



TE REO O TE REPO

THE VOICE OF THE WETLAND

CONNECTIONS, UNDERSTANDINGS AND LEARNINGS
FOR THE RESTORATION
OF OUR WETLANDS

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

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Te Reo o Te Repo

The Voice of the Wetland. Connections, understandings
and learnings for the restoration of our wetlands

2017

Edited by

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Iti ora flax.
Made by Amiria McGarvey

FOREWORD

Noo taatou te awa, noo te awa taatou

We belong to the river, the river belongs to us

Sir Robert Te Kotahi Mahuta

Te Reo o Te Repo: The Voice of the Wetland, is the first handbook to focus on the importance of repo (wetland) values in Aotearoa New Zealand from a cultural perspective. This handbook is the culmination of several years of research partnership between the Waikato Raupatu River Trust (entity of Waikato-Tainui tribal organisation) and Manaaki Whenua – Landcare Research. The editors of the handbook have successfully interwoven diverse knowledge, values, and perspectives (including maatauranga iwi (Maaori knowledge)) from kaitiaki (guardians) and kairangahau (researchers) to provide unique insights into the cultural significance of repo, that help define the priorities for repo restoration throughout both distinct tribal rohe (region) and the entire motu (Aotearoa New Zealand).

Repo have cultural, spiritual, historic, and economic value to tangata whenua (indigenous people). Despite this, more than 90% of repo throughout Aotearoa have been destroyed. For Waikato-Tainui (tribal people of the Waikato Region), repo are the kidneys for the Waikato River – they cleanse and filter out the toxins from the surrounding land catchment before entering into our tupuna awa (ancestral river). The Waikato River is more than a river: she is our tupuna (ancestor), giving sustenance to the whenua (land) that then feeds our people. Repo are also the food basket for the Waikato people – the resources on which Waikato-Tainui rely for hauanga kai (food gathering sites).

Repo are a major component within the whakapapa (connection) of our rivers and lakes, reflecting our values and providing significant spawning grounds and habitat for diverse, culturally important taonga, including plants, animals, fish, birds, and insects. The mauri (life force) of repo for Waikato-Tainui is linked to the overall ecological health and wellbeing of our whakapapa. Adverse impacts on the whakapapa of our repo will therefore have corresponding undesirable effects on mauri and the ability of the tribe to utilise hauanga kai. Our aspiration is for our tupuna awa to return to its pristine state. The awa and repo are the beneficiaries of our efforts to restore these important natural resources.

Te Reo o Te Repo reveals the rich connection that whaanau, marae, hapuu, and iwi have with their repo. It also highlights the collaborative efforts between tangata whenua and research providers to restore these unique ecosystems and increase the health and wellbeing of our repo for future generations.



Rahui Papa (Ngaati Koroki-Kahukura)
Chairman of Te Arataura o Waikato-Tainui

Ko te mātauranga he wai nō ruawhetū

Kia mahara koe i te puna inā inu koe i te wai

Ko wai koe?

Ko wai ahau?

Ko wai ahau

Māori knowledge flows from the cosmos

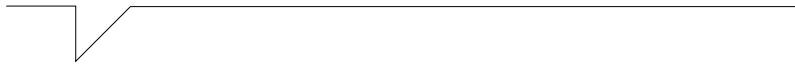
When you drink the water, remember the spring

Who are you?

Who am I?

I am water

Rangi Matamua



INTRODUCTION

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

Repo (wetlands), also known as reporepo, poharu, and roto, are regarded by Māori as taonga with historical, cultural, economic, and spiritual significance. Repo can also be reservoirs for mātauranga (knowledge), wellbeing, and utilisation. They are mahinga kai (food gathering sites) used by local marae (Māori social and cultural centres), whānau (families), hapū (subtribes), and iwi (tribes), and provide significant habitats for a range of taonga (culturally important) plants, animals, fish, birds, reptiles, insects, and micro-organisms. In addition, many repo contain a variety of culturally important medicinal plants for rongoā (Māori medicinal use).

Mallard ducks in flight at Te Pūaha o Waikato, Port Waikato.
Photo: Cheri van Schravendijk-Goodman



In the last 150 years, more than 90% of repo in Aotearoa New Zealand have been destroyed, and remaining repo are under threat from land modification and other human activities. Māori are becoming increasingly aware of the dire state of repo and this has resulted in many hapū and iwi-led projects centred on the restoration of repo within their rohe (region).

Te Reo o Te Repo: The Voice of the Wetland, highlights a range of mahi (work) undertaken by whānau, marae, hapū, and iwi to increase the health and wellbeing of their repo.

The handbook includes processes to facilitate renewed and vibrant connections between whānau and their repo, understanding of cultural resources, and learnings from case studies on repo restoration, cultural indicators, and monitoring – all led by or in collaboration with tangata whenua (indigenous people).

The articles are written by kairangahau Māori (Māori researchers) and environmental managers, as well as researchers who work with iwi and hapū partners. The handbook aims to provide best practice techniques for the enhancement and protection of cultural wetland values to share with tangata whenua throughout the motu (country). It will also help local authorities, research providers, and community groups understand the cultural priorities for repo restoration.

The handbook is a web-based resource, which is intended to be a living document, and supports and enhances the [Wetland Restoration Handbook](#) developed in 2010. In the future, other mahi can be added where whānau, marae, hapū, and iwi can share their stories on repo restoration. The current articles are only a small sample of the range of mahi occurring throughout the motu.

Weavers hui, Te Kaha. Photo: Sue Scheele



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

Handbook structure

The articles in *Te Reo o Te Repo* are a small sample of research, contributed by researchers 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. From Northland to the deep South, 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.

Whitebait spawning habitat restoration Mangatī Stream, Te Pūaha o Waikato. Photo: Cheri van Schravendijk-Goodman

Section One:

Process of engagement – 'Kapu tī'

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 ways kairangahau and whānau, marae and hapū have navigated the initial steps, and the valuable outcomes of those interactions and developing relationships.



Pre-restoration visit to Maurea Islands with local kaumātua.
Photo: Paul Champion



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 include taonga (culturally significant) plants for eating – wātakirihi (watercress), and weaving – kuta (giant spike sedge) and harakeke (NZ flax); and a range of fish, birds, and even invertebrates (e.g. insects or microscopic animals) that are highly regarded by tangata whenua.



Pā harakeke. Photo: Sue Scheele

Section Three: Tools and Approaches

Tools

The use of herbicides for the removal of unwanted plants within the natural environment can be a controversial approach to restoration. Considerations for the use or non-use of herbicides in repo restoration projects according to the whakaaro (philosophy) of the whānau, marae, hapū, and iwi can be explored collaboratively with research providers. This section investigates some of the work that has been undertaken in this area with the involvement of tangata whenua.

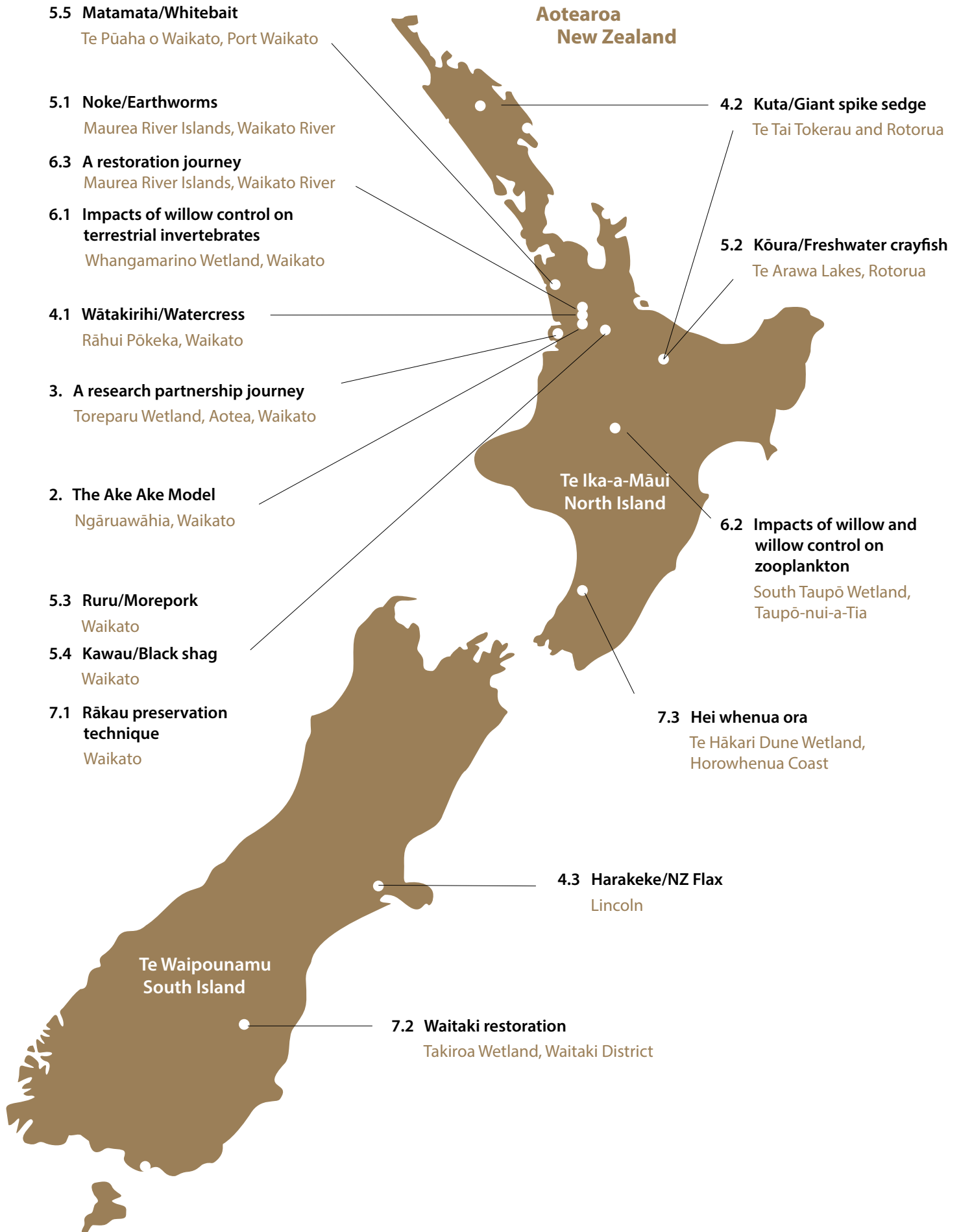
Mātauranga Māori – Māori knowledge

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.

Wetlands along Waikato River margin, Te Pūaha o Waikato.
Photo: Cheri van Schravendijk-Goodman



HOW OUR STORIES CONNECT ACROSS THE LANDSCAPE



MĀORI CONVENTIONS USED THROUGHOUT THE HANDBOOK

Haimona Waititi (Te Whānau-a-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:

- Manaaki Whenua – Landcare Research/LR
- 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.

Ō Tū Wharekai Wetland, Ashburton Lakes District.
Photo: Beverley Clarkson



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, inanga, inaka, karohe, etc.

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

Tupuna salute, te tira hoe o Waikato, Te Pūaha o Waikato, 2015.
Photo: Waikato Raupatu River Trust



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 | |
|---|--|
| <p>Pūrekireki, pūrei Swamp sedge <i>Carex secta</i> and <i>C. virgata</i></p> <p><i>Carex secta.</i> Photo: Beverley Clarkson</p> |  |
| <p>Ūpoko-a-tangata Giant umbrella sedge <i>Cyperus ustulatus</i></p> <p><i>Cyperus ustulatus.</i> Photo: Wayne Bennett</p> |  |
| <p>Kōwhitiwhiti, poniu, panapana Native watercress <i>Rorippa palustris</i> and <i>R. divaricata</i></p> <p><i>Rorippa palustris.</i> Photo: Jeremy Rolfe</p> |  |

| Exotic plants | |
|--|---|
| <p>Yellow sedge <i>Carex demissa</i> Grey sedge <i>C. divulsa</i></p> <p><i>Carex demissa.</i> Photo: Trevor James</p> |  |
| <p>Umbrella sedge <i>Cyperus eragrostis</i></p> <p><i>Cyperus eragrostis.</i> Photo: Jeremy Rolfe</p> |  |
| <p>Wātakirihi Common watercress <i>Nasturtium officinale</i> and <i>N. microphyllum</i></p> <p><i>Nasturtium officinale.</i> Photo: Jon Sullivan</p> |  |

When developing a restoration plan for a repo, it is important then to ensure that all partners understand the values that each may place on an organism, and in turn, what that might mean to the overall restoration goals, objectives and aims. Good relationship building is also about building an understanding of the local social and cultural history of an area so that restoration can more effectively meet the full gambit of aspirations for that community. It is also worth considering the development of a 'common language dictionary' or 'values' glossary as a referral document for the current partners, which can also help those entering the partnership in the future.

Posters for the classroom or office


Māori values and wetland enhancement

Posters that focuses on Māori values and repo enhancement are included in the handbook, which highlight:

- Māori values – concepts and perspectives
- Māori environmental monitoring – process and indicators
- Māori classification and species

The posters include concepts, monitoring tools and approaches, and a list of taonga species from a cultural perspective. Most of these concepts are discussed in detail throughout the handbook.

The posters are designed to be printed at A2 size for the wall and are included in the handbook.



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

Harmsworth GR 2007. *Māori values and wetland enhancement: 1. Māori values – concepts and perspective (Revised edition)*. FRST funded programme: Maintaining and restoring wetlands (C09X0508). Palmerston North, Landcare Research.

Harmsworth GR 2007. *Māori values and wetland enhancement: 2. Māori environmental monitoring – process and indicators (Revised edition)*. FRST funded programme: Maintaining and restoring wetlands (C09X0508). Palmerston North, Landcare Research.

Harmsworth GR 2007. *Māori values and wetland enhancement: 3. Taonga classification and species (Revised edition)*. FRST funded programme: Maintaining and restoring wetlands (C09X0508). Palmerston North, Landcare Research.

Howell C 2008. *Consolidated list of environmental weeds*. Department of Conservation Research & Development Series 292. Accessible from www.doc.govt.nz/documents/science-and-technical/drds292.pdf

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

Useful websites

Department of Conservation
www.doc.govt.nz/nature/native-plants/wetland-forests

Ducks Unlimited NZ
www.ducks.org.nz

Fish and Game New Zealand
www.fishandgame.org.nz/wetlands

National Wetland Trust of New Zealand
www.wetlandtrust.org.nz/Site/Why_Wetlands

New Zealand Plant Conservation Network
www.nzpcn.org.nz

Wetland Restoration Handbook
www.landcareresearch.co.nz/publications/books/wetlands-handbook

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

SECTION ONE:

PROCESS OF ENGAGEMENT 'KAPU TI'

1. KAPU TĪ 101 CUPPA TEAS AND CROSS-CULTURAL CONVERSATIONS

CHERI VAN SCHRAVENDIJK-GOODMAN
(TE ATIHAUNUI A PAPĀRANGI, NGĀTI APA,
NGĀTI RANGI)

First introductions – "Kia ora, my name is..."

Pull up a chair, have a biscuit – Two basic principles for having a good kapu tī

Process of engagement with tangata whenua – Learnings and more learnings

Serious kapu tī – Co-planning: an example of good practice for including Māori in decision-making at the local government level

Concluding thoughts – Introduction to the kapu tī section

In summary – Key characteristics of a successful kapu tī

Want to learn more?



First introductions "kia ora, my name is...."

Ko Ruapehu te Maunga

Ruapehu is the mountain

Ko Aotea te Waka

Aotea is the canoe

Ko Whanganui, Ko Whangaehu, Ko Mangawhero ngā Awa

Whanganui, Whangaehu and Mangawhero are the rivers

Ko Te Atihaunui a Paparangi, Ngāti Apa, Ngāti Rangī ngā Iwi

Te Atihaunui a Paparangi, Ngāti Apa and Ngāti Rangī are the tribes

Ko au, ko te awa; Ko te awa, ko au

I am the River and the River is me

This is the whakapapa (geneology) of my mother – from her I embrace my Māori Heritage, and also that of my Scottish great-great-great-grandfather. He was a so-called 'naughty' Scotsman who was asked to leave his homeland by the authorities, and told to jump on the next available boat to the southern-most colonies.....to the delight I guess of my lucky great-great-great-nanny.

My father came from another part of Europe – the Netherlands; and more specifically, the southern region of Brabant. Apparently, this is the place of the 'happier of the Dutch folk' (although I think all Dutch people are actually quite jolly). His mother, my oma (grandmother), was descended from Norwegian, Dutch and French heritage; and my opa (grandfather), was born and bred a Dutchman. These European strands found their way to Aotearoa New Zealand and became a part of the rope that makes my Whanganui whānau (family) who they are; and specifically, who I am today.

And, why do I share this with you? What is it that compels someone like me to want to open up to complete strangers, particularly when it is not something that comes naturally to all people? Or, even more specifically, how do you cross an invisible barrier that can exist when different cultures – sometimes naive to, and perhaps mistrusting of each other – are required to co-exist in the same space?

For Māori, sharing who we are, and where we come from, is about finding a common ground when first meeting people. It's about latching onto a familiar something that will allow you to build the bridge you need in order to achieve that thing you are keen to explore, discuss, debate, and even possibly implement together (e.g. a kaupapa or take (topic)). And, right now, this is a cuppa tea between you (the reader) and me (the author) – and our shared desire to learn more about the similar spaces we traverse. In this case, it is about our repo (wetlands), and the many wonderful species (plants and animals) that reside within them and the ecosystems that sit beside them. Along with our human ancestors, our native biodiversity also influences the way we talk, sing, and communally interpret and see the world. Right at this very moment, our repo are also influencing the make up of (what will hopefully be) a good kapu tī (cuppa tea/cup of tea) and the resulting kōrero (conversation) between you and I. So, where do you come from?...

Previous page: Kapu tī explores shared history – Te Pūaha whānau with archaeologists at a redoubt near Whangamarino Wetland, Waikato. Photo: Cheri van Schravendijk-Goodman

Koro (Mount Ruapehu) as seen from Karioi Forest. Photo: Cheri van Schravendijk-Goodman



PULL UP A CHAIR, HAVE A BISCUIT TWO BASIC PRINCIPLES FOR HAVING A GOOD KAPU TĪ

1. Initiate *kōrero* with *hau kainga/mana whenua* (indigenous people with primary rights and responsibilities over an area) for the right reasons:

Essentially, a good kapu tī comes down to the 'how' and 'why' an approach is made when reaching out to another person or group such as Māori. As the stories throughout this handbook highlight, Māori struggle to separate discussions of humans and their natural environment. Like my *pepeha* (ancestral connection) – *'I am the River, and the River is Me'* – so any discussions about the state and health and wellbeing of one, will most definitely include discussions about the state, and health and wellbeing of the other. It is therefore, a good idea to recognise up front that *whānau*, *hapū* (subtribes) and *iwi* (tribes) affiliated

with a local resource like a *repo*, *roto* (lake), or forest remnant are going to feel deeply upset if overlooked in any decision-making related to the wellbeing and management of that resource.

In other words, talk to Māori affiliated with a natural resource before a decision needs to be made (the 'how' to approach), and ensure that the approach is about building a relationship or partnership (the 'why' to approach). This is versus the past approaches of 'consultation' which generally focused on just getting Māori to 'tick the box' or sign-off on a preconceived idea. The key difference between the two is that a partnership implies something that takes time and is on-going (almost like a courtship leading to a long-term commitment); whereas 'consultation' felt more like being preached to, and then never seeing each other again (like a bad experience of 'speed dating').

Ko au, ko te awa

Ko te awa, ko au

Rangi Mahuta shares her memories growing up on the Waikato River with Taipu Paki.
Photo: Cheri van Schravendijk-Goodman



| A common worry about engaging with Māori | The 'reality' (according to my perception of the situation) |
|---|--|
| <ul style="list-style-type: none"> "They'll make me go onto their marae and do a pōwhiri (traditional welcome), and they'll expect me to speak Māori!!!" | <ul style="list-style-type: none"> Short answer: Maybe, and in some circumstances, it is highly likely that some form of a traditional welcome will be the case as is tikanga (customary values and practices) for our people. <p>However, you can get support to make the first approach (especially if it means a marae ((traditional gathering place) visit and pōwhiri) by either:</p> <ol style="list-style-type: none"> Talking to your local Office of the Te Papa Atawhai (DOC) or Council and asking for their advice and support in talking to the local people; Or, making the first contact via letter, phone call or visit to the local offices of runanga (iwi authority), iwi or hapū; who can then put you onto the marae/hau kainga contacts. <p>Ensure that you make it clear if you feel under confident about pōwhiri etc. However, as with any partnership, it will require you to make some effort to 'step into their shoes' as the relationship develops. So, even just learning your pepeha and a basic mihi (acknowledgement) in Te Reo Māori (Māori language) is a sign of your good intentions.</p> |

Kapu ti on the road – DOC Waikato staff and Te Pūaha o Waikato whānau.
Photo: Cheri van Schravendijk-Goodman



PROCESS OF ENGAGEMENT WITH TANGATA WHENUA LEARNINGS AND MORE LEARNINGS

Beverley Clarkson (Manaaki Whenua)

My experiences of engagement with tangata whenua in the development of the 2010–2016 wetland programme bid

The process of engaging with Waikato-Tainui (tribal people of the Waikato Region) and integrating Māori knowledge and values into the Ministry of Business, Innovation and Employment (MBIE) wetland research programme has been a huge learning curve for me. From a stumbling start, on my part, it has resulted in firm friendships, new projects, shared knowledge, multiple successes, and a joint mission to enhance wetland biodiversity and associated benefits.

Participants at a noho wānanga (weekend forum) for sharing wetland stories, knowledge, and aspirations: Maurea Marae. Photo: Chris Tanner

'Enjoy the relationship!
It will be solid,
supportive, enriching,
and enduring.'

This process took many months of visiting and consulting with various marae (Māori social and cultural centre) groups, management committees, and iwi educational organisations to initiate the relationship, and then develop the partnership and processes for incorporating tangata whenua (indigenous people) aspirations according to local tikanga and priorities.

I found that having a 'mover and shaker' with knowledge across both Western science and mātauranga systems helped enormously in bridging the divide and distilling the research priorities and knowledge gaps.



Some of the lessons learnt and knowledge gained with engaging with tangata whenua are listed below. These are from a personal perspective but may help other non-Māori researchers and partners in their own processes of engagement:

- Start the engagement process early to integrate mātauranga Māori (Māori knowledge) into the project, not as an add-on at the end
- Visit tangata whenua and participate in hui and other activities at their marae (meeting house), and in their own institutions to understand their aspirations and vision. Identify mutual areas of interest with respect to issues and research needs
- Respect all points of view. This leads to greater listening and understanding. I have found some of the most powerful Māori influencers are humble and respectful, and yet reveal great knowledge and wisdom
- Develop relationships and make an effort to meet with individuals and kaumātua (elders) who lead and have influence over an identified, common area of research or project
- Be prepared to spend time on developing the relationship kanohi ki te kanohi (face to face). Once it is developed, interactions may often be shorter and by email/phone because the relationship and mutual respect have been established
- If acceptable, have a point-of-contact person for liaison with a wider whānau, marae, and hapū group
- Maintain the relationship by regular communication, updates, dialogue, and personal contact
- Attend hui, contribute to and celebrate successes both within the project and more widely, with the whānau, marae, and hapū tribal members. Taking an interest on a personal level and being willing to stay involved beyond the project will indicate your commitment to the partnership
- Enjoy the relationship! It will be solid, supportive, enriching, and enduring.



Maurea River Island restoration wānanga (training): rangatahi (youth) measuring vegetation plots for restoration baselines. Photo: Beverley Clarkson



Waikato-Tainui rangatahi at a whitebait habitat monitoring wānanga, Hopuhopu. Photo: Beverley Clarkson



Waikato-Tainui wetland scholarship recipients (left and far left) assist in monitoring Whangamarino Wetland. Photo: Corinne Watts

2. Good things take time; so be patient, and don't expect everyone to be in the same starting position:

No relationship (or any 'Rome' for that matter) was ever built in a day. For this reason, don't expect one kapu tī to be all you need (refer back to the earlier comment about bad speed dating – AKA 'consultation'). Take the time to drag your kapu tī process out for as long as it needs. Unfortunately, this is a much more difficult task than people might appreciate primarily because of the historical events that have shaped our country and the way we all have interacted with one another since the signing of Te Tiriti o Waitangi (Treaty of Waitangi) and European settlement.

Throughout this handbook, the start of the story is very familiar – the strong foundational relationships between tangata whenua and their whenua (lands), awa (rivers), coastlines and repo resources, but then loss either in the form of the land ownership and/or biodiversity decline; and impacts on culture, practices and community including the removal of decision-making from those traditional owners over their natural resources.

Such histories, have left a legacy of mistrust, and for some whānau, hapū and iwi, a degree of pessimism and despair. For others, it has made their resolve stronger, their arguments and protests are highly articulate and their wit is sharp. However, they may lack the infrastructure, capacity and resources to be able to reclaim their right to care for and protect their communities and resources (kaitiakitanga), without the help of others with greater capacity, and more targeted resourcing to better enable whānau, hapū and iwi in the environmental space they once.

Good partnerships therefore, are about recognising each others' strengths, limitations, developing shared goals and aspirations, and equally bringing something to the table. Good kapu tī processes are in turn, about identifying what needs to be brought in to enhance the partnership (tools, skills etc), and the timeframes required to do that, and most importantly, ensuring that there are **always** biscuits or cake at the kapu tī sessions!!!

Kapu tī to jointly develop a project – Waikato Regional Council, Waikato-Tainui and Te Pūaha whānau.
Photo: Cheri van Schravendijk-Goodman



SERIOUS KAPU TĪ CO-PLANNING: AN EXAMPLE OF GOOD PRACTICE FOR INCLUDING MĀORI IN DECISION-MAKING AT THE LOCAL GOVERNMENT LEVEL

Shaun Awatere (Ngāti Porou), Garth Harmsworth (Te Arawa, Ngāti Tūwharetoa, Ngāti Raukawa), and Mahuru Robb (Ngāti Ranginui, Ngāti Awa)

A key issue to address for natural resource management is the empowering of mana whenua (decision making authority) within groups tasked with delivering management outputs of a natural resource like a repo. A critical step for co-planning processes is to recognise that mana whenua are more than just stakeholders; they have valuable contributions to make within collaborative planning processes for natural resources. In Aotearoa local government (i.e. district, territorial or regional councils) recognise the delegated authority from the Crown to enact the principles of Te Tiriti o Waitangi (Treaty of Waitangi) including the principle of partnership – the duty to interact in good faith and in the nature of a partnership. A meaningful and successful partnership will ideally provide opportunities for mana whenua to participate effectively in co-planning processes, via empowered, well-resourced, and well-informed contributions at core co-planning processes, particularly at the committee stage where recommendations and deliverables are developed.

The inclusion of a kaupapa Māori (approach underpinned by Māori values) focused forum is one way of ensuring effective mana whenua contributions to co-planning processes. Such forums add value to the planning process by providing a space for mana whenua to discuss and debate potential policies and methods that are mātauranga Māori informed (based on Māori values, principles and knowledge) that can contribute to each of the co-planning processes for repo. At the same time, a potential kaupapa Māori focused forum would engage with experts and other policy officials (council and iwi/hapū) to help develop robust policies and methods.



Kapu tī gets tough – Ngā Matapōpore members discuss some intense environmental issues. Photo: Cheri van Schravendijk-Goodman



Kapu tī in the field – Cheri and Tūhoe kaumātua, Tahae Doherty. Photo: Cheri van Schravendijk-Goodman



Kapu tī at the floodgates near Waahi Pā. Photo: Cheri van Schravendijk-Goodman

CONCLUDING THOUGHTS INTRODUCTION TO THE KAPU TĪ SECTION

A new and developing relationship between any human is special; and being the communal creatures that we are, there is a level of comfort and security that comes from strengthening connections between people, their whānau and wider social groups within our communities. This is part of our DNA, no matter what culture we come from.

The notion of kapu tī as expressed here is a metaphor to essentially slow down, sip quietly with your cuppa tea, and take the time to listen, reflect and get to really know each other. The incorporation of kai (food) as part of the relationship is deliberate as well. As part of our tikanga, it is important to partake in the sharing of kai and kōrero to solidify a relationship. There is a much deeper knowledge and value system related to this, but that is something that you will need to learn from your local tangata whenua partners yourself!

Within the kapu tī section of the handbook are two beautiful case studies that explored processes for establishing a relationship with the relevant whānau who then assisted in the collation of data and key information for the articles. However, the lesson from these stories is the way in which the whānau involved were able to craft the process of engagement to meet their needs alongside those of the kairangahau (researchers) – this is what could be deemed a successful co-development outcome of a project. As with the short narratives captured in this article, they are intended to provide a means by which kairangahau, environmental managers and decision makers can work towards building meaningful partnerships with whānau, hapū and iwi in a way that acknowledges and is respectful of their values.

'Laugh, laugh, and laugh some more. No one likes a grumpy face.'

IN SUMMARY KEY CHARACTERISTICS OF A SUCCESSFUL KAPU TĪ:

- **Good things take time.** So, sit back, relax and enjoy the time spent. Also, don't expect an immediate answer to your questions; but rather, enjoy the verbal journey it takes to get the final result.
- **Laugh, laugh, and laugh some more.** No one likes a grumpy face.
- **Listen with an open mind...as well as your ears.** Although it is well known that humans talk more with our bodies than we do with our mouths (i.e. body language), some Māori also tend to listen with their bodies as well. I'll let you ponder over that one in your own time. Therefore, don't be offended if you notice kaumātua (elders) close their eyes and appear to drift off – they are probably just listening very deeply; or you're boring them and they fell asleep (hopefully it's the former!).
- **Be yourself.** No more, no less.....and don't forget to tell them where you are from.

'Be yourself. No more, no less.'



Kapu tī on a boat – members of Ngā Matapōpore and indigenous guest, Dan Longboat, at Lake Waikaremoana. Photo: Cheri van Schravendijk-Goodman

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, Harmsworth GR, Robb M 2015. *Proposed Mana Whenua values, attributes and measures for Auckland Council's Wai Ora Wai Māori programme*. Hamilton: Manaaki Whenua – Landcare Research.

Useful Website

Collaborative approach:

www.landcareresearch.co.nz/publications/newsletters/discovery/discovery-issue-42/wetlands-restoration

Contact details for Cheri

Email: cheri@swampfrog.co.nz

2. THE AKE AKE MODEL FOREVER AND EVER

YVONNE TAURA (NGAATI HAUAU),
LORRAINE DIXON (NGAATI WHAAWHAAKIA),
AND MIRIAMA TURNER (NGAATI AMARU)

Ngaa mihi

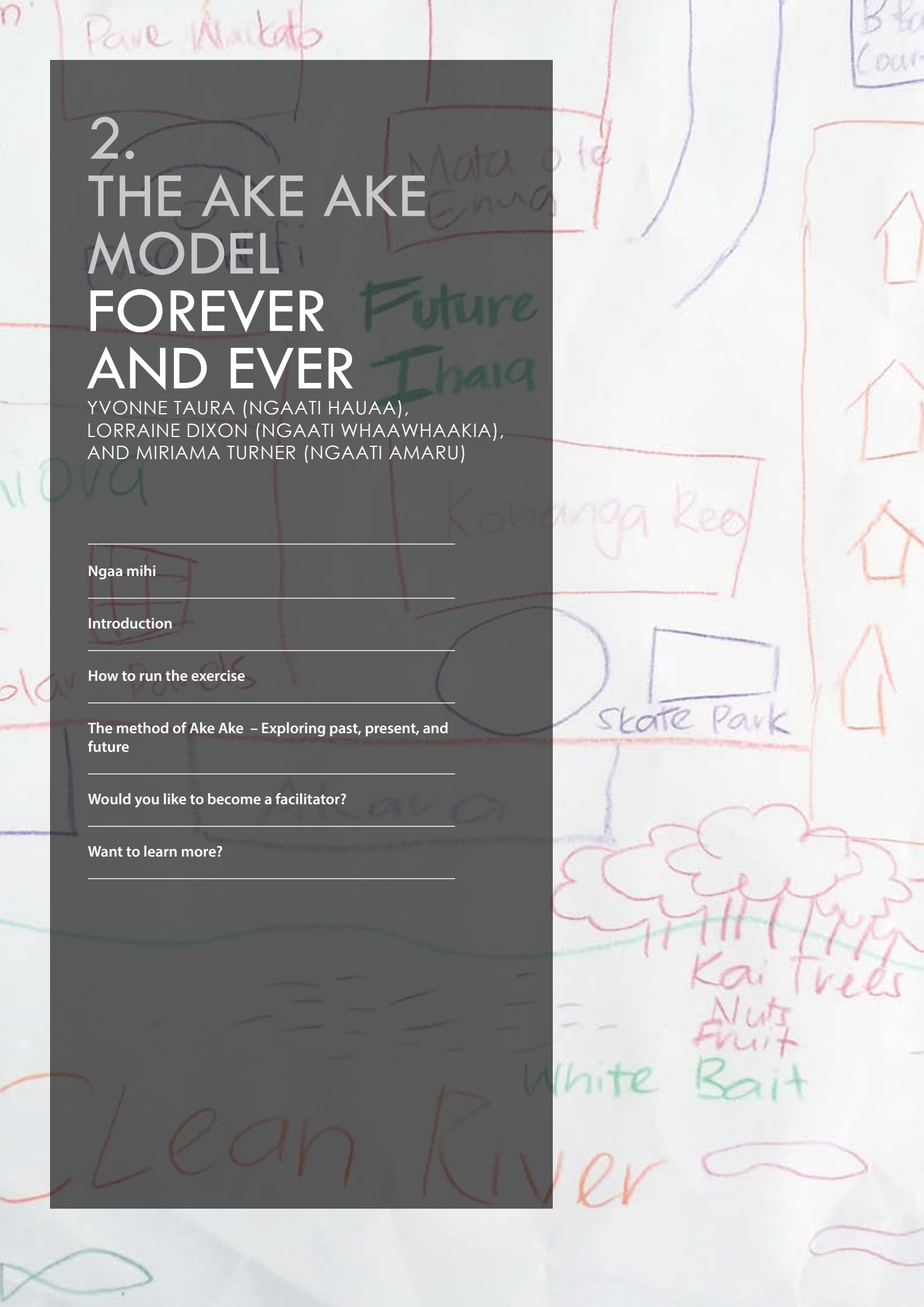
Introduction

How to run the exercise

The method of Ake Ake – Exploring past, present, and future

Would you like to become a facilitator?

Want to learn more?



Ki te kahore he whakakitenga ka ngaro te iwi

Without foresight or vision the people will be lost

Kiingi Taawhiao Te Wherowhero

When planning a restoration project – whether a repo (wetlands), a forest remnant, or even a marae (meeting house) – it can be difficult to know where to begin. One method is to use a model like the Ake Ake Model, which is a cultural mapping exercise using pictures and imagery to help whaanau (families), hapuu (subtribes), and iwi (tribes) draw out and identify cultural indicators. It is a culturally defined way to explore and express restoration initiatives to strengthen the cultural community.

Lorraine Dixon and John Te Maru (Ngaati Hauaa), researchers from Waikato-Tainui (tribal people of the Waikato Region), developed this model for whaanau, hapuu, and iwi participation. Ake Ake – meaning forever and ever – measures the changes observed over time by whaanau living in their environment and how change can affect the way they interact with their environment.

Thank you to Aunty Tilly, Uncle Barm, and whaanau for participating in the exercise. Many themes came up through the Ake Ake Model exercise that allowed the whaanau to speak openly about their future goals and aspirations for their whaanau, marae, hapuu, and iwi.

I would also like to thank the Tuurangawaewae Trust Board for permission to use images from the archive. These images are taonga and it was an honour to view the prints and choose the images appropriate for this exercise.

– Ngaa mihi Yvonne

The model is produced in three steps:

- Whaanau learn about how people lived in the **past**
- Whaanau identify the **present** situation
- Whaanau draw what they want the **future** to look like for iwi in 50 years' time

The model allows whaanau to think about the changes from the past and the current situation of the element on which they want to focus, e.g. their marae and the environment in which they live such as their awa (rivers), roto (lakes) and repo. Whaanau are encouraged to decide what they would like for the future of their resources, and, most important, for the future generations who will live there.

The exercise is broken into five components:

- Environmental
- Economic
- Cultural
- Social and recreational
- Health and wellbeing

These ideas and aspirations are drawn by whaanau as a pictorial representation of their aspirations, which are then archived for future generations. Common themes emerging from these pictures can be used as planning ideas for the restoration of their resources – e.g. marae and awa – and as guidelines for the people who live there. The Ake Ake Model encourages 100% participation, and whaanau enjoy it because they're contributing towards both their future and that of their mokopuna (grandchildren).

