Te Puni Kōkiri (Ministry of Maori Development), Sustainable Coastlines, and Ara Poutama Aotearoa (Department of Corrections).

– Ngā mihi, nā Talitha mātou ko Shannon, ko Quinton, ko Bryan

PŪNIU RIVER CARE INC.
A MARAE-BASED ORGANISATION

Pūniu River Care Incorporated (PRC) is a marae-based initiative with a mission to enable local hapū (subtribes) to be involved in the restoration of the Pūniu River catchment, Waikato region. In 5 years, we have grown our marae-based nursery, called Te Māra Taiohi, operation from producing 4,000 trees per year to 300,000 trees per year and have been able to employ and upskill local hapū members who have become a part of **Te Kāhui a Hiwa** as **Ngā Kaitiaki o Te Awa o Pūniu** (the name given to the guardians of the Pūniu River).

Our vision is to create ***he wāhi haumaru, he wai koiora, he iwi hauora – safe places, healthy waters, healthy people***, which encourages the concept that as Māori we naturally connect to our whenua (land) to give us a sense of belonging and purpose.

Being a marae-based organisation means our marae (Māori social and cultural centres) have the final say on who sits on our governing board, and who helps steer and guide the kaupapa (initiatives) to carry out the mission and vision of the organisation.

PŪNIU RIVER CARE INC.
A REGISTERED CHARITY

He wāhi haumaru, he wai koiora, he iwi hauora – safe places, healthy waters, healthy people

Kaimahi processing native seeds in the kāuta (kitchen), Te Māra Taiohi nursery, Mangatoatoa Pā. Photo: Pūnui River Care Inc.

Pūniu River Care board members and kaimahi on the mahau (porch) of Te Maru o Ihoa wharenui, following a strategic planning exercise, Mangatoatoa Pā.
Photo: Pūniu River Care Inc.

NGĀ UARA
OUR VALUES

An important aspect to guide decisions for any operation is the creation of organisational values. Working within a kaupapa Māori framework (approach underpinned by Māori values) enables us to make decisions based on what is important to us as Māori, while also helping shape and guide the culture and build the mauri (life force) of the organisation.

'We must hold onto the founding principles of our tūpuna'

Bryan Newton (Ngāti Maniapoto, Ngāti Raukawa)

Our values have developed from a karakia (prayer) through the growth of a kākano (seed) to a well-established rākau (tree) – our values represent the stages and life of a plant.

TUPU TE KĀKANO

TUPU TE TAKETAKE

TUPU TE PIHINGA

TUPU TE MAHURI

TUPU TE RĀKAU

KO AU KO KOE, KO KOE KO AU

TĪHEI MAURI ORA

Photos: Pūniu River Care Inc.

Boosting a new life force into a sustainable world

Kākano – The literal translation is seed. This can also mean a provider of new growth. New growth means new life. We are also trying to clean up our rivers and our waterways. Water is life, or a life force. We, as people, and everything breathing have a mauri.

Keepers of our waterways, rivers, whānau, and home

Taketake – The root of all things growing. For a tree to thrive, it needs a good root system and to be carefully nurtured from inception. This can also be reflected within the home where, if we want the best for our younger ones, we must first ensure they are well grounded. With the right care and nurturing in a safe and healthy upbringing, they will strive to be all they can be. We also do what we can to ensure we lead by example and show we can be guardians of our waterways, our families, and our homes.

Strategic relationships and empowering whānau

Pihinga – Seedlings. As each seedling comes into the world, with it comes a colony of other members of its species. As we grow as people, we find ourselves surrounded by whānau (families) – and then we find more whānau. We find new relationships and make new friends and before we know it, we find ourselves in partnerships we might never have thought possible.

To know your place in a sustainable world

Māhuri – A young tree at an adolescent stage of life. This is a stage where youth are trying to find themselves and where they think they can contribute to life. To be sure of why we do what we do, we also need to figure out certain things in life and in what we do and ensure the significance of what we do is also understood by those in our circle.

Self-determined to take the lead for a sustainable world

Rākau – The fully established tree that has stood its ground from the humble seed. A giant kauri tree is a sight of pride and power and has control and self-governance. For people to become and feel the same as this rākau, they will only know that feeling when they have met a challenge to the best of their ability. From buying food for the cupboard to buying our own home, having a sense of ownership, and knowing and understanding who we are and where we fit in in this world by being self-governed will give us a sense of Rangatiratanga (right to exercise authority).

Limitless generosity acknowledging the celebration of life

Celebrating and acknowledging life, and being grateful for the opportunities that arise. For PRC, it is to give without receiving, to contribute with endless generosity, and to nurture all that is life. We see it as the fully grown rākau, which produces more seed for the whenua to regenerate.

IMPORTANT INDIGENOUS SPECIES FOR PŪNIU RIVER CARE PHILOSOPHY

It is important in any restoration project to remember what drives and motivates you, what you are fighting for. We have focused on six key taonga species: tuna (freshwater eels; *Anguilla* spp.), harakeke (NZ flax; *Phormium tenax*), karamū (*Coprosma robusta*), kōura (freshwater crayfish; *Paranephrops planifrons*), mānuka (*Leptospermum scoparium*), and tūī (*Prosthemadera novaeseelandiae*):

- **Tuna** spend the early part of their lives in the freshwater systems of our awa (rivers) and roto (lakes), as tunatuna (glass eels). Here they grow slowly and, once they are of breeding age, migrate to the moana (marine environment) where they all meet in the Pacific Ocean to breed and then die. Their babies float back on the currents of the ocean to the rivers where their parents came from and start the cycle all over again.
- Before heading to the ocean, tuna live in repo (wetlands), which are the strongholds of **harakeke**. Harakeke is also a food source for the tūī, which loves to sip the nectar of their flowers during spring and summer.
- The **karamū** can also be found within wetlands, especially among the swamp forests that wrap around harakeke and the sedges (grass-like plants) and rushes. They are also found on the banks of tributaries (riparian margins) along with sedges such as the pūrei or pūrekireki (*Carex secta*). As the karamū is a hardy and versatile plant, it can also be found among scrub on dry lands dominated by mānuka and kānuka (*Kunzea ericoides*).
- Underneath the protective cover of the pūrekireki that hang over stream banks with karamū, can be found stocks of **kōura**. These delicate little crustaceans are valued food sources for the tuna, and for our people!
- In the Waikato, **mānuka** is also found on the drier edges of peat and fen wetlands, forming an important nursery for other native plant seedlings.
- Hovering over all these spaces are the **tūī** – these native birds fly across awa, roto, along coastlines, and, as highlighted earlier, can also occupy spaces in wetlands. They are found both in our cities, and among native bush blocks along ranges and mountains.

Look closely at the interactions according to how we understand and value them within Te Ao Māori (Māori worldview). For example, our six key taonga species – tuna, harakeke, karamū, kōura, mānuka, and tūī – are often treated as being creatures from separate habitats, and so are rarely considered together when focusing on restoration projects. However, as shown in the illustration (Fig. 1), the ecosystems occupied by each are not as separate as some might believe.

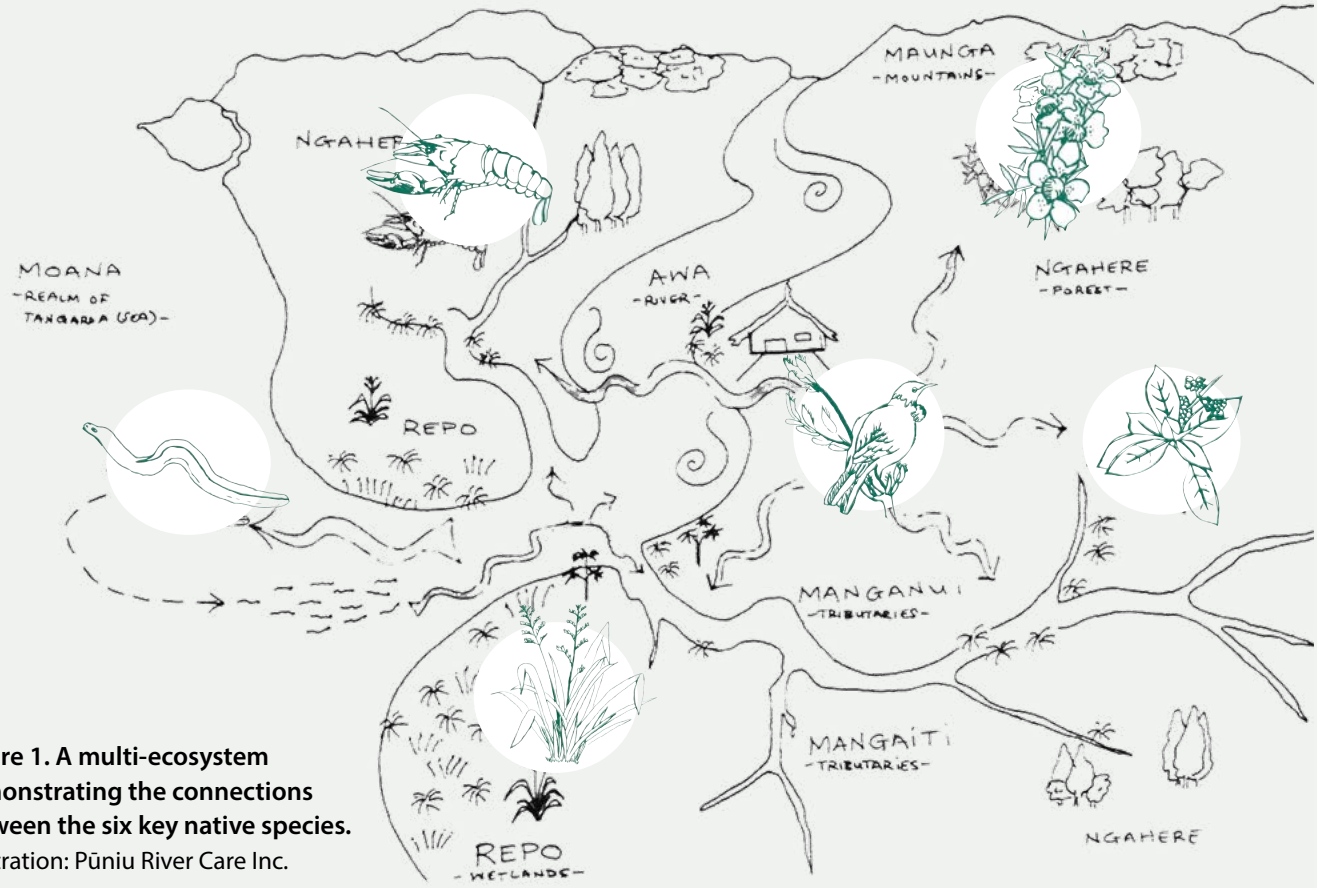


Figure 1. A multi-ecosystem demonstrating the connections between the six key native species.
Illustration: Pūniu River Care Inc.