Implementing the Ake Ake Model

How to carry out the activity with your whaanau, using a Waikato example with the Turner whaanau:

In this activity, whaanau participated in the application of the Ake Ake Model to gather and explore their aspirations for Tuurangawaewae Marae and Te Awa o Waikato (Waikato River). Whaanau were invited to explore changes in their local area from a Maaori worldview to determine the past and present state of the awa and marae, and to also determine their future aspirations for the awa.

By the end of this activity it was envisioned that whaanau should be able to:

- describe the Ake Ake Model and why it is used
- relate some of the early whaanau stories about the environment
- describe some of the aspirations and hopes that whaanau have for their environment



Turner whaanau drawing their pictorials. Photo: Yvonne Taura

HOW TO RUN THE EXERCISE

Step 1: Ake Ake Model and the five components

- a. A short presentation is delivered that explains what the Ake Ake Model is, what the whaanau will be learning, and how they can use this for future planning for their whaanau.
- b. Obtain photos of the past and present. Use these to describe place and upbringing.
- c. Ake Ake Model
 - i. Mapping the past – this requires kaumaatua (elders) input.
 - ii. Mapping the present – this requires kaumaatua and rangatahi (youth) input.
 - iii. Mapping the future – this requires kaumaatua and rangatahi input.

Within each time period the five components are discussed:

- Environmental
- Economic
- Cultural
- Social and recreational
- Health and wellbeing

- d. Each member presents to the whaanau and is video recorded and archived for future generations. In the future, rangatahi will become the kaumaatua and have mokopuna to pass down their knowledge to.

Step 2: Identify common themes

Create a spreadsheet that outlines the common themes in each of the five components, for the past, present, and future.

Step 3: Summarise the themes

Summarise these themes into a report for the whaanau to use as a future planning model.

Step 4: Future Planning

Now that we know the past, what are the aspirations for the future?

THE METHOD OF AKE AKE EXPLORING PAST, PRESENT, AND FUTURE

Step 1a: A short presentation

Lorraine took the Turner whaanau through the Ake Ake Model with Hone (Uncle Barm) and Miriama (Aunty Tilly), their tamariki, and mokopuna. Uncle Barm and Aunty Tilly are from Te Awamarahi Marae at Te Puuaha o Waikato (Port Waikato); however, they have raised their whaanau in Ngaaruawaahia for the last 4 decades. They are currently building their papakaainga (communal Māori land) in Ngaaruawaahia.

The Turner whaanau chose to focus on Tuurangawaewae Marae located on the banks of the Waikato River, Ngaaruawaahia. They are actively involved with kaupapa (matters) occurring at Tuurangawaewae Marae as it is close to their [papakaainga](#) and is important for their mokopuna.

"At Te Awamarahi Marae our whaanau view the responsibilities to the kaupapa of the Kiingitanga and Tuurangawaewae Marae as more important than the mahi at Te Awamarahi, it has been this way since Te Puea's time." – Tilly Turner



Turner whaanau drawing their pictorials. Photo: Yvonne Taura

Background of the Kiingitanga and Tuurangawaewae Marae

Kiingitanga – Whaiaa ko te mana motuhake

For Waikato-Tainui, the unity they have with their tupuna awa (ancestral river) is expressed in the Kiingitanga (Māori King movement). For 150 years, Kiingitanga has shaped and given purpose to the lives of all of those who support it; its kaupapa unites people from many marae (Māori social and cultural centre) and iwi.

Kiingitanga was established in 1858 to unite all tribes under the leadership of Kiingi Pootatau Te Wherowhero. Its primary goals were to stop the sale of land to Paakehaa (European descent), to stop inter-tribal warfare, and to provide a springboard for the preservation of Māori culture in the face of colonisation.

Tuurangawaewae Marae

Tuurangawaewae Marae at Ngaaruawaahia is the principal marae of the Kiingitanga. In 1919 Tuurangawaewae House (Kiingitanga parliament house) was built in the town, and in 1921 Princess Te Puea Herangi, granddaughter of Kiingi Tawhiao, inspired Kiingitanga supporters to build Tuurangawaewae Marae. The main meeting house, Maahinaarangi, was opened in 1929, and another, Tuurongo, in 1938.

Tribal identity and integrity

Ko Tainui te waka

Tainui is the canoe

Ko Taupiri te maunga

Taupiri is the mountain

Ko Waikato te awa

Waikato is the river

Ko Te Wherowhero te tangata

Te Wherowhero is the chief

Waikato Taniwharau

Waikato of a hundred chiefs

He piko, he taniwha

Every bend, a chief

He piko, he taniwha

Every bend, a chief

Step 1b: Photos of the past and present

Using the photographs as prompts, the whaanau learned about how iwi and hapuu view the past (1900–1970).

To help the whaanau understand the model, Lorraine explained the following:

- [What is the Ake Ake Model?](#)
- [Working through the steps of the Ake Ake Model](#)
- [What are cultural indicators?](#)

Steps 1c and d: Discussion of past, present, and future using the five components

The whaanau were then broken up into three groups:

- **Past:** As the kaumaatua, Aunty and Uncle were asked to draw and talk about Tuurangawaewae Marae and the awa as they remembered it while they grew up.
- **Present:** Half the whaanau were asked to draw and talk about the present condition of the people and the awa at Tuurangawaewae Marae.
- **Future:** The other half of the whaanau were asked to create a pictorial representation of Tuurangawaewae Marae and the awa as they would like to see it in 50 years.



Presentations by mokopuna. Photo: Yvonne Taura

The following questions were used as prompts for each of the key areas – past, present, and future.

Questions related to the past were asked specifically of the kaumaatua from across the five components of the Ake Ake Model. For example:

- **Environmental:** Describe the environment as it was when you were young (between 1900 and 1970).
- **Economic:** Describe how it was for your whaanau economically? What jobs did your parents have? Was kai (food) plentiful? Was kai harvested from te taiao (the environment)? Did you trade kai with others? If so, what kai and how was it transported?
- **Cultural:** Did you feel culturally connected? Was there cultural support? How important was tikanga (values and practices)? What were the values?
- **Social and recreational:** Did you get together socially? Were whaanau living independantly or did they meet often? Did people work together? Did they share housing? Did they share kai?
- **Health and wellbeing:** What was the state of health and wellbeing of your whaanau? Did they suffer illnesses?

Whaanau then learn together about how they collectively **view the present** (1970–2016).

- **Environmental:** What has happened to the local taiao, whenua (land), ngahere (bush), awa, taonga species (native plants and animals of cultural significance) since you were young (1970+)? How may that have affected you and your whaanau?
- **Economic:** What mana (authority) do you have now, if any? Such as, land settlements, whenua for maara kai (vegetable garden), kai from te taiao and kaitiakitanga (exercise of guardianship). What values are associated with this area for you?
- **Cultural:** Do you feel culturally connected now? What cultural support is there?
- **Social and recreational:** Do you feel socially connected? Do you share kai, mahi (work), and housing? Or is it mainly at gatherings that these are shared?
- **Health and wellbeing:** What is the state of health and wellbeing of your whaanau now? What illnesses do iwi suffer? How are they physically, emotionally, and mentally? Do people feel they have mana?

Whaanau were then invited to imagine they were **50 years into the future** (2066) and to draw the local area (environment) as they would like to see it, including images that relate to the five components (environmental, economic, cultural, social and recreational, and health and wellbeing).

Mapping the past

Aunty Tilly's pictorial represents Tuurangawaewae Marae between the 1950s and 1970s, during the time of Princess Te Puea Herangi.



Drawn by Miriama Turner



Aerial photo 1947. Photo: Tuurangawaewae Trust Board

1



Maara kai, Tuurangawaewae Marae, 1973.
Photo: Tuurangawaewae Trust Board

5



Boys playing along the Waikato River, Ngaaruwaahia, 1973.
Photo: Tuurangawaewae Trust Board

2



The Big House, Tuurangawaewae Marae.
Photo: Tuurangawaewae Trust Board

4



Dame Te Atairangikaahu beside the Waikato River.
Photo: Tuurangawaewae Trust Board

3



Princess Te Puea Herangi on the wharf at Ngaaruwaahia.
Photo: Tuurangawaewae Trust Board

6



Construction of Kimikimi II, Tuurangawaewae Marae, 1973.
Photo: Tuurangawaewae Trust Board

Mapping the Present

Aunty Tilly’s daughter Miruwai drew a pictorial that represents Tuurangawaewae Marae in the present, 2016.



Drawn by Miruwai Turner

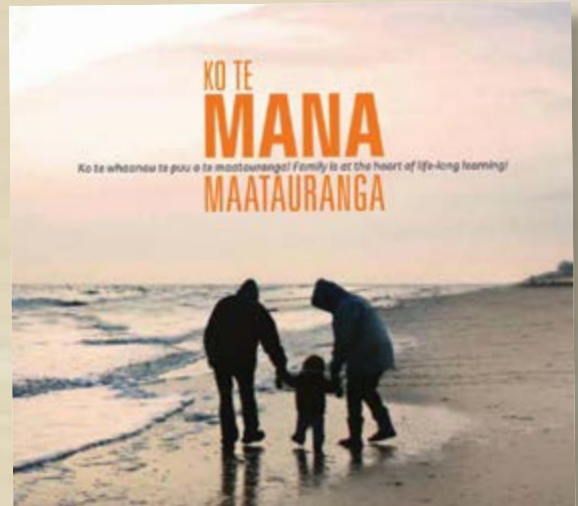
1



Nga Waaka Kia Rite. Tupuna Salute Tuurangawaewae Regatta, 2016.
Photo: Tuurangawaewae Regatta 2016



Supporting Waikato-Tainui Education poster, 2014.
Image: Waikato-Tainui Education Grants



Front cover of Ko Te Mana Maatauranga – Waikato-Tainui Education Strategy 2015-2020

2



Turangawaewae Marae Riverbank Restoration Project 2015, Ngaaruawaahia, Waikato River. Photo: Tamoko Ormsby

3



Return of Rangiriri Pa.
Photo: Koroneihana 2016

Mapping the Future

The rangatahi created a pictorial representation of Tuurangawaewae Marae and the awa as they would like to see them in 50 years. Drawn by mokopuna.





Step 2: Identify common themes

As a whaanau, they were then invited to discuss common themes across their pictorials. Common themes identified for each component – past, present, and future – are illustrated in Table 1.

Table 1. Common themes in the five components, for the past, present, and future

| Environmental | | |
|--|---|--|
| Past (1950–1960) | Present (2016) | Future (2066) |
| Willow started infesting the edge of the awa | Willow established along the edge of the awa | The banks of the awa are covered in native plants and trees |
| The kids swam all day during the summer holidays | The kids are supervised with caution when swimming | The kids are swimming in clean and blue water No rubbish sign – no rubbish allowed on the banks of the awa |
| We caught kooura and kaaeo | We no longer catch kooura and kaaeo | The awa is clean and the kai is back in the awa. The native fish species are abundant – kooura, kaaeo, iinanga, and tuna |
| We acknowledge our tupuna maunga | We acknowledge our tupuna maunga | We acknowledge our tupuna maunga |
| We acknowledge our tupuna awa | We acknowledge our tupuna awa | We acknowledge our tupuna awa |
| We acknowledge our marae, hapuu, and iwi | We acknowledge our marae, hapuu, and iwi | We acknowledge our marae, hapuu, and iwi |
| We acknowledge our waka | We acknowledge our waka | We acknowledge our waka |
| Economic | | |
| Past (1950–1960) | Present (2016) | Future (2066) |
| Whaanau worked at the freezing works | Corporate viability – whaanau had to find work elsewhere | All houses and buildings are run by solar power, to help whaanau |
| All of those who lived in the papakaainga at the marae, did not pay rent but had a role to work at the marae | We rent homes and work away from the papakaainga | The tribe has taken ownership of the Hakarimata Ranges |
| Housing scheme – residence had to live in a house for 6 years and then had the opportunity to buy it | We have mortgages, we pay for rates, water and power | The tribe have worked in the ngahere so that whaanau can go hunting for kai |
| Poukai kai comes from te taiao, maara kai and ngahere | Poukai kai comes from supermarket | |
| Cultural | | |
| Past (1950–1960) | Present (2016) | Future (2016) |
| Swimmers at the river always had to do a karakia before entering the awa, this was to prevent any drownings | Acknowledgement to the Ariki. A blessing that acknowledges the Kings of the Kiingitanga before entering the awa | Karakia to acknowledge the Ariki |
| Whaanau would recite paimaarire in the mornings and at night, Monday – Friday | Paimaarire is recited at every major hui at the marae | Paimaarire is recited at every major hui at the marae |
| Piri Poutapu ran the youth groups | Youth are still encouraged to be at the marae | Youth are encouraged to be at the marae |
| Strongly support Kiingitanga | We still support the Kiingitanga | We support the Kiingitanga |
| Strongly support poukai | We still support poukai but we have to work as well | We support poukai |
| Strong Waikato tikanga | Strong Waikato tikanga | Strong Waikato tikanga |

| Social & Recreational | | |
|---|---|--|
| Past (1950–1960) | Present (2016) | Future (2066) |
| All whaanau shared their kai | We only share kai at gatherings | All whaanau share their kai |
| When the kids were hungry, they would pick fruit from the trees and catch kooura and kaaeo from the awa | There are no more hua raakau at the papakaainga, and kooura and kaaeo are no longer available from the awa | There are maara kai and hua raakau at the papakaainga. The native fish species are abundant in the awa – kooura, kaaeo, iinanga, and tuna |
| All whaanau lived on the papakaainga | The flats were built in the 1980s as a training scheme – cheap labour, no insulation, and now require upgrading and repairs | Papakaainga is made bigger and only haukainga that work at the marae can stay there |
| Te Pua lived in the 'Big House' at the marae | The 'Big House' was demolished during the demolition of the old papakaainga | All the houses at the papakaainga can hold up to 12 people, so that whaanau can live together |
| The ringawera for Koroneihana would stay with whaanau, kai preparation would occur at the marae | The ringawera for Koroneihana still stay with whaanau | The ringawera for Koroneihana stay with whaanau |
| Every Saturday night there would be dancing on the mahau at the marae – waltz, etc. Te Pua believed it was important for there to be music and youth around | Youth are still encouraged to be at the marae | Build skate park and basketball courts for tamariki and rangatahi. Make the marae more kid friendly Free wi-fi for whaanau with a computer room |
| People would catch the train to attend these dances | Now people use cars to attend gatherings | A shelter to be built at the marae to house the homeless until they get back on their feet |
| Te Reo Maaori is spoken | Revival and active Te Reo Maaori is spoken | All whaanau are fluent in Te Reo Maaori |
| Education up to seventh form (high school) | University education – undergraduate and postgraduate levels | University education – undergraduate and postgraduate levels |
| Washing in the awa | No longer wash in the awa | Swimming in the awa |

| Health & Wellbeing | | |
|--|--|--|
| Past (1950–1960) | Present (2016) | Future (2066) |
| There were maara kai and hua raakau throughout the papakaainga | There is no longer any maara kai and hua raakau throughout the papakaainga | A big communal maara kai and hua raakau to feed the whaanau at the marae |
| | | Gym to be upgraded Akara (the window area in Kimiora (whare kai) at Tuurangawaewae Marae) becomes a maara kai |
| | | Gondala for the tamariki and kaumaatua, especially those who aren't mobile but still want to go up the Hakarimata Ranges |
| | | Gondala at the Hakarimata Ranges, that looks like waka ama, to represent the tribes relationship to the awa |
| | | Encourage whaanau to be fit |
| | | Flying fox at the Hakarimata Ranges, the shape of an upside-down waka taua, the kids can walk up and fly down |
| | | Hua raakau are planted throughout the papakaainga so whaanau can enjoy foraging for kai |

Step 3: Narratives about the themes

Mapping the past – Aunty Tilly recalls:

This pictorial allowed all the whaanau to hear the stories of their whaanau, marae, hapuu, and iwi from the past. The five components of the Ake Ake Model help clarify these stories into sections.

Environmental: *Willows were established along the banks of the Waikato River (Aerial Image 1947: True left bank lined with willow). Whaanau were able to catch kooura (freshwater crayfish) and kaaeo (freshwater mussel), and children swam all day in the awa during the summer holidays (Image: boys playing along the river).*

Economic: *Most of the whaanau from Tuurangawaewae Marae worked at the freezing works at AFFCO (Horotiu). In Te Puea's time she had established relationships with whaanau and marae in other tribal areas. During times of major events, such as poukai (King movement gathering) and Koroneihana (coronation) at Tuurangawaewae Marae, food by the truckloads would arrive with meat from AFFCO, vegetables from Pukekohe market gardens, seafood such as (pipi, puupuu (cat's eye), and kutai (green-lipped mussel)) from Hauraki, and kai (such as puha (sow thistle), tuna (freshwater eels), catfish, and watercress) from Whangamarino wetland. This was carried on by tribal members at this time.*

All the whaanau who lived in the papakaainga at the marae did not pay rent but had a role to work at the marae. A Housing NZ scheme at that time involved living in the house for 6 years with the opportunity to purchase it. This is why we eventually moved away from the marae to our current residence a few blocks away from the marae.

Cultural: *The whaanau of Tuurangawaewae Marae had strong acknowledgement for their whakapapa (genealogy):*

Ko Taupiri te maunga (ancestral mountain)

Ko Waikato te awa (ancestral river)

Ko Tainui te waka (ancestral canoe)

Ko Tainui te iwi (tribe)

Ko Ngaati Mahuta te hapuu (subtribe)

Ko Tuurangawaewae te marae (meeting house)

The Kiingitanga, poukai, and tikanga were strongly supported by the whaanau at Tuurangawaewae Marae. Paimaarire (Christian faith) was recited at 7am and 7pm, Monday to Friday.

Swimmers in the awa were taught to do a karakia (prayer) before entering the awa, in order to prevent any drownings.

Piri Poutapu, an adopted child of Te Puea Herangi, a master carver and tribal leader during the reign of Dame Te Atairangikaahu, ran youth groups at the marae.



Presentation of the past. Photo: Yvonne Taura

Social and recreational: *All the whaanau lived on the papakaainga, and whaanau would share kai. When kids were hungry, they would pick fruit from neighbouring trees and catch kooura and kaaeo from the awa.*

Te Puea lived in the 'Big House' at the marae which had maara kai beds growing right next to it (Image: The Big House).

At Koroneihana, the kaimahi (workers) and ringawera (kitchen workers) would come from our tribal rohe (region) and stay with whaanau close to the marae and the manuwhiri (visitors) came from all over the motu (country) staying on the marae. Each whaanau were designated jobs during Koroneihana and kai was prepared at the marae.

Every Saturday there would be dancing on the mahau (porch of the meeting house) at the marae – the waltz, etc. Te Puea believed it was important for there to be music and youth around. People would catch the train to Ngaaruawaahia from across the rohe to attend these dances. One of my aunts (Aunty Noki) told me that when she crossed the bridge on the train she could hear the bands playing, and she loved coming.

Te Reo Maaori (Maaori language) was spoken on the marae.

Education up to the seventh form (high school).

Health and wellbeing: *There were maara kai (Image: Maara kai) and hua raakau (fruit trees) throughout the papakaainga that were more often shared to the workers but the majority of the kai was stored for hui (gatherings) at the marae.*

Mapping the present – reflections of the whaanau:

This pictorial allowed all the whaanau to see and hear about the current situation of their whaanau, marae, hapuu and iwi. The five components of the Ake Ake Model help clarify these stories into sections.

Environmental: *Willows are well established along the river banks of the Waikato River and are well known as a pest plant species throughout the motu. Whaanau are no longer able to catch kooura and kaeao, and children are supervised with caution when swimming in the awa.*

In 2014 the Tuurangawaewae Trust Board applied for funding from the Waikato River Authority to undertake a [Tuurangawaewae Marae Riverbank Restoration Project](#) (Image: Riverbank Restoration Project). The project was developed to restore, beautify, and revitalise the bank of the Waikato River located adjacent to the marae. This included the establishment of native planting, construction of pathways connecting the marae to the river, construction of pathways to the water's edge and event viewing areas, and construction of waka launching ramp for safe access to the awa for users.

Economic: *Lots of the whaanau have to live and work out of town in the neighbouring cities, either paying rent or mortgages that include council rates. Work responsibilities make it difficult for whaanau to take time off for poukai and Koroneihana (a few Waikato iwi still traditionally donate kai for Kiingitanga at Koroneihana). Kai now comes from the supermarket.*

Cultural: *The whaanau of Tuurangawaewae Marae continue to strongly acknowledge their whakapapa.*

The Kiingitanga, poukai, and tikanga are strongly supported by the whaanau at Tuurangawaewae marae (Image: Koroneihana 2014). Paimaarire is recited at every major hui at the marae such as Koroneihana, poukai and visits by dignitaries. The Tuurangawaewae Regatta has been held every year since 1894, and has played an important role in sustaining aquatic and cultural activities on the tupuna awa. Activities include waka kopapa (canoe racing) and waka ama racing, and the star attraction being the ceremonial parade of the Waka Taua (great war canoe) (Image: Tupuna salute).

Swimmers in the awa still do a karakia before entering the awa, in order to prevent any drownings. The karakia involves splashing river water on yourself six times to acknowledge the six Kings of the Kiingitanga.

Social and recreational: *There are no longer any maara kai or hua raakau at the papakaainga, and kooura and kaeao are no longer available in the awa. The 'Big House' and maara were removed during the demolition of the old papakaainga and replaced with flats that were built in the 1980s as a training scheme using cheap labour, materials, and no insulation. These flats still exist today and require maintenance and upgrades.*

Education: In 2016, Ko Te Mana Maatauranga – Waikato-Tainui Education Strategy 2015–2020 was launched. The strategy is guided by the principle that whaanau is at the heart of lifelong learning, and that Waikato-Tainui will commit to supporting all whaanau to become lifelong learners and leaders who determine their own futures. This sentiment is echoed in the words of Princess Te Puea Herangi:

Kia tupu, kia hua, kia puawai

To grow, to prosper, to sustain

The strategy focuses on three main priorities:

1. All Waikato-Tainui tribal members are fluent in Waikato reo (language) and tikanga
2. All Waikato-Tainui tribal members transition into meaningful pathways
3. All Waikato-Tainui tribal members know their whakapapa and are reconnected to their marae

Traditional priorities include active revival of Te Reo Maaori to be spoken at the marae, with Te Reo Maaori being spoken by most whaanau at the marae.

Tertiary educational achievements range from undergraduate to post-graduate levels. Tertiary education grants are available to tribal members to pursue higher education.

I am committed to Kiingitanga, fluent in Te Reo Maaori, strong in my tikanga, healthy, well-educated and financially secure.

Health and wellbeing: *There are no longer any maara kai and hua raakau throughout the papakaainga.*

Mapping the future – reflections from the whaanau, especially the rangatahi:

From these pictorials it was evident that the rangatahi have very clear values and aspirations for their whaanau, marae, hapuu, and iwi. The five components of the Ake Ake Model help clarify these aspirations into sections.

Environmental: *The rangatahi have aspirations for the awa to be clean, surrounded by native plants and abundant with taonga species (native plants and animals of cultural significance) such as kooura, kaaeao, tuna (freshwater eels), and iinanga (whitebait).*

Economic: *The rangatahi believe that solar power to run the marae, whaanau homes and buildings will alleviate financial pressure and also be environmentally viable.*

Cultural: *The Kiingitanga, poukai, and tikanga are still strongly supported by the whaanau at Tuurangawaewae Marae. The waka are housed in a purpose-built building and the barge is put into a museum or moved for more swimming space.*

Social and recreational: *There are maara kai and hua raakau at the papakainga. Taonga species from the awa, such as kooura, kaaeao, tuna, and iinanga are abundant. The papakainga is made bigger, for houses that hold up to 12 people so that whaanau can all live together.*

Free wi-fi is important to rangatahi in order to keep up with technology. A shelter to be built at the marae to house the homeless until they get back on their feet. The marae can be a boring place, so a skatepark and basketball courts for the tamariki and rangatahi will be a great addition to make the marae more child friendly.

Health and wellbeing: *A big communal maara kai to feed all the whaanau at the marae. Kai trees to be planted throughout the marae so that whaanau can enjoy fresh vegetables and fruit all year round. The gym needs to be upgraded to meet the needs of a healthier whaanau.*

Would you like to become a facilitator of the Ake Ake Model?

If you would like to become a facilitator in order to undertake the Ake Ake Model with your whaanau, please contact:

Lorraine Dixon: korowaimaori@yahoo.com

Step 4: Future Planning

Now that we know the past, what are the aspirations for the future?

The Ake Ake Model helps highlight the values of the past and present, and maintain values for the future. Some of these values for the Turner whaanau include:

Environmental: To actively participate as kaitiaki (guardians) by walking in both worlds, obtaining knowledge from Western science and maintaining and restoring knowledge of the cultural perspective.

Economic: To utilise our natural resources and become economically sustainable from a unique cultural community perspective.

Cultural: To maintain a cultural connection to marae, hapuu, iwi, awa, and whenua.

Social and recreational: To build the strength of the tribe through tikanga.

Health and wellbeing: To support whaanau aspirations.

The Ake Ake Model provides 100% participation and whaanau enjoy it because they are contributing towards their future map – no one is wrong, everyone is right! It highlights the trends, the different patterns of what was in the past and what to achieve in the future.

It's the next generation's responsibility to carry their aspirations into the next 50 years. It carries on and on, hence the name Ake Ake, the forever and ever.

My whaanau are amazed at the Ake Ake Model and how valuable it is to understand the perspectives of three generations. We're going to add this resource to our whaanau time capsule, which will be built into the walls of our papakainga. This capsule will be opened on the 80th anniversary of the Whaanau Trust, when a new Trust will be established to deal with our future uri and to run the whaanau affairs. We intend to use the Ake Ake Model as a guideline to map the future of the Whaanau Trust, and to see whether the plans of our mokopuna have been realised.

A special thank you to Lorraine and John – this model is a taonga that will send a message to our future mokopuna with our special whaanau mantra.

Mehemea ka moemoeaa ahau, ka ahau anake

Mehemea ka moemoeaa e taatou, ka taea e taatou

If I dream, I dream alone. If we dream together, then we shall achieve – Princess Te Puea Herangi

Ma te Atua koutou hei manaaki tiaki paimaarire kia koutou katoa

– Ngaa mihi Tilly

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.

Links to video and teaching resources

Working through the steps of the Ake Ake Model

<http://sciencelearn.org.nz/Contexts/Toku-Awa-Koiora/NZ-Research/Model-for-identifying-cultural-indicators>

What is the Ake Ake Model?

<http://sciencelearn.org.nz/Contexts/Toku-Awa-Koiora/Sci-Media/Video/The-Ake-Ake-model>

What are cultural indicators?

<http://sciencelearn.org.nz/Contexts/Toku-Awa-Koiora/Sci-Media/Video/Cultural-indicators>

Learning the Ake Ake Model

<http://sciencelearn.org.nz/Contexts/Toku-Awa-Koiora/Teaching-and-Learning-Approaches/Ake-Ake-forever-and-ever>

The Turner Whaanau Papakainga Development 2016

www.maoritelevision.com/news/regional/126mil-boost-papakainga-project

Tuurangawaewae Marae Riverbank Restoration Project

<http://makearipple.co.nz/Action-groups/ripples/Turangawaewae-Marae-Riverbank-Restoration>

References

Waikato Raupatu River Trust 2015. *Te Tira Hoe o Waikato 2015 participant resource journal, Volume 6*. Waikato Raupatu River Trust, Hamilton.

Waikato-Tainui 2015. *Ko te mana maatauranga – Education strategy 2015–2020*. Waikato-Tainui, Hamilton.

Contact details for Yvonne

Email: yvonne.taura@tainui.co.nz

3. TOREPARU WETLAND A RESEARCH PARTNERSHIP JOURNEY

MAHURU ROBB (NGĀTI RANGINUI,
NGĀTI AWA) AND TARUKE THOMSON
(NGĀTI WHAKAMARURANGI)

[Ngā mihi](#)

[About Toreparu](#)

[Working together for better outcomes](#)

[Collaboration and how to do it](#)

[Key learnings from the research partnership](#)

[What can we do to support the continued booming
of the Matuku?](#)

[Want to learn more?](#)

Tēnā kei te repo, he matuku noho puku

In the marsh the bittern sits in silence

ABOUT TOREPARU

Located along the Waikato West Coast, between the mountain of Karioi and Āotea Harbour is the Toreparu wetland, a 223 ha repo (swamp) at the head of the Toreparu Stream. This wetland is considered a significant site for the *toi whenua* of the area (the customary designation for hapū (subtribes) holding ancestral rights to a particular area), Ngāti Whakamarurangi and Tainui. Te Kōwhatu, Te Ruataniwha, and Te Kaitiaki are old boundary markers that lie within the wetland that feed numerous tributaries, the principal ones being the Waimāori, Waitomotomo, and Matahahaia streams. At the northern end of the wetland is Horokawau, a 310 acre block, which, after the sale of the Ruapuke block in 1855, was set aside as a Native Reserve for Ngāti Whakamarurangi. It was a significant cultivation area as well as the site of a large waterfall. From 1820 onwards, the land surrounding the Toreparu wetland was occupied by tribes whose lineages were Ngāti Hauā, Ngāti Whakamarurangi/Tainui, Ngāti Whare, Ngāti Hourua, and Ngāti Naho. The principal settlements were at Te Mākaka and Mōtakotako, and their descendants still live on the land around the Toreparu.

I really want to thank Mōtakotako Marae and Taruke for your support, time and knowledge throughout this project. I could not have done it without you and hope that the outcomes from this will support your aspirations for the wetland and for your hapū. I also want to thank the surrounding landowners, the University of Waikato, my MSc supervisors Ian Duggan and Shaun Awatere, Te Pūtea Whakatipu Trust for my scholarship and of course my whānau and friends for their ongoing support both in the field and out.

- Ngā mihi Mahuru



A native plant-dominated arm of the wetland provides a guide and direction for current restoration initiatives. Photo: Mahuru Robb

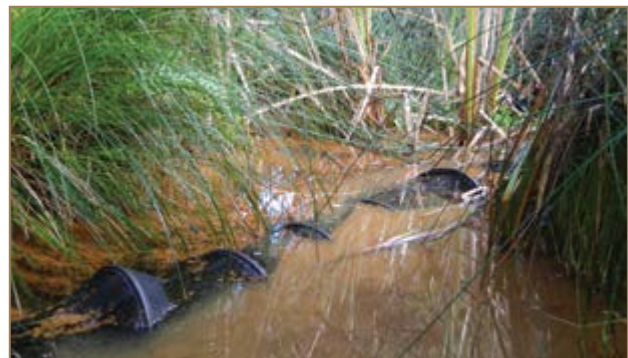
The Toreparu wetland is rich in cultural history. The remains of numerous pā (fortified place) and kāinga (settlement) sites on the north and south sides overlooking the length of the wetland attest to the abundance of resources it once provided, such as, tuna (freshwater eels), piharau (lamprey), inanga (whitebait), kākahi (mussels), etc. as well as materials for building, netmaking, clothing, dyeing, and bird snaring. Te Kōkiri and Te Awa a Heketoru were important pā tuna (eel weir) sites, with numerous other sites for setting hīnaki (eel basket) throughout the Toreparu.

Toreparu wetland is surrounded by a mixture of regenerating native bush, farmed pasture, and karst limestone outcrops. The repo itself has patches of mostly native plants, with the centre of the wetland covered in grey willow, spreading east up the wetland. Some of the southern arms of the Toreparu are surrounded in regenerating native bush and have a variety of native plant species such as tī kouka (cabbage tree), harakeke (NZ flax), rushes and sedges, raupō, ponga (sliver fern), and native ferns. These provide a guide to what the wetland once looked like, and what the kaitiaki (guardians) want to achieve through a combination of pest control, fencing, and restoration planting in the Toreparu catchment.

Carrying out the scientific-based field work and CHI assessment. Photo: Mahuru Robb



Carrying out the scientific-based field work and CHI assessment. Photo: Mahuru Robb



This site had an abundance of kokopū and was dominated by native plants. The brown water was due to iron-floc, a naturally occurring, iron-oxidizing bacteria that creates the soft brown growths seen to the left of the net. Photo: Mahuru Robb



He kahu kē i te waru, kei te matuku e hū ana i te repo

A hawk screaming in the eighth month, a bittern booming in the marsh

(From the ancient lament 'Whakarongo e te rau')

WORKING TOGETHER FOR BETTER OUTCOMES

In 2013, Mahuru worked with a kaitiaki group from Mōtakotako Marae which is adjacent to the Toreparu wetland as part of her MSc project looking at how mātauranga Māori (Māori knowledge) and science worked together to assess the health of wetlands. Although she does not have a direct whakapapa (genealogy) link to the toi whenua associated with the Toreparu, her involvement was through whānau relationships and a mutual desire to restore and rejuvenate the Toreparu wetland.

For Taruke (Ngāti Whakamarurangi), *“the heart of kaitiakitanga (exercise of guardianship) is the concept of equilibrium, both between and among species, humans, the animate and inanimate. Equilibrium can only be achieved when the importance of those relationships are recognised, fostered, maintained and protected. Like the matuku (Australasian bittern), the Toreparu repo has lain silent in the face of rampant willow invasion, exotic predators, stock damage, and public apathy. But we know it is possible to rejuvenate and restore this amazing area where the boom of the bittern can again be heard by all. This can only come about when we all shoulder the wheel, so to speak, as hapū, ecologists, researchers, community groups, farmers, statutory bodies, and others to collaborate using our combined knowledge, skills, and resources to give voice to this special place. We have been extremely fortunate to have Mahuru working with us*

and assisting us, her passion and knowledge has been invaluable, ā mā pango mā whero ka oti pai ai te mahi.”

Mahuru's role was to focus on the science monitoring and to help facilitate the development of a wetland Cultural Health Index (CHI) with the kaitiaki. The CHI was adapted from previous models, with alterations of indicators to suit the Toreparu and the hapū.

“I think it is really important to note that this project would not have happened without the support of kaitiaki and the hapū. This provided a foundation of trust, open and honest communication, and for me, the work was more meaningful as I wanted the research outcomes and process to provide benefits for the toi whenua, and of course the wetland.

The personal relationship and the one as researcher are not mutually exclusive. The approaches that I took, and the responsibility that I felt to support toi whenua aspirations, and the outcomes that I was looking for obviously had a very personal element to them. The relationships that were built and strengthened throughout this project, like any relationship, require maintenance and communication. Based on my experiences working at the Toreparu and subsequent collaborative research experiences with other iwi (tribes) and hapū groups, I have summarised some of the important steps to working together to restore the health of wetlands.”

Below: Livestock and vegetation clearance are impacting parts of the Toreparu.
Photo: Mahuru Robb



COLLABORATION AND HOW TO DO IT

The research relationship must be collaborative throughout the whole process – from the seed of the project being planted to the end.

As a researcher, it is important to think of these projects as growing along the way. If you go in with a set agenda and outcomes, you are going to miss opportunities for mutual growth and understanding, and you are obviously not going to create a mutually beneficial relationship. And the research world is well overdue for moving on from the "researcher vs the researched" mentality.

The steps outlined below (Fig. 1) identify the process we used at the Toreparu, which may be helpful for others. The process was iterative and reiterative, to make sure the project was providing useful outcomes for our hapū research partners and, obviously, for the wetland as well.

So what has this all meant in terms of restoring the Toreparu? The collaborative approach discussed in this chapter produced a comprehensive wetland assessment that used a combination of wetland CHI and science approaches. The comparative assessment confirmed that cultural values and working closely with toi whenua results in a holistic, more detailed picture of wetland health and highlights key focus areas for future restoration, that could not be captured by using science alone.

This work has put the Toreparu in the spotlight as a priority wetland for restoration. The restoration project will be led by toi whenua and the catchment landowners, with

support from the Waikato Regional Council, Te Papa Atawhai – Department of Conservation, and Manaaki Whenua – Landcare Research. The restoration of the Toreparu is currently in the planning stage and it is hoped to have more details and updates online soon.

KEY LEARNINGS FROM THE RESEARCH PARTNERSHIP

- Research partnerships with marae (Māori social and cultural centre), hapū, and iwi kaitiaki need to be collaborative from the beginning. The relationship that is built will be the foundation for the success of the project
- Researchers need to be open and accepting of mātauranga Māori, and not impose their views or values on this. Mātauranga Māori is valid in itself
- Be aware that science, in this context, is a tool and a useful approach for collecting information
- Māori research partners need to be resourced and funded for their work. Unfortunately, many projects do not factor this in
- Māori and non-Māori research partners should familiarise themselves with kaupapa Māori research methodologies (an approach underpinned by Māori values)
- Collaborative research is an iterative, dynamic, and learning experience. It is important that we listen and look beyond our disciplines for solutions to help our environment and those who are connected to it.

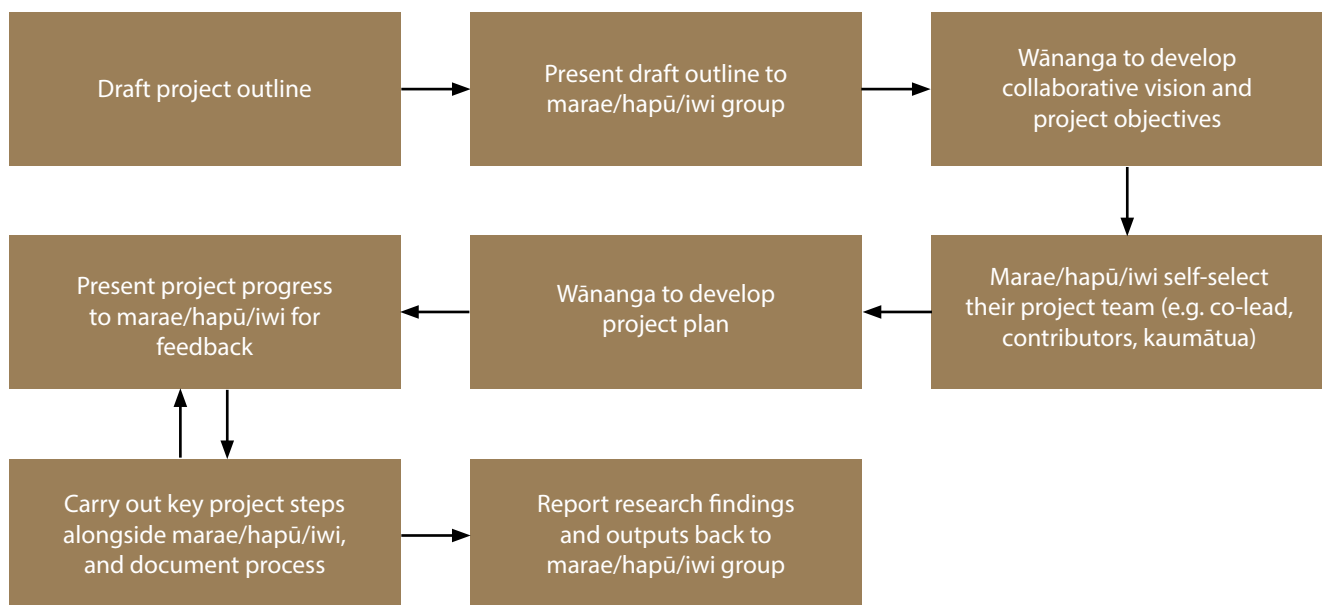


Figure 1. Toreparu research relationship collaborative process

Kei te matuku e hū ana i te repo, 'Hu'!

The bittern makes a deep booming call in the swamp, 'Hoo'!

WHAT CAN WE DO TO SUPPORT THE CONTINUED BOOMING OF THE MATUKU?

Emma Williams and Andrew Styche
(Te Papa Atawhai)

The matuku (Australasian bittern, *Botaurus poiciloptilus*) is an important wetland bird species, but due to its shy (cryptic) behaviour, it can be difficult to study. It is highly endangered, with current populations in Aotearoa New Zealand predicted to be under 900 birds. Much of the decline has been attributed to the destruction of its preferred wetland habitats, making wetland restoration all the more important. However, in reality, threats will be numerous because bitterns nest on the ground and have specific foraging behaviours that make them highly susceptible to predators and changes in prey accessibility.

Matuku produce a distinctive low, booming call that sounds rather like air-blowing across a bottle. In general, these calls are associated with territorial defence and mate attraction during the breeding season. The booms are key indicators for monitoring bittern populations, i.e. people monitoring them listen for the boom, note the direction (N, S, W, E) from which the boom is coming and the time heard to distinguish between individuals calling, and thus estimate the number of individual males in the population. In general it is assumed every male has at least one female; in reality male bitterns are polygynous, meaning they can have more than one female. Also they will still call even if they have not found a mate, suggesting that booming males could have anything between zero and five females.



Matuku/Australasian bittern. Photo: Craig Bullock

For some hapū and iwi, the matuku formed both an important component of cultural information transferral (via carvings, waiata (songs), karanga (welcome call) and our reo (language)), and also part of some hapū/iwi diets. However, with the huge decrease in their numbers, the focus is now on increasing their populations through habitat restoration, and monitoring programmes. The growing recognition of the important connection between matuku habitat and inanga spawning habitat deserves greater exploration with whānau.

WHAT CAN WE DO TO HELP OUR MATUKU?

Key actions we can take to build our understanding of the matuku based on our collective mātauranga (knowledge).

Kōrero (speak) with local kaumātua (elders) and other whānau (family) members about the matuku:

- **The socio-cultural value of the matuku?** How did whānau/tūpuna (ancestors) interact with the bird? Has this changed, and if so, how and why?
- **What are the local names (if any) for the matuku, and other species are they connected (whakapapa)?** What plants, other birds, insects, and fish were also found in the same habitat? Have these animals and plants also changed in physical appearance, distribution or population size? This is fundamental to building a bigger, more holistic picture of connections and associated health and wellbeing of the whole system.
- **Where were populations of matuku? Has their distribution changed in the past compared with the present?** Identifying remnant wetland areas within the rohe (region) of importance to the whānau, and how they relate to whānau memories of matuku locations.
- **What do the matuku and the habitat they lived in look like, smell like, and sound like?** Our senses (eyes, nose, and ears) are very good at picking up changes, providing important information about population densities and quality of their habitats.

Observations

- **Population features** – The absence of birds could suggest that survival is low. Similarly, sightings of birds that are very dark in colour could suggest few juveniles are making it to breeding age. In general:
 - Adult bitterns of breeding age are brown and darker on their backs and wings
 - 1st year birds are lighter, with more buff-yellow mottling on their wings.
- **Predators** – reasons why you may be seeing more adults and fewer juveniles are numerous and difficult to determine. However, one possibility is predators. Bitterns are ground nesters, which makes females, eggs, and chicks particularly vulnerable to cats, ferrets, stoats, and dogs.
- **Food sources** – another possibility (worse for juveniles but could also affect adults) is that food sources can become inaccessible to bitterns for

prolonged periods. Availability and accessibility of food appear to be critical to bittern survival:

- **Availability – Is your wetland drying out?** If the wetland dries out it can reduce the availability of small prey items, such as frogs, fish, and tuna. If so, bitterns may not have access to prey during these periods.
- **Accessibility – Does your wetland have deep drains?** And does water become concentrated in these drains, drying out completely elsewhere during summer? Bitterns rely on shallow water in areas with protective vegetative cover to feed, e.g. raupō stands. Catching food in deep drains is difficult because of the steep sides. In areas where water levels become too shallow and are without cover, bitterns will not forage because of exposure.

Smell

- A change might suggest changes to the air quality, or subtle shifts in the types and health condition of plants in the habitat. It can also provide information about the condition of water and soil in the wetland, e.g. decomposition may cause a rotten egg smell.

Sounds

- Changes to the times when the birds boom can provide important information about changes to the natural maramataka (calendar); but also consider changes to other sounds in the wetland habitat of matuku – are other wetland birds still calling too? Frogs?
- Males go through several changes to produce booms:
 - Quiet, croaky booms at the start
 - Louder booms as the season progresses
 - Frequency and loudness of booming tapers off, in general, around egg laying (September/ October).
- **When does booming peak in your wetland? Does this change in relation to other changes in the environment?** The timing of the booming peak may change if breeding success has changed. It may be possible for booming to peak sooner or later than expected; more than once; or not at all. For example, if extreme water-level changes or predators cause nests to fail and there is still time to breed, males may start booming again to compete for females that are available and fancy-free once more.

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

More on collaborative research:

www.landcareresearch.co.nz/science/portfolios/enhancing-policy-effectiveness/vmo/planning-and-decision-making/matauranga-maori

Kaupapa Māori Research:

Smith LT 2012. *Decolonizing methodologies: research and indigenous peoples*. 2nd edn. London and New York, Zed Books. View here: https://books.google.co.nz/books/about/Decolonizing_Methodologies.html

Harmsworth GR 2002. *Coordinated Monitoring of New Zealand Wetlands, Phase Two, Goal 2: Maori Environmental Performance Indicators for Wetland Condition and Trend*. Palmerston North, Landcare Research: 1–66.

Useful websites

More on matuku:

<http://nzbirdsonline.org.nz/species/australasian-bittern>

<http://doc.govt.nz/nature/native-animals/birds/birds-a-z/australasian-bittern-matuku>

Author research

Mahuru's Masters research thesis:

Robb MJG 2014. *When Two Worlds Collide: Mātauranga Māori, Science and Health of the Toreparu Wetland*. Unpublished MSc thesis, University of Waikato, Hamilton. <http://researchcommons.waikato.ac.nz/handle/10289/8776>

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SECTION TWO:

CULTURAL RESOURCES

INDICATORS FOR CULTURAL RESOURCES

GARTH HARMSWORTH
(TE ARAWA, NGĀTI TŪWHARETOA,
NGĀTI RAUKAWA)

In 1998 A Māori advisory panel was asked to provide a concept and definition of a Māori environmental performance indicator. The following definition was given:

A Māori Environmental Performance Indicator (MEPI) is a tohu created and configured by Māori to gauge, measure or indicate change in an environmental locality. A Māori EPI leads a Māori community towards and sustains a vision and a set of environmental goals defined by that community.

Indicators help to understand the health and wellbeing of cultural resources within our repo (wetlands). They are also used for monitoring and detecting changes over time. If the changes are negative, i.e. a downward trend in indicator health, this signals remedial actions need to be taken, preferably at the earliest opportunity. On the other hand, positive changes reflect improvements in the state of the indicator, which may be a result of restoration activities centred on the cultural resource or the wider repo.

This section of the handbook defines cultural indicators and outlines their importance in managing and restoring cultural resources in our repo. It provides a snapshot of some of the wetland species, and some traditional practices or cultural indicators that have been identified as important components of a broader monitoring tool-kit from the perspective of authors. It is important to recognise that these are relevant to specific kaitiaki (guardians), whānau (families), marae (Māori social and cultural centre), hapū (subtribes), iwi (tribes), and rohe (districts), and should not be taken as the only indicators of importance to tangata whenua (indigenous people). However, they provide a useful set from which a conversation can start between tangata whenua and others interested in wetland rehabilitation and restoration across the motu (country).

Culturally significant plants in wetland. Photo: Monica Peters



WHAT IS AN INDICATOR?

An Indicator is essentially something that can be measured or monitored spatially and through time to show an explicit change or trend and tell us something about what is happening in the environment. Indicators can be developed from ecosystems, habitats, sites, species, or organisms and collectively help us explain and understand the whole system. When collected at regular intervals (e.g. years) indicators can show a trend or pattern in a certain direction. Depending on perspective, a change could be positive or negative – a negative change for example being something harmful or damaging to an organism or ecosystem. Monitoring of indicators, which can be made through measures, observations, or descriptions, give quantitative (numerical data) and qualitative (verbal data) information that can help our understanding of the broader health and wellbeing of the environment or systems we want to protect and manage.

Indicators can also provide information to help determine a response or intervention to sustain or enhance health and wellbeing. Some organisms are called 'proxy' or 'keystone' indicator species; in other words, they are sensitive enough to detect and show small incremental changes and therefore become signals or early warning signs of environmental change. By developing a narrative (or measure) about the health and wellbeing of indicators and their interconnections and interdependencies in the system, a wider whakapapa (connections) can be constructed (e.g. providing links and interdependencies between all the organisms in a natural ecosystem). Matamata

(whitebait) provides a good example. By measuring and evaluating the health of matamata and its habitat through time, and understanding its whakapapa, we can build a bigger picture of the overall health and wellbeing of the state of repo and associated habitats to support and sustain matamata into the future.

In the case of repo, a monitoring programme can be developed using ecologically or culturally significant flora (plant) and fauna (animal) indicators (e.g. taonga species) alongside key introduced plant and animal species that compete with or impact on those important species and habitats we value and wish to maintain. Examples of pests may include invasive weedy plants, pest fish, and mammalian predators such as mustelids and feral cats. By better understanding the patterns, movements, and densities of unwanted species, we can develop more effective techniques to restore the habitats, species, and systems we want to value and enhance.

Māori have monitored their environment for centuries to assess natural resources as a basis for sustenance and wellbeing. Using their in-depth knowledge systems (mātauranga Māori), strengthened through a close interdependent relationship with the environment, they were able to detect subtle changes in resource availability and condition to help manage resources. Traditionally, Māori used the term 'tohu' (i.e. a sign, marker, pou (post)) to indicate a signal or direction of change, often using specialist or expert knowledge (e.g. tohunga) used to manage resources.



4.1 Wātakirihi/Watercress



4.2 Kuta/Giant spike rush



4.3 Harakeke/NZ Flax

WHAT IS A CULTURAL INDICATOR?

The term 'cultural indicator' (which can also include 'cultural health indicators') has only emerged in the last 20–30 years. A cultural indicator therefore can be a marker or signpost for local Māori, and needs to be a relevant and meaningful indicator or tohu that can be used to show change within the context of both Māori values and the wider system. Collectively, cultural indicators should be used to understand the overall state of health and wellbeing of resources of the specific environment or ecosystem (e.g. repo) being managed. Cultural indicators should therefore be developed from localised knowledge, in collaboration with whānau, marae, hapū, iwi, and kaitiaki communities to make them relevant and connected.

For example, indicators based on local community knowledge could include assessing or monitoring the harvest levels of specific taonga species such as; native plants – wātakirihi (watercress), kuta (giant spike sedge), and harakeke (New Zealand flax); fish – matamata (whitebait) and kōura (freshwater crayfish); birds – ruru (morepork) and kawau (shags); and invertebrates – noke (earthworms). The change of harvest in quantity and condition over time can detect a change in the state of the resource. These specific, locally derived indicators are incredibly valuable for a number of reasons:

1. Cultural indicators originate from Te Ao Māori or a Māori world view (belief system), which provides a Māori epistemology (study of knowledge) of source, origin, knowledge, and application. That is, the indicators are generally linked back through generations and whakapapa (genealogy) to Papatūānuku (Earth mother) and Rangi-nui (God of the sky) through important Atua (God, deities) such as Tāne Mahuta (God of forests and birds), Tangaroa (God of sea and fish), Haumiatiketike (God of fernroot and uncultivated food), Tāwhirimātea (God of winds), Rongo mā Tāne (God of kūmara and cultivated food), and Tūmataunga (God of war). They therefore reflect important Māori values, including rangatiratanga (rights to exercise authority), kaitiakitanga (exercise of guardianship), whakapapa, wairuatanga (spirituality), mauri (life force), and tapu (sacred). Values also define the tikanga (values and practices) and kawa (protocols) for local area restoration, planning and management of resources.
2. Cultural indicators are often founded on generations (e.g. hundreds of years, 1 generation equates to 25 years) of mātauranga Māori (traditional, historic, and contemporary local Māori knowledge), largely built from inter-generational knowledge, technology, relationships, experience, and a long interaction and use with certain resources, species, and organisms and the habitats and ecosystems to which they belong to and which sustain them.



5.1 Noke/Earthworms



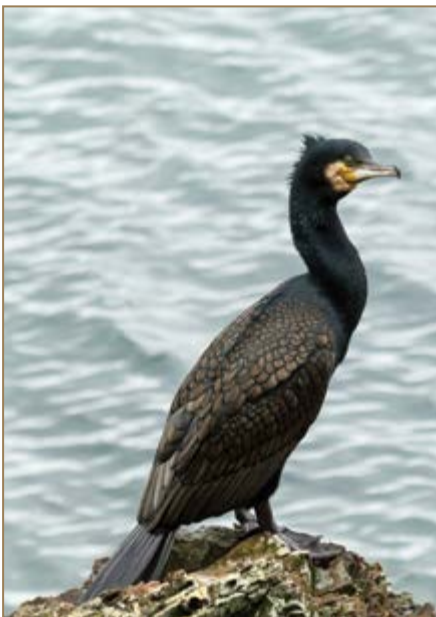
5.2 Kōura/Freshwater crayfish



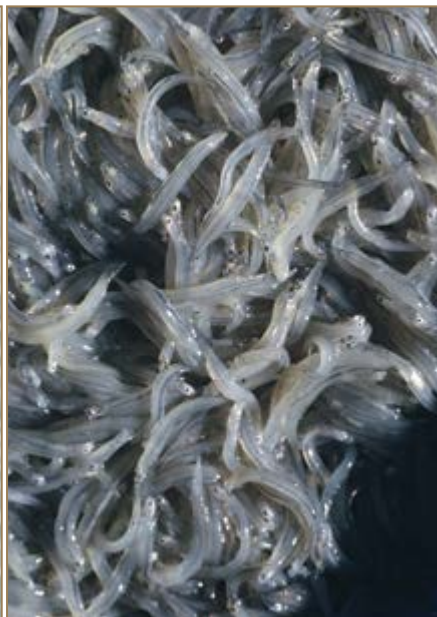
5.3 Ruru/Morepork

3. Cultural indicators have local context and meaning. Indicators are derived from local knowledge and developed from long-term relationships within specific areas giving important meaning and relevance to whānau, marae, hapū, iwi, and kaitiaki communities. This strengthens and maintains the reo (language) for a community around resources, species, customary use, and the management of resources. This means local knowledge is specific and understood and explicit within a local context of interactions between tangata whenua and the resource or species. Indicators are therefore locally important for resource management, and can indicate change, or trends over time, such as changes in harvest and resource condition.
4. Cultural indicators represent important Māori values, such as iconic, or taonga species that are valued highly by local communities. This local knowledge is critical when planning a restoration or rehabilitation project to protect and manage these taonga values (e.g. wātakirihi, kuta, harakeke, matamata, kōura, ruru, kawau, noke) in order to sustain the ecosystem, habitat, species, and organisms.
5. They provide the tikanga and kawa (values, customary practice), regulations (ritenga, tapu, noa), and rules to carry out customary use of resources, and define, in a local context, the practices associated with use and management of the resource. They also, through generations of knowledge, provide the methods by which that interaction with the resource can be applied (e.g. through tikanga). In addition to the species of interest, the practices associated can incorporate a range of observations and learnings, such as:
 - i the time of flowering of specific native plants as clues to a new seasonal phase; or
 - ii observing bird behaviour (or listening for specific bird calls) to gauge the appropriate time for harvesting of valued fruits, seeds or leaves as a direct part of traditional harvesting.
6. Cultural indicators also recognise the significance of, and strengthen rangatiratanga. Most importantly, these types of indicators are selected from local people and communities, and so greater incorporation of these indicators sets is not only an appropriate recognition of the value of that local knowledge and expertise, but, also generates a new level of ownership and community application. Ultimately, personal, on-the-ground experience (which may or may not be coupled with other complementary tools within science and policy) can generate new innovations and techniques that can further improve the way we interact with the systems and taonga species we treasure.

Māori have become increasingly interested in combining mātauranga Māori and locally based indicators with scientific or ecologically based indicators. Current research on cultural monitoring and indicators is exploring improved methods to better incorporate locally relevant approaches and indicators with science-based indicators to include them effectively into regional and district monitoring and planning.



5.4 Kawau/Black shag



5.5 Matamata/Whitebait

Watch this space

Additional articles will be added to this online resource over time.

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

Harmsworth GR 2002. *Coordinated Monitoring of New Zealand Wetlands, Phase 2, Goal 2: Māori environmental performing indicators for wetland condition and trend*. SMF Project 5105. Palmerston North, Landcare Research Contract Report LC 0102/099. 66 p.

Ministry for the Environment (MfE) 1998. *Māori Environmental Monitoring: Prepared for the Ministry for the Environment by a panel of independent Māori*. Written by Te Ahukaramu Charles Royal. Technical paper No. 26 – Māori, July 1998. Part of a series of environmental performance indicators reports. 70 p.

Ministry for the Environment (MfE) 1999. *Environmental Performance Indicators: Māori Input into the Environmental Performance Indicators Programme, April 1999*. Prepared by the Ministry for the Environment, Wellington. 48 p.

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FLORA

4.1 WĀTAKIRIHI TE HUAKITA O TE WĀTAKIRIHI BACTERIAL QUALITY OF WATERCRESS

LORRAINE DIXON (NGAATI WHAAWHAAKIA)

The importance of wātakirihi

Native wātakirihi

Impacts of wātakirihi loss on traditional practices

How do we restore wātakirihi?

Traditional versus non-traditional harvesting
methods and bacterial quality of wātakirihi

Want to learn more?

THE IMPORTANCE OF WĀTAKIRIHI

Wātakirihi, or watercress (also called kōwhitiwhiti, *Nasturtium officinale* and *N. microphyllum*) is a highly prized food source for tangata whenua (indigenous people) in Aotearoa New Zealand. An aquatic or boggy ground plant associated with drains, small creeks, wetland streams, and the calmer edges of rivers, wātakirihi is a vigorous plant, provided there is a good level of water quality (i.e. lack of sedimentation). It is a member of the mustard family and is highly regarded for its medicinal properties as well as its taste in many cultures across the world. As avid botanists and gardeners, tangata whenua were quick to identify its properties, and it now forms a major component of many traditional dishes. Harvest sites are highly coveted and sometimes known only to whānau (family/ies).

Since the onset of intensified land use – such as farming, and associated practices of draining – harvesters of wātakirihi comment that populations and the quality of wātakirihi have fluctuated dramatically at most sites. Farm drains associated with farming can have populations of the plant, but there is a higher risk of pollution and bacterial infection (such as *Escherichia coli*), which can make it unsuitable for consumption.

Wātakirihi is also a very good accumulator of nitrogen, and has been used in some instances for nitrogen 'scrubbing' (removal via plant uptake into roots and leaves) in freshwater feeder systems adjacent to farmland. Discussions with tangata whenua across the motu (country) indicate that areas once used for harvest are becoming fewer, possibly due to sedimentation and also pugging of habitat. Sedimentation is where high loads of silts, clays, and other soil components (often loaded with high concentrations of nitrogen, phosphorus, potentially pathogenic microbes, and other nutrients) are deposited on the plants as the waterbody settles out in the calmer areas.

Like other plants, wātakirihi makes its food via photosynthesis in leaf cells, so heavy sediment deposits can greatly affect this process by smothering leaves and blocking sunlight. Pugging is caused by the movement of stock along a riparian margin, which can also create small slips that fall onto wātakirihi beds and smother them.



Wātakirihi (*Nasturtium officinale*). Photo: © Jon Sullivan, some rights reserved (CC BY-NC)



Wātakirihi (*Nasturtium microphyllum*). Photo: Trevor James



Wātakirihi (*Nasturtium microphyllum*). Photo: Trevor James

NATIVE WĀTAKIRIHI

Among the earliest botanical surveys conducted by the first settlers are references to a 'native cress' – probably *Rorippa palustris* and *R. divaricata* (now a threatened plant). *Rorippa palustris* is the more widespread cress found in repo (wetlands) across the motu. These native watercress were identified as wātakirihi or kōwhitiwhiti, but may also be known as panapana, ponui, and matangaoa. They can colonise similar habitats to the more common exotic wātakirihi (*N. officinale*, *N. microphyllum*), although this does not necessarily mean the exotic wātakirihi has outcompeted them.

All the native cresses are recognised as being edible, and have been suggested as a great addition to 'indigenous summer salads', along with Cook's scurvy grass (traditional name of 'Nau'), native celery, and native spinach (traditional names include kōkihi, rengamutu, tūtae-ika-moana). All these indigenous summer salad plants are usually also associated with coastal and estuarine wetlands.



Kōwhitiwhiti (*Rorippa palustris*). Photo: Jeremy Rolfe

IMPACTS OF WĀTAKIRIHI LOSS ON TRADITIONAL PRACTICES

Wātakirihi is more than simply a foodstuff. Tikanga (values and practices), the correct cultural way of doing things, are handed down to each new generation. Embedded in these practices are stories and broader environmental management systems unique to the whānau, hapū (subtribes), and iwi (tribes), and their respective rohe (region).

One of the easiest impacts to measure is the decline in the use of traditional names for our valued plant and animal species across each generation. This decline in turn can generate a gradual decline in the knowledge of the origin and purpose of the name. In some cases, the name of a plant, for example, provides clues to a whakapapa (connections between and within species) that can also become hidden as the name disappears from the local reo (language).

Traditional names, such as those associated with wātakirihi, can be lost for a range of reasons including localised extinction or increased rarity of the plants due to:

- other plants (especially invasive wetland and riparian plants) outcompeting them
- browsing and trampling by mammalian herbivores, e.g. deer, goats, sheep and cattle
- pollution and sedimentation
- insect pests: our native cresses are from the same family (Brassicaceae) as cabbages, broccoli, and cauliflower, and so are prone to attack from the same insects and diseases
- habitat loss caused by human-induced land changes.

A second cultural impact to measure is the changes in harvesting and other practices associated with the species, particularly harvesting by our younger generations. Localised extinction or rarity can lead to a decrease in the application of knowledge and understanding of the plant. This is exacerbated by large decreases in populations within one human generation that can cause a very quick 'out of sight, out of mind' response. Losing a valued species, no matter how insignificant at the time, can hugely affect the relationship people can have with that organism, which in turn, impacts directly on the cultural, spiritual, and economic health and wellbeing of the people.

HOW DO WE RESTORE WĀTAKIRIHI?

STEP 1: Build relationships with the local community to get a better understanding about:

- the socio-cultural value of the plant. Is it important to bring it back as a mahinga kai/hauanga kai (food gathering site), and as a nitrogen-scrubber?
- pinpointing and mapping where wātakirihi populations used to be, and still are
- identifying how those populations have changed
- what may have caused decline: the 'cause' may need to be addressed first, e.g. sediment loads upstream or pugging in the immediate area, before any new populations can be reintroduced to the area.

STEP 2: Consider the ecological and environmental whakapapa of the system to get a better understanding about:

- the best areas to restore wātakirihi. Consider sites that have good fertility, high water quality, adequate water flow, sufficient light, and no weed competition (or weeds are easily maintained)
- adjacent land use and how you can mitigate any adverse impacts where possible, e.g. pollutant run-off
- benefits for other organisms – fish species (i.e. tuna (freshwater eels), inanga (whitebait), porohe (smelt), kanae (grey mullet)); water invertebrates (i.e. caddis flies, mayflies, beetles)
- habitat vegetation: a vegetation survey of what is there now is a good way of building a baseline to help monitor change over time.



Wātakirihi bordered by Carex wetland. Photo: Yvonne Taura

STEP 3: Building a monitoring and restoration framework

Key actions that we can take to build our understanding of wātakirihi (both the commonly harvested *Nasturtium* spp., and the lesser known native *Rorippa* spp.) based on our collective mātauranga (knowledge):

1. **Kōrero (speak) with local kaumātua (elders) and other whānau (family) members about their memories and current interactions with their wātakirihi:**
 - **What does their wātakirihi look like, smell like, sound like, and taste like?** Our senses (eyes, nose, ears, and taste buds) are very good at picking up changes, provided we pay attention to them! Recording these sensory changes are just as important as collecting scientific-type information on population densities, plant sizes, and water quality:
 - i. A change in colour, size and form (shape of the plant) might suggest that the essential nutrient levels are changing (potentially declining or increasing to toxic levels), or that there may be pollutants in the water. It might also provide clues to an invasive insect or virus affecting the plants
 - ii. A change in smell might suggest pollutants in the water
 - iii. Changes to the sound that the wātakirihi makes when you snap the stem provide important clues as to plant health, e.g. that the plants are being weakened by some unknown environmental factor; or, that you have missed the harvesting period – particularly if stems are hard to snap and have turned purple. Depending on how other plants in the population are affected, further work might be needed to establish what is causing any changes to stem structure, and if harvesting programmes should be implemented with the whānau
 - iv. Changes in taste might suggest changes to the water, soil or plant chemistry, or that the harvesting period has occurred at the wrong time (which may indicate a shift in uptake of practices, and a shift in local climate).
 - **What are the practices associated with harvest and preparation of wātakirihi, and have these changed?** Also consider whether whānau have any thoughts about the reasons why harvest practices may have changed (if they have). Include here the calendars of harvest for the areas, which is usually late spring to summer but can vary slightly between harvest areas.
 - **What are the local names (if any) for the wātakirihi, 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 wellbeing of the whole system. For example, paru (dyeing muds), insects, fish and other plants, and place names may provide a clue.

Note: Many national databases hold examples of Māori names for plants, but they are often sourced from only a small sample of Māori dialects. It is important then, that restoration of wātakirihi accommodates and supports restoration of the local dialect and names, and also considers return of the wider whakapapa associated with those plants.

2. Identify your own monitoring areas based on what you have learnt from your people. Think about:

- where the populations of wātakirihi were in the past compared with the present
- monitoring your aspirations for wātakirihi, including relevant knowledge for future use. Note that some whānau 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 that they feel may be affecting the plants.

A warning – ensure you understand the system in which you are going to grow wātakirihi. There are areas along the upper Waikato River, for example, that are known as no-go harvest areas for wātakirihi due to high arsenic loads. Wātakirihi is very effective at taking up heavy metals to toxic levels, making them unsuitable for consumption. This also applies if restoring wātakirihi as a nitrogen-scrubber – it is best not to harvest wātakirihi in this circumstance because of the potential for nitrogen loads in the plant to be above those considered safe for eating.

- 3. Who to talk to?** Talk to scientists and other communities with additional experience in wātakirihi ecology and restoration, and work with them to help build a restoration framework that best meets the needs of your local community and the plant.



Wātakirihi growing in a puna. Photo: Yvonne Taura

TRADITIONAL VERSUS NON-TRADITIONAL HARVESTING METHODS AND BACTERIAL QUALITY OF WĀTAKIRIHI

Because wātakirihi can and does grow in waterbodies that are at risk of pollution from adjacent land use and run-off, there is a risk that the plants will be exposed to harmful pathogens and bacteria associated with animal effluent. These impact on the safety of the plant for human consumption, although the symptoms of pathogen exposure are not always easily identifiable without some form of scientific analysis. *Escherichia coli* (or *E. coli*) is a key pathogen associated with effluent, and is used widely as an indicator of effluent pollution in waterways and on foods like wātakirihi.

A study was undertaken to assess the bacterial (*E. coli*) content of wātakirihi harvested by two

methods: (1) traditional: targeted and governed by culturally defined practices; and (2) non-traditional: randomised with no set method or governing practices (Table 1).

Results

Public Health Laboratory System microbial guidelines outline that for every gram of a salad vegetable:

- **Less than 20 *E. coli*** is satisfactory for human consumption;
- **20–100 *E. coli*** represent the minimum standard for human consumption; and
- **Greater than 100 *E. coli*** is unacceptable.

Of the 14 non-traditionally harvested wātakirihi samples, while 9 were satisfactory, 5 were unacceptable as a food. Of the 13 samples harvested using traditional methods, 12 were satisfactory, and 1 was of minimum standard.

Table 1. Traditional compared with non-traditional techniques for wātakirihi harvest (based on tikanga from harvesters in the Huntly region of the Waikato)

| Key feature of method | TRADITIONAL (13 samples collected) | NON-TRADITIONAL (14 samples collected) |
|------------------------|--|--|
| Area selection | <ul style="list-style-type: none"> • No evidence of grazing animals • Wātakirihi in flowing water close to riparian margins | <ul style="list-style-type: none"> • Selection of areas where wātakirihi was easy to access • No attention paid to presence of grazing animals • Picked from banks and on riparian margins |
| Plant selection | <ul style="list-style-type: none"> • Absence of adventitious roots at nodes of plants • Wātakirihi not in flower – youngest shoots are being harvested • There are no green/purple wātakirihi stalks | <ul style="list-style-type: none"> • No special care taken when plants selected |
| Picking method | <ul style="list-style-type: none"> • Picked as single stems, approx. 30 cm length • A sample of the plant picked is released to flow downstream and encourage a new population of wātakirihi | <ul style="list-style-type: none"> • Harvested in bunches and pulled towards harvester • Roots still attached were ripped off and discarded on site • No release of plant material to encourage new populations |
| Washing method | <ul style="list-style-type: none"> • Submerged as picked bunches in flowing water of stream with leaves facing the current • Submerged bunches agitated gently • Given a shake to remove excess water when removed from stream • Packed upright in a clean plastic bag | <ul style="list-style-type: none"> • If washed, was washed by submerging in water that had been disturbed by the roughly harvested bunches |

What do the results tell us?

- Adventitious roots that grow from nodes along the stem can provide a good habitat for bacteria like *E. coli* to enter and move through a plant to its (edible) leaves. By selecting plants without these roots the traditional harvester reduced the potential to select plants with higher bacterial loads.
- Wātakirihi beds can clog small waterbodies like channels and narrow streams, encouraging deposition of bacteria into the beds. The risk of bacterial contamination is highest in areas of high wātakirihi density, and very low/no water flow such as on the banks and riparian margins of the waterbody.
- Traditional harvesting utilises a common sense approach that preceded the introduction of cattle to Aotearoa. In applying that common sense, our traditions have enhanced the potential to reduce the risk of food borne bacterial diseases such as those caused by *E. coli*.
- Traditional harvesting also adopts a practice that encourages long-term sustainability of the wātakirihi beds by releasing a portion of the material harvested for propagation downstream.
- Protecting and supporting inter-generational transfer of traditional harvest and preparation information are just as important as protecting the presence of wātakirihi in an area.

Full article *Te Huakita o te Waatakirihi/Bacterial quality of purchased and harvested watercress* can be found at: www.researchgate.net/publication/34903534_Bacterial_quality_of_purchased_and_harvested_watercress



Wātakirihi growing in a puna. 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

Barker DJ 2009. *Nasturtium officinale* (watercress). *Pacific Northwest Aquatic Invasive Species Profile*. FSH 423. Document available from: http://depts.washington.edu/oldenlab/wordpress/wo-content/uploads/2013/03/Nasturtium-officinale_Barker.pdf

Cumbus IP, Hornsey DJ, Robinson LW 1977. *The Influence of phosphorus, zinc, and manganese on absorption and translocation of iron in watercress*. *Plant and Soil* 48: 651–660.

Donnison A, Ross C, Dixon L 2009. *Faecal microbial contamination of watercress (Nasturtium officinale) gathered by a Māori protocol in New Zealand Streams*. *New Zealand Journal of Marine and Freshwater Research* 43 (4): 901–910.

Dixon L 2014. [Phamplet] *Te Huakita o te Waatakirihī: Bacterial quality of harvested watercress*. www.researchgate.net/publication/34903534_Bacterial_quality_of_purchased_and_harvested_watercress

Dixon L, Donnison A, Harfoot C, McDonald IR 2007. *Survival of Escherichia coli in toroi: a traditional Māori food*. *New Zealand Journal of Marine and Freshwater Research* 41: 369–371.

Edmonds C, Hawke R 2004. *Microbiological and metal contamination of watercress in the Wellington region, New Zealand – 2000 survey*. *Australian and New Zealand Journal of Public Health* 28(1): 20–26.

Kisten K, Gounden D, Moodley R, Jonnalagadda SB 2015. *Elemental distribution and uptake by watercress (Nasturtium aquaticum) as a function of water quality*. *Journal of Environmental Science and Health, Part B: Pesticides, Food Contaminants, and Agricultural Wastes* 50(6): 439–447.

Gardener-Gee R, Graham S, Griffiths R, Habgood M, Heiss Dunlop S, Lindsay H 2007. Section two: *Restoration of Motuora's plant community. Motuora native species restoration plan*. Wellington, New Zealand: Department of Conservation. Pp. 7–2.

Howard-Williams H, Davies J, Pickmere S 1982. *The dynamics of growth, the effects of changing area and nitrate uptake by watercress Nasturtium officinale R. BR in a New Zealand stream*. *Journal of Applied Ecology* 19: 589–601.

Kuhnlein HV, Turner NJ 1991. *Traditional plant foods of Canadian Indigenous Peoples: nutrition, botany and use*. Food and nutrition in history and anthropology, vol. 8. Amsterdam, The Netherlands: Gordon & Breach. 619 p.

New Zealand Food Safety Authority (NZFSA) 2005. *Review of non-commercial wild food in New Zealand: He whakawhitihitinga kōrero mo ngā kai rangatira o te whenua, no ngā Ngāhere, o ngā awa, o ngā moana, o Aotearoa*. NZFSA Draft Position Paper (No. 01/05).

Robinson B, Outred H, Brooks R, Kirkman J 1995. *The distribution and fate of arsenic in the Waikato River system, North Island, New Zealand*. *Chemical Speciation & Bioavailability* 7(3): 89–96. Free access at: www.tandfonline.com/doi/abs/10.1080/09542299.1995.11083250

Wetland Restoration Handbook: www.landcareresearch.co.nz/publications/books/wetlands-handbook

Whaanga H, Papa W, Wehi P, Roa T 2013. *A code of practice for naming new species in Aotearoa?* Poster session presented at the meeting of Australasian Wildlife Management Conference. Conference held at Massey University Palmerston North. www.awms.org.au/assets/docs/Conferences/awms13programme.pdf

Useful websites

Māori Plant Uses Database: <http://maoriplantuse.landcareresearch.co.nz/WebForms/default>.