WHAREKORINO WETLAND ENHANCEMENT PROJECT

One of our first projects (November 2016) was the Wharekorino Wetland, located south of Te Awamutu, in Tokanui, Kihikihi (Waikato), on a stream that feeds into Te Awa o Pūniu (Pūniu River). Known for its pā tuna (eel weir) spots where we would always find good tuna stocks, it was a rich source of kai (food) and wai māori (freshwater) for our tūpuna (ancestors). Another activity performed here was the practice of whaikōrero (formal speech). One of our koroua (elder), Bryan Newton, explained that he often heard his father down at Wharekorino Wetland practising manu kōrero (oration). This is where he too practises manu kōrero to this day.

This wetland was an obvious place for us to begin our restoration, with the area being identified as a 'Potential Significant Natural Area'in the Waipā District Plan Appeals Version (2014).

Dense willow growth throughout the Wharekorino Wetland. Photo: Pūniu River Care Inc.

Kaimahi being taught tikanga practices to up-hold the kaupapa of Pūniu Rive Care, Mangatoatoa Pā. Photo: Pūniu River Care Inc.

Members of Te Kāhui-a-Hiwa potting up whanake (*Cordyline australis*; also known as tī kōuka) juveniles at Te Māra Taiohi nursery, Mangatoatoa Pā. Photo: Pūniu River Care Inc.

Building best practice for wetland restoration projects

The wetland restoration at Mangatoatoa Pā is an ongoing exemplar of best practice for restoring a safe wetland area. The wetland is sited on the southern side of the Pūniu River below Mangatoatoa Pā (Fig.2). The project reintroduced native plant species that had historically provided kai for our whānau as well as habitat for wetland native fish and birds. Plant species that support rongoā Māori (traditional medicine), mahinga kai (cultivated foods), and toi Māori (traditional art) have also been selected to create a seed source for other local wetland restoration projects. This 2-year project led to 32,000 native species planted, 560 m of fencing, and 3.5 ha of willow (*Salix* spp.) and weed control within and around the repo.

The wetland at Mangatoatoa Pā is subject to regular floods, the impact of which will be reduced when native trees and plants slow water flows. By restoring this wetland, native biodiversity will also be enhanced and important ecological services such as groundwater replenishment, sediment reduction, and nutrient retention will add ongoing value to ecological communities downstream.

The Wharekorino Wetland enhancement project is a great showcase for Pūniu River Care and a template for future wetland restoration projects. With Te Māra Taiohi, our marae-based native plant nursery, located on site at Mangatoatoa Pā, the Wharekorino Wetland will become even more significant. When the wetland establishes it will become the native seed sourcing area, as well as providing opportunities for intergenerational practices of rongoā Māori, mahinga kai, and toi Māori for our hapū. This project initiated marae-based employment and has given our hapū opportunities to be involved in the restoration of a significant natural wetland, which delivered ongoing benefits to the community.

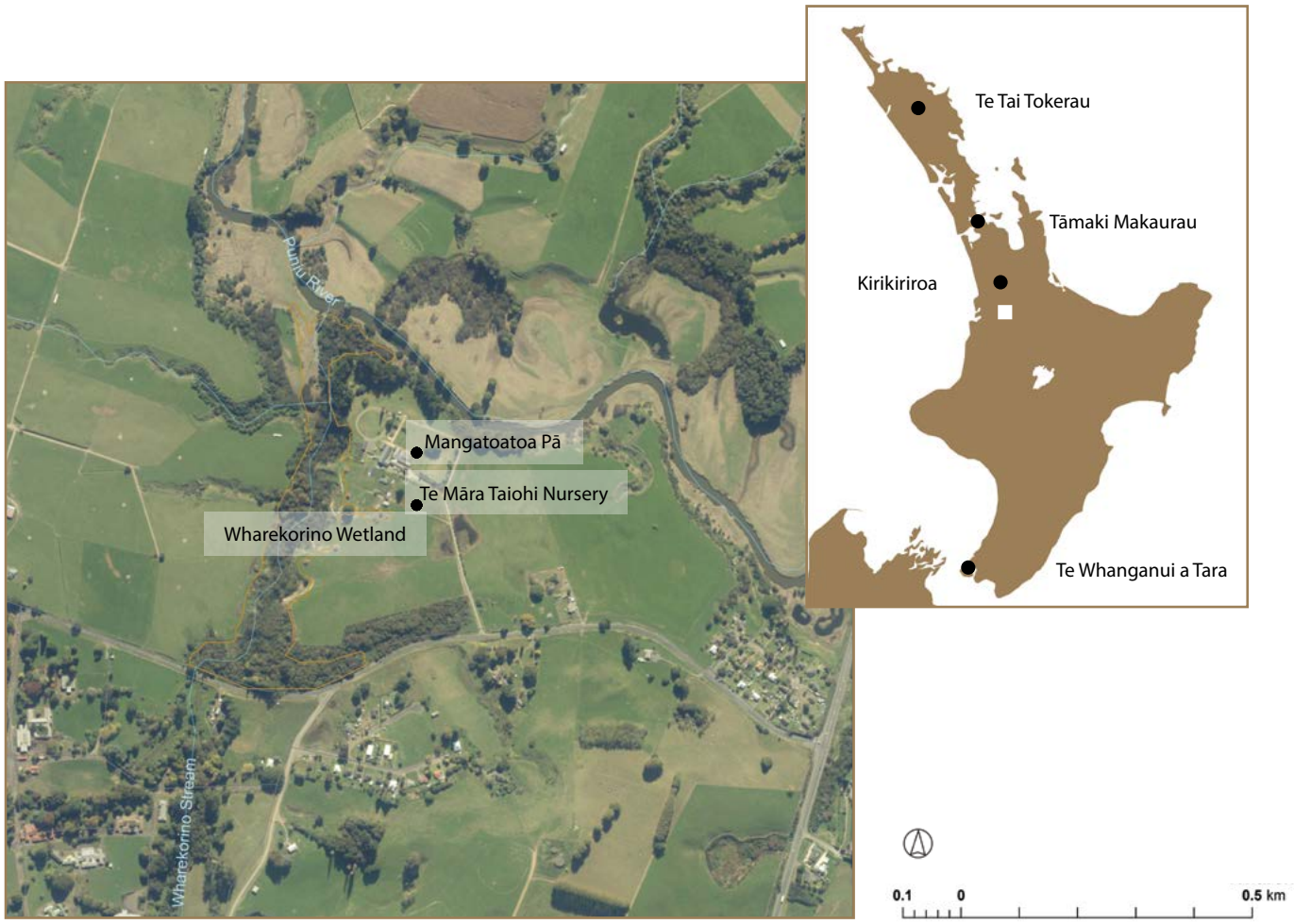


Figure 1. Location of Wharekorino Wetland alongside Mangatoatoa Pā and Te Māra Taiohi native nursery in the Pūniu River Catchment, Waikato region. Source: Manaaki Whenua – Landcare Research

Kaimahi getting ready to 'throw down' along Te Awa o Pūniu. Photo: Pūniu River Care Inc.

Prepping cell trays for native plants at Te Māra Taiohi nusery, Mangatoatoa Pā. Photo: Pūniu River Care Inc.

KEY STEPS FOR PLANNING AND IMPLEMENTATION OF WETLAND RESTORATION

When undertaking a project, we consider the following five key steps to help us plan and implement restoration at sites like Wharekorino Wetland.

Creating our vision: We identified **tuna, harakeke, karamū, kōura, mānuka,** and **tūī** as being important to our hapū and relevant to the entire Pūniu River catchment. Restoration at Wharekorino Wetland was a way to begin a staged process of restoration that would see the gradual return of these valued species, alongside our aspirations for improvements to the health of the awa.

Seeking knowledge: We then spent time with our whānau to gather mātauranga (knowledge) about what restoration means for our sites from within our worldview. By understanding the knowledge we already have, as we did for Wharekorino Wetland, we can then use it to guide our restoration priorities.

Understanding our cultural needs: This involved identifying our cultural landscapes and reviving our history. In the case of Wharekorino Wetland, we identified the following key needs for our awa and whānau: enhancing valued species, restoring and protecting the water quality of Te Awa o Pūniu, and reinvigorating our tikanga (cultural values and practices).

Generating sustainable partnerships: We identified the partners who could help make the vision a reality for our awa and whānau. We recognised that the Waipā District Council, Te Papa Atawhai (DOC), and the Waikato River Authority were key partners to help us with the resourcing and support necessary to achieve our vision.

Building the Journey: When we clearly understood our collective restoration purpose, we were then able to act in a way we felt best met our spiritual, cultural, and economic aspirations. This included building Te Māra Taiohi, our native plant nursery, and our capacity in horticulture for our tribal members to lead, plan, design, and undertake the mahi (work).

Out in the field, kaimahi undertaking technology training.
Photo: Pūniu River Care Inc.

We have written a guidebook about our restoration experiences to help other communities with the same purposes and aspirations (released 2019). Downloadable versions in te reo Māori and English:
https://puniuinc.org/get-involved-1-1

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

Useful websites

Pūniu River Care Inc.
https://puniuinc.org

Safe places, healthy waters, healthy people – A guide to assist marae and hapū to build their capacity in restoration
https://puniuinc.org/get-involved-1-1

He wāhi haumaru, he wai koiora, he iwi hauora – He aratohu taunaki i nga hapū ki te whakawhanaka i a rātou ki ngā mahi whakaora taiao
https://puniuinc.org/get-involved-1-1

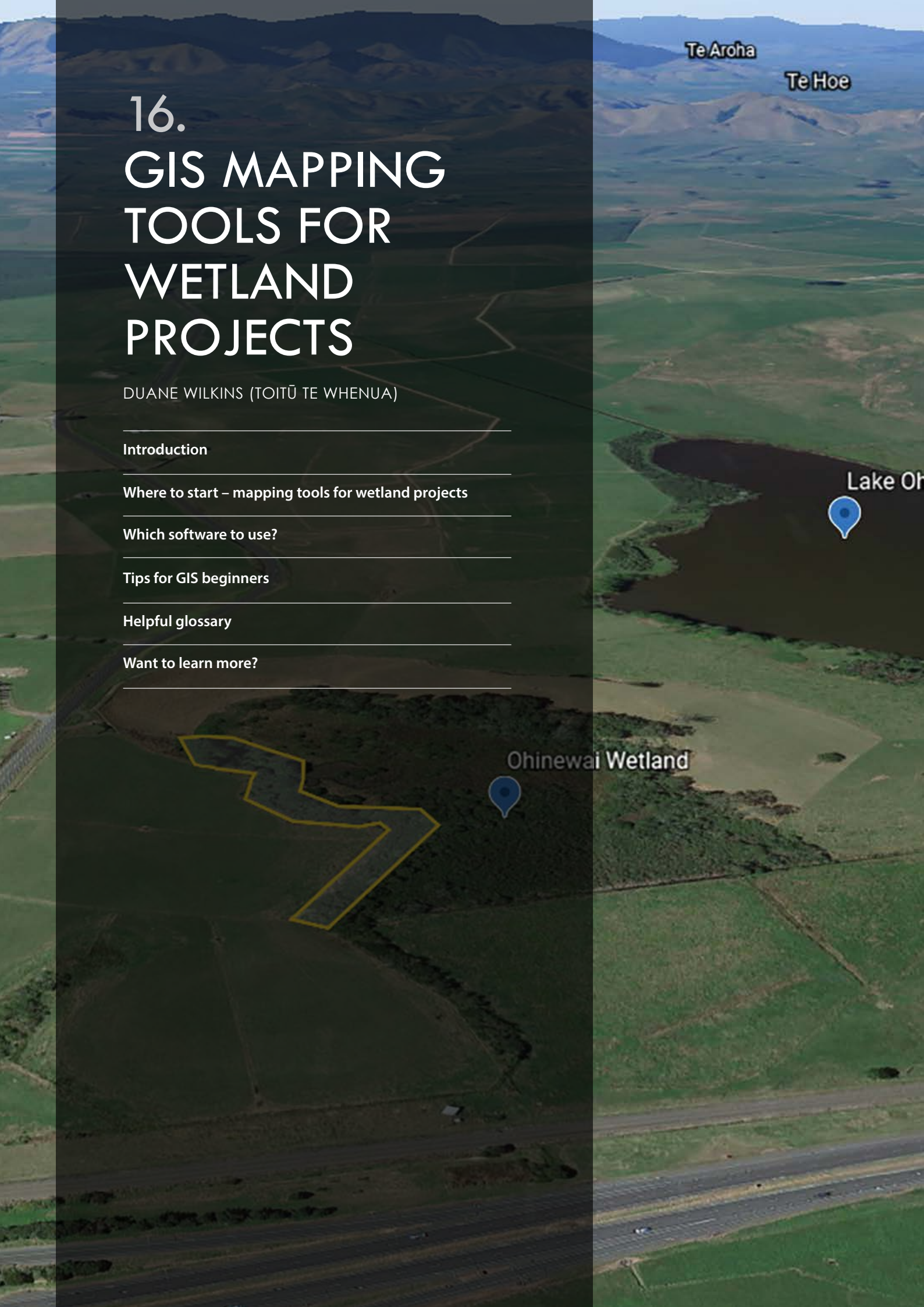
Wharekorino Wetland Restoration Project
https://waikatoriver.org.nz/wharekorino