Herb Federation of New Zealand: www.herbs.org.nz/information/watercress.html

Watercress.com: www.watercress.com

Examples of projects restoring and researching watercress can be found at the following websites using the key words 'watercress':

- Naturewatch: <http://naturewatch.org.nz>
- The Ripple Effect: <http://makearipple.co.nz>
- Sustainable Farming Fund ('Earlier Funding Rounds'): www.mpi.govt.nz/funding-and-programmes/farming/sustainable-farming-fund

Author research

Lorraine's Masters research thesis:

Dixon LL 2007. *Microbiological quality of toroi: A Māori food delicacy*. Unpublished MPhil thesis, University of Waikato, Hamilton. <http://researchcommons.waikato.ac.nz/handle/10289/2229>

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4.2 KUTA THE GIANT OF FRESHWATER HABITATS

MIEKE KAPA (TE WHARE WĀNANGA
O WAIKATO)

Ngā mihi

The tall and short of it

Spreading the word

Where has kuta gone?

Using kuta

Harvesting and preparation

How do we grow kuta plants used for restoration?

Building a monitoring and restoration framework

Want to learn more?

THE TALL AND SHORT OF IT

Kuta (also known as paopao or ngāwhā; giant spike sedge, *Eleocharis sphacelata*) is one of the giants of Aotearoa New Zealand's freshwater flora when it comes to length. In suitable deep water habitats kuta can grow longer than 4.0 m from its rhizome, providing most of the culm (stem) is underwater. Stems are fatter and of higher quality in deep water; in shallow water they are wiry and lack the strength of their longer counterparts. Growth occurs from compressed shoot sections on the rhizome; and fertile stems have a single flower arrangement at the tip of the stem. Kuta grows in a range of freshwater habitats throughout Aotearoa, from North Cape to Stewart Island. Small plants can also be present in warm geothermal water.

Previous page: Golden hues of kuta in a finished product.
Photo: Mieke Kapa

Below: Kuta growing in deeper pools of water in a wetland complex.
Photo: Mieke Kapa

All information in this chapter has come through interviewees with specific information from their rohe (mostly from Te Rarawa and Ngāti Pikiao) and my own personal research and experiences. As a researcher, I acknowledge that I am not the author nor the owner of information and communications I have received regarding kuta, merely the recorder. I acknowledge the significant amount of cultural information that exists, which is not covered within this chapter.

Support, encouragement, help, and guidance for this research came from a huge number of people who should all be acknowledged. Specifically, there are those who have passed on since sharing their valuable knowledge and experiences of kuta with me, for that I am deeply indebted – this chapter would have little substance without them. Nō reira e ngā Rangatira, koutou kua whetūrangī haere, haere, haere atu ra. To those who are still with us, my many thanks for your time, knowledge, and experience which have contributed significantly to the writing of this paper. Again, thank you, thank you, thank you.

– Ngā mihi Mieke



SPREADING THE WORD

Cultural harvest, used by tangata whenua (indigenous people) universally, requires all those collecting material to understand and actively care for the environment in which they are harvesting. Traditional sites, or local pā kuta, that consistently produce good quality weaving material are nurtured by tangata whenua. People gathering without local knowledge or guidance should use the same kaitiaki (guardians) principles used when collecting other resources such as harakeke.

Working and building partnerships with tangata whenua can reveal a wealth of information on the nurture, cultivation, and utilisation of their valued wetland plants. Within indigenous cultures, environmental knowledge is based on observations that are memorised and passed down through many generations and adapted by ongoing experience. The intergenerational information transfer had to be accurate and reliable for communities that depended on the land, sea, and freshwater for food, clothing, and shelter. While the everyday use of kuta has declined, a living repository of traditional ecological knowledge relating to this plant still continues to be passed down from older generations.

Information on the cultural harvest, preparation, and use of kuta presented in this section has been sourced from experts from Ngāti Pikiao (Te Arawa waka, Bay of Plenty) and Te Rarawa (Te Tai Tokerau, Northland). Interviewees were expert weavers, distinguished researchers, and collectors of items made from kuta. Participants in the study learnt their craft from others around them who held the knowledge, more specifically kaumātua (elders) from their hapū (subtribes) or weaving peers. Kaumātua, kuia (elder women), and tohunga (experts), who hold the weaving knowledge, provide guidance for the timing, location, and methods to harvesting stems, preparation of the fibre, and use of readied material.



WHERE HAS KUTA GONE?

The strongest message received from research contributors was the overwhelming sadness and loss felt with the reduced ability to harvest kuta from traditional sites. These good quality harvesting sites are suffering from vegetation clearance, increased pollution, drainage, and limited access. Land-use changes and site degradation are often a result of differences in perceived land, water, and resource values between the owners and resource users.

Consequently, some kuta harvesters, whose traditional harvesting sites have been lost, need to travel further afield to access plant material and may intrude on sites traditionally harvested by others. This is a significant issue for hapū with limited traditional harvesting sites. To ensure the mana (authority) and knowledge of kuta use continues, it is important to nurture existing pā kuta, preserve the connection with harvesting sites, and celebrate the mana and wairua (spirit) of finished articles.

USING KUTA

The soft, spongy, and hollow stems of kuta are easily damaged and do not have the same fibre strength for which harakeke (NZ flax) and wharariki (mountain flax) are renowned. However, kuta is highly valued as a weaving resource in areas where good quality material can be found. The section of the stem that extends above the water before harvesting is not used for weaving as it is weaker. Woven gently, the kuta stem holds air, which provides warmth and softness in the finished article. Woven products such as tāpau (kuta mats) can be used on either side, as there is no right or wrong side.

Tāpau in marae (meeting house) are prized in Te Rarawa and Ngāti Pikiao, who used them as sleeping mats or general floor covering, providing comfort and warmth. Often they were made large enough for a single mat to fit a whole room. Carpets and mattresses have mostly replaced tāpau, which were once thought of as a luxury and often saved for manuhiri (guests) or hapū members of higher rank. During the restoration of Pukepoto Marae (Te Rarawa) in the 1970s, new tāpau replicated patterns from worn mats were placed on the walls as a dedication to the skill of past weavers. Published information describes and photographs various items made from kuta, including maro kuta (small loincloth), pāke (cape), pōtae taua (mourning cap or wreath), kete (bags), sun pōtae (sun hats), and tuwhara and tāpau (both floor mats). Kuta has also been used as wall insulation of kāuta (shed or lean-to) and whare (house).

A small (width of 9.5 cm) kete made with split kuta remnants by Toi Te Rito Maihi. Photo: Mieke Kapa

HARVESTING AND PREPARATION

Te Rarawa and Ngāti Pīkiao rohe (regions) both have kuta (paopao in Te Arawa, Ngāti Pīkiao) growing on the edge of deep freshwater lakes. These sites could be likened to pā kuta that hapū members have accessed for many generations. Traditional pā kuta used for collecting resource material are always in deep water and are held in high regard and treated with mana by weavers. The length of kuta stems is important to consider as shallow water levels produce wiry and distorted stems and the finished woven product would be compromised if weak stems were used.

The best time to harvest kuta for raranga (weaving) use is when growth is dormant, between April and August, before the water has become too cold and stem quality reduced. Some hapū time their harvest for early autumn, while others harvest around Matariki (the first appearance of the star cluster, Pleiades or 'the seven sisters') in winter.

Interviewees believed that pā kuta were effectively self-managed through natural means and sustainable cultural harvest, which includes:

- taking only what is needed
- not harvesting an entire site, and
- not harvesting from the same area in consecutive years

Colours of the 'old' stems at the end of a winter represents the variety of hues that can be captured in a finished product. Photo: Mieke Kapa

Harvesting is an organised group activity, with the jobs divided between divers and sorters. Divers cut mature stems at the rhizome base deep under water to capture the strongest part for weaving. Mature stems are cut regardless of age and condition.

Live stems float to the lake surface and are guided towards the edge. Any damaged stems among them are put to one side and the remaining good quality stems are carefully bundled together with those of a similar length.

Dead, damaged or rotting stems are returned to the harvested area. Back at the marae (or wherever the material is to be dried and stored) the stems are re-checked and re-sorted.

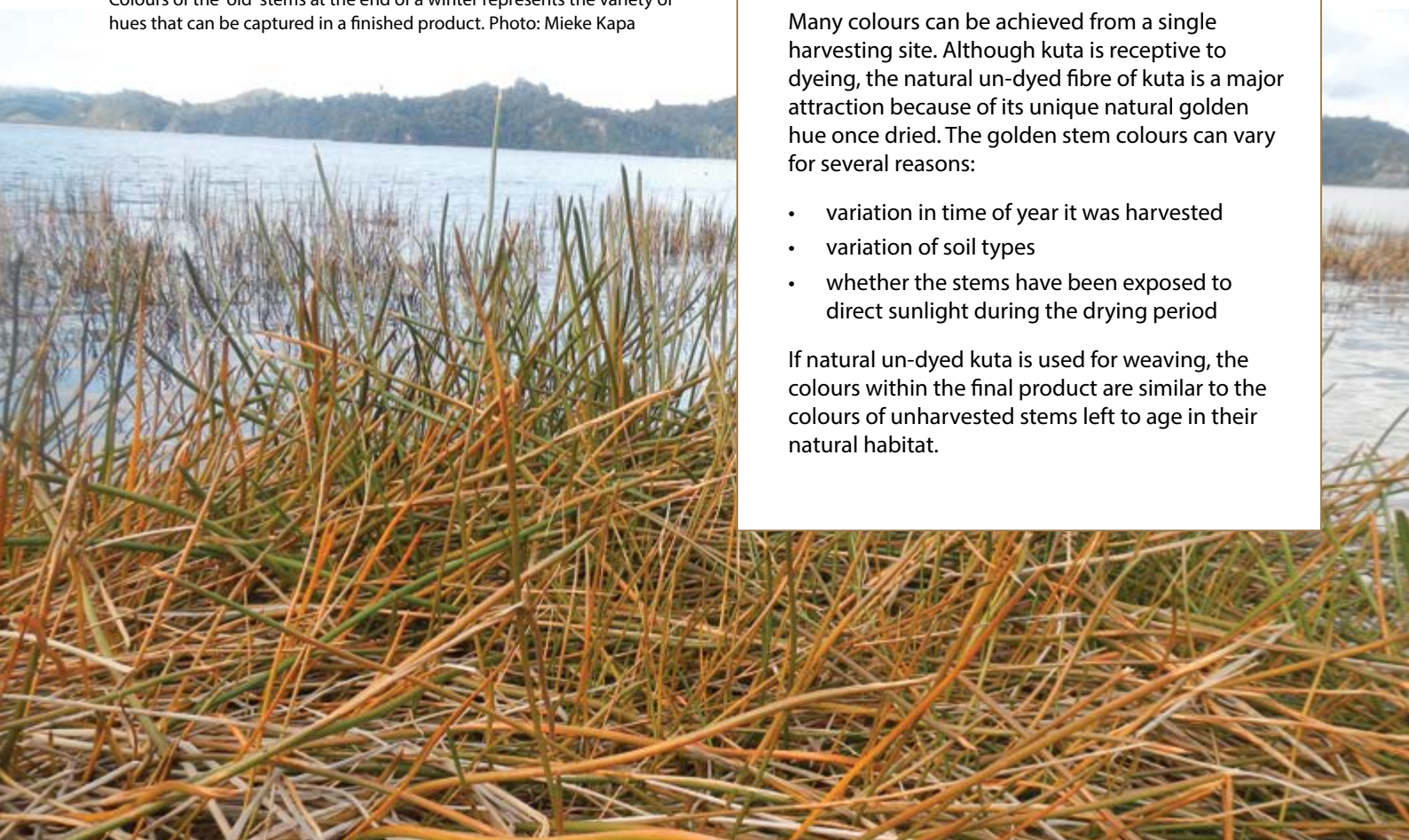
Unlike harakeke and wharariki, which need extensive stripping and boiling before use, once kuta is harvested the only preparation needed before weaving is to ensure it is dry. Once stems are dry, which may take only a few days, they are ready for use. A natural golden colour remains in kuta stems if a light covering is placed over drying stems to exclude all sunlight. Kuta can also be dried hanging from trees in the shade, although these stems will have a lighter colour than those dried in the dark. During the drying process any rotten stems are removed. The stored stems can last for years if they are kept dry and looked after in a well-ventilated space.

Colour

Many colours can be achieved from a single harvesting site. Although kuta is receptive to dyeing, the natural un-dyed fibre of kuta is a major attraction because of its unique natural golden hue once dried. The golden stem colours can vary for several reasons:

- variation in time of year it was harvested
- variation of soil types
- whether the stems have been exposed to direct sunlight during the drying period

If natural un-dyed kuta is used for weaving, the colours within the final product are similar to the colours of unharvested stems left to age in their natural habitat.



HOW DO WE GROW KUTA PLANTS USED FOR RESTORATION?

Growing kuta seed

Specific conditions are required for the germination of kuta seed in plant nurseries. First, collect your seed and soak them in bleach overnight. Seed should be sown just under the soil surface in a container that will hold water and keep the soil wet. Slowly increase water levels over time as the seedlings grow so that by early spring the water depth is at least 15 cm deep.

Planting out

Seedlings should be approximately 30 cm tall before they are planted into water at least 15 cm deep on the edge of a freshwater lake or deep pond. Rhizomes sourced from an established mature population can also be used. To improve the chances of successful establishment, it is recommended that each of these harvested rhizomes should have four or five 15 cm-long stems. To decrease the likelihood of contamination between discrete gene pools, seed and rhizome cuttings should be sourced from the same ecological district (nearby locality) in which they are to be planted.

Transferring seedlings or rhizome material outside the rohe where kuta is traditionally harvested to create a new site is not common – weavers would prefer to nurture their own pā kuta. One weaver interviewed gathered seed at the time of harvest and distributed it in the same general area to help regeneration of the pā kuta.



Kuta seeds. Photo: Barry O'Brien



New fertile stems emerging in Spring. Photo: Mieke Kapa

BUILDING A MONITORING AND RESTORATION FRAMEWORK

Key actions we can take to build our understanding of kuta based on our collective mātauranga (knowledge):

- Kōrero (speak) with local kaumātua (elders) and other whānau (family) members about their memories and current interactions with their kuta:**
 - What did their local kuta look like, smell like, and sound like?** Recording our sensory changes is as important as collecting scientific information about population densities, plant sizes, and water quality.
 - What are the local practices associated with harvest and preparation of kuta, and have these changed?** Also consider whether they have any thoughts about the reasons why harvest practices may have changed (if they have). Include the calendars of harvest for the areas.
 - What are the local names (if any) for the kuta, 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 wellbeing of the whole system. For example, the presence of wīwī (other weaving rush-type plants), kahikatea, harakeke, insects, fish, and birds – especially the very rare, matuku (Australasian bittern).
- Identify your own monitoring areas based on what you have learnt from your people. Think about:**
 - where the populations of kuta were in the past compared with the present
 - monitoring your aspirations for kuta, including relevant knowledge for future use. Note that some whānau 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 that they feel may be affecting the plants.
- Who to talk to?** Talk to scientists and other communities with experience in kuta ecology and restoration, and work with them to help build a restoration framework that best meets the needs of your local community and the plant.

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

de Lange PJ, Rolfe JR, Champion PD, Courtney SP, Heenan PB, Barkla JW, Cameron EK, Norton DA, Hitchmough RA 2013. *Conservation status of New Zealand indigenous vascular plants, 2012*. New Zealand threat classification series 3. Wellington, New Zealand: Department of Conservation.

Kapa MM 2010. *Ethnobotany of kuta (Eleocharis sphacelata) in Bay of Plenty and Northland, New Zealand*. Journal of the Polynesian Society 119(2): 131–148.

Kapa MM, Clarkson BD 2009. *Biological flora of New Zealand 11. Eleocharis sphacelata, kuta, paopao, bamboo spike sedge*. New Zealand of Botany 47(1): 43–52.

Moore LB, Edgar E 1970. *Flora of New Zealand. Vol. II. Indigenous Tracheophyta: Monocotyledones except Gramineae*. Wellington, New Zealand: Botany Division, Department of Scientific and Industrial Research.

Sorrell B, Tanner CC, Sukias JPS 2002. *Effects of water depth and substrate on growth and morphology of Eleocharis sphacelata: Implications for culm support and internal gas transport*. Aquatic Botany 73(2): 93–106.

Wehi C 2006. *Kuta (Eleocharis sphacelata, Cyperaceae), a locally important and highly valued weaving plant*. He Puna Kōrero: Journal of Māori and Pacific Development 7(2): 40–45.

Useful websites

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

Manaaki Whenua – Landcare Research

- Weaving Plants Database: www.landcareresearch.co.nz/science/plants-animals-fungi/plants/ethnobotany/weaving-plants
- Information Sheet: www.landcareresearch.co.nz/science/plants-animals-fungi/plants/ethnobotany/weaving-plants/information-sheets/kuta-and-kapungawha

Te Māra Reo – The Language Garden:
www.temarareo.org/TMR-Kuta.html

Author research

Mieke's Masters research thesis:

Kapa MM 2009. *Ethnobotany, germination and growth of Eleocharis sphacelata*. Unpublished MSc thesis, University of Waikato, Hamilton.
<http://researchcommons.waikato.ac.nz/handle/10289/3268>

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4.3 HARAKEKE WEAVING PEOPLE TOGETHER

SUE SCHEELE (MANAAKI WHENUA)

Harakeke ātaahua

Considerations for restoring harakeke

Restoring harakeke for weaving

Wahakura

Want to learn more?

Me te wai kōrari

Like the honey of the harakeke flower

"On my arrival in this country the Māoris... would often inquire after the vegetable productions of England; and nothing astonished them more than to be told there was no harakeke growing there. On more than one occasion I have heard chiefs say, 'How is it possible to live there without it?' and 'I would not dwell in such a land as that.'"¹

¹William Colenso 1892. *Vestiges: Reminiscences: Memorabilia of works, deeds and sayings of the ancient Māoris*. Transactions of the New Zealand Institute 24: 445–467.

Previous page: Harakeke seed capsules. Photo: Sue Scheele

HARAKEKE ĀTAAHUA

While no longer essential for our very survival, it is hard to think of another plant that is more important to and symbolic of customary Māori life than harakeke (New Zealand flax, *Phormium tenax*), whether for medicinal uses or for creating the myriad of domestic items crucial to day-to-day living. Today, on the marae (meeting house) and in wānanga (learning forum), raranga (weaving) tikanga (values and practices) and techniques have been revitalised and are flourishing.

Harakeke grows throughout Aotearoa New Zealand and is commonly found in lowland repo (wetlands) and along awa (rivers), and in coastal areas on estuaries, dunes and cliffs. However, large wild stands remaining are much diminished. Harakeke is a common feature of riparian plantings. The bushes help prevent stream bank erosion and can intercept nutrient run-off from surrounding farmland. The roots tolerate submersion and the tough bush can withstand the drag of fast-flowing water.

The flowers are a wonderful source of high-quality pollen, essential for bee health, and tuī, bellbirds, and starlings throng to collect the nectar. It isn't palatable to animal pests such as possums and rabbits, though cattle will strip the green matter off the leaf leaving the fibre exposed. The bushes are also home to many native insects, including caterpillars such as the anuhe (windower, also known as moka and mūharu) and the mokamoka harakeke (notcher) that can damage the leaves so they are useless for weaving.



Weavers hui, Te Kaha. Photo: Sue Scheele

CONSIDERATIONS FOR RESTORING HARAKEKE

Plants are easy to establish by taking divisions (fans) from mature bushes, which is a cost-effective approach for restoration projects. For minimum maintenance, plant the fans close together, so there is less opportunity for weeds such as blackberry to invade.

A general principle of restoration planting is to have eco-sourced (plant species known to be native to the local area) material. For harakeke, this means using divisions from plants growing wild in the area, or collecting seed off those bushes and propagating them. Seed should be chilled (put in the fridge) for 12 weeks to ensure good germination.

What is a pā harakeke?

A pā harakeke is where varieties of harakeke, selected for their good muka (fibre) or raranga (weaving) qualities, are planted together for easy access and maintenance.

As with all restoration projects (particularly when focused on one species), there are some key matters to consider with the whānau (family):

- **Why do we want to restore harakeke?** For weaving? For other plants and animals? For water quality improvement? All of the above?
- **What is the best way to restore harakeke?** Restoration plantings often include harakeke, preferably sourced from the local rohe (area). The plants themselves are robust, long-lived, wind tolerant, and frost resistant. Once established, harakeke are able to withstand flooding and drought.
- **Are there specific varieties of harakeke that are important to the whānau/rōpū (group)?** Some varieties may have disappeared, or others are at risk of disappearing.
- **Do we want a pā harakeke?** If we want to develop an area to grow weaving varieties (pā harakeke), is there a 'champion' in the whānau to keep up the maintenance? And what is the succession plan to ensure there is a champion in each generation to safeguard the long-term sustainability of the pā harakeke?

Harakeke on West Coast river. Photo: Sue Scheele



RESTORING HARAKEKE FOR WEAVING

Harakeke in restoration plantings can be difficult to access and the leaves are not necessarily of good quality for raranga or muka (fibres). Cultivating harakeke is a way to ensure vigorous, healthy bushes that will provide superior leaves and fibre for specific weaving purposes.

Think of the pā harakeke as an orchard or garden. Many of the same principles apply. We choose varieties that best suit the site and climate, and the weaving purposes we have in mind. We space the plants so they have room to grow, don't have to compete with other plants for their nutritional requirements, and so we can easily get to them when it's time to harvest or prune. Ideally, we keep the plot weed-free and use whichever means we find acceptable to control pests and diseases.

Choosing harakeke varieties

Local weavers will know which types of harakeke are best to use. Are you mostly interested in weaving kete (basket) and mats, or using muka for korowai (cloak) making? Do you want to make piupiu (skirt-like garment) for kapa haka (Māori performing groups)? Are there beginners or schoolchildren needing soft-leaved bushes to practise with?

Suitable varieties may be available through local weavers. Another source is the [Rene Orchiston Collection](#) maintained by Manaaki Whenua at Lincoln.

Vegetative division or seed?

To ensure a plant has the same properties as the parent bush, take a division from it (a fan with some root material attached). If we plant seeds, we can't be sure whether the characteristics of the resulting bush will be what we want. In botanical terms, harakeke preferentially out-crosses, i.e. the pods develop best when the flower has been pollinated by pollen from a separate plant. And just like people, the progeny of two harakeke bushes may have different characters from their parents.

Seedlings also take longer to mature, about 6–8 years. Plants grown from root stock take about half that time.

Choosing a site

Although harakeke is naturally associated with wetlands, including swamps, the best quality plants for weaving grow on fertile, well-drained soil. Choose a sunny site. Avoid growing harakeke under large trees or in too shaded an area.

Planting time

The best time for planting depends on growing conditions in your rohe.

Autumn/winter is a good time for transplanting. But in very cold areas, wait until spring. We generally don't transplant harakeke when the kōrari (flower stalks) are emerging, or in the dry summer months.



Harakeke planted in weed mat. Photo: Sue Scheele



Kōrari, harakeke flowers. Photo: Sue Scheele

Preparing a site

The planting area should be cleared of perennial weeds. If appropriate, use glyphosate (RoundUp®) to clear the site. In planting experimental trials throughout Aotearoa, we used weed matting and found it very effective in reducing maintenance time. It had the added advantage of keeping the soil moist. Lay the matting down first, and then poke holes in it to plant the fans. Old wool carpet is also good to use, because it will rot away nicely as the harakeke grows.



Dividing harakeke. Photo: Sue Scheele

Planting the harakeke

Taking fans off the parent bush can be hard work! If possible, choose a time when the soil is moist. We like to use a long-bladed planting or trenching spade, a grubber, or a crowbar to dig around and get under and behind the fan we are lifting.

Divided fans are usually trimmed of outer leaves, leaving the rito (growing shoot) and the two parent leaves on either side (awhi rito or mātua). The parent leaves should be cut back if too long, but it is a good idea to have some protection of the rito. If possible, plant the harakeke fans together in groups of three. This will give them a good start.

The traditional way to plant harakeke is to 'plant the puku (stomach) to the sun', so that the bulge on the fan faces halfway between the rising and setting sun. This protects the baby fans, which will emerge at the back of the clump, and gives them shade and moisture.

Allow at least 3 metres between each clump. This looks like a ridiculously large gap at first! This spacing will allow good air movement among the plants as they grow, which helps prevent build-up of scale and fungal diseases, and allows easier access for trimming and harvesting.

If the soil is poor, apply general fertiliser containing phosphate. Plants will also benefit from regular watering.



Harakeke fans ready for planting. Photo: Sue Scheele



Pā harakeke. Photo: Sue Scheele

WAHAKURA

Harakeke varieties with long leaves of medium strength are best suited for weaving wahakura. Wahakura is a bassinet for infants ranging from birth to 6 months of age. It provides a 'safe sleeping space' and allows pēpe (baby) and māmā (mother) to remain close, which is important for bonding and breastfeeding. The wahakura protect babies when they are sharing a bed with their mātua (parents).



Wahakura made from harakeke by Katarina Tawiri. Photo: Sue Scheele

Maintenance

Keep the area around the base of the plants weeded and trim dead leaves. To reinvigorate the bush, trim each fan back to the central three leaves – the rito and the awhi rito. We usually do this in winter. Another time for pruning is when the leaves are harvested. Take the leaves required, and then clean the rest of the bush. Pruning results in vigorous growth of good quality leaves and helps keep insect pests and diseases at bay.

Use a sharp knife for cutting, not secateurs. Cut the leaves on an angle at the base of the fan. This is to ensure that rainwater flows to the ground and doesn't rot the new growth. It's also safer not to have sharp blades sticking out where they can jab people working around the bush.

Some weavers prefer to cut off the kōrari when they emerge, so that the plant's energy goes into leaf growth rather than flowering. If a pā harakeke of 'imported' varieties is planted close to wild plants, cutting off the kōrari also ensures that there is no seed contamination of local types.

Traditionally, old leaves and weaving scraps were placed back under the parent bush. It is best not to do this. This material provides a home for the insects that chew the harakeke leaves. Keep the bushes clear of dead leaves, weeds, and debris.



Dividing harakeke for orders. Photo: Sue Scheele

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

Craig JL, Stewart AM 1988. *Reproductive biology of Phormium tenax: A honeyeater-pollinated species*. New Zealand Journal of Botany 26(3): 453–463. Full paper available from: www.tandfonline.com/doi/abs/10.1080/0028825X.1988.10410647

Harris W, Woodcock-Sharp MTA 2000. *Extraction, content, strength, and extension of Phormium variety fibres prepared for traditional Māori weaving*. New Zealand Journal of Botany 38(3): 469–487. Full paper available from: www.tandfonline.com/doi/abs/10.1080/0028825X.2000.9512697

Harris W, Scheele SM, Brown CE, Sedcole JR 2005. *Ethnobotanical study of growth of Phormium varieties used for traditional Māori weaving*. New Zealand Journal of Botany 43(1): 83–118. Full paper available from: www.tandfonline.com/doi/abs/10.1080/0028825X.2005.9512946

Forrester GJ, Peltzer DA 2005. *Varietal differences and environmental effects on leaves of Phormium harvested for traditional Māori weaving*. New Zealand Journal of Botany 43(4): 791–816. Full paper available from: www.tandfonline.com/doi/abs/10.1080/0028825X.2005.9512991

Harris W, Scheele SM, Forrester GJ, Pahewa E, Te Kanawa K, Murray M 2007. *Varietal differences and environmental effects on the characteristics of leaf strips of Phormium prepared for traditional Māori plaiting*. New Zealand Journal of Botany 45(1): 111–137. Full paper available from: www.tandfonline.com/doi/abs/10.1080/00288250709509708

Harris W, Scheele SM, Forrester GJ, Te Kanawa K, Murray M, Pahewa E 2008. *Varietal differences and environmental effects on fibre extracted from Phormium leaves and prepared for traditional Māori weaving*. New Zealand Journal of Botany 46(4): 401–423. Full paper available from: www.tandfonline.com/doi/abs/10.1080/00288250809509779

Harris W, Scheele SM, Forrester GJ, Pahewa E, Te Kanawa K, Murray M 2009. *Varietal and environmental influences on the properties of strands prepared from Phormium leaves to make the Māori garment piupiu*. New Zealand Journal of Botany 47(3): 249–269.

Pendergast M, Brake B 1987. *Te Aho Tapu. The sacred thread: traditional Māori weaving*. Auckland, NZ, Reed Methuen.

Scheele SM, Smissen RD 2010. *Insights into the origin and identity of National New Zealand Flax Collection plants from simple sequence repeat (SSR) genotyping*. Journal of New Zealand Botany 48(1): 41–54. Full paper available from: www.tandfonline.com/doi/abs/10.1080/00288251003685510

Wehi C 2009. *Indigenous ancestral sayings contribute to modern conservation partnerships: examples using Phormium tenax*. Ecological Applications 19(1): 267–275. Full paper can be read online at: <http://onlinelibrary.wiley.com/doi/10.1890/07-1693.1/full>

Wehi P, Clarkson BD 2007. *Biological flora of New Zealand 10. Phormium tenax, harakeke, New Zealand flax*. New Zealand Journal of Botany 45(4): 521–544. Full paper available from: www.tandfonline.com/doi/abs/10.1080/00288250709509737

Useful websites

He Kōrero Kōrari: Newsletters on trial progress and results of the experimental harakeke trials carried out in the 1990s. www.landcareresearch.co.nz/resources/collections/harakeke/newsletter

National Weavers Collective: Te Rōpu Raranga Whatu o Aotearoa: www.maoriart.org.nz/weavers-c-52_75.html

Harakeke pests and diseases: www.landcareresearch.co.nz/resources/collections/harakeke/insect-pests-and-diseases-of-harakeke

Facebook: www.facebook.com/Polynesian.Textile.Plants

Science Learning Hub: <http://sciencelearn.org.nz/Contexts/Exploring-with-Microscopes/NZ-Research/Harakeke-under-the-microscope>

Te Ara Encyclopaedia: www.teara.govt.nz/en/search/teara?keys=flax

Wahakura: www.radionz.co.nz/news/national/292910/baby-bassinet-makers-get-weaving

Collections

Rene Orchiston Harakeke Collection at Manaaki Whenua – Landcare Research: www.landcareresearch.co.nz/resources/collections/harakeke/rene-orchiston-collection-catalogue

Te Papa – <http://collections.tepapa.govt.nz/topic/3623>

Auckland – www.aucklandbotanicgardens.co.nz/our-gardens/harakeke-collection

Iwi and community stories:

- Ngāti Rereahu: www.paharakeke.co.nz/paharakeke/about-harakeke
- Ngai Tahu: http://ngaitahu.iwi.nz/our_stories/the-art-of-weaving
- Project Twin Streams, Auckland: <http://projecttwinstreams.com>
- Ali Brown (weaver): www.alibrown.co.nz
- Flaxworx, Bay of Islands, Russell: www.flaxworx.co.nz/Home_Page.php

Contact details for Sue

Email: scheeles@landcareresearch.co.nz

FAUNA

5.1 NOKE ENGINEERING OUR SOILS

SCOTT BARTLAM (MANAAKI WHENUA)

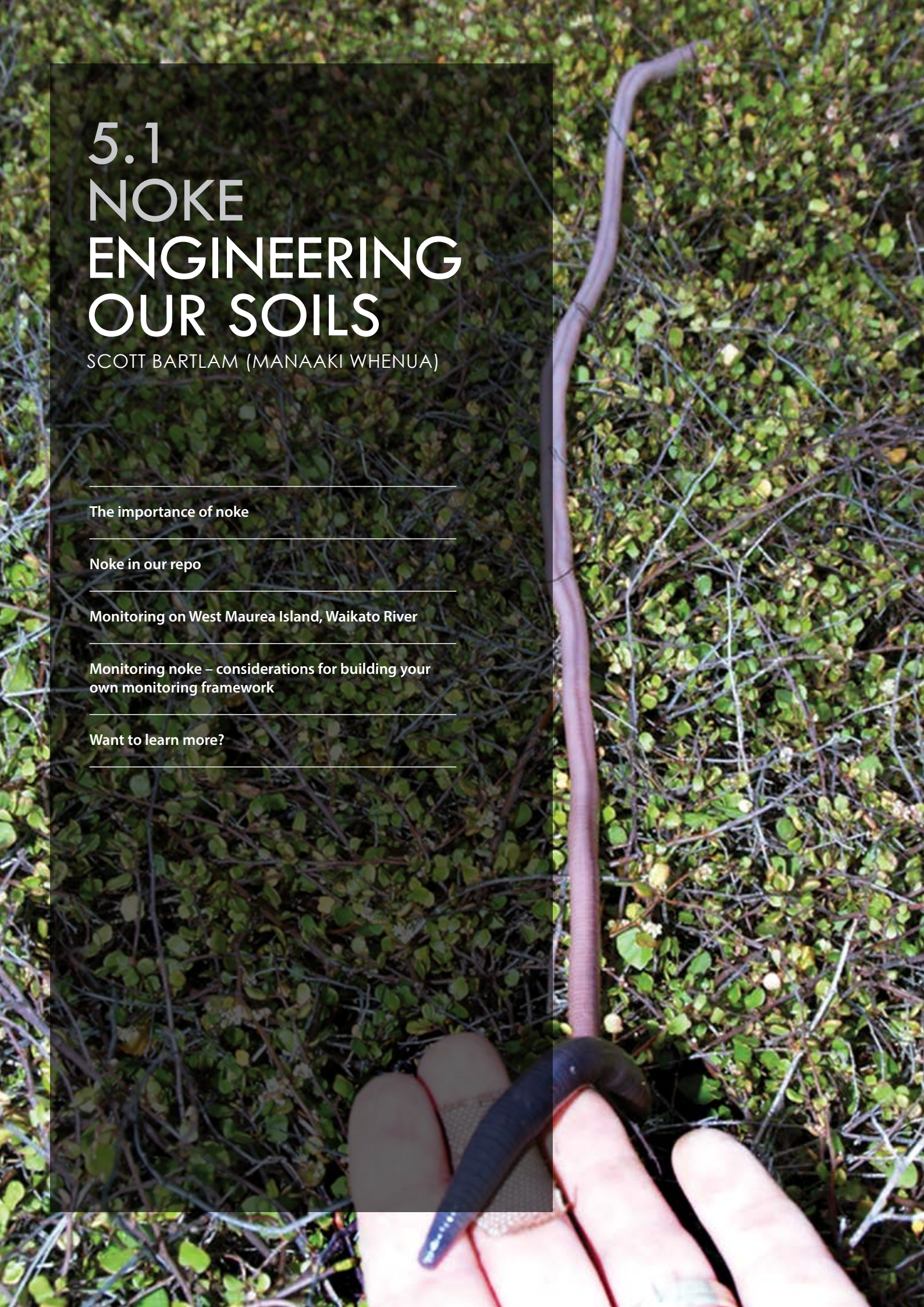
The importance of noke

Noke in our repo

Monitoring on West Maurea Island, Waikato River

Monitoring noke – considerations for building your own monitoring framework

Want to learn more?



He painga tō te noke

Even earthworms have their value (good things take time)

THE IMPORTANCE OF NOKE

Earthworms around the world are known to be extremely important in building new soil, keeping soils resilient to droughts, recycling leaf-litter/organic matter, and as food for many animal species.

Aotearoa New Zealand has more than 200 species of native earthworms or noke (also known as toke) with many more of our diverse native noke species yet to be discovered and named. Some of our incredible noke can glow in the dark, possibly to scare away foraging kiwi and other hungry predators. We also have some extremely small noke, about 15 mm long and other species that are huge, up to 1.4 m long!

Noke constantly burrow and recycle nutrients in our forest soils and is a crucial element in keeping our native plants, birds, and other animals thriving. Our forest noke living below the ground appear to be intrinsically connected to the forests above the ground, so when the native forest is cleared and converted to intensive agriculture, native noke die.

Despite their importance, we still have much to learn about noke. There are many new species of noke to discover, important relationships with our soils, plants and other animals to reveal, and possible risks to uncover. What we do know is that native noke are common in our forests, up to 333 kg/ha, and that together they can outweigh all the insects, possums, rats, birds, and other animals weighed together!

We also know that Aotearoa has more than 20 introduced exotic earthworm species from Europe and Asia that are mostly found in our pasture and weedy areas. From what has occurred in other countries we can learn that exotic earthworms can invade and alter intact native ecosystems but that the ecosystems most at risk of large-scale changes are those that have not evolved with earthworms.



Noke (*Megascolides maoricus*). Photo: Gonzalo Giribet

In North America, Hawaii, and Eurasia some of the same exotic species that are found in our pastures are invading their forests and changing their soils dramatically. These introduced earthworms have changed the soil microbiological and invertebrate communities, as well as the rates of nutrient cycling, soil carbon levels. They have also reduced the soil nutrients available to plants, and are mixing the soil layers. In North America these changes to the soils threaten the existence of some of the native plants, and are also thought to have caused the destruction of habitat for a rare fern species.

In constructed wetlands overseas, the addition of earthworms has been linked with nitrogen cycle changes and a consequent nutrient change in the leaves of the wetland plants. Further observations, monitoring, and research are needed to understand whether in Aotearoa these exotic earthworm species are changing the nature of our wetland soils and what can be done about such change.

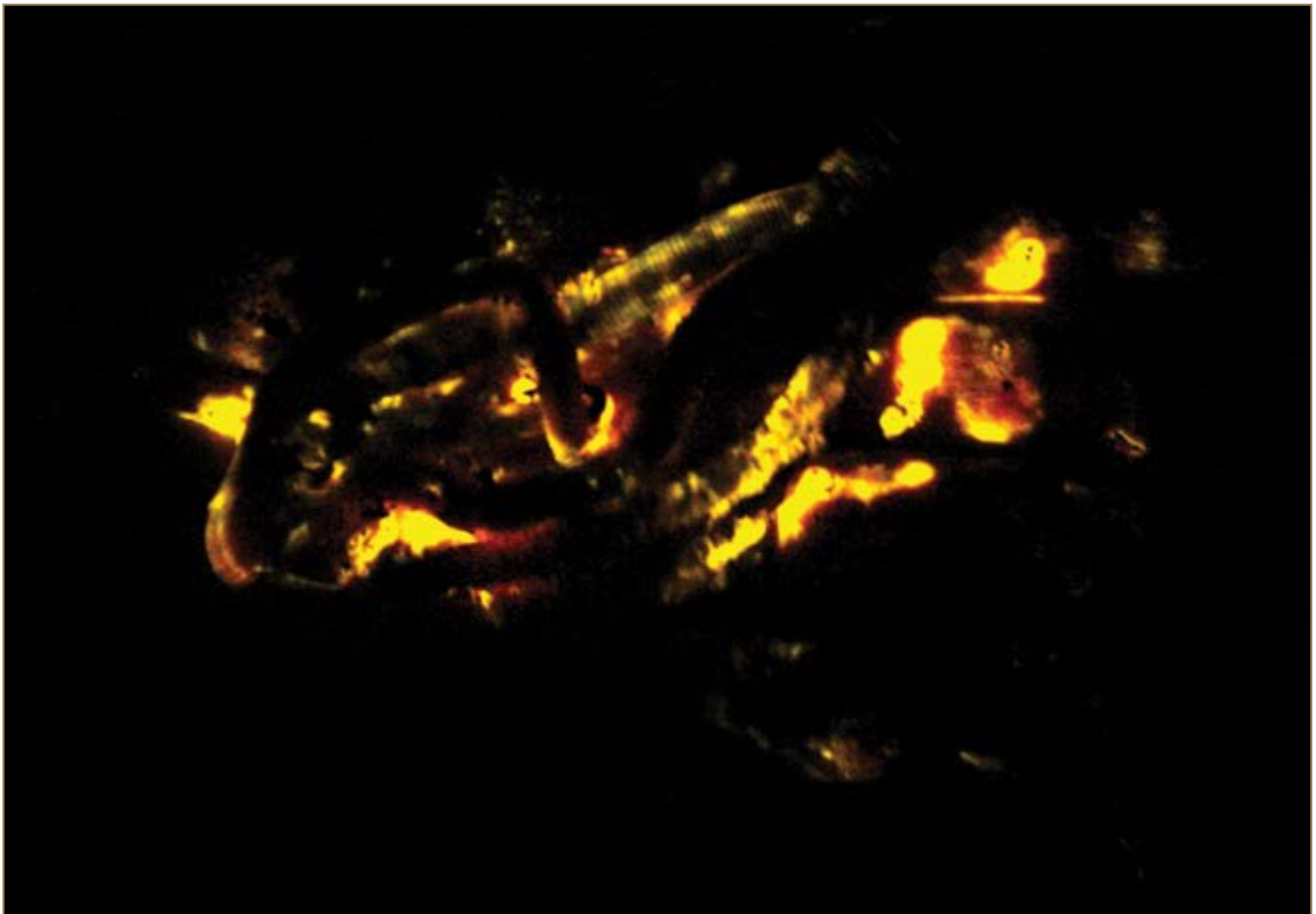
NOKE IN OUR REPO

Despite native noke being common and remarkably diverse in our forests, our undisturbed (natural state) repo (wetlands) have relatively few native noke species. With the burning, draining, and converting to pasture of our lowland wetlands since humans arrived in Aotearoa, this lack of earthworms in our wetlands may be changing.

Along with the invading exotic plants like grey willow, crack willow, alder, and numerous pasture weeds, introduced European and Asian earthworm species appear to be invading some of our lowland wetlands. Recently, populations of European earthworms have been discovered in wetlands in Hawke's Bay, Bay of Plenty, and Waikato. In 2014 introduced earthworms were discovered while monitoring an island restoration project in the Waikato River (see inset box).



Carefully searching soil during sampling for Maurea Island noke.
Photo: Beverley Clarkson



Native noke (*Octochaetus multiporus*) glowing orange/yellow. Photo: Ross Gray

MONITORING NOKE CONSIDERATIONS FOR BUILDING YOUR OWN MONITORING FRAMEWORK

Key actions we can take to build our understanding of noke based on our collective mātauranga (knowledge):

1. **Kōrero (speak) with kaumātua (elders) and other whānau (family) members about their memories of noke.**

- What did they look, smell and taste like? These memories can give clues about the health of the noke.
- A change in colour or size might suggest the species of noke may have changed, which can be linked to changes to the environment.
- A change in smell might indicate a change in the soil or water, or vegetation (waterbodies and plants can have their own unique smell, which maybe absorbed by the noke).

2. **Elsdon Best, the well-known ethnographer, recorded in 1902 that several species of noke were once a highly valued food source by tangata whenua (indigenous people).** There is no harm in asking if this was actually the case with your own whānau:

- Where did they find them, and why did they look for them (e.g. using them to catch tuna (freshwater eels) or for medicinal benefits)? Places where the noke might have been found can give clues to the whakapapa (connections) associated with the noke, i.e. certain tree or plant species; ledges under sedge-lined streams. It is also important to consider what tikanga (values and practices) may have been associated with the noke, because those links can help increase understanding about any changes to the practice and other animals or plants with which they are connected.
- Can they remember if they were found under certain trees or plants? Again, this helps increase overall understanding about the habitat and wider whakapapa of the noke. Perhaps those trees and plants are no longer there? If this is the case, have the noke also gone?
- Were there other practices (e.g. collecting harakeke (NZ flax) or paru (dyeing mud) when they may have seen them? Sometimes the observations we make when we are not meaning to can tell us a lot about the health and wellbeing of the larger system. Noticing noke where they may not have been before or vice

versa, including observations of the health and wellbeing of other animals and plants in the area can provide clues about patterns that may need to be monitored over a longer time scale.

- Long-term observation and monitoring were natural for our tūpuna (ancestors), so when applied today, can help us better understand if what we are seeing is 'normal', or if something more concerning is happening.

3. **Identify your own monitoring areas based on what you may have learnt from your people.** Think about the areas where noke used to be found, and choose areas to monitor them under different plant types, e.g. ngahere (bush) versus a repo (marsh wetland) versus a paddock.

4. **Talk to worm scientists** (Manaaki Whenua – Landcare Research and Āta mātai, mātai whetū – AgResearch, and others) and work with them to support whānau and community monitoring programmes by offering advice (e.g. data collection and recording) and training in noke identification and ecology.



Excavating a 50 cm x 50 cm pit during sampling of Maurea Island noke. Photo: Beverley Clarkson

MONITORING ON WEST MAUREA ISLAND, WAIKATO RIVER

A survey from 2014 on West Maurea Island (10.89 ha) on the Waikato River showed clearly that exotic earthworms can definitely colonise and inhabit areas that get very wet and boggy.

The Maurea River Islands, recently returned to Waikato-Tainui in the Waikato Raupatu River Settlement (2010), are located near the important historical pā site (fortified place) at Rangiriri, north of Huntly. The islands have gradually formed in the main stream of the Waikato River from the sediments deposited by the river in this part of the catchment. Very little is understood about their age (i.e. when they started to be formed), but local information suggests they have been there for at least 80 years, and the local people have interacted with the islands during the past 50 years.

The Waikato River periodically floods the lower areas of the islands, creating a marsh wetland ecosystem during autumn, and winter. By mid-late summer, the islands start to dry out with small boggy areas scattered across the largest of the islands. Over time, the islands have become colonised in exotic tree species such as willow, alder (also called 'rākau Pākehā' by some Waikato peoples), privet, and a range of highly invasive plants such as reed sweetgrass and yellow flag iris.

Small pockets of native trees, ferns and groundcover plants exist on the islands, which have been further supported by a small control and restoration trial led by Waikato-Tainui and Maurea Marae in conjunction with Manaaki Whenua, Taihoro Nukurangi (NIWA), the Waikato Regional Council, and Te Papa Atawhai (DOC) (see section 6.3: Maurea Islands, for more on this project).

Despite ten separate locations across the mostly exotic plant-covered island being surveyed for earthworms, no native noke were found. However, three species of exotic worm were discovered: large numbers of toke momo rāwaho (*Octolasion tyrtaeum tyrtaeum*); an Asian snake-worm species, also known as toke momo rāwaho (*Amyntas cortices*) that has spread to large parts of the world; and a common pasture species, toke tūtae tawhiti, dung worm (*Lumbricus rubellus*). Overall, the results highlighted that marsh wetlands like those found on the Maurea River Islands can be invaded by introduced earthworm species.

Overseas research has shown that when earthworms are introduced into constructed wetlands they can modify or engineer significant changes to those wetlands. Further observations, monitoring, and research are needed to understand whether in Aotearoa these exotic earthworm species are changing the nature of our wetland soils and what can be done about such change.



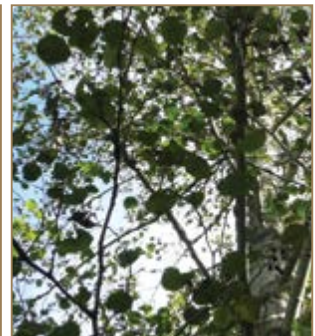
Grey willow.
Photo: Trevor James



Grey willow.
Photo: Paul Champion



Alder.
Photo: Trevor James



Alder canopy.
Photo: Paul Champion



Reed sweetgrass.
Photo: Paul Champion



Reed sweetgrass.
Photo: Trevor James



Yellow flag iris.
Photo: Paul Champion



Yellow flag iris.
Photo: Paul Champion

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

Bartlam S 2014. *Earthworm Survey of the Maurea Islands by Landcare Research*. Internal report for Waikato Raupatu River Trust, Waikato-Tainui Te Kauhanganui Inc., Waikato.

Benham WB 1904. *Some earthworms from the North Island of New Zealand*. Transactions and Proceedings of the Royal Society of New Zealand 1868–1961 37: 281–285.

Best E 1902. *Food products of Tuhoeland: being notes on the food-supplies of a non-agricultural tribe of the natives of New Zealand; together with some account of various customs, superstitions, &, pertaining to foods*. Transactions and Proceedings of the Royal Society of New Zealand 1868–1961 35: 45–48.

Blouin M, Hodson ME, Delgado EA, Baker G, Brussaard L, Butt KR, Dai , Dendooven L, Peres G, Tondoh JE, Cluzeau D, Brun JJ 2013. *A review of earthworm impact on soil function and ecosystem services*. European Journal of Soil Science 64: 161–182.

Bohlen PJ, Scheu S, Hale CM, McLean MA, Migge S, Groffman PM, Parkinson D 2004. *Non-native invasive earthworms as agents of change in northern temperate forests*. Frontiers in Ecology and the Environment, 2: 427–435. doi:10.1890/1540-9295(2004)002[0427:NIEA AO]2.0.CO;2

Brockie RE, Moeed A 1986. *Animal biomass in a New Zealand forest compared with other parts of the world*. Oecologia, 70, 24–34.

Buckley TR, James S, Allwood J, Bartlam S, Howitt R, Prada D 2011. *Phylogenetic analysis of New Zealand earthworms (Oligochaeta: Megascolecidae) reveals ancient clades and cryptic taxonomic diversity*. Molecular Phylogenetics and Evolution 58: 85–96.

Buckley TR, Boyer S, Bartlam S, Hitchmough R, Rolf J, Stringer I 2015. *Conservation status of New Zealand earthworms, 2014*. Wellington, New Zealand, Department of Conservation.

Callaham MA Jr, Gonzalez G, Hale CM, Heneghan L, Lachnicht SL, Zou X 2006. *Policy and management responses to earthworm invasions in North America*. Biological Invasions 8: 1317–1329.

Clarkson BR, Sorrell BK, Reeves PN, Champion PD, Partridge TR, Clarkson BD 2004c. *Handbook for monitoring wetland condition. Coordinated monitoring of New Zealand wetlands*. Ministry for the Environment Sustainable Management Fund Project. Wellington, MfE.

James SW, Hendrix PF 2004. *Invasion of exotic earthworms into North America and other regions*. Earthworm Ecology 441: 75–88.

Lee KE 1959. *The earthworm fauna of New Zealand*. New Zealand Department of Scientific and Industrial Research Bulletin, vol. 130. Wellington, DSIR.

Lee KE 1985. *Earthworms – their ecology and relationships with soils and land use*. Sydney, Academic Press.

Rakena T, Bodmin KA 2015. *Restoration of Maurea Island, Waikato River: Year 2 and final report WRA12-054 and WCEET 2013-19*. Prepared for Waikato River Authority by NIWA.

Szlavec K, McCormick M, Xia L, Saunders J, Morcol T, Whigham D, Filley T, Csuzdi CS 2011. *Ecosystem effects of non-native earthworms in Mid-Atlantic deciduous forests*. Biological Invasions 15: 1165–1182. doi: 10.1007/s10530-011-9959-0.

Xu DF, Li YX, Howard A, Guan YD 2013. *Effect of earthworm Eisenia fetida and wetland plants on nitrification and denitrification potentials in vertical flow constructed wetland*. Chemosphere 92: 201–206.

Yeates G. *Earthworms – earthworms in New Zealand*. Wellington, New Zealand, Te Ara – Encyclopaedia of New Zealand (updated 1 March 2009).

Useful Websites

Āta mātai, mātai whetū – AgResearch

<http://agpest.co.nz/wp-content/uploads/2016/02/EARTHWORM-ID-BROCHURE-Jan2016.pdf>

Massey University

<http://soilbugs.massey.ac.nz/oligochaeta.php>

Manaaki Whenua – Landcare Research

www.landcareresearch.co.nz/resources/identification/animals/bug-id/what-is-this-bug

Science Learning Hub

<https://beta.sciencelearn.org.nz/resources/20-native-and-introduced-earthworms>

T.E.R.R.A.I.N (Taranaki Educational Resource, Research Analysis and Information Network)
www.terrain.net.nz/friends-of-te-henui-group/local-snails-slugs-worms.html

The New Zealand Organisms Register (2011) NZOR.

<http://nzor.org.nz>

Help to Make Contact with your local iwi, hapū or marae

Tūhono

www.tuhono.net/en/iwi-info

Department of Conservation – Contact your local office to talk to the regional Pou Kura Taiao (iwi liaison staff) – look under the "Regional Enquiries" tab for local DOC office contact numbers
www.doc.govt.nz/footer-links/contact-us

Contact details for Scott

Email: bartlams@landcareresearch.co.nz

5.2 KŌURA THE ANCIENT SURVIVOR

IAN KUSABS (TE ARAWA, NGĀTI TŪWHARETOA)

The importance of kōura

How do we restore kōura?

The tau kōura – a traditional Māori method for
harvesting and monitoring kōura

Want to learn more?



He manako te kōura i kore ai

Crayfish are scarce when they are expected

THE IMPORTANCE OF KŌURA

Freshwater crayfish are endemic to Aotearoa New Zealand where they are known locally by the Māori name kōura (and less commonly kēwai). Aotearoa has two species of freshwater crayfish, the northern kōura, *Paranephrops planifrons*, which occurs in the North Island and the West Coast of the South Island, and the southern kōura, *P. zealandicus*, which occurs in the east and south of the South Island.

Kōura are one of the original inhabitants of Aotearoa. They have a very ancient lineage that diverged from their Australian relatives about 109–60 million years ago. Because 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. As far as our evolutionary history goes, kōura are as significant as tuatara, wētā, and kiwi (other native animals).

Kōura have an important role in freshwater ecosystems and are a food source for fish, kawau (shags), and people. Kōura are omnivores, consuming plant and animal food as well as detritus (i.e. rotting matter). They play a keystone role directly through predation, or indirectly by breaking down plant material and by cleansing the streambed of fine silt. This in turn affects other aquatic invertebrates (i.e. insects, crustaceans, molluscs, and worms). Furthermore, kōura increasingly feature as indicator species because of their important role in aquatic ecosystem food webs and their iconic and heritage values.

Previous page: Measuring a kōura. Photo: Ian Kusabs

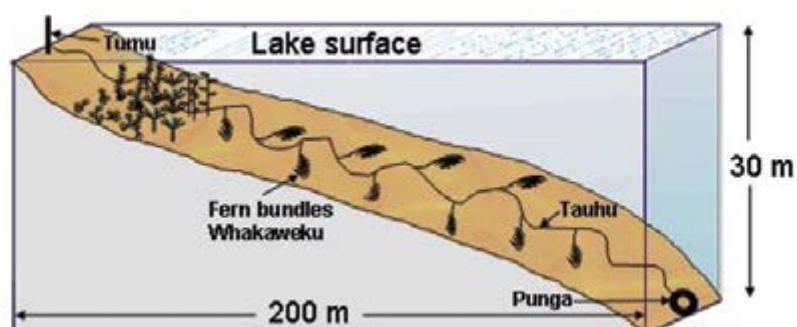
Although the ecology of stream-dwelling kōura is well studied in Aotearoa, few detailed assessments have been carried out on populations of kōura in lentic (non-flowing) waterbodies, i.e. lakes, ponds, and wetlands. There is therefore little published information on kōura in repo (wetlands). As kōura generally prefer coarse bed substrates and avoid low-dissolved oxygen conditions ($DO > 5\text{mg l}^{-1}$), they are most likely to be present in areas of flowing water and on substrates composed of gravels and cobbles, as found in wetlands associated with rivers and lakes. Despite their ecological and cultural significance, this lack of quantitative information makes it difficult for iwi (tribes) and government agencies to manage kōura populations.

Until recently, the main reason for the lack of information on lake-dwelling kōura was the absence of suitable representative sampling methods. However, the development of the tau kōura (Fig. 1), based on a traditional Māori method for harvesting kōura, has stimulated research and monitoring on lake kōura populations. This method, using individual whakaweku (bracken fern bundles) can also be used in streams and ponds and, potentially, in wetlands.

Historically, kōura were an important food for the indigenous Māori people, particularly in the central North Island lakes where large numbers were harvested for consumption and trade. Today, kōura are considered a taonga (treasure) or heritage species and support important customary fisheries in some North Island lakes (Rotomā, Rotoiti, Tarawera, and Taupō) where large populations are still present. Nevertheless, there is considerable anecdotal evidence of declines in populations of kōura in Aotearoa since European settlement. Several environmental factors have been implicated in this decline, including introductions of exotic fish and plant species as well as reduced concentrations of dissolved oxygen in the bottom waters of lakes due to eutrophication (nutrient enrichment) predominately from farming activities and municipal wastewater and sewage.

This article is based on work funded by NIWA through the Ministry of Business Innovation and Employment programme on Maintenance and Rehabilitation of Aquatic Ecosystems (C01X1002).

Figure 1: Schematic diagram of the modern day tau kōura. The depth and length of tau are indicative and can be varied depending on lake bathymetry.



HOW DO WE RESTORE KŌURA?

Key actions that we can take to increase our understanding of kōura based on our collective mātauranga (knowledge):

STEP 1: Kōrero (speak) with local kaumātua (elders) and other whānau (family) members about their memories and current interactions with kōura:

- The socio-cultural value of kōura: Is it important to bring it back as mahinga kai/hauanga kai (food gathering site), as a keystone species for conservation value, or both of the above?
- Record where, when, and how kōura were harvested.
- Identify how those populations and harvesting practices have changed.
- What may have caused decline: The cause may need to be addressed first, before any new populations can be reintroduced to the area, e.g. restoring bankside vegetation, and reducing introduced aquatic weeds and the abundance of pest fish (if present).

STEP 2: Consider the ecology and environmental whakapapa (connection) of the system to understand better:

- The best areas to restore kōura. Consider sites that have good water quality, low levels of fine sediment.
- Consider adjacent land use and how you can mitigate any adverse impacts from those where possible, e.g. fencing to exclude livestock access – kōura love undercut banks and lots of woody debris.

- Benefits (if any) for other organisms – fish species (i.e. tuna (freshwater eels), kōkopu (*Galaxias* spp.), inanga (whitebait), porohe (smelt)) and aquatic invertebrates (i.e. caddis flies, 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.

STEP 3: Building a monitoring and restoration framework:

- **What are the practices associated with harvest and have these changed?** Also consider whether they have any thoughts about the reasons why practices may have changed (if they have).
- **What are the local names (if any) for the kōura, 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 wellbeing of the whole system. For example, insects, fish, and plants.
- **Where to monitor?** Identify your own monitoring areas based on what you have learnt from your people. Think about where the populations of kōura were (past) and are now. Note that some whānau 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 kōura populations.
- **Who to talk to?** Talk to scientists and other communities with additional experience in kōura ecology and restoration, and work with them to help build a restoration framework that best meets the needs of your local community.

Figure 2: Constructing a whakaweku (bracken fern bundle) for catching kōura



Collecting bracken fern. Photo: Ian Kusabs

Binding 10 bracken fern fronds together using cable ties. Photo: Ian Kusabs

A finished whakaweku ready for deployment. Photo: Ian Kusabs

Figure 3: Using whakaweku in streams



A whakaweku set in a small stream for catching kōura.
Photo: Ian Kusabs



How to measure a kōura. The OCL or orbit-carapace length is measured from behind the eye to the end of the carapace (above the tail) along the top and centre of the back. Photo: Ian Kusabs



The use of a korapa awa (a stop net composed of shade cloth) for retrieving a whakaweku. Photo: Ian Kusabs



Whakaweku monitoring tools, i.e. a korapa awa, measuring calipers, clip board, and a 2L ice cream container for holding the catch. Photo: Ian Kusabs

THE TAU KŌURA A TRADITIONAL MĀORI METHOD FOR HARVESTING AND MONITORING KŌURA

Crayfish monitoring methods world-wide are largely derived from traditional capture methods, and the tau kōura is no exception. The tau kōura was the preferred method of harvesting large quantities of kōura in the Rotorua (Te Arawa tribal area) and Taupō lakes by pre-European Māori. The tau kōura was the culmination of over 500 years of mātauranga and rangahau (research) that had proved it was superior to other methods such as baited traps (called pouraka; similar to modern day minnow traps), hīnaki (fyke nets), pae pae (dredge nets), and rama kōura (hand nets).

One of the main advantages of the tau kōura is that it is a representative (non-biased) sampling method, catching a wide size range and equal numbers of male and female kōura. In contrast, baited traps and nets catch mainly large, aggressive male kōura. Moreover, the tau kōura does not depend on good water clarity or suitable weather conditions, which are required for visual methods such as rama kōura or underwater dive surveys. However, although these methods have disadvantages they are still useful harvesting methods and for obtaining presence/absence data.

The tau kōura involves the placement of bracken fern bundles (known as whakaweku in Te Arawa Lakes and as koere and taruke in other districts) on the lake/stream/wetland bed for kōura to take refuge in (Fig. 1). To harvest the kōura, the whakaweku are lifted onto a net to prevent the kōura from escaping. Whakaweku are composed of approximately ten fern fronds bound together with 250 mm industrial cable ties (Fig. 2). Whakaweku can be set together as in a traditional tau kōura, which is used in lakes and large ponds (Fig. 1), or individually (Fig. 3), for use in streams, rivers, wetlands, or the lake margins. For kōura to colonise them, the whakaweku should be left for about 6 weeks in lakes, and 2 weeks in streams.

Egg-bearing kōura are mostly found from April through to November. Therefore, the best time to harvest kōura is from December to March so as not to disturb the breeding females.

Whakaweku are not only effective for catching kōura, they can also be used for sampling small, bottom-living fish such as bullies, as well as freshwater snails and insects.

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

Hiroa TR 1921. *Māori food supplies of Lake Rotorua, with methods of obtaining them, and usages and customs appertaining thereto*. Transactions of the New Zealand Institute 26: 429–451.

Kusabs IA, Quinn JM 2009. *Use of a traditional Māori harvesting method, the tau kōura, for monitoring kōura (freshwater crayfish, Paranephrops planifrons) in Lake Rotoiti, North Island, New Zealand*. New Zealand Journal of Marine and Freshwater Research 43: 713–722.

Useful websites

NIWA – Monitoring Kōura

www.niwa.co.nz/our-science/te-kuwaha/research-projects/all/monitoring-koura/monitoring_koura

www.niwa.co.nz/our-science/te-kuwaha/research-projects/all/monitoring-koura/monitoring_koura/background

www.niwa.co.nz/our-science/freshwater/research-projects/all/restoration-of-aquatic-ecosystems/monitoring_koura/protocol

NIWA – Measuring kōura – Orbit Carapace Length (OCL)

www.niwa.co.nz/our-science/te-kuwaha/research-projects/all/monitoring-koura/monitoring_koura/protocol/ocl

NIWA – New Zealand Freshwater Fish Database

www.niwa.co.nz/our-services/online-services/freshwater-fish-database

NIWA – SHMAK (Stream Health Monitoring and Assessment Kit): www.niwa.co.nz/freshwater/tools/shmak

Manaaki Whenua – Landcare Research

www.landcareresearch.co.nz/resources/identification/animals/bug-id/what-is-this-bug

Author research

Ian's PhD research thesis:

Kusabs IA 2015. *Kōura (Paranephrops planifrons) populations in the Te Arawa lakes: An ecological assessment using the traditional Māori tau kōura harvesting method and recommendations for sustainable management*. Unpublished PhD thesis, University of Waikato, Hamilton. <http://researchcommons.waikato.ac.nz/handle/10289/9346>

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5.3 RURU HE TANGI NA TE RURU CONVERSATIONS IN THE NIGHT

RANGI MAHUTA (WAIKATO),
CHERI VAN SCHRAVENDIJK-GOODMAN
(TE ATIHAUNUI A PAPĀRANGI, NGĀTI APA,
NGĀTI RANGI), AND HURIWAI PAKI
(NGĀI TUHOE)

Ngā mihi

About the ruru

Relationships with the ruru

How are ruru connected to wetland restoration?

What can we do to help our ruru?

Want to learn more?



Tangi ā te ruru, kei te hokihoki mai e, E whakawherowhero i te pūtahitanga....

**The cry of the morepork keeps coming back to me,
It is hooting out there where the paths meet....**

Beginning lyrics to waiata "Te Hokinga Mai"; composed by Te Taite Cooper and Father Mariu (1986)

ABOUT THE RURU

The ruru (morepork, *Ninox novae-zelandiae*) is our only surviving native owl.¹ At an average height of 29 cm, ruru are recognised by their predominantly brown and white speckled plumage, and wide, round yellow-green coloured eyes. They live in densely forested areas, both native and exotic, using older trees like pines, macrocarpa, gums, and our larger native podocarps (i.e. tōtara, kahikatea, miro, mataī) as important nesting and roosting areas. Their preferred food items are insects such as the pūriri (moth), but occasionally include:

- small birds such as tauhou (silver eye)
- small mammals such as pekapeka (native bat) and rodents (rats and mice).

¹ Another of our owls, whēkau (the laughing or white-faced owl; *Sceloglaux albifacies*) is believed to have become extinct somewhere between 1910 and 1940.

A lot of the thinking in this paper has come from personal experience and discussions with our own whānau. We are currently beginning a journey exploring how we can help our ruru, and the ideas explored in this paper would not have been possible without our whānau and tribal members at the Poukai of three Waikato marae – Ngā Tai e Rua, Maurea and Waingarō. Ngā mihi nui ki a koutou.

– Ngā mihi Rangi, Cheri, and Huriwai

RELATIONSHIPS WITH THE RURU

The relationship of our people with the ruru is a complex one borne out of a deeply spiritual connection that places the bird as both a messenger (usually with sombre news), and as an important kaitiaki (guardians) for hapū (subtribes) and iwi (tribes) across the motu (country). Tangata whenua (indigenous people) across the world have a similar relationship with their own owls, highlighting the owl family (Strigiformes) as a universally important one for many first nations people.

Reasons why the owl is revered (and sometimes feared) universally by indigenous groups are just as complex as the relationships themselves. But it could be argued that some of its characteristics distinguish it from other native birds:

- the physical presence of the bird – big wide eyes glowing in the dark
- its haunting 'kou-kou' call
- its silent movement through the bush – owls do not make the same beating wing sounds as other birds
- it normally appears only at night.

As with all our native animals and plants, the ruru has an important role to play in the development and evolution of our culture as sources of inspiration for:

- the sounds, rhythms, and inflections we make in our waiata (songs), karanga (ceremonial call), and reo (language)
- the ways in which we graphically depict our stories and histories in carvings, weaving, and more contemporary artwork forms
- the ways in which we move, as is seen in wero (challenge) and other forms of mau rākau (wielding of weapons) and kapa haka (Māori performing group, including poi (poi dance)).

It is because of this dynamic and multi-layered relationship that ruru are important species for riparian and wetland restoration. This relates primarily to the way in which they are considered and accommodated within the broader goals of freshwater restoration as they are largely considered a terrestrial/bush bird.

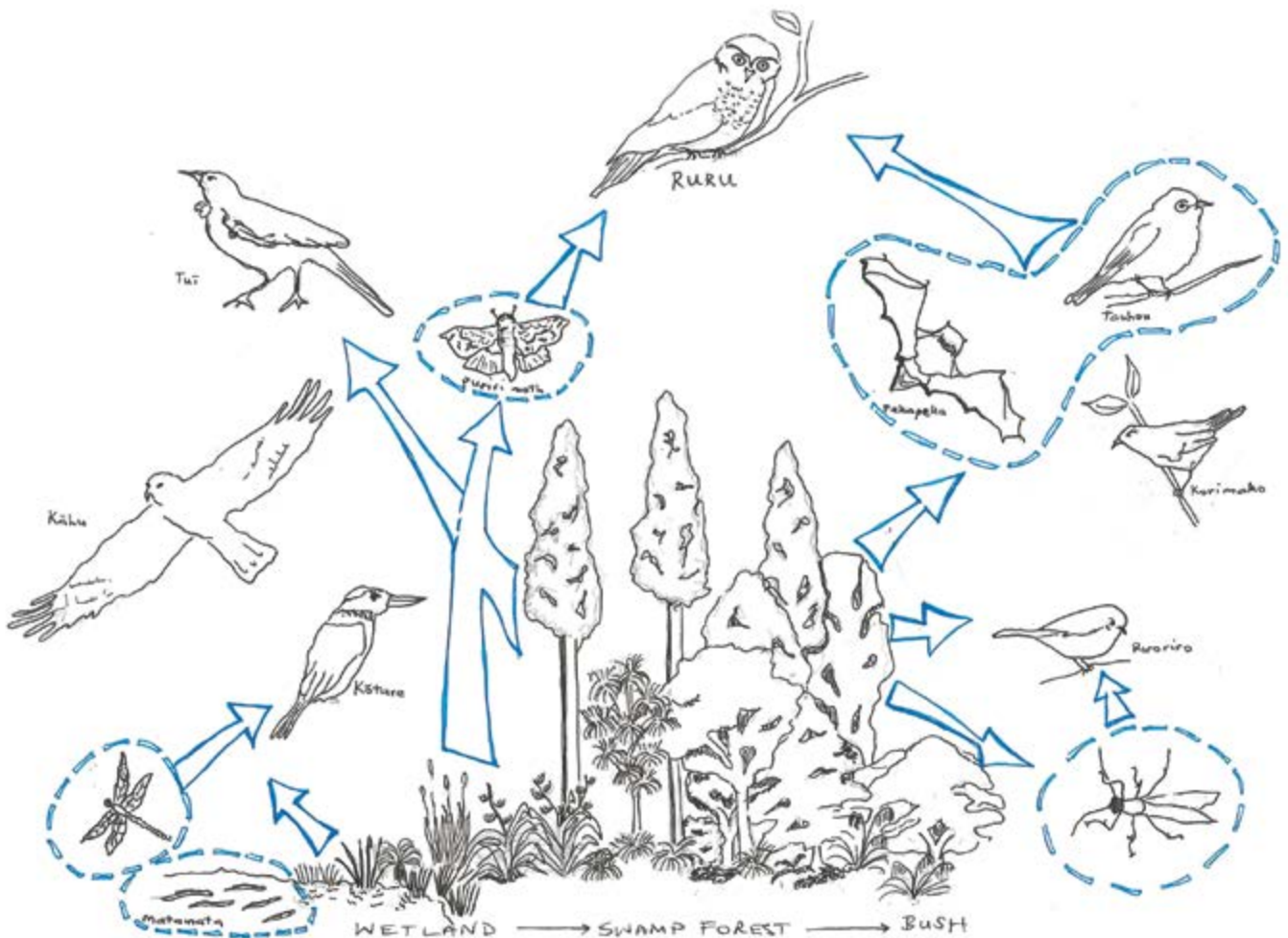
HOW ARE RURU CONNECTED TO WETLAND RESTORATION?

Ruru are not your typical repo (wetland) bird like the matuku (Australasian bittern), kōtare (sacred kingfisher), and pūweto (spotless crakes). They are a 'forest dwelling bird', implying a disconnection with the immediate wetland environment. However, the tall trees and dense scrub associated with swamp forests surrounding wetlands are recognised by many whānau (families) as important habitats for ruru. Kōrero (conversation) shared with the authors also note that te reo o te repo (the language of the wetland) include their distinctive night calls. The seemingly disparate relationship between ruru and repo is, therefore, challenged by the relationships recognised by tangata whenua between the bird and repo species.

- Information shared from tribal members in the lower Waikato highlight whakapapa (connection) links between ruru and specific trees connected with pūriri moth that are found in the shrub layer and sub-canopy of lower Waikato swamp forests.

- These trees are connected directly to the wider habitat considered by kaumātua (elders) as important for matamata (whitebait) spawning.
- These same areas of spawning habitat are recognised as important habitat for matuku, kōtare, kahu (swamp harrier), long-fin tuna (freshwater eel), and a wide range of important weaving plants including harakeke (NZ flax), kuta/ngāwhā (giant spike sedge), and wīwī (rushes).
- Returning to the surrounding swamp forest we see connections to tuī (also connected to the harakeke as a food source), korimako (makomako/bellbird), riroriro (grey warbler), tauhou, pekapeka, and insects.
- And finally, returning full cycle to a predator of tauhou, pekapeka, and insects, the ruru. It is important to note that ruru whakapapa can also move in the opposite direction towards mountain ranges, into gullies, and along the coast.

It is not difficult then to understand why it is a challenge for whānau to separate freshwater, from wetlands, from (dry) land – the connections know no boundaries like those prescribed and often enforced through statute and policy.



WHAT CAN WE DO TO HELP OUR RURU?

- **Consider carefully before felling/removing big rākau (trees) near your marae (meeting house), whare (home), and whenua (land).**

These trees may potentially be nesting and roosting sites for the birds. Monitor the tree for any ruru activity, particularly around breeding and nesting season (Sept–May).

- **Kōrero (speak) with kaumātua (elders) and whānau (family) about plants or trees that may connect the ruru to wetland animals and fish.**

Are there particular native plants that could attract insects and so increase that food source for the ruru? What can be planted as roosting-spots around the wetland? It is important that these trees and plants are factored appropriately into plans for riparian and swamp forest restoration.

- **Always accommodate mammalian control in sites where you are trying to encourage the return of birds like ruru (and including matuku and pūweto).**

Cats, stoats, ferrets, possums, and rats are important predators of the birds, their chicks, and their eggs. Because ruru sometimes nest and forage on the ground, this makes the risk of predation greater.



A preferred food of the ruru is the pekapeka/native bat.
Photo: Colin O'Donnell

- **Protect swamp forest remnants and, where possible, enhance them with additional buffer plantings.**

The more habitat available to them, the greater the potential for breeding and nesting successfully.

- **Learn as much as you can about what they mean to your hapū/iwi.**

This is not only an exercise in finding solutions to enhance ruru's health and wellbeing, but also about protecting your own unique dialects (mita), names, and mātauranga (knowledge) about the ruru and its whakapapa.



Ruru, lino cut print from 'He Putea Kōrero' kit. Artwork: Te Maari Gardiner

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.

There are few publications available specifically about the ruru and its relationship with tangata whenua (indigenous people). However, the following websites provide useful and important ecological information. They are a good starting point for any restoration, protection, and enhancement work you may want to initiate.

Useful websites

DOC: <http://doc.govt.nz/nature/native-animals/birds/birds-a-z/morepork-ruru>
www.doc.govt.nz/nature/native-animals/birds/birds-a-z/morepork-ruru/stories

Communities working to save their ruru:
www.radionz.co.nz/national/programmes/ourchangingworld/audio/201785989/citizen-science-giving-ruru-a-helping-hand

NZ Birds Online: <http://nzbirdsonline.org.nz/species/morepork>

Wingspan: www.wingspan.co.nz/birds_of_preymorepork_zealand_morepork_native_owl.html.