Contact details for Shannon Te Huia

Email: shannon@puniuinc.org

16. GIS MAPPING TOOLS FOR WETLAND PROJECTS

DUANE WILKINS (TOITŪ TE WHENUA)



Whatungarongaro te tāngata toitū te whenua

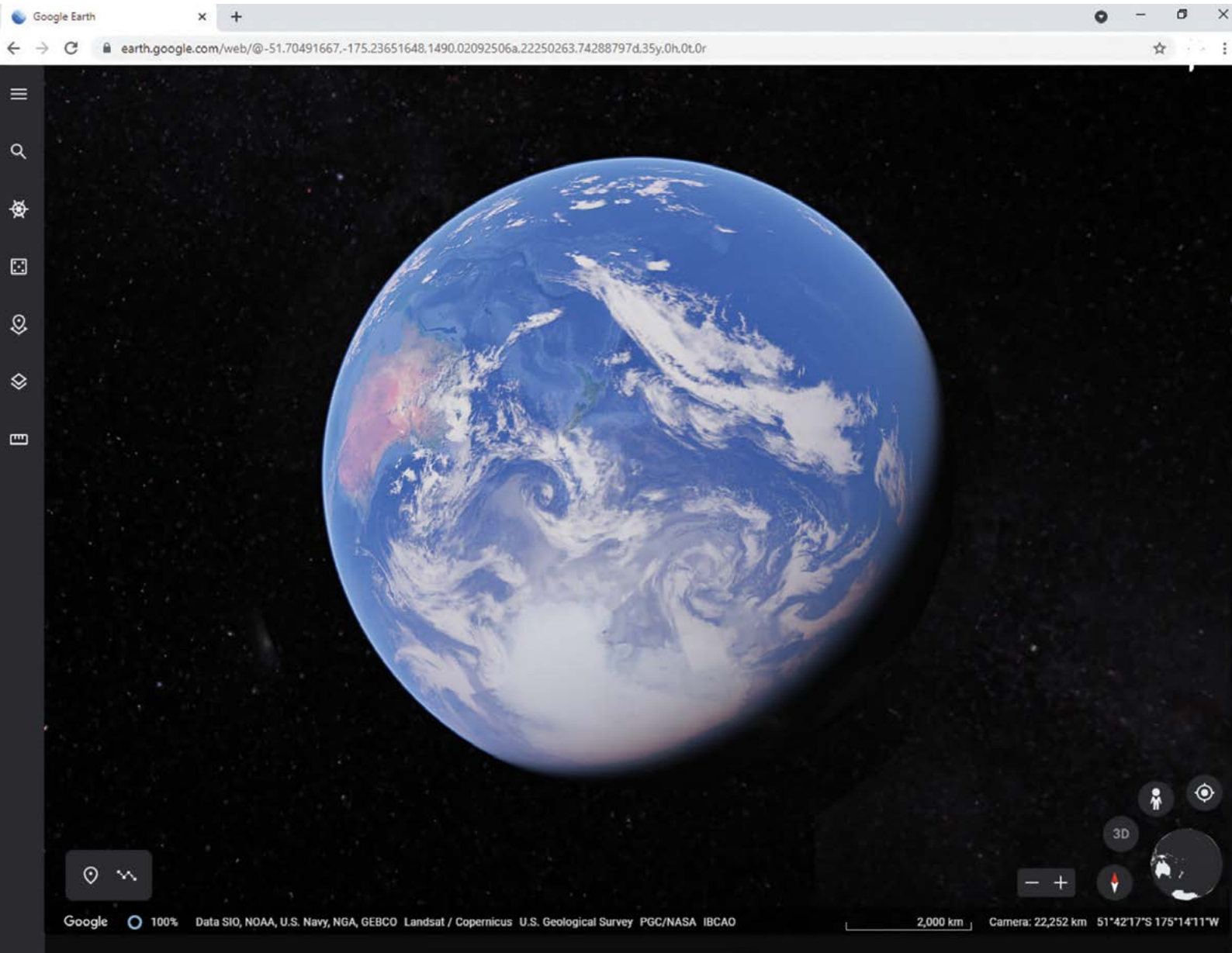
As people disappear from sight, the land remains

When we think about maps, we might remember several years ago frustratingly unfolding, folding, and refolding large maps of towns or cities on the bonnet of the car. Huge advances in mobile technologies and access to datasets to the wider public now mean those large, multi-creased paper maps have been replaced by smartphone-based maps that even talk to you as you navigate through unfamiliar roads and streets.

If we move that idea to mapping areas such as 'sites of significance', there are huge advances from hand-drawn paths, places, and areas on topographic maps, to the wonder of digital 'real world'images with data layers that can be edited and turned on and off.

Previous page: A snapshot view using Google Earth Web.

The Earth's globe on Google Earth Web.
Source: https://earth.google.com/web

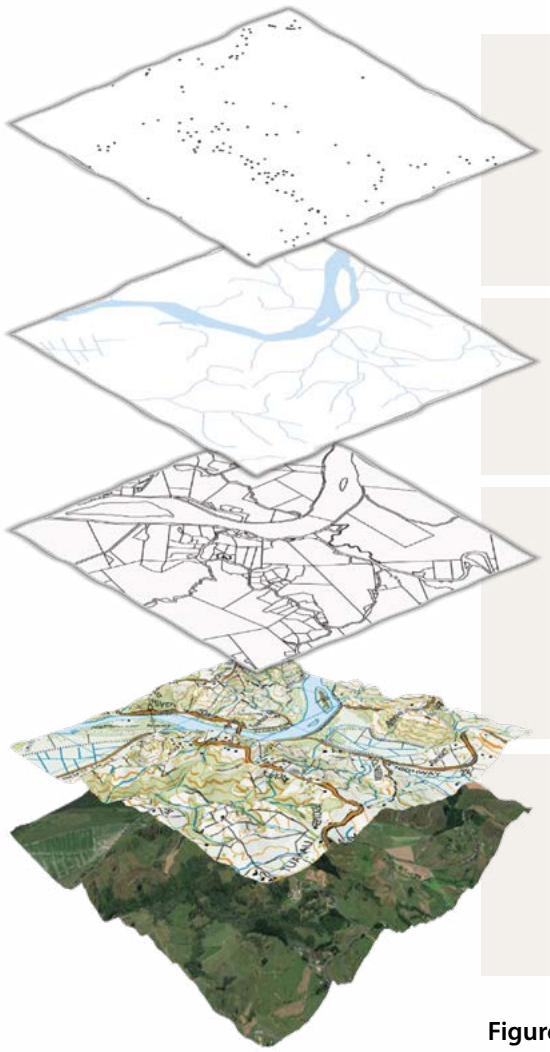


The same single data source can be transformed into 3D (three dimensional) scenes with flythrough capabilities and can be used to tell a story – like a journey with photos, video, and audio using Google Earth and StoryMaps. These tools are related by geography or the term geospatial – data linked to a place or geographical location that includes information on both the surface of the earth and underneath it. These data sets are portrayed visually as a map or 3D globe. Map layers, like layers of a pizza, can be collated and overlaid using coordinate systems – latitude/longitude or northing/easting – that line up using geography. You can have any flavours you want on your pizza map, but only if they all use the same square box (Fig. 1). You'll also want a variety of different pizza toppings for different appetites, as one with everything on is not the easiest to consume.

Geospatial tools can be used to support all types of wetland projects. Mapping applications can be used to:

- monitor and report on ecological restorations over time
- plan riparian planting, to calculate requirements
- monitor water quality, and use real time live streams
- track pest control, and automate trap monitoring
- assess cultural sites using forms to collect and describe values
- communicate a problem or results in an easy-to-understand, map-based, and 3D story format.

GIS or **Geographic Information Systems** is a collection of tools that allow you to overlay and integrate data from a variety of different sources to understand relationships and derive new understandings. The most recognisable feature of GIS are different map layers from many different sources being placed on top of each other to tell a story about a particular site or local species. This can be accessed by a smartphone, desktop, and internet mapping tools working together to overlay, map, and manage data from a variety of sources.



Points, Places

Used for: Sites of significance – urupā (burial site), pā (fortified village), puna (springs), pou (poles), mahinga kai (cultivated foods), mara kai, traditional harvest sites, middens; place names, and any pin or latitude longitude type location.

Lines, Paths

Used for: Paths, roads, tracks, ridges, tree lines, boundaries, and awa (rivers).

Polygons, Areas

Used for: Areas of interest (e.g. Post Settlement Government Entity (PSGE)), area of association, takiwā (core area of focus), rohe (tribal area), blocks, boundaries, rahuī (temporary prohibition), buikdings, urupā, and cultivations.

Raster, Imagery

Used to represent: Topographical maps, satellite images, aerial photography, historical scanned survey plans, 3D elevation surfaces, processed LiDAR elevation, depth, and bathymetry.

Figure 1. Overlaying different types of data to create a map.

We can use GIS to help collect data, understand relationships between different physical features, discover and analyse new interactions, or share information based on its shared geography. You could, for example, use historical imagery from the 1950s to the 1990s to identify change, and then use satellite imagery to illustrate change over the past decade (i.e. 2010–2020). You can use this imagery to help understand patterns, and the impacts of local policy, and land use change.

We can also use GIS to help others understand our findings by using stories, maps, and 3D flythroughs (Fig. 2). In this chapter, we'll take you through some of these tools and how they can be applied to your own wetland mapping projects.

Figure 2. An example wetland near Kimihia, Waikato region, in 3D using Google MyMaps. Source: https://www.google.com/maps/about/mymaps

WHERE TO START MAPPING TOOLS FOR WETLAND PROJECTS

Before starting a mapping project, it is important to consider as a whānau (family), what it is you are trying to achieve, and work from there. Start with trying to identify the problem you want to solve:

- For some, it is a case of forming a clearer idea where wetlands used to be, and whether they are still there.
- For others, it might be about understanding changes to either the wetland or valued wetland species over time by using historical aerial photographs.
- Or there might be an interest in better understanding the impacts on wetlands, e.g. loss of vegetation, surrounding land use management, and increases in vertebrate (such as possums, stoats, and rats) pests and predators, to help better plan for restoration.

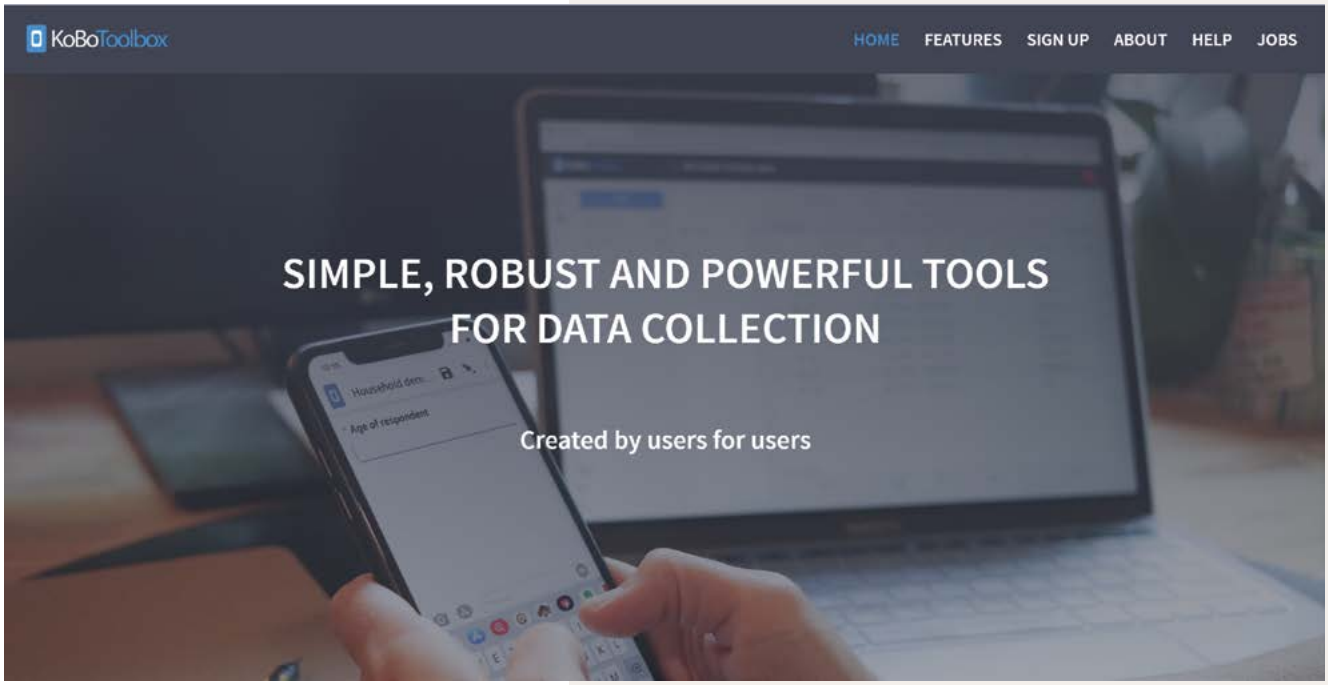
Using data from other organisations to overlay with your own information is a key foundation of GIS. Here are a few examples of how mapping can be used in your project.

Monitoring changes over time

Map-based forms can be developed to collect water quality and observations of current vegetation for use on smartphones, including a GPS location, a photograph, recent weather trends, and location name or placename. The information collected can help describe a trend over time, for example, the relationship between seasons, weather events, physical change or other variables.

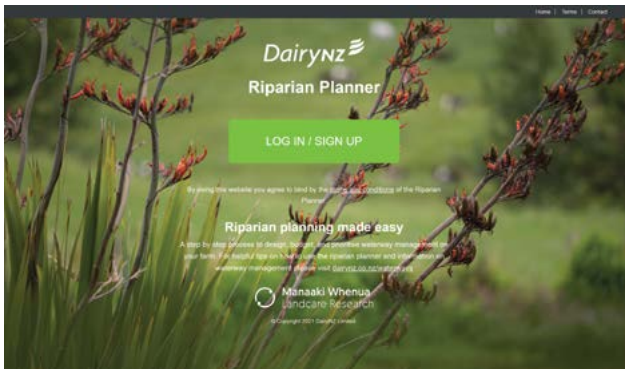
In the case of vegetation, any changes to the types of plants on the site can indicate changes to water levels, nutrient levels, and water quality (Retrolens.nz). The presence of mānuka (NZ tea tree; *Leptospermum scoparium*), for example, is a good indicator of normally wetter lands becoming drier (i.e. the water table dropping). In this case, aerial photography and satellite images can be used to show broader landscape and vegetative change over time.

If you were monitoring species caught in a trap overnight – such as tuna (freshwater eels; *Anguilla* spp.) across a range of hīnaki (eel baskets) locations – you can visualise these data to understand species diversity within a wetland, by creating a graph with a map showing monitoring sites. Low abundance of species can be indicators of a wetland in poor condition. Mapping the abundance of valued species like tuna, and where low relative abundance is found, can help to look further at underlying causes such as lowered habitat diversity or nutrient pollution, which can then be overlaid with your own water quality observations using forms developed in tools like ArcGIS Survey123 or KoBoToolbox. Check: https://survey123.arcgis.com or https://www.kobotoolbox.org



KoBoToolbox home page. Source: https://www.kobotoolbox.org

Retrolens.nz home page. Source: https://retrolens.co.nz



Riparian Planner (DairyNZ and Manaaki Whenua) home page. Source: https://riparian-planner.dairynz.co.nz

What was there before?

Retrolens NZ is a treasure trove of scanned aerial photographs that have been taken between 1936 and 2005 and contains more than 500,000 free downloadable images. This historic image resource came about as the result of a scanning project started in 2015 by partnerships between the Local Government Geospatial Alliance and Toitū Te Whenua (Land Information of New Zealand). You can filter by year or decade to gather a series of images that demonstrate change over time. The easiest way to use this imagery is as standalone photographs of the same location, one for each decade, animated within a presentation using slideshow. The advantage is that you can show the impact of local environmental change over time, such as habitat loss or deforestation. Check the Retrolens NZ website: https://retrolens.co.nz

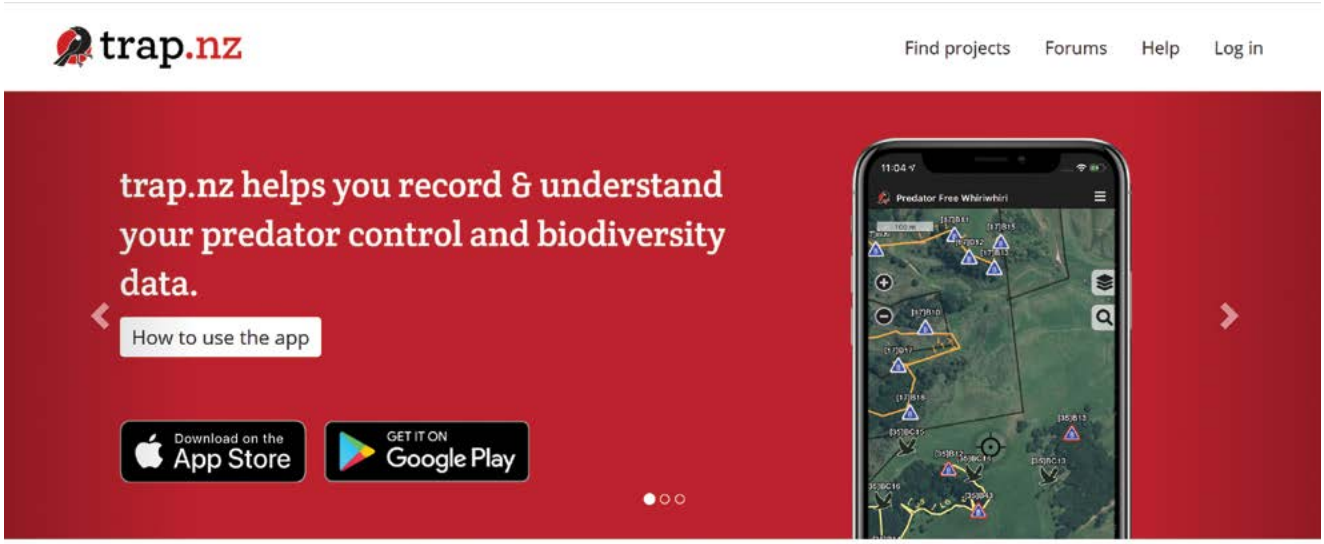
Riparian planting

Planning and managing riparian plantings can use GIS to help calculate an area to be planted, the number of plants, length of fencing, and other resources required to support funding applications. 3D visualisations can show the changes over time and what the vegetation will look like. Considering the length of time it can take for native plants to establish, a 3D visualisation can help predict a restoration project for those generations who may not live long enough to see it reach its full potential. Check the Riparian Planner: https://riparian-planner.dairynz.co.nz

Animal pest and predator, and weed control

You can use GIS to help identify and track progress for trapping and pest control, as well as for recording weed control. These are particularly useful in supporting funding applications and reporting on progress made with existing grants. There are many existing trapping applications you can use, such as Trap.nz, and export the visualisation data within your own tools. Check the Track.NZ website: https://trap.nz

Trap.NZ home page. Source: https://www.trap.nz



trap.nz is a free service used throughout NZ for recording trap, bait, monitoring, and biodiversity outcome data.

Cultural Health Indicators

Geospatial information can support monitoring observations of Cultural Health Index (CHI) assessments. The CHI is a tool Māori can use to assess and manage waterways in their area – measuring factors of cultural importance by incorporating Māori perspectives and values for freshwater health in management decisions. The index allows whānau, hapū (sub-tribes), and iwi (tribes) to assess the cultural and biological health of a stream or catchment, and then communicate this information to water managers in a way that can be understood and integrated into resource management processes. Geospatial information can support restoration projects by quantitatively (numerical data) measuring change over time, or providing a baseline before, during, and after restoration. These can help in understanding qualitative (descriptive and conceptual) values alongside quantitative assessment that can indicate change or trends over time. Check the CHI publication: https://environment.govt.nz/publications/using-the-cultural-health-index-how-to-assess-the-health-of-streams-and-waterways

Sharing Narratives using ArcGIS StoryMaps

3D flythroughs are a great way to tell a story, and these can be embedded within an interactive ArcGIS StoryMaps. StoryMaps are free to create using a personal ArcGIS account. The use of historical images and photographs describing the current situation and can help expand your story in ways other tools can't.