This website also shares information about some traditional relationships tangata whenua have with ruru:

www.wingspan.co.nz/maori_and_birds_of_preymorepork.html

www.wingspan.co.nz/maori_and_raptor_weather_forecasts.html

www.wingspan.co.nz/maori_mythology_and_the_rurumorepork.html

Image related credit

Ruru lino print: He Putea Kōrero [kit] is a collection of picture cards and verses of New Zealand native animals illustrating the Māori alphabet to help extend the use of Te Reo Māori in Kohanga Reo, Kura Kaupapa Māori, Bi-lingual Units in schools and Māori language at all levels. Artwork by Te Maari Gardiner and Gabrielle Belz. Published by Whanganui [N.Z.]: Te Puna Publications, 1989. Format: 15 picture cards and 1 verse booklet in envelope 32 cm x 32 cm.

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5.4 KAWAU TE MOKOPUNA A TERE PUNGA THE OFFSPRING OF TERE PUNGA

TEKITEORA ROLLESTON-GABEL (NGĀI TUHOE,
NGĀTI KAHU, NGĀI TE RANGI)
AND JOHN INNES (MANAAKI WHENUA)

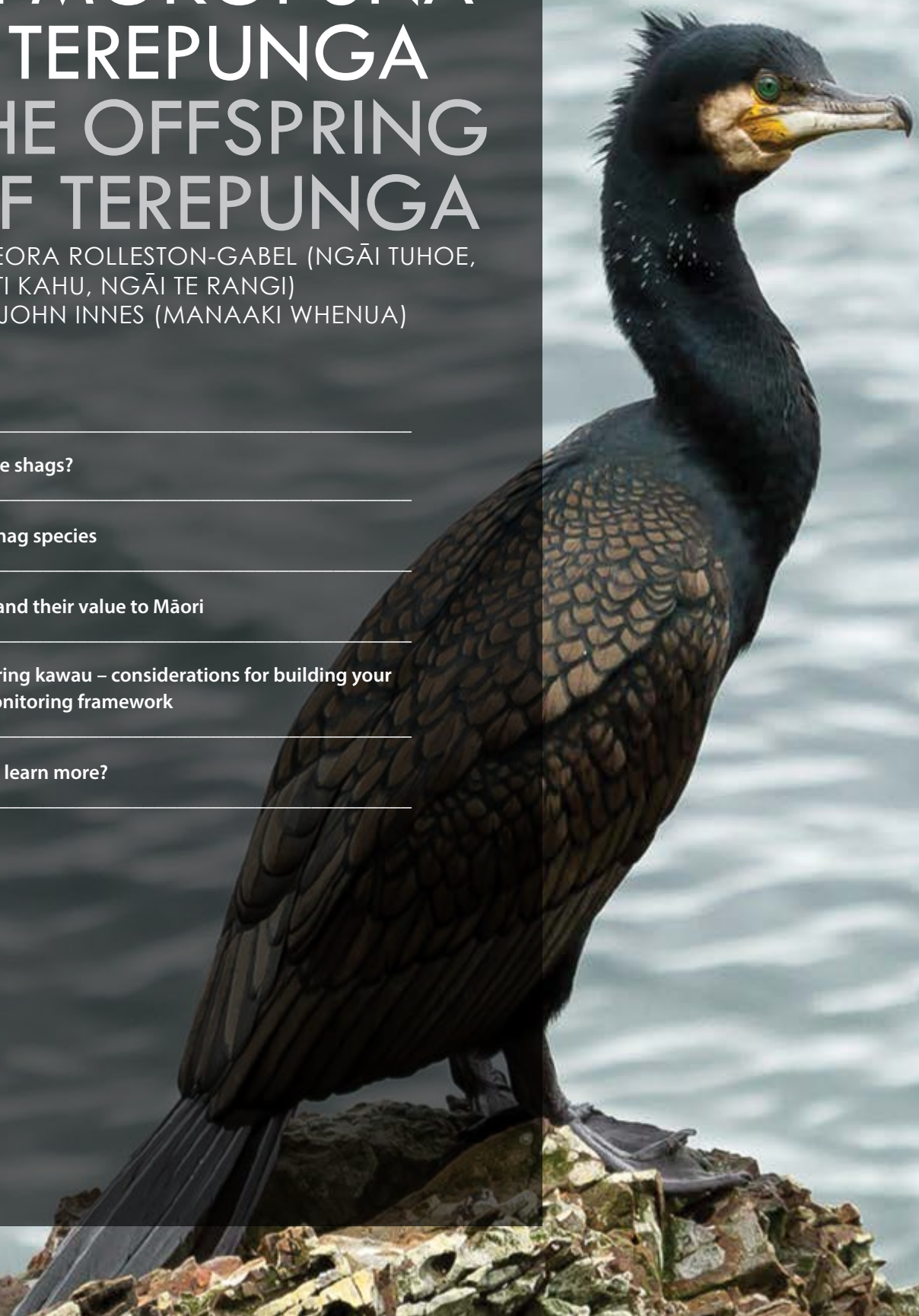
What are shags?

Other shag species

Kawau and their value to Māori

Monitoring kawau – considerations for building your
own monitoring framework

Want to learn more?



Kia mau ki tēnā, kia mau ki te kawau mārō

Hold fast to that, hold fast to the swoop of the shag

Ngāti Maniapoto

WHAT ARE SHAGS?

Shags are medium to large aquatic birds. There are 36 species of shag or cormorant worldwide, of which 12 are present in the Aotearoa New Zealand. Eight of the species found in Aotearoa are endemic, which means they are only found here.

The kawau, or black shag (also known as the black cormorant and great cormorant; *Phalacrocorax carbo*) is one of the most common and widespread shag species in Aotearoa. As a native species, kawau are highly valued by some hapū (subtribes) and iwi (tribes), and is considered as a taonga bird species (cultural significance).

Kawau occupy a variety of habitats from Northland to Stewart Island, including repo (wetlands), estuaries, coastal waters, lakes and ponds. Although widespread, the population is estimated to be between 5,000 to 10,000 individuals. Large colonies of over 50 individuals have been recorded in Waikato, Lake Wairarapa wetlands, and the Chatham Islands.

As a top predator in freshwater systems, kawau consume small and medium-sized fish. However, this natural behaviour puts them in conflict with human fishers and they have a reputation for stealing from nets, and being 'menaces' or unwanted 'pests' because they are viewed as competing with humans for fish. Between 1890 and 1940, fishers were actually encouraged to cull (shoot) them, and as a result population decline occurred in some areas. In 1986 kawau were given partial protection as a native bird and it is also currently classified as 'At Risk: Naturally Uncommon' in the New Zealand Threat Classification System'.

As kawau are easily frightened by humans, urban development near their habitat, and an increase in human recreational activity may have an effect on the presence of kawau in that particular area. This may also have further impacts on local kawau population numbers.

Previous page: Kawau/black shag. Photo: © Janice McKenna

Below: Kawau paka/little shag and kāruhiruhi/pied shag nesting or roosting along the Lower Waikato River. Photo: Nardene Berry



OTHER SHAG SPECIES

There have been numerous studies on the population size, diet, and breeding habits of different shag species that also occupy habitats near repo and share different variants of the name 'kawau'. These shag species are protected and include the little shag (*Phalacrocorax melanoleucos*), pied shag (*P. varius*), and little black shag (*P. sulcirostris*).

Kawau paka/little shag

As suggested by the name, the kawau paka or little shag, are the smallest of the shag species. With an estimated population of 5,000–10,000 breeding pairs, the kawau paka are common in the North Island, and are found in sheltered coastal areas, harbours, rivers, lakes, and dams. They are known for their variety of plumage and have relatively longer tails than other shag species, such as the kawau, kāruhiruhi, and kawau tūi.

Kāruhiruhi/pied shag

The kāruhiruhi or pied shag, mainly inhabit coastal areas throughout Aotearoa but are also found in and around wetlands. They are closely related to the kawau, and have similar breeding patterns and behaviour, lifespan, and population size. They are generally slightly smaller than the kawau, and the face, throat, and underpart are white. As with the kawau, they used to be seen as a menace; however, restrictions on culling (shooting) have possibly contributed to an increase in their population size in the central North Island.

Kawau tūi/little black shag

The kawau tūi or little black shag was first reported in 1840 and is a relatively new species in Aotearoa. Kawau tūi is smaller than kawau and has all-black plumage with a glossy dark green sheen. The distribution of this species is increasing and the birds are primarily seen in the North Island, particularly in Northland, Rotorua, Taupō, Wairarapa, and the Wellington region. Kawau tūi are adapted to both freshwater and coastal environments, and fish form a major component of their diet. Classified as 'naturally uncommon' and protected, there are estimated to be between 1,000 and 5,000 breeding pairs.



Kawau paka/little shag. Photo: © Janice McKenna



Kāruhiruhi/pied shag. Photo: © Jonathan Astin



Kawau tūi/little black shag. Photo: John Innes

KAWAU AND THEIR VALUE TO MĀORI

Although there have been many studies of the kawau, very little is understood about their role and influence within our wetland ecosystems. However, cultural information and knowledge about these birds exist that highlight their value to Māori within these systems, and could potentially provide key information for their future enhancement.

There are numerous whakataukī or sayings that use kawau – particularly their behaviour or appearance – as a metaphor. For example, '**Ka mārō te kakī o te kawau**' is a well-known whakataukī that describes the neck of the kawau when preparing for flight. It is often used to describe a person, group or taua (war party) preparing for battle.

Although kawau were historically used as a kai (food) by some hapū/iwi, other bird species were generally preferred as a more important kai. The feathers of kawau may also have been used for korowai (cloak); however, there is a lack of research and evidence to support such use.

For some iwi, kawau are considered a taonga (treasured) species. Ngāi Tahu have acknowledged a special relationship with 'kōau', the local name for a variety of shag species including the kawau, kawau paka, and kāruhiruhi.

There are many different Māori names used by different iwi and it is important to recognise if your iwi or the iwi in your region have their own name for the bird.

The use of traditional Māori names for bird species is at risk of declining, which could mirror a similar decline in our knowledge system of kawau and other shags. When people can't see the birds, knowledge about them may also fade away with each new generation. As noted earlier, this decline may be attributed to:

- efforts to remove localised populations of kawau because of their nuisance behaviour to fishers
- kawau having only partial protection under conservation legislation
- a significant amount of recreational and human activity near habitats, which may cause them to move to other areas or affect their habitats. This has been especially noted in coastal areas where kawau have moved to offshore islands where there is less human activity.

Ka mārō te kakī o te kawau

The neck of the shag is stretched out



Kawau/black shag. Photo: © Janice McKenna

MONITORING KAWAU CONSIDERATIONS FOR BUILDING YOUR OWN MONITORING FRAMEWORK

Long-term observations and monitoring were natural activities for our tūpuna (ancestors), who also drew on their mātauranga (knowledge). This knowledge system is still relevant today and can help develop our collective understanding of our natural resources, especially wetlands, in our respective regions.

Key actions we can take to build our understanding of kawai based on our collective mātauranga:

1. **Kōrero (speak) with kaumātua (elders) and key whānau (family) members about their memories of kawai:**
 - **Are they aware of any whakataukī or kōrero about the kawai or the other shags?**
Whakataukī provide not only key guidance and life learnings to whānau about a particular take (issue) or kaupapa (topic), they also provide important clues to the observations made by our tūpuna about the things with which they interacted. Whakataukī from your iwi about the kawai (and other shags) can help build an important cultural picture about:
 - i the presence of the birds in the rohe, and the time of year when that occurred, and
 - ii the different types of interactions between the hapū/iwi and the birds (both historically and currently).
 - **What does the kawai look or sound like?**
Our senses are very good at detecting changes provided we pay attention to them. Recording of these sensory changes is just as important as collecting scientific information about the kawai. This information can provide an indication of the health of black shags as well as wetlands:
 - i A change in colour and size might suggest the species of shag had changed, which can be linked to environmental changes and human influences
 - ii A change in sound might indicate changes in population size (louder if many, quieter if less); or changes in breeding cycle – kawai have distinctive calls during these times.

- **Where did they find them and why did they look for them?** Places where the kawai might have been found can indicate their whakapapa (connections) as well as their relationship to other plants and animals. It is also important to consider any associated practices or past use of kawai as tohu (signs).
 - **Can they remember if they were found in certain areas of the region or near any particular trees or plants?** Again, this can help increase overall understanding about the habitat and wider whakapapa of the kawai. All species of shag described in this section enjoy having trees to roost on and dry their wings. Perhaps key trees and plants they use are no longer there? If this is the case, have kawai also gone?
There are many other practices where you may have seen kawai. Often people unintentionally make important observations. These observations may seem insignificant at the time but can also provide an indication of the health of the wider ecological system. Noticing the presence or absence of kawai in a certain area can give clues about patterns and other cultural indicators (e.g. the fish they eat) that could also be monitored over time.
2. **Identify your own monitoring areas based on what you may have learnt from your people.**
Think about the areas where kawai and other shag species used to be found, and choose areas to monitor them based on those different habitat types e.g. lake edge versus wetland versus dams.
 3. **Who to talk to?** Talk to scientists and other experienced communities and groups and work with them to support the development of personalised iwi and community monitoring programmes. These programmes may be tailored to iwi aspirations for kawai (and other shag) populations and health of wetlands. Some scientists are able to offer advice (e.g. data collection, recording, information), or training in identification and ecology of the different shag species that may be seen in your area.

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 n.d. *Māori religion and mythology. Part 2.*

Retrieved from <http://nzetc.victoria.ac.nz/tm/scholarly/tei-Bes02Reli-t1-body-d4-d4-d24.html>

Hutchings G 2015. *Shags – a variety of species.*

Retrieved from www.TeAra.govt.nz/en/shags/page-1

Hutchings G 2015. *Shags – black-footed shags.*

Retrieved from www.TeAra.govt.nz/en/shags/page-2

Mead HM, Grove N 2003. *Ngā pēpeha a ngā Tipuna.*

Wellington, New Zealand: Victoria University Press.

New Zealand Birds 2005. Kawai, the black shag.

Retrieved from www.nzbirds.com/birds/kawai.html

New Zealand Birds Online 2013. Black shag. Retrieved

from <http://nzbirdsonline.org.nz/species/black-shag>

New Zealand Birds Online 2013. Little black shag.

Retrieved from <http://nzbirdsonline.org.nz/species/little-black-shag>

New Zealand Birds Online 2013. Little shag. Retrieved

from <http://nzbirdsonline.org.nz/species/little-shag>

New Zealand Birds Online 2013. Pied shag. Retrieved

from <http://nzbirdsonline.org.nz/species/pied-shag>

Heather B, Robertson H 2005. *The field guide to the*

birds of New Zealand. Rev. edn. Auckland, New Zealand: Viking.

Taylor GA 2000. *Action plan for seabird conservation in*

New Zealand. Department of Conservation. Retrieved from www.doc.govt.nz/documents/science-and-technical/TSOP16.pdf

Useful websites

NZ Birds Online: www.nzbirdsonline.org.nz

NZ Birds: www.nzbirds.com

Booklet: *Initial Focus Group Findings.* Manaaki

Whenua – Landcare Research: [www.](http://www.landcareresearch.co.nz/science/plants-animals-fungi/animals/birds/biodiversity-measures/in-pictures/booklet-focus-group-finding)

[landcareresearch.co.nz/science/plants-animals-fungi/animals/birds/biodiversity-measures/in-pictures/booklet-focus-group-finding](http://www.landcareresearch.co.nz/science/plants-animals-fungi/animals/birds/biodiversity-measures/in-pictures/booklet-focus-group-finding)

A Code of Practice for naming new species in

Aotearoa: www.landcareresearch.co.nz/__data/assets/pdf_file/0010/84187/code_practice_naming_new_species.pdf

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5.5 MATAMATA EATING WITH OUR TŪPUNA

RANGI MAHUTA (WAIKATO),
CHERI VAN SCHRAVENDIJK-GOODMAN
(TE ATIHAUNUI A PAPĀRANGI, NGĀTI APA,
NGĀTI RANGI), AND CINDY BAKER
(TAIHORU NUKURANGI)

White gold

What are matamata?

Impacts of declining matamata numbers on
traditional practises

How do we restore matamata?

Want to learn more?

WHITE GOLD





To some, matamata (whitebait, *Galaxias* spp.) are viewed as 'white gold' – delicate silvery fish highly coveted for their taste (especially when cooked up with egg and the right mix of flour). To others, whitebait represent more than a delicacy – they are an important way of life for a short few months of the year, with knowledge about harvesting and cooking techniques passed down through each respective generation. For tangata whenua (indigenous people), that knowledge system can also encompass an even broader set of social-environmental interactions and learning opportunities linked to the fishing environment.

This knowledge includes, but is not limited to:

- learning how to operate a boat and swim
- harvesting plants such as harakeke (NZ flax), kuta (giant spike sedge), wīwī (rushes), and kiekie (gigi bush) along the stream or river's edge
- learning how to harvest other species moving through or inhabiting the waterbody at the same time (Table 1)
- undertaking revegetation of important species such as the kahikatea.

And all of this can happen almost subconsciously while waiting for the matamata to swim into the net.

Table 1. Some examples of other freshwater and estuarine species harvested during whitebaiting

| Māori and common name(s) | Scientific name | Key feature | Image |
|--|------------------------------|--|---|
| Porohe <ul style="list-style-type: none"> • Common smelt • Number two whitebait • Cucumber fish | <i>Retropinna retropinna</i> | Cucumber smell, slightly larger than whitebait and creamier colour. Has scales and a small fin between the dorsal and tail fin |  <p>Photo: Stephen Moore</p> |
| Tunatuna <ul style="list-style-type: none"> • Glass eels • juvenile tuna | <i>Anguilla</i> spp. | Longer length than whitebait and move in tight groups |  <p>Photo: NIWA</p> |
| Kāeo, kākahi <ul style="list-style-type: none"> • Freshwater mussels | <i>Echyridella menziesi</i> | Shellfish found in the sandy beds of large rivers or lakes |  <p>Photo: Ngaire Phillips</p> |
| Kahawai | <i>Arripis trutta</i> | Marine-based fish but will move into the more estuarine (saltier) areas of a river system, e.g. river mouths/entrances |  <p>Photo: Malcolm Francis</p> |

WHAT ARE MATAMATA?

Whitebait are the juvenile forms of fish from the Galaxiidae family, and are recognisable by their almost translucent (see through) appearance that can give the impression of 'glittering' in the water, similar to stars. It is this glittering effect that earned them the name '**Ngā Karu ō Matariki**' by kaumātua (elders) from Te Pūaha o Waikato (Port Waikato) as they enter the river mouth. As they progress through the waters, they are referred to by other names, including matamata, karohi, karohē, and inanga.

There are 17 species of the Galaxiidae fish family but only five of these species – giant kōkopu (*Galaxias argenteus*), inanga (*G. maculatus*), banded kōkopu (*G. fasciatus*), shortjaw kōkopu (*G. postvectis*), and kōaro (*G. brevipinnis*) – make up the 'whitebait catch'. These species will move out to sea for part of their early life (called diadromy), and are harvested when they return from their marine kōhanga (larval nurseries) to the freshwater systems that will become their adult habitats. The species referred to more commonly as 'inanga' form the largest proportion of the whitebait catch.

In the Waikato River over 93% of whitebait consist of matamata/inanga, with the remaining 7% made up of the four other species. All whitebait species will feed and grow throughout the lower Waikato River system, with adult inanga found right up to Karapiro Dam some 150 km away. Most kōkopu whitebait species will grow to adulthood within tributary streams of the Waikato River rather than the river itself.

Top to bottom: Kōaro, shortjaw kōkopu.
Photos: Peter Hamill



Another important fish species that is caught during the whitebait season is the porohe (common smelt). Porohe are slightly larger in size and tasty to eat, but they can cause upset stomachs if not thoroughly cooked. Fish buyers refer to them as 'number 2 whitebait' as they run at the same time as the matamata, which are the 'number 1s'.

Other fish that also run during the main whitebait season are juvenile tuna, commonly referred to as tunatuna or 'glass eels' because of their almost transparent appearance (although they are longer than number 1 and 2 whitebait). Kōrero (conversations) from fisher-whānau on the Waikato River highlight that tunatuna (glass eels) can run as an almost 'impenetrable wall of fish'. Sadly, though, numbers are getting so low that whānau (families) have shared that they are lucky to catch half a cup (less than 250 gm) when once they could catch a net full.

Top to bottom: Giant kōkopu, banded kōkopu, inanga.
Photos: Stephen Moore



IMPACTS OF DECLINING MATAMATA NUMBERS ON TRADITIONAL PRACTICES

Changes to whitebait harvesting practices

The traditional scoop nets are known as 'kaka' to some Waikato fishers. These were hooped nets usually made from netting and the aka aka (native vine supplejack), attached to a long pole handle that was usually made from kahikatea, and mānuka (kahikatoa) or mauku (tī kōuka, kōuka, cabbage tree). The kaka (scoop net) based fishing technique required the fisher to stand either in the river (sometimes up to chest height), or on perches (trees, rocks or 'river beaches') to catch the fish.

Catching the fish therefore required much skill both to:

1. understand where the fish were going to run within the river stem each day of fishing and why (i.e. environmental conditions dictating movement)
2. get the correct timing and scooping action on the kaka.

To help fishers, another technique used was the 'ariari board'. Traditionally, this was the white interior bark of the mauku that was placed in the water to enhance visibility of the fish when they moved through the water towards the kaka. As the water quality of the river has declined, so too has the visibility, and the ariari board is now relegated to cultural history and memory in many parts of the river catchment.

This was a very different approach compared with the techniques now commonly used in whitebaiting.

Present-day set nets allow the fisher to place their nets in the water, with screens (legally up to 6 m long) 'guiding' the fish into the mouth of the net. The size of the nets (no larger than 4.5 m around the 'inside edge'), use of the screens, and wire framing can allow very large catches (sometimes over 80 kg) to be taken from the river in one sitting.

In comparison, catches in the kaka (scoop net) rely on the strength of the fisher and the carrying capacity of the kaka. Because the volume of the net is generally smaller than the set net, it takes more effort to pull in the same amount of fish. This is a key reason why the set net has gained in popularity, particularly on big rivers like the Waikato.



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



Fisher from Mokau with set net. Photo: Supplied by Cheri van Schravendijk-Goodman

Loss of local dialects and names for species associated with whitebaiting

With the increasing interest in traditional Māori names for plants, there are issues about the dialects from which these names come. Work with fishing whānau at Te Pūaha o Waikato has highlighted that many of the local names for plants and fish species are being overwhelmed by the 'common Māori names' used by nurseries and scientists, or the names have disappeared with the loss of kaumātua.

Localised names for plants, for example, not only provide clues to the amazing level of understanding of our tūpuna (ancestors) as botanists (plant experts), but can also highlight unique interactions with other species, environments, practices, uses of the species, and individual tūpuna. Losing these names from the local memory and dialect, therefore, has much wider implications than the loss of the name alone (Table 2).

Table 2. Examples of native plant species associated with whitebait spawning habitat in the lower Waikato as described by Te Pūaha kaumātua in the early 1990s

| Local (Waikato) and common name | Scientific name |
|---|---|
| Tūtunāwai* Swamp willow weed | <i>Persicaria decipiens</i> |
| Pūrekireki, pūrei Swamp sedges | <i>Carex virgata</i> and <i>C. secta</i> |
| Kōwhai*, kō'wai Kowhai | <i>Sophora</i> spp. |
| Mauku, tī kōuka, kōuka Cabbage tree | <i>Cordyline australis</i> |
| Mouka Water fern, hen and chicken | <i>Histiopteris incisa</i> (also known as mātātā) <i>Asplenium bulbiferum</i> |

* Refers to names that are also common to other iwi



Tūtunāwai, swamp willow weed. Photo: Jeremy Rolfe



Pūrekireki (also known as pūrei), swamp sedge. Photo: Beverley Clarkson



Mouka (also known as mātātā), water fern. Photo: Jeremy Rolfe

Other issues – access

For the people in the lower Waikato, policy related to 'stand registration' with the Regional Council has also had an effect on the ability of whānau to fish in their traditional areas. A recent baseline survey in 2011–2012 highlighted that the number of baches and benches being built on the river, and in most cases, 'registered' with the Council, were reaching unsustainable numbers, and were also encroaching on traditional fishing stands, and beaches (Figure 1).

The challenges for access to sites are complicated by a range of issues that goes beyond just policy barriers. Much of the challenge in the lower Waikato is the absence of whānau who, in most cases, have moved away for work, and who cannot get home to protect their areas during the season. Mapping these impacts, therefore, has been helpful for monitoring purposes, but there is still much to do to ensure long-term protection of access rights for whānau in the lower river.

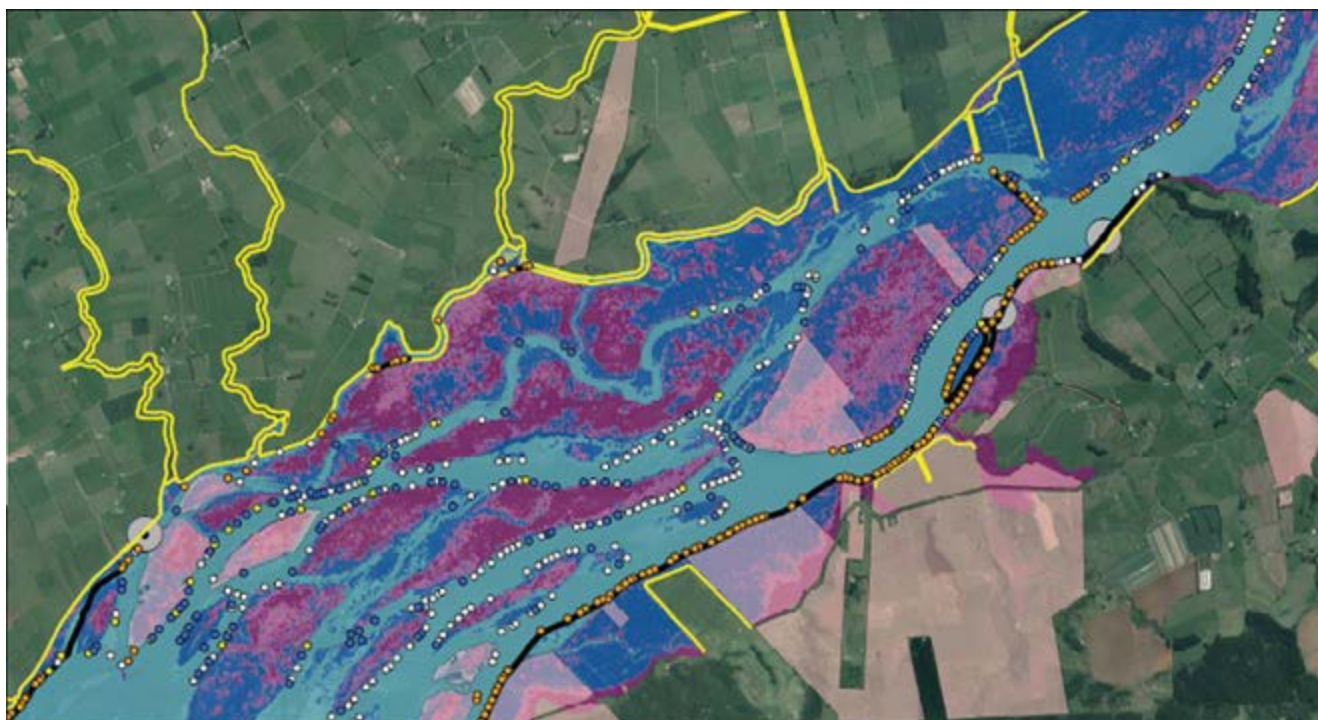
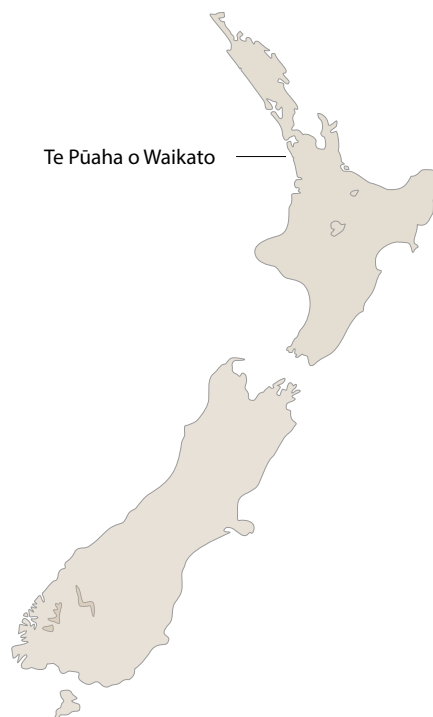


Figure 1: Part of the main map generated for the whitebait structures scoping study – Te Pūaha o Waikato (Port Waikato), Waikato River (adapted from Morris et al. 2011, and Jones and Hamilton 2014)

Black lines mark the areas still being fished by whānau but at risk of encroachment from other fishers registering stands with the Regional Council.

Orange dots mark benches/stands.

White dots indicate stands with small baches (one room, larger than 10 m²) behind them.

Blue dots indicate stands with baches (more than 2 rooms) behind them.

Yellow lines indicate agricultural drainage/flood protection systems.

Pink and purple areas indicate river flooding potential.

Other issues – pest plants that are important spawning habitat

Perhaps one of the biggest problems for the respective restoration of spawning habitat and wetland restoration is the interesting adaptation of our whitebait (in part) to many pasture grasses and other introduced plants that are found along drains and waterbodies. Some of the most important plants for matamata/inanga spawning are recognised wetland and forest invasives such as Yorkshire fog, kikuyu grass, and wandering jew (Table 3).

In the absence of intact native ecosystems, the issue of pest plants providing important habitat and, in other cases food sources for native species, presents challenges for wetland restoration. This is similar to the debates on the need for crack willow control/removal to support native restoration, balanced against the important role they can also play as habitat for our tuna (freshwater eels) that provide the same complex instream cover.

For whitebait, the lack of intact native ecosystems has therefore created gaps in our understanding about:

- where whitebait species, the banded, shortjaw, and giant kōkopu in particular, are actually spawning¹ in streams that have been modified through human development
- the native plant mixes that can provide the best indigenous spawning habitat. We do have some examples from recent work, but these are not necessarily what they might have spawned on historically and require further research.

For the moment, we must work with what we have. This includes testing current knowledge and boundaries of what might be possible (based on our collective knowledge sets), and focusing on restoration methods that support native wetland restoration, but which do not compromise the only habitat that our fish may have to use in the meantime.

¹ Only one documented site has been recorded for the giant kōkopu in Hamilton. This site was discovered by NIWA scientists in 2013.

Table 3. Some plants commonly associated with inanga eggs (Note although suitable for inanga spawning, the exotic plants indicated by * outlined here are not ideal for wetland restoration)

| Common name | Scientific name | Where eggs are commonly found |
|------------------|---------------------------------|---|
| Tall fescue* | <i>Schedonorus arundinaceus</i> | Around the root hairs or on the decaying grass blades around the base |
| Creeping bent* | <i>Agrostis stolonifera</i> | Under the mat of runners that forms on the soil surface |
| Mercer grass* | <i>Paspalum distichum</i> | Attached to the leaves and stems |
| Wandering jew* | <i>Tradescantia fluminensis</i> | Attached to the leaves and stems |
| Kikuyu* | <i>Cenchrus clandestinus</i> | Attached to the leaves and stems |
| Yorkshire fog* | <i>Holcus lanatus</i> | Attached to the leaves and stems |
| Twitch, couch* | <i>Elytrigia repens</i> | On the thick root mat |
| Water celery* | <i>Apium nodiflorum</i> | Attached to roots and stems |
| Wiwi | <i>Juncus edgariae</i> | Around bases and lower stems |
| Harakeke/NZ flax | <i>Phormium tenax</i> | Around bases, often in association with grasses in the periphery |
| Raupō | <i>Typha orientalis</i> | Attached and under decaying leaves |

HOW DO WE RESTORE MATAMATA?

Because whitebaiting is an activity around which other practices occur, it is also important to consider the wider range of activities, and the impacts (if any) on those activities.

The following steps outline what we can do to build our understanding of our whitebait (including the five galaxiid species, and the porohe) based on our collective mātauranga (knowledge):



Showing our next generation the adult kōkopu species present in our rivers. Photo: Joanna Katipa



Alligator weed choking potential whitebait spawning habitat. Photo: Cheri van Schravendijk-Goodman

STEP 1: Kōrero (speak) with local kaumātua (elders) and other whānau (family) members about their memories and current interactions with whitebait and other fish and plants during the season:

- **The socio-cultural value of the fish.** What activities do whānau do during whitebaiting (see earlier), and have these changed? If there have been changes to these activities during whitebaiting, do they know why?
- **Pinpointing and mapping** spawning sites of the fish, also mapping locations of other associated mahinga kai (food gathering site) within the fishing area.
- **Identifying how fish populations have changed**, i.e. generational changes in catch, or changes to the fishery regime in their area.
- **What may have caused declines in the fishery?** NOTE that the 'cause' may need to be addressed first, before any new revegetation can occur, e.g. addressing nutrient run-off, fencing off spawning sites, and removing serious pest plants like reed sweetgrass and alligator weed.



Waikato River whānau learning about fish pass design for whitebait access. Photo: Joanna Katipa

STEP 2: Consider the ecology and environmental whakapapa (connections) of the system to get a better understanding about how to restore whitebait populations:

- Identify the best areas to restore whitebait habitat and spawning sites. NOTE that our different whitebait species have slightly different habitat preferences, so it is important to get reliable information about this early in restoration planning (see useful references later)
- Re-plant stream margins to provide food and cover for growing whitebait such as wīwī, carex, and raupō. To provide bankside shading and help keep water temperatures low, increasing canopy cover by planting trees is also important
- Consider adjacent land use and how you can mitigate any adverse impacts from those where possible, e.g. fencing off stock
- Potential for other organisms – fish species (i.e. tuna, matamata, porohe, kanae (grey mullet)); birds, water invertebrates (i.e. caddis flies, mayflies, beetles, etc.)
- Doing a vegetation survey of all native and exotic plant species on site, and the ratio of native to exotic, is a good way of building a baseline to help monitor change and guide restoration over time.

HOT TIP: A good way to gather information about fish numbers is to monitor daily catch weights over the season, and the time taken to bring the catch in (i.e. 30 kg in a 4 hour day).

This will require identifying key fisher people in the whānau/community to record their information in a diary, which can then be shared with those collecting the data during and at the end of each season.

The greater the number of years you can measure this, the better the information to understand fish patterns and densities.

Waikato River whānau learning about impacts of urban design for native fish habitat. Photo: Joanna Katipa



STEP 3: Building a monitoring and restoration framework

- **What does the whitebait look like, smell like, and taste like?** Our senses (eyes, nose, ears, and taste buds) are very good at picking up changes, provided we pay attention to them! Recording these sensory changes is just as important as collecting scientific-type information about population densities, fish sizes, and the quality of their habitats:
 - i. A change in colour and size might suggest changes to food sources (note connection also to marine environment here). It might also provide clues to illnesses affecting the fish.
 - ii. A change in smell might suggest pollutants in the water.
 - iii. Changes in taste might suggest changes to the water quality (i.e. 'muddy tasting'), or changes to food sources, i.e. "you are what you eat".
 - iv. Changes to the length of time that fish can be stored is also important. Overall health and wellbeing of the fish can affect its storage potential. However, little is understood at this stage as to what might influence that.
- **What are the local names (if any) for the whitebait, 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 wellbeing of the whole system.
- **Who to talk to?** Talk to scientists and other communities with additional experience in whitebait ecology and restoration, and work with them to help build a restoration framework that best meets the needs of your local community and the fish.



Understanding barriers to fish passage (NIWA experiment).
Photo: Joanna Katipa

Waikato River whānau learning about impacts of urban design for native fish habitat. Photo: Joanna Katipa



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

Baker CF 2006. *Predation of inanga (Galaxias maculatus) eggs by field mice (Mus musculus)*. Journal of the Royal Society of New Zealand 36(4): 143–147.

Baker CF, Boubée JAT 2006. *Upstream passage of inanga Galaxias maculatus and redfin bullies Gobiomorphus huttoni over artificial ramps*. Journal of Fish Biology 69: 668–681.

Baker CF, Smith JP 2015. *Influence of flow on the migration and capture of juvenile galaxiids in a large river system*. New Zealand Journal of Marine and Freshwater Research 49(1): 51–63.

Baker CF, Franklin PA, van Schravendijk-Goodman C 2014. *Restoration of inanga spawning habitat*. NIWA Client Report HAM2014-115. 53 p.

Bonnett ML, Sykes JRE 2002. *Habitat preferences of giant kokopu, Galaxias argenteus*. New Zealand Journal of Marine and Freshwater Research 36: 13–24.