You can browse the Esri ArcGIS gallery at https://tinyurl.com/StoryGallery, or check some of these StoryMaps examples:

- Great Wetlands of the World: https://tinyurl.com/WetlandsStory
- Working Wetlands, removing nutrients: https://tinyurl.com/workingwetlands
- https://tinyurl.com/workingwetlands
- Te Puni Kōkiri. Te Matapaeroa: Insights – research reveals a clearer view of Māori business https://tinyurl.com/tpk21
- First Nations: The Voices of Grand Canyon – read, listen, watch, and learn https://tinyurl.com/GCVoices
- Sounds of the Wild West – an audio tour of four major ecosystems https://tinyurl.com/WWSounds
- Climate Change – weather, science, impacts, affects, and what we can do https://tinyurl.com/NZClimate

Figure 3. StoryMaps used to show the impact of sea level rise. Source: https://www.learnz.org.nz/climatechange201/readings

Create 3D views by setting a 'default bookmark' on each view within most 3D mapping tools; Google Earth Pro calls these 'snapshot views'. Data from environmental monitoring, planting, and pest control can be overlaid on maps, and provide a real time map showing all available data. StoryMaps is a relatively quick way to deploy a feature-long, scrolling interactive article (Fig. 3). You may also see these on online news articles (i.e. stuff.co.nz). For more help with setting up a StoryMaps, have a look on the ArcGIS StoryMaps website: https://storymaps.arcgis.com or join an online training session with Toitū Te Whenua (LINZ): https://www.linz.govt.nz/poutama.

Google Earth now supports creating and sharing map-based, place-to-place tours. These work on smartphones and can be readily viewed in low-cost cardboard '3D Virtual Reality', providing an immersive perspective. Google Earth Web is one of the simplest tools for creating a virtual reality tour as seen in Figure 4.

Figure 4. A snapshot view of a proposed planting area at Lake Ohinewai, Waikato region, using Google Earth Web.
Source: https://earth.google.com/web

Creating 3D flythroughs as a video and online experience

3D tours are an easy and engaging way to communicate a sense of relationships or a journey from place to place. While Google Earth Pro and Google Earth are the easiest way to do this, StoryMaps can provide a more professional design but takes a little more effort. Live, interactive 3D experiences are more engaging than video, but sometimes you will need to create a static video snapshot of a 3D fly through. Google Earth Studio is a free web application that can be used to create frame-by-frame 'broadcast quality'3D flythrough video. QGIS and ArcGIS desktop applications can also provide greater options for using local elevation and aerial photography at higher resolutions.

Developing an Environmental Monitoring system

Geospatial software can provide you with the tools to establish your own long-term environmental monitoring system; however, this is just one part and often the technology is the easiest part. You'll need support to map your environmental mahi (work). Consider bringing your whānau along on the journey to help you with planning, learning, and the technical work, as well as helping describe your work to others. The schematic (Fig. 5) can provide a good process to get an applied GIS project underway.

Figure 5. An iterative step-by-step approach to using GIS for environmental projects.

1. **Research and investigate other projects currently underway.** Taking notes of other people's efforts can help you better identify key tasks in your own planning. Table 1 provides examples of online support, training, and resources. Use your networks to look at some previous or existing examples of mahi, and seek advice from other whānau, hapū, and iwi-led projects.

2. **What are you trying to restore and why?** At the beginning of your journey, it may feel overwhelming, but a good first step is to consider what it is that you are trying to better understand about your wetland. You can start by having a wānanga (workshop) with your whānau about tikanga and kawa (cultural values and practices) associated with the wetland site:
   - connected landscapes like awa (rivers) or maunga (mountains)
   - the native plant and animal species that once or still reside there
   - the sounds, smells, and observations remembered by kaumātua (elders) and others as associated with a healthy wetland.

   The key is to identify your goals for the site – restoring of valued taonga species (culturally important), improvements for water quality, or rejuvenation of tikanga and kawa. These goals will then become the drivers or mission for your project and make it easier to identify what could and should be mapped.

3. **Plan what you want to do and how you might map it.** Be sure to be kind to yourselves, by setting achievable goals and actions, within a realistic timeframe. Remember that you don't have to be experts in everything. You may not even need to develop your own GIS if existing tools provide what you need. There are organisations including Manaaki Whenua – Landcare Research, Toitū Te Whenua LINZ, Te Tumu Paeroa, Te Papa Atawhai (Department of Conservation) or ngā kaunihera-a-rohe (regional councils) that can help you access maps, data, and some agencies may be able to support with funding.

4. **Implement an example and test it.** Begin with small steps, give yourself and the whānau the space to adapt and modify as you learn new things.

5. **Evaluate what you have done.** This links very tightly with stage 3. It is important to keep reviewing your activities so that you can adjust quickly if need be. Most important, remember to share your data and learnings. There are many other whānau out there who might also be in the same stage of your journey, and so the more data and learnings shared, the greater the benefits for the environment and our people.

WHICH SOFTWARE TO USE?

There are many different software options to choose from. If you're starting out, here are some suggestions and links to access or download the applications (Table 2).

- **Google MyMaps** is ideal for beginners. It will provide you with the essential tools to create a map of your wetland project, and help you design your first map in a matter of minutes. Your information is stored in your google account, and no-one has access unless you choose to share it.
- You can then move into **Google Earth Pro**. Download and open your KML (keyhole markup language) layer files from MyMaps. You can also access historical satellite imagery and start to compile a collection of KML files from other sources such as Manatū Mō Te Taiao (MfE) website and overlay with your own data.
- When you reach the limits of Google Earth Pro, or develop technical confidence, you will want to upgrade to **QGIS**, a free desktop GIS software. However, at this stage you'll need to considering file back-ups on external hard drives and access for others beyond your own computer.
- Alternatively, if you need a set of tools for group collaboration, you may want to consider joining the **New Zealand GIS in Conservation group (NZGiC)**, who can facilitate free access to **Esri ArcGIS Online**, and a suite of tools like Microsoft Office 365. If you prefer to have your own ArcGIS Online account, non-profit organisation licenses are available at about $250 per user per year.
- **KoBoToolbox** is a great starting place for building geo-enabled forms, or **Survey123** if you have access to an **ArcGIS** online subscription.
- **Arc GIS StoryMaps** is a free online tool to combine text and interactive maps with other multimedia content to tell your restoration story.
- **ODK Collect** is an open source Android app that replaces paper forms used in survey-based data gathering, and supports location, audio, images, video, barcodes, signatures, multiple-choice, free text, and numeric answers.

Every project has different needs, and you'll need several applications to achieve your goals.

Existing GIS data relevant to wetland projects

Over the past decade, agencies, and research institutes have developed commonly used geospatial datasets available for free public download, enabling users to add projects. Table 3 describes some useful datasets for all wetland types and related mapping projects. Although these sites are designed with data access in mind, you can also simply use them as sources of maps or browse the source organisations website for maps and presentations using these data sets.

Table 1. Finding support and training

Organisation	Support, training, and resources
Manaaki Whenua – Landcare Research	• A range of websites and tools to help get you started https://www.landcareresearch.co.nz/tools-and-resources/mapping
NZ GIS in Conservation (NZGiC)	• GIS Volunteers who can provide one-to-one guidance https://nzgic-gicnz.hub.arcgis.com
Ngā Kaunihera-ā-Rohe | Regional Councils	• Asking for guidance, advice, and support can give you a running start
Te Kāhui Manu Hōkai | National Māori GIS Association	• Follow National Māori GIS Association on Facebook https://www.facebook.com/groups/TeKahuiManuHokai
Te Papa Atawhai | Department of Conservation (DOC) Geospatial Services Team	• Make a request with local staff for maps, data, and guidance
Toitū Te Whenua | Land Information New Zealand (LINZ) Capability Team and Business with Maori	• Ngā Poutama Matawhenua – Practical Māori GIS Mapping Wānanga https://www.linz.govt.nz/poutama • Follow Grow GIS NZ on Facebook https://www.facebook.com/growgisnz • Right of First Refusal (RFR) portal https://www.linz.govt.nz/crown-property/acquisition-and-disposal-land/crown-property-disposal-process/right-first-refusal-rfr
YouTube	• Tutorials exist for wide variety of workflows on almost all software types • Try a variety of different key search terms, include Indigenous Peoples and First Nations

Table 2. Available online GIS software and weblinks

GIS Software		Weblinks
Esri ArcGIS applications	• ArcGIS Online web maps and applications • ArcGIS StoryMaps • Survey123 geo-enabled forms • ArcGIS Pro desktop software (advanced)	• https://www.arcgis.com • https://storymaps.arcgis.com • https://survey123.arcgis.com • https://www.esri.com/pro
Google Mapping applications	• Google Earth Pro • Google Earth on the web • Google Earth Studio • MyMaps	• https://www.google.com/earth/versions • https://earth.google.com/web • https://www.google.com/earth/studio • http://mymaps.google.com
KoBoToolbox	• Open source sponsored hosted mobile and web from data capture, collation, and mapping	• https://www.kobotoolbox.org
ODK Collect	• Open source, self-hosting mobile data capture	• https://play.google.com/store/apps/details?id=org.odk.collect.android
QGIS	• Free open-source desktop GIS software (advanced, also available for Mac)	• https://qgis.org

Table 3. Organisations and GIS data sets available for free download

Organisation	GIS Data Layers of interest	Link
data.govt.nz	• A wide collection of references to map data and research documents (Links to other download sources).	• https://catalogue.data.govt.nz/dataset?q=Wetlands
Manaaki Whenua – Landcare Research	• NZ Land Use Capability Assessment • Land Cover Database v5.0 1996–2018 • Various detailed soil layers • Various detailed environmental layers	• https://lris.scinfo.org.nz • https://whenuaviz.landcareresearch.co.nz/
Manatū Mō Te Taiao | Ministry for the Environment (MfE)	• Current wetland extent • River Environment Classification 2010 • Watersheds based on catchment orders • River flows, and sea draining catchments • Lake water quality trends 2004–2013	• https://data.mfe.govt.nz
Retrolens NZ	• Historical aerial photography from 1936–2005	• https://Retrolens.nz
Taihoro Nukurangi | NIWA	• Research and wetland inventory	• https://niwa.co.nz/research-subject/wetland
Te Kooti Whenua Māori | Māori Land Court	• Māori Land Spatial Dataset (2017) • Trustees and management structures	• https://maorilandcourt.govt.nz/your-maori-land/
Te Papa Atawhai (DOC)	• Protected Conservation Areas • Marine Reserves • Coastal Marine data Ecosystem management units • Campsites, huts, and tracks	• https://maps.doc.govt.nz
Toitū Te Whenua (LINZ)	• Labelled river lines and areas • Swamps, drains, ponds, estuaries • Property boundaries, titles, and ownership • Survey plan points and survey markers • 1-m elevation data derived from LiDAR • Current aerial imagery, topographical maps, and marine charts	• https://data.linz.govt.nz

KEY TIPS FOR GIS BEGINNERS

- Every good GIS project starts with a group discussion – seek support and help from your peers, and avoid taking all the burden on yourself
- Make use of the free online GIS tutorials available for all the most common workflows and software tools on YouTube
- Start small and simple, complete small point datasets before expanding your scope
- 3D visualisations can help get you started quickly and aid in communication with others to understand the context
- Avoid drawing areas and creating points in 3D; use a 2D view for data capture and creation (for viewing in 3D afterward)
- Don't be afraid to ask for help and support from other GIS practitioners
- Label your files with useful names using a formula like 'project_topic_date_version'
- Store your data in a grouped folder structure by theme or project name. This helps you make file back-ups and share files easily with others
- Make copies of your important GIS content files and store them in a secure external hard drive or use secured cloud storage.

HELPFUL GLOSSARY

Understanding GIS terminology

Aerial photography – images, like those sourced from Retrolens.nz, are taken using analogue film and digitally scanned from prints. More recent images, like those sourced from the Land Information NZ data service, were captured using high resolution digital cameras.

Coordinate Systems

- **Latitude, Longitude (WGS84)**

  Latitude/Longitude is a global coordinate system used by GPS, mapping software like Google Earth, and all GPS enabled smartphones. Where possible, use the decimal degrees format 'DD. DDDDDD', like this: -37.412813, 175.559631

  Avoid DD° MM'SS" Degrees Minutes and Seconds: 37°24'46.1"S 175°33'34.7"E, as these must always be converted to decimal format before they can be used in GIS software.

- **Easting and Northing (NZTM)**

  Map grid references are a way to reference a location using a metric grid in metres. All map grid coordinate pairs must be a positive number of at least 7 numbers each, which reference a positive distance from a false map origin in the south Tasman Sea.

  For example: the same location above in NZTM Map Grid is described as **E 1826555, N 5856365**. https://www.topomap.co.nz is a good site to check this map reference system. LINZ has a very detailed web-based coordinate converter for more technical users.

Geographic Information System GIS – a Geographic Information System, or suite of tools, software. Data, people, and processes that create a mapping system. Examples are QGIS, ArcGIS, or Google Earth.

Global Positioning System GPS – initially deployed by the US military but recognised as an important means for locating a place on your map. Many phones have these as part of the media apps, so when taking photos, the GPS automatically identifies where in the world the photo was taken.

Light Detection and Ranging LiDAR – elevation data created from point sources using laser light. The data are transformed into square grid elevation surface images called Digital Elevation Models and used to create 3D effects.

Open Data – open data are data anyone can access, use, and share. Most agencies ask to be referenced in reports when their data are used. https://data.govt.nz is a useful catalogue.

Qualitative data – data that approximate and characterise based on interpretation, for example, 'There's so many hungry tuna here this morning, it freaked me out!'

Quantitative data – data that can be observed and recorded in a repeatable manner, for example, 'I counted 14 tuna at X site at 4am on 1 February 2021'.

Satellite imagery – from satellites in space from low earth orbit, formatted and provided for use as base-maps.

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below try copying and pasting the web address into your browser search bar.

References

Tipa G, Teirney L 2006. *A cultural health index for streams and waterways: a tool for nationwide use.* Report prepared for the Ministry for the Environment. https://www.environment.govt.nz/assets/Publications/Files/cultural-health-index-for-streams-and-waterways-tech-report-apr06.pdf

Toitū Te Whenua – Land Information NZ

Toitū Te Whenua facilitates a programme of short, online mapping wānanga to help you learn how to map your whenua and tell your stories through GIS mapping. These interactive wānanga, specifically tailored to those working for iwi, Māori trusts, and environmental groups, are all recorded for on-demand viewing.

Ngā Poutama Matawhenua – Practical Māori GIS Mapping Wānanga
https://www.linz.govt.nz/poutama

Contact details for Duane Wilkins

Email: DWilkins@linz.govt.nz

GLOSSARIES

NGĀ WHAKAMĀRAMA GLOSSARY

This glossary has been produced to support the reader in their understanding of the Māori words used in this handbook. Such is the complex nature of the Māori language, one word can have different meanings depending on the context it is used in. The glossary has endeavoured to provide multiple meanings for these complex words. However, the direct translations used for some of these more complex words may not truly represent the meaning in which the authors was intending.

The definitions of the words/terms found in this glossary are based on the *Tai Tumu, Tai Pari, Tai Ao Waikato-Tainui Environmental Plan* and the online *Te Aka Māori-English, English-Māori Dictionary* http://maoridictionary.co.nz

*Indicates definitions from *Tai Tumu, Tai Pari, Tai Ao Waikato-Tainui Environmental Plan* https://waikatotainui.com/tai-timu-tai-pari-taiao

Te Reo Māori	Te Reo Pākeha
A	
Aotearoa	Traditional name for New Zealand
Ahu otaota	Shell middens
Ake, ake	Forever and ever
Ariari	Board used during white-baiting
Ariki	Paramount chief, high chief, chieftain, lord, leader, aristocrat, first-born in a high ranking family – qualities of a leader is a concern for the integrity and prosperity of the people, the land, the language and other cultural treasures
Arohatanga	To love, feel compassionate, empathise
Ātaahua	Beautiful, handsome, pleasant, pretty, lovely
Atua	God
Awa	River, stream, waterways, fresh water bodies
Awhi rito or mātua	The 'parent' leaves of the harakeke (NZ flax); these leaves sit on either side of the youngest leaf (rito) in the fan
H	
Hapū*	Subtribe, usually containing a number of whānau (family unit) and marae (gathering place) with a common ancestor or ancestors
Hāpua	Lagoon
Hauanga kai*	The customary and contemporary gathering and use of naturally occurring and cultivated foods (see mahinga kai)
Haukāinga	Home, true home, local people of a marae, home people
Haumiatiketike	Atua (God) of fernroot and uncultivated food
Hawaiki	Ancient homeland
Hīkoi	To step, stride, march, walk
Hīnaki	Wicker eel basket Fyke net – used in this context as a method for kōura (freshwater crayfish) monitoring
Hītori	History
Hua rākau	Fruit tree
Hui	To gather, congregate, assemble, meet
I	
Iwi*	Extended kinship group, tribe, nation, people, nationality, race; often refers to a large group of people descended from a common ancestor
Iwi rangatiratanga	Iwi direction, leadership, authority
K	
Kāhui	Collective, committee
Kai	Eat, food, dine
Kaihaukai	Tribal feast
Kaimahi	Worker

Kāinga	Home, settlement, residence
Kairongoā	Medicinal practitioner
Kaitiaki*	Caregiver, caretaker, guardian, the role of protecting and nurturing the māuri of all things and the surrounding inanimate environment
Kaitiakitanga*	The exercise of kaitiaki (guardian) roles and responsibilities. The exercise recognises the intricate balance and integral relationship between all natural resources
	Sustainable resource management
Kaka	Traditional form of the scoop net used to harvest whitebait on the lower Waikato River
Kanohi ki te kanohi	Face to face, in person, in the flesh
Kāo	No – used only as a negative answer to a question
Kapa haka	Māori performing group
Kapua	Cloud, bank of clouds
Karakia	To recite ritual chants, say grace, pray, recite a prayer, chant
Karanga	Formal call, ceremonial call, welcome call; a ceremonial call of welcome to visitors onto a marae (gathering place), or equivalent venue, at the start of a pōwhiri (welcome ceremony)
Kaumātua*	Elders (male or female)
Kaupapa	Topic, policy, matter of discussion, plan, purpose, scheme, proposal, agenda, programme, theme, issue, initiative
Kaupapa Māori research	An approach underpinned by Māori values; generally utilised by researchers who are Māori, and who are undertaking research with, and for Māori
Kāuta	Cooking shed, kitchen, cookhouse, house, shack, lean-to
Kawa	Protocols and customs
Kawenata	Covenant, testament, charter, contract, agreement, treaty – any undertaking that binds parties in a permanent and morally irrevocable relationship
Kete	Handwoven basket
Kīngitanga	King Movement, developed in the 1850s, and established to stop the loss of land, promote Māori authority, maintain law and order, and promote traditional values and culture
Ki uta ki tai	Recognising the connections across landscape, people and ecosystems. Literally translated as 'From the mountains to the sea'
Koere	Bracken fern bundles used for kōura (freshwater crayfish) monitoring
Koha	Gift, offering, donation, contribution
Kōhanga	A nursery for the young – used in this handbook as a reference to the important role of healthy ecosystems in the rearing of important species from juvenile to adult
Kōiwi	Human bones, corpse
Korapa awa	A stop net made of shade cloth
Kōrari	Generic term for the flowers of the harakeke (NZ flax)
Kōrero	Conversation, discussion
Koroneihana	Coronation. The largest annual gathering of followers of the Kīngitanga (King movement), celebrating the anniversary of the anointing of the Māori King or Queen
Korowai	Cloak
Kōwhaiwhai	Painted scroll ornamentation – commonly used on meeting house rafters
Kuia	Elder woman
M	
Mahau	Porch of the meeting house
Mahi	Work, job, employment, trade (work), practice, occupation, activity, exercise, operation, function
Mahinga kai	Customary and contemporary gathering and use of naturally occurring and cultivated foods
Mahinga mātaitai	Customary seafood gathering site, shellfish bed
Maimai aroha	Lament, expression or token of affection
Mahi toi	Artwork
Māmā	Mother
Mana	Authority, spiritual authority, protective power and prestige
Manaakitanga	The provision of sustenance, care, and support, particularly in the hospitality shown to manuhiri
Manaaki tāngata	To show support and hospitality
Mana motuhake	Separate identity, autonomy, self-government, self-determination, independence, sovereignty, authority – mana (authority) through self-determination and control over one's own destiny
Mana whakahaere	The exercise of rights and responsibilities to ensure that the balance and mauri (life force) of the rohe (area) is maintained
Mana whenua	The tāngata whenua (Indigenous people) group or groups with primary mana whakahaere (rights and responsibilities) over an area
Manuhiri, manuwhiri	Visitor, guest