Charteris SC, Allibone RM, Death RG 2003. *Spawning site selection, egg development, and larval drift of Galaxias postvectis and G. fasciatus in a New Zealand stream*. New Zealand Journal of Marine and Freshwater Research 37: 493–505.

Cowan J 1930. *The Maori: yesterday and to-day*. Whitcombe & Tombs, Wellington.

Franklin PA, Smith J, Baker CF, Bartels B, Reeve K 2015. *First observations on the timing and location of giant kōkopu (Galaxias argenteus) spawning*. New Zealand Journal of Marine and Freshwater Research 49(3): 419–426.

Jones HFE, Hamilton DP 2014. *Assessment of the Waikato River estuary and delta for whitebait habitat management: field survey, GIS modelling and hydrodynamic modelling*. Prepared for Waikato Regional Council. Environmental Research Institute Report No. 27, University of Waikato, Hamilton. 79 p.

Morris B, van Schravendijk-Goodman C, Williams J, Ormsby G 2012. *Identifying traditional whitebait stands in the lower Waikato River – a joint spatial analysis project*. Waikato Regional Council Technical Report 2013/18. Report drafted for the Waikato Regional Council, Kirikiriroa/Hamilton, and Waikato Raupatu River Trust, Waikato. 58 p.

Stancliff AG, Boubée JAT, Mitchell CP 1988a. *The whitebait fishery of the Waikato River*. New Zealand Freshwater Fisheries Report 95. 96 p.

Useful Websites

Whitebait Connection:
www.whitebaitconnection.co.nz

Whitebait regulations:
www.doc.govt.nz/parks-and-recreation/things-to-do/fishing/whitebaiting

About whitebait:
www.niwa.co.nz/freshwater-and-estuaries/faq/what-are-whitebait

Science Learning Hub (web-based resource for schools): <http://sciencelearn.org.nz/News-Events/Latest-News/News-Archive/2008-News-archive/Stopping-whitebait-from-frittering-away>

Examples of website-based resources and projects

EOS Ecology: www.eosecology.co.nz/Our-News/Whaka-Inaka-Causing-Whitebait.asp and see also: www.doc.govt.nz/news/stories/2016/february/increasing-whitebait-spawning-habitat

NZ Landcare Trust – resources focused on fish restoration, written in Te Reo Māori and English: www.landcare.org.nz/Regional-Focus/Hamilton-Office/Hooked-On-Native-Fish/Fish-Fact-Sheets1

NIWA Kaitiaki Tools: www.niwa.co.nz/freshwater/management-tools/water-quality-tools/kaitiaki-tools

WETMAK monitoring and assessment kit. Module 4. Mapping wetland vegetation: www.landcare.org.nz/wetmak

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SECTION THREE:

TOOLS AND APPROACHES

HERBICIDE USE FINDING THE BALANCE

CHERI VAN SCHRAVENDIJK-GOODMAN
(TE ATIHAUNUI A PAPĀRANGI, NGĀTI
APA, NGĀTI RANGI)

The use of herbicides and other toxins for removal of unwanted organisms within the native environment can be a very emotionally charged and controversial approach to restoration. Herbicides are used to control weeds, particularly large invasions, and have now become an essential management tool in many restoration projects. The herbicides glyphosate (the primary ingredient in Roundup®) and, to a lesser extent, metsulfuron (present in Escort®), are routinely used to control the invasive weed, grey willow, within our repo (wetlands). Without management, the grey willow can change the whakapapa (connections) of a repo, including:

- outcompeting native plants like wīwī (rushes), pūrekireki, pūrei (sedges), and harakeke (NZ flax). These plants prefer open, well-lit areas, but willows form thick and wide canopies that can completely shade them out
- encouraging different insect and aquatic animal species into the wetlands (usually introduced beetles, flies, zooplankton, and others), which in turn outcompete our native fauna and alter the food available to native birds and fish.

For some groups, including tangata whenua (indigenous people), the use of a toxin – even for control of an invasive species – can be regarded as hugely disrespectful and unsafe to the whenua (land), to the whakapapa of that whenua, and to the people. For other groups (who can also include tangata whenua) a certain level of comfort may be reached by using herbicide as a means to work towards a bigger aspiration for returning taonga species (native plants and animals of cultural significance). However, a decision in one area should not be taken as a blanket decision for elsewhere. Many groups work on a case-by-case basis, and may prefer to treat each control option as a new discussion, with new aspirations (even if they are similar to other projects), and as a means for exploring and discussing the development of new approaches to restoration.

No matter what is finally decided, the key consideration is that tangata whenua and the wider local community must be informed about proposed actions for restoration. Managers should show a commitment to listen to and work with them to find a path towards shared outcomes for:

- restoration of ecosystems
- the return, protection and enhancement of valued plant and animal species
- the protection and sustainability of human-nature relationships with that environment.

The restoration of Mangaiti Gully wetland in Hamilton, involved both herbicide and manual control.
Photo: Beverley Clarkson





Pre-restoration planning visit to Maurea River Island.
Photo: Beverley Clarkson



Kahikatea planting on Maurea River Island.
Photo: Beverley Clarkson

This section explores some of the work that has been undertaken in this area with the involvement of tangata whenua. Two research projects evaluated the effects of herbicidal control on species that were valued by hapū (subtribes) and tribal members affiliated with the areas studied – terrestrial (land) insects in the Whangamarino Wetland, Waikato, and small aquatic (water) animals in a reserve of the South Taupō Wetland, Turangi. A third case study examined the use of herbicides for invasive plant control compared with non-herbicidal control on the Maurea River Islands, Waikato River.

The purpose of this section is to:

- provide learnings and findings related to different control methods
- help whānau (families), hapū, iwi (tribes), and communities with decisions on the future application of these methods in their respective rohe (region).

These collaborative efforts have resulted in the delivery of science-based guidelines, techniques, and tools to improve management and guide restoration of freshwater wetlands throughout Aotearoa New Zealand.

Maurea River Island, early stages of revegetation.
Photo: Beverley Clarkson



6.1 IMPACTS OF WILLOW CONTROL ON TERRESTRIAL INVERTEBRATES

CORINNE WATTS (MANAAKI WHENUA)

Why are invertebrates important?

Invertebrates in Whangamarino Wetland

Results

What do the results tell us?

Helpful glossary

Want to learn more?

WHY ARE INVERTEBRATES IMPORTANT?

Invertebrates (animals with no backbone) play a very important role in the function of a healthy ecosystem. They maintain the balance of the whakapapa (connections) of a system and undertake a wide variety of roles including:

- 'gardening' roles typical of noke (earthworms) and other soil organisms
- controlling other insects that can cause problems for plants, animals, and humans if left unchecked, such as ladybird beetles preying on aphids
- pollinating a wide range of our native plants, which is done by our many native flies, moths, and short-tongued bees
- providing a food source for our native animals and fish.

Because invertebrates are less obvious and perhaps not as attractive as our birds, bats, and freshwater animals, they tend to be overlooked in the restoration of a native ecosystem. This is true for repo (wetlands) as well.

Previous page: Dead sprayed willows over recovering native sedges at Whangamarino Wetland. Photo: Kerry Bodmin

INVERTEBRATES IN WHANGAMARINO WETLAND

Recent work in the Waikato at Whangamarino Wetland raised a number of concerns for tangata whenua (indigenous people), including the potential impacts of herbicide (glyphosate; the primary ingredient in Roundup®) control of grey willows (*Salix cinerea*), on invertebrates, which are an important food source for tuna (freshwater eels). In response to this, and also to explore the wider effects on invertebrate relationships within the wetland, Manaaki Whenua – Landcare Research researchers investigated the response of the wetland invertebrates in the canopy (tree tops) to glyphosate spraying of the willows. This was part of a larger project looking at the effects of the spray for broad-scale willow control in the wetland.

A baseline survey was conducted in the wetland to gather information about the invertebrate population 1 year before spraying (before spray). Responses were then measured at three key intervals: (1) at spray; (2) short-term (27 days after spraying); and (3) longer-term (2-years after spraying). We collected the data from plots where grey willow had been sprayed and from plots where no spray had been applied (i.e. control). Beetles are routinely selected as 'bio-indicators' as they represent a large component of the invertebrate biodiversity, have representatives in all trophic groups, and have a wide range of habitat preferences.



An aerial view of the Whangamarino Wetland highlighting the spread of the invasive tree, grey willow, into the native vegetation in the wetland interior. Photo: Department of Conservation

RESULTS

Initially (at spray), there were no obvious signs that the spraying had caused death in the invertebrate populations in the canopy (Table 1).

However, 27 days after herbicide application there were huge losses in the canopy foliage of the grey willow. At the same time, there were decreases in the abundance of invertebrates in the glyphosate-treated plots compared with the unsprayed plots.

One year after spraying, the plant community of the plots changed from weedy plants (like the grey willow) to native species including pūrei and Baumea. After 2 years, natives became more dominant in the plant community (Table 2).

As the vegetation changed, the abundance of invertebrates began to increase. At 2 years, all beetle categories apart from detritivores showed increases compared with pre-spray levels (Table 1).

Table 1. Responses of the beetle community to willow control compared with before spray baselines

— no significant change ↓ decrease ↑ increase

| | At spray | 27 days after spray | 2 years after spray |
|--------------------|----------|---------------------|---------------------|
| Abundance | — | ↓ | ↑ |
| Species richness | — | ↓ | ↑ |
| Native beetles | — | ↓ | ↑ |
| Introduced beetles | — | ↓ | ↑ |
| Herbivores | — | ↓ | ↑ |
| Predators | — | ↓ | ↑ |
| Detritivores | — | — | — |

Table 2. Habitat changes over time in the Whangamarino Wetland

| Before or no spray | 1 year after spray | 2 years after spray |
|---|---|---|
| <ul style="list-style-type: none"> • Thick willow canopy • Native vegetation present in understorey | <ul style="list-style-type: none"> • No willow canopy (dead trunks) • Sparse native vegetation • Influx of weedy annuals | <ul style="list-style-type: none"> • No willow canopy (dead trunks) • Native vegetation recovery • Fewer weedy annuals |



Photo: Danny Thornburrow

Photo: Danny Thornburrow

WHAT DO THE RESULTS TELL US?

- Using glyphosate at the recommended concentrations does not appear to have a direct effect on canopy invertebrates. In other words, the spraying did not kill the beetles and other invertebrates.
- Instead, the invertebrates appeared to be more sensitive to changes in vegetation structure. For example, the loss of leaves in the willow canopy reduced the available invertebrate habitat, which likely forced them to leave the plots to find new habitats in the surrounding wetland.
- Restoration via invasive plant control can promote the re-establishment of invertebrate communities typical of native wetlands. But, to meet long-term sustainability of the whakapapa, it is important that:
 - i grey willow reinvasion is prevented; and
 - ii re-establishment of the native plant habitat is well planned for and supported.



Pāpapa, also known as tātaka, a native ground beetle (*Physolaesthus insularis*) common in Whangamarino Wetland.
Photo: Stephen Thorpe

HELPFUL GLOSSARY

Understanding the terminology

Abundance – this refers to the number of individuals of each species. In this research, this was about finding out the total number of individuals within each invertebrate taxon, including beetles found in the wetland

Detritivores – organisms that feed on and break down dead plant or animal material, and recycle essential nutrients back into the ecosystem (see 5.1 Noke/earthworms)

Herbivores – organisms that eat plant material

Predators – organisms that eat other animals

Species richness – the number of different species found within an ecological community, landscape or region. Essentially, the higher the number of different species, the higher the species richness. For this experiment, it is referring to the number of different invertebrates recorded in the plots

Trophic group – organisms, based on their mode of feeding



A tent trap for collecting flying insects in Whangamarino.
Photo: Danny Thornburrow

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

Watts C, Rohan M, Thornburrow D 2012. *Beetle Community responses to grey willow (Salix cinerea) invasion within three New Zealand wetlands*. New Zealand Journal of Zoology 39: 1–19.

Watts C, Ranson H, Thorpe S, Cave V, Clarkson B, Thornburrow D, Bartlam S, Bodmin K 2015. *Invertebrate community turnover following control of an invasive weed*. Arthropod Plant Interactions 9: 585–597.

Useful documents

Taranaki Regional Council. 2009 (rev. edn). *A photographic guide to freshwater invertebrates of Taranaki's rivers and streams*. Available online from: <https://www.trc.govt.nz/assets/Documents/Research-reviews/Freshwater/Photographic-Guide-sm.pdf>

Wetland Restoration Handbook – Native Fauna (Chapter 12): www.landcareresearch.co.nz/__data/assets/pdf_file/0013/41422/Chp_12_Native_fauna_2012.pdf

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6.2

IMPACTS OF WILLOW AND WILLOW CONTROL ON ZOOPLANKTON

YVONNE TAURA (NGĀTI TŪWHARETOA)
AND IAN DUGGAN (TE WHARE WĀNANGA
O WAIKATO)

Ngā mihi

Working with whānau

What are zooplankton and why are they important?

About the Waiotaka Scenic Reserve

Research objectives

Helpful glossary

Want to learn more?

WORKING WITH WHĀNAU

While working for Ngā Runuku hapū (subtribe) in Turangi on their Environmental Enhancement programme (2008–2009), we became aware of the intensive grey willow (*Salix cinerea*) control regime occurring throughout the South Taupō Wetland. As kaitiaki (guardians), hapū members wanted to investigate further the impacts of willow and willow control on aquatic life in their reporepo (swamp). With the support of Ngā Runuku and financial contribution from the Ngāti Tūwharetoa Genesis Energy Committee, I (Yvonne) enrolled in a Master of Science programme to explore this kaupapa (topic) further. The research was undertaken with supervision by Ian Duggan, specialist in zooplankton ecology and senior lecturer at the University of Waikato.

In the Whangamarino Wetland, studies were already underway examining the impacts of grey willow control on terrestrial (land) invertebrates. We decided to examine a different invertebrate group, investigating the responses of zooplankton communities living under live willows, and under those subject to willow control treatment, compared with those living among native vegetation.

Throughout my studies I was strongly supported to undertake and complete my MSc.

My inspiration was drawn from the mentorship of my uncles, Te Rangituamatotoru Tamaira and Rakato Te Rangiita. Their passion for pūtaiao, kaitiakitanga, our reporepo, and teaching our people the importance of our environment was the main reason I became a freshwater ecologist and kairangahau. A big mihi to the Ngāti Tūwharetoa Genesis Energy Committee for funding the study, and to those iwi and hapū who, through their financial contributions, believed this mahi was important.

– Ngā mihi Yvonne

Previous page and below: Waiotaka Scenic Reserve.
Photo: Yvonne Taura



WHAT ARE ZOOPLANKTON, AND WHY ARE THEY IMPORTANT?

Zooplankton are small (<5 mm) aquatic animals that feed on algae and bacteria in freshwater systems, including awa (rivers), moana (lakes), and reporepo (wetlands), which in turn provide food for aquatic insects and small fish. Three major zooplankton groups are commonly found in Aotearoa New Zealand: cladocerans, copepods, and rotifers. Many zooplankton species are sensitive to changes in water quality, and as such, can provide important biological indicators for identifying changes in wetlands, and may thus indicate whether the growth of willows or willow control have detrimental impacts on food webs and water quality in wetlands.



Daphnia galeata. Photo: Barry O'Brien from Duggan et al. 2006. (Permission of Taylor & Francis Ltd.)

ABOUT THE WAIOTAKA SCENIC RESERVE

Waiotaka Scenic Reserve is in the eastern section of the South Taupō Wetland, bordering the shore of Lake Taupō. It covers an area of 29.18 ha situated between State Highway 1, the Waiotaka River, and Stump Bay. Water levels (hydrology) in the wetland are influenced by the Waiotaka River, the artificial management regime of the Lake Taupō water levels, and periodic flooding from the floodplain. The reserve consists of two blocks divided by a sandbar, which are known to Te Papa Atawhai – Department of Conservation (DOC) as Blocks 1 and 2.

The main vegetation types and habitats are:

- native indigenous wetland plant species of tī kōuka and kānuka forest on the dune ridges
- sedge peatland
- raupō reedland
- mānuka shrubland
- harakeke flaxland
- toetoe tussockland and
- open water
- a variety of exotic plants, including grey willow scattered throughout

DOC included the Waiotaka Scenic Reserve in their operational plan for weed management of future willow control programmes throughout the South Taupō Wetland.

Ground control of grey willow took place in Block 1 in summer 2007/2008. Block 2 received no willow control before our study.



Aerial view of the Waiotaka Scenic Reserve. Photo: Department of Conservation

RESEARCH OBJECTIVES

The aim of our research

Our aim was to examine the zooplankton communities living in South Taupō Wetland, and determine whether these assemblages are affected by willows and willow control treatment.

Two experiments were designed to examine:

- the composition of zooplankton communities in native vegetation, and under living and dead willow (i.e. long-term effects of willow control)
- the direct effects of the herbicide metsulfuron on zooplankton communities following willow control (i.e. short-term effects of willow control).

Methods

- To determine the long-term effects of willow control on zooplankton communities, seven sites were sampled in both Blocks 1 and 2, which represented indigenous wetland plant species not encroached by willow (native sites)
- A further seven dead willow trees in Block 1 and seven live willow trees in Block 2 were also chosen. These trees were taller than 2 m, and scattered throughout the blocks in permanently wet areas
- Sampling of zooplankton was undertaken in February (late summer), July (winter), and December (early summer) 2011. During these times the grey willow were in late summer bloom, had lost their leaves, or were in early bloom, respectively
- To better understand the short-term effects of willow control, a further eight living willow trees (Block 1 and 2) were selected for herbicidal control and sampled on 1 February 2012 (before treatment). These were treated on 16 February 2012, and sites were re-sampled (after selected treatment) on 14 March 2012. Living willow trees (Block 1 and 2) were used as the control.

Long-term effects of willow control

No significant differences in zooplankton species richness or composition were found between the native, living, and dead willow sites in any of the seasons, indicating willow and willow control have little effect on zooplankton community composition. This experiment did, however, find differences in species composition on either side of the sand bar, suggesting that the hydrology of Blocks 1 and 2 functioned independently, and that hydrology is a more important driver of zooplankton composition than the presence of willows.

Short-term effects of willow control

Ground control application of metsulfuron resulted in no significant changes in zooplankton species richness or composition before or after treatment. This suggests that the herbicide, and the associated opening of the canopy and leaf fall into the water column post-treatment, do not pose threats to wetland zooplankton.

Overall, our findings indicate that the presence of scattered grey willow has no significant influence on zooplankton composition and diversity. Furthermore, ground control treatment of grey willow using metsulfuron also had no direct or indirect impacts to zooplankton. However, had the study been undertaken under a dense canopy of grey willow, the results might have been different.

What do the results tell us?

- The presence of grey willow, dead or alive, has little effect on zooplankton communities
- Ground control treatment of grey willow, using metsulfuron, has no apparent impacts on zooplankton communities.



Recording data in the field, Waitotaka Scenic Reserve.



Living willow tree surrounded by native plants and open water. Photo: Yvonne Taura



Drill and Inject method – holes drilled into the trunk of the tree. Photo: Yvonne Taura



Dead willow trees one month post-treatment. Photo: Yvonne Taura

HELPFUL GLOSSARY

Understanding the terminology

Assemblages – zooplankton communities

Diversity – the variety of zooplankton species

Species composition – the identity of all the different species in a community

Species richness – the number of different species found within an ecological community, landscape or region, essentially, the higher the number of different species, the higher the species richness. For this study, species richness refers to each individual species that was counted at each site



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

Champion P, James T, Singers N, Bodmin K 2011. *Garlon 360(R) trial for the control of wetland weeds*. Science for Conservation 311. Wellington, New Zealand: Department of Conservation. 34 p.

Husted-Andersen D 2002. *Control of the environmental weed Salix cinerea (grey willow) in the South Taupō Wetland, Central North Island, New Zealand*. Unpublished thesis, The Royal Veterinary and Agricultural University, Copenhagen, Denmark.

Watts C, Rohan M, Thornburrow D 2012. *Beetle community responses to grey willow (Salix cinerea) invasion within three New Zealand wetlands*. New Zealand Journal of Zoology 39(3): 1–19.

Wech J, Brady M, Annandale C, Jones K, Kilroy C, Suren A 2016. *Getting rid of wetland willows: what happens to the water beetles and bugs?* National Wetland Symposium, Nelson. www.wetlandtrust.org.nz/Cache/Pictures/2813547/Wech_willow_control_and_beetles.pdf

Useful Websites

Zooplankton description: www.doc.govt.nz/nature/native-animals/invertebrates/zooplankton

Effects of introduced fish on zooplankton: www.lernz.co.nz/uploads/pest-fish-zooplankton.pdf

Willow and alder guidelines: www.landcare.org.nz/Willow-and-Alder-Guide

Image related credit

Zooplankton image: Duggan I C, Green JD, Burger D F 2006. *First New Zealand records of three non-indigenous Zooplankton species: Skistodiaptomus pallidus, Sinodiaptomus valkanovi, and Daphnia dentifera*. New Zealand Journal of Marine and Freshwater Research, 40: 561–569. Copyright © The Royal Society of New Zealand, image granted permission of Taylor & Francis Ltd, www.tandfonline.com

Author research

Yvonne's Masters research thesis:

Taura Y 2012. *The effects of willow and willow control on wetland microfaunal assemblages in South Taupō Wetland*. Unpublished MSc thesis, University of Waikato, Hamilton. <http://researchcommons.waikato.ac.nz/handle/10289/7577>

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6.3 MAUREA ISLANDS A RESTORATION JOURNEY

CHERI VAN SCHRAVENDIJK-GOODMAN
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APA, NGAATI RANGI), JAEDYN FALWASSER
(NGAATI MAHUTA), AND JOHN BROWN
(NGAATI TE ATA, NGAATI MAHUTA)

Nгаа mihi

Introduction

About the Maurea Islands

The challenge – to spray or not to spray?

Initial steps – setting the scene

Key project learnings – the hard lessons

**Key project learnings – observations unique to river
islands and non-herbicidal control**

Concluding thoughts

Want to learn more?

Tooku awa koiora me oona pikonga he kura tangihia o te maataamuri

The river of life, each curve more beautiful than the last

Kiingi Taawhiao

Cheri van Schravendijk-Goodman

The Maurea Islands project was developed from an idea to explore different options for the restoration of the Waikato River. One of the key gaps in our overall understanding for river restoration was the best way to approach restoring the many islands that were scattered along the length of the lower river.

These islands form important ecological stepping stones for native birds and fish moving around the catchment. However, their location in the river sits within highly modified landscapes and their edges are encroached on by urban and rural settlement, and associated land use (including the roads and railways that connect them). Impacts can be very pronounced and include changes to native biodiversity (plants, animals, and fish) found on and around them.

Islands can't be ignored as part of the bigger picture for river restoration, because they also create 'sinks' for restoration problems like pest plants, e.g. yellow flag iris, willows, and alligator weed. However, their location within the centre of dynamic and large river systems like Waikato presents a series of challenges that sometimes make you want to bury your head in the sand and ignore them – mainly because of the overwhelming nature of the work required to explore ways to 'fix' them.

In choosing to work on the islands we took a series of risks, namely:

- i. Attempting to find ways to restore river islands and,
- ii. Trying to find ways to do this without chemicals.

Needless to say, there was much to learn, and much to cry about, with some token 'told you so's' for good measure. In hindsight, it was a very ambitious task. But would I change the chance to experience all this? Kao, not on your nelly!

Working on the islands at times felt like a lesson in 'what not to do' and 'I wanna go home now', but actually, it also made us take the time to listen to the awa (river), feel the wind, watch the fish, find time to laugh with each other, as well as shrug shoulders and have to think very quickly on our feet. This is not the ideal recipe for restoration, but it gave us insights that few others would have been able to experience. It presented us with laugh-out-loud moments, shaking-our-head moments, pat-on-the-back moments and what-was-I-thinking moments. Underlying it all was a drive to discover and tease out everything we could (no matter how small), to add to the kete (basket) for wetland and river restoration – mainly because we love the awa, and we loved being on the islands with her.

Too often we focus on the feel-good projects – the ones that ticked all the boxes and did everything right. Sometimes though, it is just as important to hear about the ones that didn't quite go the way that was expected or hoped, so that others can learn from these experiences. But, most important, so that those of us involved in the project also remember and continue to learn from it. So, this is our story about the ambitious project on the Maurea Islands – the ups and downs and in-betweens, but most important, the learnings.



Maurea Islands. Photo: Cheri van Schravendijk-Goodman

As one of the more challenging projects to have been involved in, we could not have done any of it without the tautoko, koorero, and imaginations of these amazing people: the whaanau from Maurea Marae, especially the Brown whaanau, and the marae komiti; Kerry Bodmin and Paul Champion (Taihoro Nukurangi); Bev Clarkson (Manaaki Whenua); Terina Rakena and the team at the Waikato Raupatu River Trust and Waikato Raupatu Lands Trust; Chris Annandale and Lucy Roberts (Te Papa Atawhai); Kev Hutchinson (Waikato Rivercare); Phil Mabin and Wendy Mead (Waikato Regional Council); our 30 tribal members who attended the pilot restoration training programme; staff and crew at Te Rau Aroha House and Raukura Hauora o Tainui; Darcel Rickard and team on 'Project Whenua' (Scottie Productions); Don Scarlet (Meridian Energy); the super whaanau of Barm and Tilly Turner; Rimutere Wharakura and Will Brown for their amazing efforts to help on the islands; and our funders – the Waikato River Authority and the Waikato Catchment Ecological Enhancement Trust.

– Ngaa mihi Cheri, Jaedyn, and John

"Take baby steps with big ideas! One of the biggest learnings from the project was that the experimental design of the project didn't necessarily have to take place on the islands, where logistics were a challenge. The same results could have been achieved on a small land-based plot."

– Jaedyn and John

"The islands looked like a jungle of weeds with no native plants anywhere."

– Jaedyn and John

The team checking out native marsh plants on the bigger island.
Photo: Supplied by Cheri van Schravendijk-Goodman



ABOUT THE MAUREA ISLANDS

The Maurea Islands are a group of small islands in the Waikato River located near Rangiriri, northern Waikato (Fig. 1). The larger, western island is 10.89 ha, and the smaller, eastern island is 5.91 ha. The islands were returned to Waikato-Tainui under the Waikato Raupatu River Settlement (2010) as part of a conglomerate of islands, marginal strips, and small land parcels returned to the iwi (tribe).

But the islands came with a legacy of environmental-related issues. With the return of their land, this all-too-common situation places a contemporary burden on Maaori to seek solutions to the problems they inherit; in particular, how to restore the systems to a state as similar as possible to when they were last under the management of their traditional iwi and hapuu (subtribes) owners.

In the case of the Maurea Islands, these were part of an important marsh wetland area in this part of the lower river providing potential habitat for kaaeo (freshwater mussels), long and shortfin tuna (freshwater eels),



A view to the west across the larger island showing the range of plants (mostly exotic) on the islands. Photo: Cheri van Schravendijk-Goodman

whitebait species, kaae (mullet), and an array of native birds and insects migrating up and down the river.

Today, both islands have small pockets of native plants. But a majority of the vegetation is exotic, with serious invasive and pest plants such as reed sweetgrass, pampas, crack willow, yellow flag iris, and alder (also called 'raakau Paakehaa') dominating much of the island-scape.

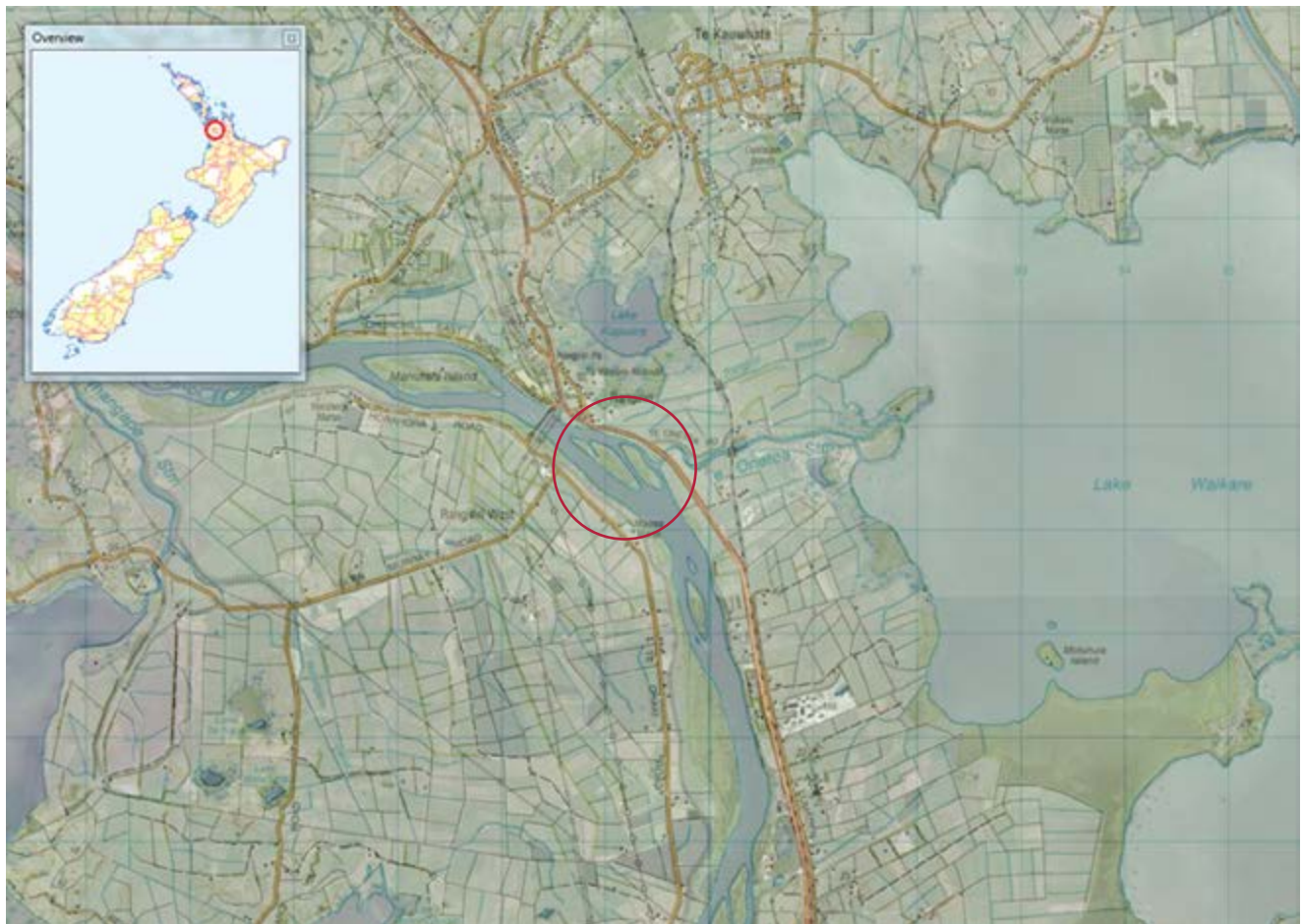


Figure 1. Location of the Maurea Islands (red circle) (Champion et al 2013)

THE CHALLENGE TO SPRAY OR NOT TO SPRAY?

The Maurea Islands project was part of a tribal response to the calls from haukainga (local people) for non-toxic methods for control of aquatic pest plants. This had been brought to the forefront following concerns about the regular need to spray yellow flag iris (*Iris pseudacorus*) in particular, which has become a serious pest along the lower river.

The main goals for this 2-year funded project were:

1. Find ways to restore the marsh wetlands of the islands and re-establish native swamp forest on the drier areas.
2. Investigate how restoration could be done in the absence of herbicidal control (in a small section of the large island), versus herbicidal control on the smaller island.
3. Test native plants as non-herbicidal 'tools' for the bigger island by investigating plant competition, i.e. could harakeke (*Phormium tenax*) outcompete yellow flag iris? **Could purua grass (*Bolboschoenus fluviatillis*) outcompete reed sweetgrass (*Glyceria maxima*)? Could alders (*Alnus glutinosa*) be manipulated as a nursery for kahikatea (*Dacrycarpus dacrydioides*) establishment?**

Restoration in general is incredibly tough. When a decision is made to add a component focused purely on non-herbicidal control, it increases the level of work ten-fold because it relies solely on 'people power' and mechanical control. This goal is complicated even further when the plants to be controlled are on an island. The counter challenge though, was a lack of good data about non-herbicidal rather than herbicidal control; and there were even bigger gaps in our collective understanding of river island restoration in general.

Vegetation survey on the smaller island. Photo: Cheri van Schravendijk-Goodman

INITIAL STEPS SETTING THE SCENE

Step 1:

As all good restoration projects should, work was done to understand the vegetation types. This involved vegetation surveys along several transect lines running across both of the islands (1-day each island) (Fig. 2). More than 30 tribal members on a pilot restoration course were brought in to survey the big island with scientists, and to learn about ecological survey techniques. The smaller island was surveyed by a science team on the second day.

The surveys highlighted major populations of key invasive plants like the reed sweetgrass, wandering willy, and yellow flag iris. But we also found unexpected populations of native grass-like sedges; marsh plants such our native waatakirihi (watercress), and the stunning marsh wetland plant, naahui; the maahoe (our native 'firestick'); and lace-like water ferns.

Step 2:

Our tribal GIS (mapping) expert was engaged to generate maps of the flooding potential on the islands (Fig. 3).

Step 3:

Hui (meetings) were held with Maurea Marae members to explore their memories of the islands, and the native animal and plant species they would like to see on them. This included long-term aspirations for a paa harakeke (harakeke gardens) and rongoa (medicinal plants), for the return of native birds, and to enhance habitat for important fisheries. These aspirations were drafted into a long-term vision for the whaanau (family) and a colouring-in picture was also drawn up. Each part of the picture could then be coloured-in as each of the aspirations were met (Fig. 4).



Step 4:

Taihoru Nukurangi (NIWA) and Manaaki Whenua – Landcare Research scientists were engaged to draft a restoration plan to help guide the vision, and the methods for the herbicide versus non-herbicide control. This included:

- identifying small discrete areas to undertake the trials (up to 1 ha on each island), and
- guidance for establishing different kinds of planting trials to test the competition of native species – purua grass and harakeke – against reed sweetgrass and yellow flag iris, respectively.

Step 5:

A 2-year work plan was developed, and work began on the big island to clear out pest plants according to non-herbicide methods. Discussions also began with Waikato Regional Council staff and contractors to spray the smaller island as an in-kind contribution to the project.

"Whaanau need to have knowledge of the mahi, and a good relationship with the partner agencies. The whaanau also need a long-term 5–10 year commitment by the funders, agencies, and kaimahi to enable successful outputs and build strong relationships with each other..."

The key to project planning is organising logistics, budgets, and project teams."

– Jaedyn and John



Figure 2. Maurea and Eastern Island. Marks out key vegetation types and lines and orange dots show the transects and plots used in the surveying

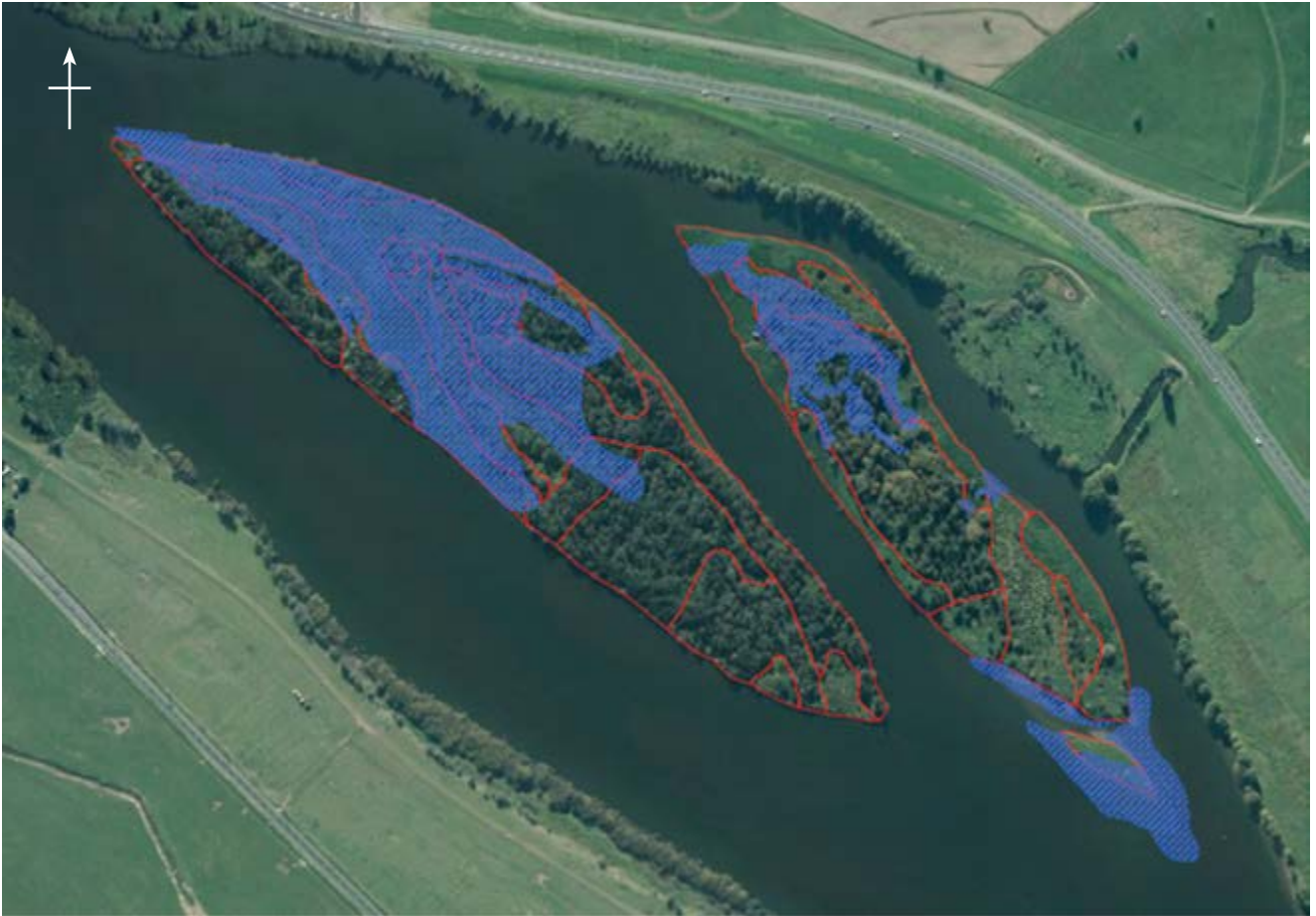


Figure 3. Map showing the main areas where flooding can occur (blue hatched lines)



Artist: Chrissy Morehu

Figure 4. A colouring-in picture designed to capture and monitor the aspirations of Maurea Marae for the islands

KEY PROJECT LEARNINGS THE HARD LESSONS

Considering we did everything right in the initial set-up of the project, why did things not eventuate exactly the way we had hoped?