Māori	Indigenous New Zealander, indigenous person of Aotearoa New Zealand
Marae*	Traditional and contemporary gathering places that may contain a wharenui (meeting house), wharekai (dining room), wharepaku (ablution block), whare (other houses or structures); may also include a papakāinga (communal Māori land)
	In Māori society, the marae is a place where the culture can be celebrated, where the Māori language can be spoken, where intertribal obligations can be met, where customs can be explored and debated, where family occasions such as birthdays can be held, and where important ceremonies, such as welcoming visitors or farewelling the dead (tangihanga), can be performed. Like the related institutions of old Polynesia, the marae is a wāhi tapu (sacred place) which carries great cultural meaning
Māra kai	A place where food is grown, often used in reference to the more contemporary version of a vegetable garden
Maramataka	Planting and fishing calendar
Maro kuta	Small loincloth worn by women, made from kuta (giant spike rush)
Mātaitai	Seafood, shellfish
Mātai tuarangi	Cosmology
Matariki	Pleiades, the Seven Sisters – an open cluster of many stars in the constellation Taurus, with at least six stars visible to the naked eye
Mātauranga	Knowledge, wisdom, understanding
Mātauranga Māori*	Traditional and contemporary Māori knowledge, knowledge systems and knowledge bases. This includes the body of knowledge originating from Māori ancestors, including Māori worldview and perspectives, Māori creativity, and cultural and spiritual practices. As an organic and living knowledge base, mātauranga Māori is ever growing and expanding
Mātua	Parents
Maunga	Mountain
Mau rākau	Wielding of weapons
Mauri*	Life force. Some hold the view that both animate and inanimate objects have mauri
Mita	Pronunciation, sound of a language distinct to a hapū (subtribe) or iwi (tribe) when compared to others from other rohe (areas)
Moana	Sea, ocean, large lake
Moko kauae	Traditional female facial tattoo
Mokopuna	Descendant, grandchild
Mōteatea	Lament, traditional chant
Motu	Island, country
Muka	Fibre inside the leaf of the harakeke (NZ flax) highly valued for its strength
N	
Ngā atua wāhine	Founding female elements, female Gods
Ngahere	Bush, forest
Ngā mihi	Acknowledgements
Ngāti	Prefix for a tribal group
Nohoanga	Dwelling place, abode
O	
Oriori	Lullaby
P	
Pā	Inhabitants of a fortified place
	Large groupings of plants valued by Māori weavers, e.g. pā harakeke, pā kuta, pā raupō
Pae pae	Dredge net used for kōura (freshwater crayfish) monitoring
Paimārire	Christian faith still practiced by Waikato Māori
Pāke	Cape
Pāke kuta	Cape made from kuta (giant spike sedge, *Eleocharis sphacelata*)
Papakāinga	Original home, home base, village, communal Māori land
Papatipu rūnanga	Uphold the mana (authority)of Ngāi Tahu (South Island tribal group) people over the land, sea, and natural resources
Papatūānuku	Earth, Earth mother and wife of rangi-nui – all living things originate from them
Paru	Muds valued by Māori weavers for their dyeing properties
Pā tuna	Eel weir, weir for catching eels
Pēpe	Baby, infant
Pepeha	Formulaic expression, saying of the ancestors
Piupiu	Woven garment
Poho	Chest
Poi	Lightweight ball on a string of varying length that is swung or twirled rhythmically to sung accompaniment
	Poi dance – songs performed in which the poi is swung in various movements to accompany the singing
Pōtae	Hat
Pōtae taua	Mourning cap or wreath
Pōtiki	Youngest child
Pou	Post, pole, pillar

Poukai	King movement gathering – hui (gathering) held on marae (gathering place) where people who support the Kīngitanga (King movement) demonstrate their loyalty, contribute to funds, and discuss movement affairs
Pōwhiri	Welcome ceremony on a marae
Puku	Stomach
Puna	Spring, well, pool
Puna kauhoe	Swimming holes
Pūrākau	Mythology, ancient legend, story
Pūtaiao	Science
R	
Rākau	Tree, stick, timber, wood, spar, mast, plant
Rama kōura	Hand nets
Rangahau	Research
Rangatahi	Youth, younger generation
Rangatira	Chief (male or female), chieftain (male or female), master, mistress, boss, supervisor, employer, landlord, owner, proprietor. The qualities of a leader are of concern to the integrity and prosperity of the people, the land, the language, and other cultural treasures (e.g. oratory and song poetry); an aggressive and sustained response to outside forces that may threaten these
Rangatiratanga	Chieftainship, right to exercise authority, chiefly autonomy, chiefly authority, ownership, leadership of a social group, domain of the rangatira (chief), attributes of a chief
Rangi-nui	Atua (God) of the sky and husband of Papatūānuku (Earth mother)
Raranga	To weave
Raupatu	Confiscation, conquered, overcome. Often used in relation to forceful land acquisition
Repo	Swamp, bog, marsh
Reporepo	Swamp
Ringatoi	Artist
Ringawera	Kitchen workers
Ritenga	Custom, customary practice, habit, practice, resemblance, implication
Rito	Growing shoot of the harakeke (NZ flax)
Rohe	District, area, territory, vicinity, region (see takiwā)
Rongoā Māori	Traditional medicine, remedy
Rongoā rākau	Traditional medicinal plants
Rongo mā Tāne	Atua (God) of the kūmara and cultivated food
Rōpū	Group, party of people, company, gang, association, entourage, committee, organisation
Rua	Storage pit
Rūnanga	Tribal council, iwi authority
T	
Takiwā	District, area, territory, vicinity, region (see rohe)
Take	Topic, subject, matter, issue, concern
Taiao	Earth, natural world, environment
Tā moko	Traditional tattoo
Tā moko uhi	Chisel for traditional tattoo
Tāngata tiaki	Caregiver, caretaker, guardian, the role of protecting and nurturing the māuri of all things and the surrounding inanimate environment. See also kaitiaki
Tangata whenua*	Local people, hosts, Indigenous people – Māori and their whānau (families), hapū (subtribe), iwi (tribe) that whakapapa, or have genealogical connections, back to the land by virtue of first or primary occupation of the land by ancestor(s) through a variety of mechansims such as maintaining ahi kā roa (long term occupation) or conquest
Tangaroa	Atua (God) of the sea and fish
Tangi/tangihanga	Funeral
Tāne mahuta	Atua (God) of the forests and birds
Taniwha	Water spirit, powerful creature, leader, chief
Taonga	Treasure – applied to anything considered to be of value including socially or culturally valuable objects, resources, phenomenon, ideas and techniques
Taonga species	Native birds, plants, and animals of cultural significance
Tāpau	Floor mat (see also tuwhara)
Tapu	Sacred, prohibited, restricted – a supernatural condition
Tapu noa	To be free from the extensions of tapu (sacred), ordinary, unrestricted, void
Taruke	Fern bundles used for kōura (freshwater crayfish) monitoring
Taua	War party
Tau kōura	Method of catching kōura (freshwater crayfish)
Tāwhirimātea	Atua (God) of the winds, clouds, rain, hail, snow and storms
Te Ao Tūroa	Earth, nature, natural world
Te Ira Tāngata	Humankind

Te Ika-a-Māui	North Island of New Zealand
Te Reo Māori	Māori language
Te Urutapu o Tāne	The sacred realm of Tāne
Te Wai Pounamu	South Island of New Zealand
Te Waonui a Tāne	Forest mythology
Tikanga	The customary system of values and practices that have developed over time and are deeply embedded in the social context
Tohu	Sign, mark, symbol, indicators of an event
Tohunga	Chosen expert, healer
Tohunga whakairo	Master carver
Toi whenua	Customary designation for hapū (subtribe) holding ancestral rights to a particular area
Tūmanako	Hopes, dreams, desires
Tūmatauenga	Atua (God) of war
Tuna heke	Downstream eel migration
Tupuna/tūpuna	Ancestor/ancestors
Tupuna awa	Ancestral river
Tuwhara	Floor mat (see also tāpau)
U	
Uri	Descendants
W	
Wāhi tapu	Sacred site, sacred place
Wai	Water
Waiora	Healing waters
Waiata	Song
Waikato-Tainui*	People who descend from or affiliate to a recognised Waikato-Tainui (tribal people of the Waikato Region) marae, hapū, or iwi
Wairākau	Medicinal tea
Wairua	Spirit
Wairuatanga	Spirituality
Waka taua	War canoe
Wānanga	Seminar, conference, forum, educational seminar
	Tribal knowledge, lore, learning
Wero	Challenge
Whakaaro*	Thought, opinion, plan, understanding, idea, intention, gift
Whakairo	Carving, sculpture, ornament with a pattern
Whakapapa	Genealogy, lineage, descent, layers of kin relationships
	Connections between and within flora/fauna species
Whakararu	Frustrating, confusing, exasperating, annoying, problem
Whakatauākī	Proverb, significant saying; where the person who said it first is known
Whakataukī	Proverb, significant saying; where the person who said it first, is not known
Whakaweku	Fern bundles used for kōura (freshwater crayfish) monitoring
Whānau*	Family unit, not always immediate family, and may include those that are family by marriage, adoption, fostering, or other close relationship
Whanaungatanga	Relationship, kinship, sense of family connection
Whānui*	Broad, wide, extensive
Whare	House
Whenua	Land
Whetūrangi	To appear above the horizon (a star or the moon)
Whītau	Harakeke (NZ flax) fibre

LIST OF FLORA AND FAUNA SPECIES

	A sample of Māori name(s)	Common names	Scientific Names
Ngā ika | Fish	Īnanga, īnaka, karohi, karohe	Whitebait, īnanga	*Galaxias maculatus*
	Īnanga	Dwarf īnanga	*Galaxias gracilis*
	Kahawai	Kahawai	*Arripis trutta*
	Kanae	Grey mullet	*Mugil cephalus*
	Kōkopu	Banded kōkopu	*Galaxias fasciatus*
		Giant kōkopu	*Galaxias argenteus*
		Shortjaw kōkopu	*Galaxias postvectis*
	Kōaro	Climbing galaxias	*Galaxias brevipinnis*
		Shortjaw kōaro	*Galaxias postvectis*
	Hauhau, waikaka	Brown mudfish	*Neochanna* spp.
	Matamata, Ngā karu o Matariki	Whitebait, No. 1 whitebait	*Galaxias* spp.
	Morihana	Common gold fish	*Carrassius auratus*
	Piharau, kanakana	Lamprey	*Geotria australis*
	Porohe, karawaka	Common smelt, cucumber fish	*Retropinna retropinna*
	Toitoi	Common bully	*Gobiomorphus cotidianus*
	Tunatuna	Glass eel	*Anguilla* spp.
	Tuna	Long-fin eel	*Anguilla dieffenbachii*
		Short-fin eel	*A. australis*
		Australian longfin eel	*A. reinhardtii*
		Brown bull-headed cat fish	*Ameiurus nebulosus*
		Bullies	*Gobiomorphus* spp.
Ngā mātaitai | Molluscs & bi-valves	Kāeo, kākahi	Freshwater mussel	*Hyridella menziesii*
	Karahū	Mud snail	*Potamopyrgus* spp.
	Kōura, kēwai	Freshwater crayfish	*Paranephrops planifrons* *P. zealandicus*
	Kūtai, kuku	Green-lipped mussel	*Perna canaliculaus*
	Pipi	Pipi	*Paphies australis*
	Pūpū	Cat's eye	*Turbo smaragdus*
	Tuatua, kahitua	Tuatua	*Amphidesma subtriangulatum* *Paphies subtriangulata*
Ngā tipu taketake | Native plants	Harakeke	New Zealand flax	*Phormium tenax*
	Hangehange	New Zealand privet	*Geniostoma ligustrifolium*
	Hoheria, houhere	Ribbonwood, lacebark	*Hoheria* spp.
	Kahikatea	White pine	*Dacrycarpus dacrydioides*
	Kānuka	Kānuka	*Kunzea robusta*
	Karaka	New Zealand laurel	*Corynocarpus laevigatus*
	Karamū	Coprosma	*Coprosma robusta*
	Kareao, piritā	Supplejack	*Ripogonum scandens*
	Kāretu	Kāretu	*Hierochloe redolens*
	Kauri	Kauri	*Agathis australis*

	A sample of Māori name(s)	Common names	Scientific Names
Ngā tipu taketake | Native plants continued...	Kawakawa	Kawakawa	*Piper excelsum*
	Kiekie	Gigi bush, gigi	*Freycinetia banksii*
	Kōkihi, rengamutu, tūtae-ika-moana	Native spinach	*Tetragonia* spp.
	Koromiko	Hebe	*Veronica salicifolia, V. stricta*
	Kōwhai, kō'wai	Kōwhai	*Sophora* spp.
	Kowhangatara	Spinifex	*Spinifex sericeus*
	Kōwhitiwhiti, poniu, panapana	Native watercress	*Rorippa* spp.
	Kūmara	Sweet potato	*Ipomoea batatas*
	Kūmarahou	Gumdigger's soap	*Pomaderris kumeraho*
	Kuta, ngāwhā, paopao	Giant spike sedge	*Eleocharis sphacelata*
	Māhoe	Whiteywood	*Melicytus ramiflorus*
	Maire tawake, waiwaka	Swamp maire	*Syzygium maire*
	Makamaka	Marsh, saltmarsh ribbonwood	*Plagianthus divaricatus*
	Makomako	Wineberry	*Aristotelia serrata*
	Mamaku	Black tree fern	*Cyathea medullaris*
	Mānuka, kahikatoa	New Zealand tea tree	*Leptospermum scoparium*
	Mapou, matipo	Mapou, matipo	*Myrsine australis*
	Mataī	Mataī	*Prumnopitys taxifolia*
	Mikoikoi, tūkāuki	New Zealand satin flower	*Libertia* spp.
	Mingimingi	Swamp mingimingi	*Coprosma propinqua*
	Miro	Miro	*Prumnopitys ferruginea*
	Mouka, mātātā	Water fern Hen & chicken fern	*Histiopteris incisa* *Asplenium bulbiferum*
	Nahui	Nahui	*Alternanthera nahui*
	Nau	Cook's scurvy grass	*Lepidium oleraceum*
	Nīkau	Nīkau palm	*Rhopalostylis sapida*
	Oioi	Jointed wire rush	*Apodasmia similis*
	Pānakenake	Pratia	*Lobelia angulata*
	Patē, patetē	Seven finger	*Schefflera digitata*
	Pīngao	Pīngao, golden sand sedge	*Ficinia spiralis*
	Piripiri	Purple bidibidi	*Acaena inermis*
	Ponga	Silver fern	*Cyathea dealbata*
	Puha	Sow thistle	*Sonchus* spp.
	Pukatea	Pukatea	*Laurelia novae-zelandiae*
	Pukupuku	Rasp fern	*Doodia media*
	Pūrekireki, pūrei, pūreirei, pukio	Carex, swamp sedge	*Carex virgata, C. secta, C. gaudichaudiana*
	Putaputawētā, kaiwētā	Marbleleaf	*Carpodetus serratus*

	A sample of Māori name(s)	Common names	Scientific Names
Ngā tipu taketake | Native plants continued...	Rautahi	Cutty grass	*Carex geminata*
	Rauparaha	Shore bindweed	*Calystegia soldanella*
	Raupō, koarearea	Raupō, bulrush	*Typha orientalis*
	Raurekau, manono, kanono, kawariki	Raurekau, manono, kanono, kawariki	*Coprosma grandifolia, C. autumnalis*
	Remuremu	Bonking grass	*Selliera radicans*
	Rimu	Rimu	*Dacrydium cupressinum*
	Tapuwae karitehe	Musk	*Mazus radicans*
	Tātarāmoa	Bush lawyer	*Rubus cissoides*
	Tauhinu	Tauhinu	*Ozothamnus leptophyllus*
	Tawapou	Native jasmine	*Parsonsia heterophylla*
	Tī kōuka, kōuka, mauku, whanake	Cabbage tree	*Cordyline australis*
	Toetoe	Toetoe	*Austroderia* spp.
	Turutu	Swamp turutu	*Dianella haematica*
	Tūtae kōau	Native celery	*Apium prostratum* subsp. *prostratum* var. *filiforme*
	Tutu, tūpākihi	Tutu	*Coriaria* spp.
	Tūtunawai	Swamp willow-weed	*Persicaria decipiens*
	Ūpoko-a-tangata	Giant umbrella sedge	*Cyperus ustulatus*
	Ureure (tidal)	Glasswort	*Salicornia quinqueflora*
	Waewae kahu	Tangle fern	*Gleichenia dicarpa*
	Whaririki	Mountain flax	*Phormium cookianum*
	Whekī	Rough tree fern	*Dicksonia squarrosa*
	Wīwī	Bamboo rush	*Sporadanthus* spp.
		Bulrush, three-square	*Schoenoplectus pungens*
		Jointed twig rush	*Machaerina rubiginosa*
		Rushes	*Juncus* spp.
		Sand coprosma	*Coprosma acerosa*
		Shore pimpernel	*Samolus repens*
		Soft stem bulrush	*Schoenoplectus tabermontanii*
		Wire rush	*Empodisma* spp.
		Fountain sedge	*Lepidosperma neozelandicum*
		Gumland grass tree	*Dracophyllum lessonianum*
		Kākābeak	*Clianthus* spp.
		Little hard fern	*Blechnum penna-marina*
		Maidenhair	*Adiantum* spp.

	A sample of Māori name(s)	Common names	Scientific Names
Ngā tipu taketake | Native plants continued...		Shore cotula	*Leptinella dioica*
		Swamp daisy	*Olearia solandri*
		Swamp millet	*Isachne globosa*
		Tussock	*Chionochloa* spp.
Ngā tipu mai tāwāhi | Exotic plants	Rākau Pākeha	Alligator weed	*Alternanthera philoxeroides*
		Brazilian waterweed	*Egeria densa*
		Blackberry	*Rubus* spp.
		Crack willow	*Salix fragilis*
		Elephant grass	*Pennisetum purpureum*
		Grey willow	*Salix cinerea*
		Gum tree	*Eucalyptus* spp.
		Hornwort	*Ceratophyllum demersum*
		Kikuyu grass	*Cenchrus clandestinus*
		Macrocarpa	*Cupressus macrocarpa*
		Oxygen weed	*Elodea canadansis*
		Pampas	*Cortaderia* spp.
		Pine	*Pinus* spp.
		Privet	*Ligustrum lucidum, L. sinense*
		Reed sweetgrass	*Glyceria maxima*
		Wandering willy	*Tradescantia fluminensis*
		Yellow flag iris	*Iris pseudacorus*
		Yorkshire fog	*Holcus lanatus*
	Taro	Taro	*Colocasia esculenta*
	Wātakirihi	Common watercress	*Nasturtium* spp.
Ngā manu | Birds	Kāhu	Swamp harrier	*Circus approximans*
	Kāruhiruhi	Pied shag	*Phalacrocorax varius*
	Kawau, kawau-tua-whenua	Black shag, great cormorant	*Phalacrocorax carbo*
	Kawau paka	Little shag	*Phalacrocorax melanoleucos*
	Kawau tūī	Little black shag, little black cormorant	*Phalacrocorax sulcirostris*
	Kiwi	Kiwi	*Apteryx* spp.
	Korimako, makomako	Bellbird	*Anthornis melanura*
	Kōtare	Sacred kingfisher	*Todiramphus sanctus*
	Kotoreke, koitareke	Marsh crake	*Porzana pusilla*
	Kotuku	Kotuku, egret	*Egretta alba modesta* *E. garzetta immaculatae*
	Kotuku-ngutupapa	Royal spoonbill	*Platalea leucorodia regia*

	A sample of Māori name(s)	Common names	Scientific Names
Ngā manu | Birds continued...	Kuruwhengi	Australasian shoveler, spoonbill	*Anas rhynchotis variegata*
		Northern shoveler	*Anas clypeata*
	Mātātā	Fernbird	*Bowdleria punctata*
	Matuku	Australasian bittern	*Botaurus poiciloptilus*
	Matuku-moana	White-faced heron, blue crane	*Ardea novaehollandiae*
	Pāpango, matapōuri, raipo, titipōrangi	New Zealand scaup, black teal duck, diving duck	*Aythya novaseelandiae*
	Pārera	Grey duck	*Anas superciliosa*
	Pāteke	Brown teal	*Anas chlorotis*
	Poaka	Pied stilt	*Himantopus himantopus*
	Pūtangitangi, pūtakitaki, pari	Paradise shelduck	*Tadorna variegata*
	Pūteketeke, kāha, kāmana	Australasian crested grebe	*Podiceps cristatus*
	Pūweto, putoto	Spotless crake	*Porzana tabuensis*
	Riroriro	Grey warbler	*Gerygone igata*
	Ruru, rurukoukou, koukou	Morepork, New Zealand owl	*Ninox novaeseelandiae*
	Tauhou	Silvereye	*Zosterops lateralis*
	Tuī, koko	Tui, parson bird	*Prosthemadera novaeseelandiae*
	Tūturiwhatu, pohowera	Banded dotterel	*Charadrius bicinctus*
	Wāna, wani, kakiānau	Black swan	*Cygnus atratus*
	Weka	Woodhen	*Gallirallus australis*
	Weweia, taihoropī, taratimoho, totokipio	New Zealand dabchick	*Poliocephalus rufopectus*
		Canada goose (exotic)	*Branta canadansis*
		Caspian tern	*Hydroprogne caspia*
		Greylag goose (exotic)	*Anser anser*
		Mallard (exotic)	*Anas platyrhynchos*
		White swan (exotic)	*Acygnus olor*
Ngā whāngote | Mammals	Kiore	Rat (exotic)	*Rattus* spp.
	Pekapeka	Short-tailed bat Long-tailed bat	*Mysticina tuberculata* *Chalinolobus tuberculatus*
	Tuatara	Tuatara	*Sphenodon* spp.
		Common (brushtail) possum (exotic)	*Trichosurus vulpecula*
		Ferret (exotic)	*Mustela* spp.
		Mouse (exotic)	*Mus* spp.
		Stoat (exotic)	*Mustela* spp.
Ngā tuaiwi-kore | Invertebrates	Anuhe, moka, mūharu	Windower caterpillar	*Orthoclydon praefactata*
	Mokamoka harakeke	Flax notcher caterpillar	*Tmetolophoto steropastis*
	Noke, toke	Earthworm	*Megascolides maoricus, Octochaetus multiporus*

	A sample of Māori name(s)	Common names	Scientific Names
Ngā tuaiwi-kore | Invertebrates continued...	Pāpapa, tātaka	Ground beetle	*Physolaesthus insularis*
	Toke tūtae tawhiti	Dung worm (exotic)	*Lumbricus rubellus*
	Toke momo rāwaho	Asian snake worm (exotic)	*Amynthas cortices*
		Earthworm (exotic)	*Octolasion tyrtaeum*
	Toke (Te Tai Tokerau)	North Auckland giant eartworm	*Spenceriella gigantea*
	Wētā	Wētā	*Stenopelmatidae* spp. *Rhapidophoridae* spp.
		Daphnia	*Daphnia galeata*

'Te Reo o Te Repo – Kei konei tonu au is the culmination of much effort, bringing together many individuals and organisations to share their ngākau whiwhita (passion), tikanga and mātauranga Māori (cultural values and knowledge), wheako (experiences), whakaaro (thoughts and ideas), and tūhononga ki te repo (connection to wetlands) and kaitiakitanga (guardianship) …. There is no more important lesson than the power of collaboration when we agree to work together for a common purpose or goal – especially one that benefits our whenua and Earth Mother Papatūānuku.'

Garth Harmsworth (Te Arawa, Ngāti Tūwharetoa, Tūhourangi, Ngāti Raukawa)

Toi Rangahau Māori, Principal Scientist

Manaaki Whenua