- The workload of non-herbicidal versus herbicidal control became overwhelming. This meant monitoring was well below par with what had been planned
- We discovered that river island restoration requires a range of administrative factors of which we had not been aware and had not considered. For example, the types of boat licences our crew needed, clashes with other activities on the islands such as the hunting season, which required extensive conversations to resolve, and the need for permissions to get water for irrigation on the island
- Having to shift from the normal planting season in autumn and spring to the more unusual planting time of summer (see later)
- A very small team, with members being stretched across too many roles
- Large periods of downtime created by flood and bad weather events, which sapped valuable restoration time.

"[River islands] present an unpredictable environment: nature does her own thing that is out of our control; river levels change where the river is too low to get to island by boat or flooding, which washes out the islands and creates a safety hazard...realistically, the nature of conservation includes a hard month and then an easy month."

– Jaedyn and John

The daunting prospect of invasive plant removal on a river island. The target plants are the longer leaved grass-like plants – reed sweetgrass, yellow-flag iris, and alder (raakau Paakehaa).
Photo: Cheri van Schravendijk-Goodman



Key factors that tested the outcomes of the project (and the project team) therefore, revolved around:

- A. The complexity of the environments within which island restoration groups must work**
- B. Project management and personnel changes**
- C. The overwhelming nature of non-herbicidal control method.**

A. Environment:

- i. Restoring river islands is very different from restoring land-based habitats. First, the timing for planting may be different. Unlike land-based restoration, where plantings should occur during the cooler/wetter seasons (autumn, spring), planting on a river island can be affected by flooding over the areas that you want to plant. Some river islands act like sponges, and when wet, low-lying parts become saturated, creating boggy holes that can trap machinery, spades, and gumboots. There is also the risk of autumn and spring river flows disturbing the new plantings and potentially lifting out the plants (and tools!) and carrying them downstream. For the Maurea Islands, the best time for planting was in late spring to mid-summer (Nov–Feb), when the soil was dry and exposed and there was no risk of flooding. This, however, increased the risk of plants dying from low soil moisture, which was made harder by a lack of any form of irrigation infrastructure. Identifying the appropriate planting season and the issues this involved were major learning curves.
- ii. A second factor was access to the islands, which is via boat. As simple as this sounds, movement across a river system is dictated by the amount of water flowing through the system. Because planting needed to happen in summer, this coincided with lower river levels. Low river levels can expose 'rubbish' like old trees, and other dumped items, which create navigational hazards. Additionally, sand bars can appear, causing issues for boat engines; particularly for bigger boats, which can suck up debris or are too big to navigate over shallower parts of the river. This made transportation of plants and people to plant them, very difficult.

B. Project management and personnel changes:

We often get distracted with the outcome of restoration projects being about 'planting trees' and 'bringing our taonga (treasures) back'. But the most overlooked and underappreciated components of a restoration project actually concern administration. Some of the greatest learnings in this area included the following:

- i. Project management is a huge task, particularly for a complex project like this. Although contractors are on hand to undertake much of the work, it is vital that the project manager is also on site regularly to deal with unexpected issues as they arise (and they do!), and to provide the relevant guidance when needed. Regularly getting on site makes the reality of the challenges easier to understand.
- ii. Projects as complex as this one require very tight communication. Fortnightly meetings (as a minimum) among the wider team are advisable. Challenges can be dealt with faster by the collective brains and experience at the table, and such meetings also give the project manager and contractors an additional level of support.
- iii. Restoration projects are sometimes developed with too little attention paid to the 'sitting-at-the-desk' stuff; and many community groups can fall into this often overlooked and underappreciated trap. It is important that the expertise on hand is apportioned correctly to the right focus areas, i.e. administrators to focus on admin, scientists to focus on science, restoration contractors to focus on restoration.
- iv. During the project there were shifts in project management. For the contractors, this was a particularly difficult situation as they had to adapt to a new project leader as the project team pushed to complete milestones to meet the finish date for funding.

"Keep everyone in the loop, ensure that everyone is on board with decisions and deviations around key milestones and stick to those milestones."

– Jaedyn and John

C. Manual labour is tough!

- i. Initial clearance of pest plants using non-herbicidal control is a fairly straight forward approach. The team actually developed new approaches to the removal of the yellow flag iris that had not been recorded before – cutting down the leaves, burning off the area to damage and expose the rhizomes, and then mowing over the area with an industrial lawnmower. This slowed down regrowth enough to get the native plants in the ground and give them some time to establish before reinvasion from the yellow flag.

But without the herbicide, it can be very tough to stay on top of regenerating invasives over time, and this is where a lot of the manual labour hours were dedicated.

- ii. Manual labour, without a doubt, is incredibly tough. For every 5 ha (approx.) that were sprayed to control pest plants like yellow flag iris on the small island, only 1.32 ha here was able to be controlled successfully (i.e. low pest plant return) by hand and tool removal on the big island. In total, 6,041 hours were spent trying non-herbicidal techniques compared with only 177 hours using herbicides.

Key considerations for the manual labour aspects of the project:

- i. Don't underestimate the value of having some form of herbicidal control to bring down restoration time and labour costs.
- ii. However, it should not put you off exploring non-herbicidal techniques, just make sure you:
- pick the right sites, i.e. river islands may not be the best place to start practising
 - start small to get your experience up regarding when to use herbicides and when you can restore without them, and
 - build up some reliable/useful information about the plants you want to target (their flowering times, and seed production are important things to know), and the types of techniques that could be applied, including the selection of the right tools. **Remember that the key is keeping on top of the control of the invasive and pest plants so that your native plants have a chance to outcompete them and survive.**



A carpet of the serious forest invasive, wandering willy, covers the higher areas of the bigger island. Photo: Cheri van Schravendijk-Goodman



Rolling up the wandering willy as a non-chemical control technique – it took ages! Photo: Cheri van Schravendijk-Goodman

KEY PROJECT LEARNINGS OBSERVATIONS UNIQUE TO RIVER ISLANDS AND NON-HERBICIDAL CONTROL

Key observations that we may not have made if we had used chemicals.

Despite the hard lessons, situations arose that we would not have been seen if we had done things the 'normal' way:

- i. **Yellow flag iris vs reed sweetgrass and wandering willy.** Perhaps one of the most surprising observations was the competition between the invasive plants themselves. We often think restoration is as simple as getting rid of something unwanted, so that something we want can be put in its place. What we took for granted was that in removing something that we didn't want (e.g. wandering willy or reed sweetgrass), we opened the door for something else we didn't want (e.g. yellow flag iris), which had been held back by the greater competitiveness of the other weeds.
- ii. **Yellow flag iris rhizome sizes.** Across the two islands we noted some big differences in the sizes of the rhizomes of the yellow flag iris. These 'underground food bunkers' are part of the reason why this plant is so invasive, along with its pods full of hundreds of buoyant seeds. It's difficult to fully understand why the rhizome sizes were different across the two islands, but the lack of herbicide gave us a chance to look at them more closely, which would not have been possible if they were all sprayed and killed.
- iii. **The surprising native plant seedbanks being opened up to the sunlight.** It's difficult to say with confidence that this was the result of no spraying. But it did make us pay closer attention to what was growing back after the invasive plants were removed through mechanical control and burn off. We were pleasantly surprised to see a burst of native marsh plants like our native waatakirihi and the beautiful naahui crawling into areas where yellow flag iris had been burnt off.



Yellow flag iris rhizomes uncovered after removing reed sweetgrass. Photo: Cheri van Schravendijk-Goodman



Yellow flag iris seeds. Photo: Cheri van Schravendijk-Goodman



Waatakirihi/watercress amongst the grasses on the big island. Photo: Cheri van Schravendijk-Goodman

Key observations that we may not have made if we had worked on the mainland.

One of the biggest take-home messages from the project was that we could have done our trials on the mainland instead of a river island. While in hindsight that is a very sensible suggestion, there are several things we were able to experience thanks to the time that we were forced to spend on the islands. If we had been on the mainland, we would not have been able to travel the journey in the same way:

- i. **Juvenile kanae (mullet) 'playing' in the island cove.** At the northern tip of the big island is an area that periodically goes under water and then dries and shrinks into a small 'cove'. In this area, we got to watch a small school of juvenile kanae appearing to chase, and then jump over each other. This kept members of the team (especially those who had an affiliation with them) very entertained.
- ii. **Adult kanae grazing over and hiding in oxygen weed.** On the same day we watched the juvenile kanae, we also saw three adult kanae grazing over a large clump of oxygen weed – a major invasive plant in the main stem of the awa. This showed us that life in the awa still ticked along, despite the presence of exotic plants that we didn't want.
The ultimate goal must always be to return our natives, but this particular event made it very clear that we also needed to be careful in how things are restored, so as not to disrupt the delicate balance that currently exists for our native fish.

The big western island after the first clearance of wandering willy and native plantings. Photo: Cheri van Schravendijk-Goodman

- iii. **Discovery of a kaaeo bed.** This was an unexpected surprise and made it very clear that there was so much more to our river islands than we had originally appreciated. Unfortunately, the bed we found was covered in sediment, but it raised our hopes that such beds could be restored again.
- iv. **The extent of native plants on the islands.** Despite the overwhelming coverage of exotic plants, pockets of natives were maintaining a stronghold, highlighting the value of the islands as areas of ecological value for restoration.
- v. **The diversity of insects on the islands attracted to the diversity of plants.** Our almost daily presence on the islands meant we got to see a small range of native parasitoids (wasp-like insects), spiders, and butterflies that we would have taken for granted on the mainland.
- vi. **The surprising extent, and diversity of exotic noke (earthworms) that have invaded the islands.** We didn't appreciate the ability of noke to move through a river system, but it does happen! The work on the islands has now been added to a slowly growing database of exotic noke densities in degrading wetlands (see section 5.1 Noke: Engineering our soils).
- vii. **The real impact of human influences on the river; rubbish regularly landing on the islands from upstream.** You can't appreciate the impact we have as humans on the awa until you get to see first-hand the amount of rubbish that moves through the system: gates, ladders, letterboxes, street signs, plastic bottles, food wrappers, shoes, clothing, electronics, plastic bags, and alcohol containers were only a small sample of what we saw and attempted to remove.



CONCLUDING THOUGHTS

As tangata whenua (indigenous people), we have a strong connection and desire to do what we can to make our rivers better, so that we, in turn, can make the future better for our people. This passion and exuberance is what makes these types of projects worth exploring. In hindsight, the concern about herbicide use, coupled with frustration at the state of the lands that had been returned (and the associated costs both to the tribe and the Council to manage the issues), generated a level of impatience. While this resulted in a well-intentioned and very innovative set of ideas, it would have been more important to have instigated a slightly longer pause, and to have taken a few more deep breaths before we dived in.

"I was happy to do the mahi because it was for the tribe and for the river"

– Jaedyn and John

We do not necessarily want to change what we experienced in this incredible journey, but there are definitely elements that we would like to avoid. So here are the take home messages:

- i. Keep your horizons wide, but take baby steps.
- ii. Build solid networks with a range of others in restoration (see the 'Make a ripple' and biodiversity websites for new potential friends), but also be prepared to be the first ones to give it a go.
- iii. Communication is important for managing 'talking past each other' and ensuring you don't take each other's experiences and loyalties for granted.
- iv. Focus on your strengths, don't lose your optimism, enjoy the sun on your back, and remember to take a big breath before diving in.



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

Champion P, Bodmin K, van Schravendijk-Goodman C, Barnsdall A, Clarkson B 2013. *Restoration Plan for the Maurea Islands, Waikato River*. Report prepared for the Waikato River Authority. Hamilton, NIWA. 40 p.

Restoring River Islands, NIWA Water and Atmosphere, 16 December 2013. Website <https://www.niwa.co.nz/publications/wa/water-atmosphere-9-december-2013/in-brief-restoring-river-islands>

River island restoration – Maurea Islands, Te Takapuu o Waikato. Te Hooiioi 43: 21. <https://issuu.com/waikatotainui/docs/issue-43>

Maurea Islands – University of Waikato Learning Science Hub 19 March 2014. Website <https://www.sciencelearn.org.nz/videos/220-maurea-islands?microsurvey-filled=true&q1=Other>

Maori Television: Project Whenua Series 1 Episode 5. 11 November 2014. Website www.maoritelevision.com/tv/shows/project-whenua/S01E005/project-whenua-series-1-episode-5

NIWA & WRRT 2015. Restoration of Maurea Island, Waikato River: Final report prepared for Waikato River Authority. www.waikatoriver.org.nz/wp-content/uploads/2011/07/Final-Maurea-report-FINAL.pdf

Participants Manual: www.waikatoriver.org.nz/wp-content/uploads/2011/07/Training-booklet-Participants-manual.pdf

Trainers Manual: www.waikatoriver.org.nz/wp-content/uploads/2011/07/Training-booklet-Trainers-manual.pdf

Useful websites

For building your networks in restoration:

New Zealand Plant Conservation Network: www.nzpcn.org.nz/page.aspx?conservation_restoration_find_a_group

Make a Ripple (Waikato): <http://makearipple.co.nz/Waikato-River-story>

NZ Landcare Trust: www.landcare.org.nz

Ngā Whenua Rāhui: www.doc.govt.nz/ngawhenuarahui

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MĀTAURANGA
MĀORI

MĀTAURANGA MĀORI MĀORI KNOWLEDGE

SHAUN AWATERE (NGĀTI POROU),
GARTH HARMSWORTH (NGĀTI
TŪWHARETOA, TE ARAWA, NGĀTI
RAUKAWA), AND MAHURU ROBB
(NGĀTI RANGINUI, NGĀTI AWA)

Mātauranga Māori is a dynamic and evolving knowledge system referring to the observations, experience, study, and understanding of the world from an indigenous cultural perspective. To many this is often equated with 'cultural wisdom'. It encompasses the physical, such as 'use values', including mahinga kai (food gathering sites), through to the metaphysical, such as 'principles', including logic (whakaaroaro), ethics (tikanga), epistemology (whakaponotanga), resource management (kaitiakitanga), and spirituality (wairuatanga). A consistent theme from much of the literature on mātauranga Māori is the multifaceted nature of this knowledge system. As with 'Western' knowledge (i.e. knowledge brought to Aotearoa New Zealand by the settler European cultures), mātauranga Māori has both qualitative (verbal data) and quantitative (numerical data) aspects.

Some core Māori values that guide the management and monitoring of repo (wetlands) include whakapapa (genealogy), tikanga, rangatiratanga (right to exercise authority), mana whenua/hau kāinga (indigenous people with primary rights and responsibilities over an area), whanaungatanga (sense of family connection), kaitiakitanga, manaakitanga (hospitality), whakakotahitanga (unity), arohatanga (expression of compassion for others), and wairuatanga. These form the heart of many Māori frameworks and models, and also provide a basis for kaupapa Māori (an approach underpinned by Māori values) assessment, evaluation, decision-making, and natural resource management. In terms of natural resource management of repo, whakapapa is useful for identifying values associated with place that can help inform freshwater objectives and limits.



WHAKAPAPA A CULTURAL CONNECTION TO PLACE AND RESOURCES

To confirm value, and in recognition of the interrelatedness and the interdependence of all things in the world, Māori commonly begin by reaffirming cultural connection and relationship to a place, or a resource, and articulate and describe particular resources and places that are 'highly valued'. This usually starts by providing whakapapa; for example, connection can involve recitals of ancestral lineage, stories, narratives, verse, whakataukī (proverbs), mōteatea (laments), pepeha (formulaic expressions of tribal identity), waiata (songs), kōrero (conversations), mātauranga (knowledge), etc., which together validate:

- connection to the resource (e.g. whakapapa)
- spiritual attachment to the resource (e.g. wairua)
- use of the resource (e.g. mahinga kai)
- a sense of wellbeing based on the resource (e.g. mauri (life force), wairua, oranga (health), whaiora (pursuit of wellness), and whanaungatanga).

Whakapapa is an integral part of all traditional Māori institutions and is a major determinant of rights to use, access, and management of natural resources. The implementation of whakapapa is through kaitiakitanga – the expression of a two-way relationship that involves obligations to give, receive, and repay. The role of tangata kaitiaki (resource manager) reflects the individual and collective role to safeguard ngā taonga tuku iho (treasures handed down) for present and future generations.

Previous page: Tupuna salute, te tira hoe o Waikato, Waikato River, 2015.
Photo: Waikato Rauapatu River Trust

Māori values can be expressed in the physical environment in tangible geographical locations and in plants, animals, and associated habitats. These may include, for example:

- **wāhi tapu** – traditionally referred to sites or places of ritual constraint or prohibition, defined as "a place sacred to Māori in the traditional, spiritual, religious, or mythological sense", and generally used to acknowledge sacred sites; they include urupā (burial sites)
- **wāhi tupuna or wāhi taonga** – these can include ancestral sites and sites of significance, including historic pā sites (fortified village), tracks (ara), kāinga (settlements), marae (traditional gathering places), rock carvings, mahinga kai, cave areas, archaeological sites, tohu (signs, marks), traditional occupation sites, rock formations, and significant stands of forest or trees
- **mahinga kai** – areas, habitats, and locations where food of any sort is gathered, grown or hunted, including forests, repo, lakes, rivers, and cultivatable soils
- **taonga** – culturally significant native plants – wātakirihi (watercress), kuta (giant spike sedge), and harakeke (New Zealand flax); fish – matamata (whitebait) and kōura (freshwater crayfish); birds – ruru (morepork) and kawau (shags); and invertebrates – noke (earthworms).



Repo rōpū (Waikato iwi representatives) wānanga with Manaaki Whenua for the Wetland Restoration Programme, Hopuhopu nursery, 2016.
Photo: Yvonne Taura

This section explores in more detail the application of mātauranga Māori and whakapapa as important drivers and foundational approaches for the restoration of valued repo across the motu (country). It is important to note that each hapū, iwi, and even whānau has gained generations of experience and knowledge unique to their 'part of the universe'. In turn, they also have their own process for incorporating and expressing their mātauranga in ways that are meaningful to them, and which can often be very distinct from the approaches of other hapū, iwi, and whānau – even within the same region. As with all other sections in this handbook, it is important that relationships are appropriately established with mana whenua/hau kāinga; and in doing so, that their knowledge is accorded the respect it deserves as a precondition for effective environmental restoration.



Te tira hoe o Waikato, Te Pūaha o Waikato, 2015.
Photo: Waikato Raupatu River Trust

Te tira hoe o Waikato, Waihi Marae, 2015.
Photo: Waikato Raupatu River Trust



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, Harmsworth GR, Robb M 2015. *Proposed mana whenua values, attributes and measures for Auckland Council's Wai Ora Wai Māori programme*. Hamilton, Manaaki Whenua – Landcare Research.

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

Best E 1942. *Forest law of the Māori*. EC Keating, Government Printer. Wellington, Dominion Museum.

Buck P 1950. *The coming of the Māori, by Te Rangi Hiroa (Sir Peter Buck)*. Wellington, Māori Purposes Fund Board.

Harmsworth GR 1997a. Māori values and GIS: the New Zealand Experience. GIS Asia Pacific: The Geographic Technology Publication for the Asia Pacific Region April 1997. Pp. 40–43.

Harmsworth GR 1997b. *Māori values for land-use planning*. GIS Asia Pacific: The Geographic Technology Publication for the Asia Pacific Region April 1997. Pp. 37–52.

Harmsworth GR 1998. *Indigenous values and GIS: a method and framework*. Indigenous Knowledge and Development Monitor 6(3): 3–7.

Henare M 1988. *Ngā tikanga me ngā ritenga o te ao Māori: standards and foundations of Maori society*. Report of the Royal Commission on Social Policy, Wellington.

Kawharu M 2000. *Kaitiakitanga: a Māori anthropological perspective of the Māori socio-environmental ethic of resource management*. The Journal of the Polynesian Society 109(4): 348–370.

Mahuika A 1998. *Whakapapa is the heart*. In: Coates K, McHugh PG eds. *Living relationships – Kōriki ngātahi: The Treaty of Waitangi in the millennium*. Wellington, Victoria Press. Pp. 215–221.

Marsden M 1989. *Resource management law reform: part A: the natural world and natural resources, Māori value systems & perspectives: part B: water resources and the Kai Tahu claim*. Working Paper 29. Wellington, Ministry for the Environment.

Marsden M 1975. *God, man and universe: a Māori view*. In: King M ed. *Te Ao Hurihuri – the world moves on aspects of Māoritanga*. Wellington, Hicks Smith & Sons. Pp. 191–219.

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

Mead HM, Grove N 2001. *Ngā pepeha a ngā tipuna*. Wellington, Victoria University Press.

Ngā Kaitūhono 2012. *Conversations on mātauranga Māori*. Wellington, New Zealand Qualifications Authority.

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7.1 RAAKAU PRESERVATION TECHNIQUE UNLOCKING DORMANT KNOWLEDGE

YVONNE TAURA (NGAATI HAUAA)

Nгаа mihi

Introduction

Importance of repo to Waikato-Tainui

Kaupapa Maaori research

Conclusion

Want to learn more?



Ko Maungatautari me Maungakawa nga Maunga

Ko Topehaehae me Piako-Iti nga Awa

Ko Tainui te Waka

Ko Ngaati Hauaa te Iwi

Ko Ngaati Werewere te Hapuu

Ko Rukumoana me Kai-a-te-mata nga Marae

Ko Hamiora/Samuels te ingoa whaanau o tooku
tupuna whaea

As an emerging kairangahau, and a tribal member of Waikato-Tainui, I am privileged to have had the amazing opportunity of a 2-year secondment working for both Waikato Raupatu River Trust (WRRT) and Manaaki Whenua – Landcare Research. Made possible through the Vision Maatauranga Capability Fund, funded by the Ministry of Business, Innovation and Employment (MBIE), this opportunity allowed me to work within the two worlds of maatauranga Maaori and Western science. My experience over that time has been a positive eye-opener and life changing. Working for the tribe has enabled me to engage with our tribal members, strengthen bonds with my own marae and hapuu, and learn more about the values and aspirations of Waikato-Tainui.

As a tribal member you continue to embrace your cultural values, so the learning never ends. I'm so grateful for the guidance of my friends and colleagues from WRRT. A big mihi to them for their patience and understanding, and for taking me under their wing and showing me a world that has added immensely to my life.

Nei te mihi manahau.

Nei te mihi matakui, kia koutou te hunga kua whakatau, kua manaaki hoki i ahau mai tooku taenga ki waenga i a koutou, tae noa ki teenei waa.

Naa koutou ahau i aawhina kia marama pai ki nga tikanga o Waikato-Tainui, me te whakahono ano i ahau ki ooku iwi noo koonei, no reira me mihi ka tika kia koutou.

E kore te puna o te aroha e mutu i konei, aa, otira ma te Atua koutou e manaaki, e arataki i nga waa kaatoa.

Paimaarire.

– Ngaa mihi Yvonne



Nga kowharau o Hineiterepo

The many hiding places of Hineiterepo (the swamp maiden)

Through the Wetland Restoration Programme 2010–2016 (C09X1002), Waikato Raupatu River Trust and Manaaki Whenua worked collaboratively to be more effective in addressing repo restoration within the Waikato rohe (region). One of the priorities of the programme was to identify and explore a cultural indicator – a tohu (sign, marker) of importance to Waikato-Tainui (tribal people of the Waikato region). A tohu must be a meaningful indicator that helps in understanding the overall state of the environment, and should be developed from local knowledge, in collaboration with tangata whenua (indigenous people), to make them relevant and connected.

Previous page: Celebrations at the end of the 4-day journey of te tira hoe o Waikato, Te Puuaha o Waikato. Photo: Waikato Raupatu River Trust

Hongi (to press noses in greeting). Photo: Waikato Raupatu River Trust

During the development of the Waikato-Tainui Environment Plan, kaumaatua (elders) from Whangamarino Wetland made the point that the lower Waikato repo (wetlands) were identified as areas of significance as our tuupuna (ancestors) would store and preserve taonga (treasures) within repo, to ensure their safety. This provided an opportunity to discuss the raakau (timber) preservation technique with tribal members. The process taken to develop this tohu with Waikato-Tainui adapted kaupapa Maaori research methodologies (an approach underpinned by Maaori values). This chapter recounts my journey to understand tribal values and aspirations, and engage with tribal members not only as a kairangahau (researcher) but more importantly as a tribal member, and build meaningful relationships with the tribe to develop a tohu that met their aspirations for the restoration of repo.



IMPORTANCE OF REPO TO WAIKATO-TAINUI

The Waikato rohe is the ancestral lands of Waikato-Tainui, and the lower Waikato repo are areas of huge significance. Repo are a fundamental component within the whakapapa (connections) of Waikato-Tainui awa (rivers) and roto (lakes), providing significant spawning grounds and habitat for a variety of taonga species (native plants and animals of cultural significance).

The mauri (life force) of repo within the Waikato-Tainui rohe is linked to the ecological health and wellbeing of their whakapapa, such as the taonga species found in those systems. These are resources on which Waikato-Tainui relies for several cultural activities that are mutually identified as hauanga kai (food gathering sites). Any damaging impacts on the whakapapa of the repo will have corresponding effects on the mauri of repo and the ability for whaanau (families), marae (Maaori social and cultural centre), hapuu (subtribes), and iwi (tribes) of Waikato-Tainui to utilise hauanga kai to satisfy physical and metaphysical needs.

KAUPAPA MAAORI RESEARCH

One of the priorities of the Wetland Restoration Programme was to explore a tohu (cultural indicator) of importance to Waikato-Tainui with tribal members. The raakau preservation technique had been signalled by kaumaatua as an essential tohu to explore. The project relied on the kairangahau to understand tribal values and aspirations, and engage with tribal members to develop a tohu that supports repo restoration and meet the aspirations of the tribe.

Tohu – cultural indicator

A cultural indicator is a tohu (sign, marker) for tangata whenua, and needs to be a meaningful indicator that can be used to understand the overall state of the environment. Cultural indicators should be developed from localised knowledge, in collaboration with whaanau, marae, hapuu, iwi, and kaitiaki (guardians) communities to make them relevant and connected. For a detailed description of cultural indicators please refer to the Cultural Resources section: Indicators for cultural resources.



Internationally important Whangamarino Wetland. Photo: Shonagh Lindsay

Raakau Preservation Technique

For Waikato-Tainui, the lower Waikato repo are areas of huge significance. Due to the concealing nature of repo, tuupuna would store and preserve taonga in them, to ensure their safety. During the early phases of *Tai Tumu, Tai Pari, Tai Ao – Waikato-Tainui Environmental Plan* development in 2008, consultation with tribal members revealed the raakau (timber) preservation technique. Information shared by kaumaatua (elders) affiliated to Whangamarino Wetland suggested that tohunga whakairo (master carvers) placed raakau in the repo before and after carving to harden/season (treat the timber). After a length of time the raakau was lifted and tested. The kaumaatua also indicated that as the lower Waikato repo became gradually less effective for this technique the practice slowly phased out.

The most well-known taonga discovered in Aotearoa is Uenuku, Atua (God) of the rainbow. Made from New Zealand tootara, Uenuku is possibly one of the oldest wooden carvings in Aotearoa, dated approximately AD1200–1500. Found in Lake Ngaroto, Waikato, in 1906, Uenuku was very well preserved as a result of being deliberately placed in the lake. Lake Ngaroto is typical of many lakes in the Waikato, providing the acidic, anaerobic conditions in swamp water that are known for preserving organic, wooden material.

You can visit Uenuku at the *Te Awamutu Museum*, Waikato.

Check out the research pamphlet that was created to promote the Raakau Preservation Technique, and secure the interest of tribal members and stimulate koorero (conversations) with them about our tupuna Uenuku.

It is included in the handbook.

Images on cover:
Uenuku, the Atua (God) of the rainbow.
Photo: Uenuku 2085
Te Awamutu Museum Collection.
Rainbow cast over Lake Ngaroto. Photo: Nardene Berry



Kaupapa Maaori Research Principles

The kaupapa Maaori research principles were the guiding processes in developing the tohu. Kaupapa Maaori research is an approach designed for kairangahau Maaori (Maaori researchers) undertaking research with Maaori. As a tribal member and kaimahi (worker) for Waikato-Tainui, it was important that I was embedded in Tainuitanga (Waikato-Tainui worldview) so that I could fully appreciate tribal values and aspirations.

Kaupapa Maaori research is based on four key working principles:

- Whakapapa: the relationships between people, communities, and landscape
- Te Reo: the Maaori worldview is embedded in the language
- Tikanga Maaori: appropriately navigate and operate within a Maaori context, and make judgements and decisions within this space
- Rangiratanga: allows Maaori to shape their own research processes.

Based on these principles, in order to develop a tohu of relevance to Waikato-Tainui, the project relied on me as the kairangahau to engage closely with tribal members, allowing us to become intimate and better communicate with each other. Please refer to the Process of Engagement 'Kapu Tii' section: Article 2. The Ake Ake Model, for more information about cultural values and future planning from the Turner whaanau of Tuarangawaewae Marae, Ngaaruawaahia.



The return of Rangiriri Paa, Koroneihana, Tuarangawaewae Marae 2016. Photo: Koroneihana 2016

Whakapapa

The opportunity to develop a tohu that would be of some benefit to Waikato-Tainui, a tribe that I affiliate to, was quite humbling. I had grand plans of sharing my scientific knowledge, as if that would be of some value. Instead, throughout the whole process I was the one learning, not only about the kaupapa (topic) but about myself as a tribal member, every time I engaged with other tribal members, whether it be tamariki (children) and rangatahi (youth) at a tribal event, kaumaatua at a marae hui (meeting), or tribal leaders in the boardroom.

When I introduced myself at tribal hui, I did so with my whakapapa (genealogy) and pepeha (ancestral connection). My qualification as a kairangahau or scientist never seemed as important as how I was tribally connected. It was this tribal connection that gave me the permission to speak openly with tribal members, to gain their trust, and ultimately to build strong relationships. This allowed me access to maatauranga (knowledge) that many non-Maori/tribal researchers working for a research institute would not usually have.

Te Reo o Waikato-Tainui

The identity, culture, and history of Waikato-Tainui are held within Te Reo o Waikato (the language of Waikato). A major commitment for the tribe is for more than 80% of tribal members to be fluent in Te Reo o Waikato by 2050. As a kairangahau, I could see this being achieved through tribal events specific to Waikato-Tainui, such as Koroneihana (coronation of the King) and poukai (King movement gathering) – both significant kaupapa for the Kiingitanga (Maaori King movement). Within these traditional events, carried out in a modern context, tribal members are able to maintain their connection both to cultural identity and to te reo unique to Waikato-Tainui.

I attended these events and they were excellent opportunities for me to fully appreciate the commitment of each generation to the Kiingitanga. Tamariki, rangatahi, paaakeke (adults), kaumaatua, and the whaanau Ariki (royal family) each played a role. The transferal of maatauranga and te reo occurred simultaneously.

Kiingi Tuheitia and whaanau Ariki, Whatapaka Marae poukai 2016.
Photo: Yvonne Taura



Tikanga Maaori

Waikato-Tainui has a responsibility to protect and nurture the mauri of all living things within their tribal rohe. The exercise of kaitiakitanga (guardianship) is integral to maintaining the tribe's relationship with Te Tupuna Awa o Waikato (Waikato River the ancestral river) and with repo. The protection, health, and wellbeing of Te Tupuna Awa o Waikato is a major priority for Waikato-Tainui.

One way for tribal members to strengthen relationships with their tupuna awa through kaitiakitanga is to participate in the bi-annual Te Tira Hoe o Waikato (the paddling crew of Waikato), hosted by Waikato Raupatu River Trust (WRRT). Tribal members have the unique opportunity to participate in the 4-day, life-changing journey. During this time, we reconnected with the tupuna awa by paddling various sections from the source at Waikato-Iti to the mouth at Te Puuaha o Waikato (Port Waikato), gained maatauranga – such as the Kiingitanga, paimaarire (Christian faith), and sites of significance, and were hosted by marae, hapuu, and iwi who have a strong connection to the Kiingitanga.

As kaimahi for WRRT, my engagement with whaanau and kaumaatua who attended the tira hoe was guided by them. Our mutual respect for the kaupapa of tira hoe enabled me to learn and participate in the tikanga o Kiingitanga (cultural practices of the Kiingitanga), paimaarire, and our ancestral relationship to our tupuna awa. By paddling on the awa – touching her, smelling her; by sleeping at the marae – building relationships; by visiting sites of significance – acknowledging our tupuna and by listening to koorero from kaumaatua – te reo o tuupuna; I was deeply immersed in the wairua (spirit) of the journey.

Over the 4 days, each participant reconnects with their ancestral relationship to Te Tupuna o Waikato, embedded in tikanga o Kiingitanga and engaged with tribal members from other marae, hapuu, and iwi. These elements provided each of us with an improved sense of cultural identity, the ability to exercise kaitiakitanga, and a renewed respect of who we are as tribal members. I am forever grateful for the experiences.

Te tira hoe o Waikato, Te Pūaha o Waikato 2015.
Photo: Waikato Raupatu River Trust



Rangatiratanga

Te Tupuna Awa o Waikato is highly regarded as an ancestral being by Waikato-Tainui. The unity the tribe have with their tupuna awa is expressed in the Kiingitanga. For 150 years, Kiingitanga has shaped and given purpose to the lives of all of those who support it; its kaupapa unites people from many marae and iwi.

Waikato-Tainui are recognised as partners in the management of natural resources in the greater Waikato rohe and exercise mana whakahaere (rights and responsibilities). They have developed various strategies that align with the tribal vision determined in Whakatupuranga 2050 – a long-term development approach to building the capacity of Waikato-Tainui marae, hapuu, and iwi that will be a legacy for the future.

Te Ture Whaimana – the Vision and Strategy is one of those strategies that focuses on restoring and protecting the health and wellbeing of the river for future generations.

"The Vision is for a future where a healthy Waikato River sustains abundant life and prosperous communities who, in turn, are all responsible for restoring and protecting the health and wellbeing of the Waikato River, and all it embraces, for generations to come."

Te Ture Whaimana

*Tooku awa koiora me oona pikonga
he kura tangihia o te maataamuri*

The river of life, each curve more beautiful than the last

Kiingi Taawhiao



These words form part of the Vision and are taken from the maimai aroha (lament) by Kiingi Taawhiao, the second Maaori King, in which he recorded his love and reverence for the Waikato River and the significance of the tupuna awa (ancestral river) as a taonga for all generations. These visionary words inspire the actions that will be necessary to restore the health and wellbeing of the Waikato River, including repo.

To meet the aspirations of Waikato-Tainui, it was important that I was consistently engaged with the tribe throughout the duration of the project, whether through tribal events, hui, and kaupapa, or through one-to-one interviews with select tribal members. This was to make sure that, as the kairangahau, I recognised any sensitivities while developing the tohu for them, so that what was being developed aligned with tribal aspirations.



Te Tupuna Awa o Waikato, the ancestral Waikato River. Photo: Waikato Raupatu River Trust

Tribal events such as Koroneihana and poukai are in keeping with the values of Kiingitanga. For generations, Waikato-Tainui have kept these values alive through inter-generational participation in the kaupapa. The annual Koroneihana commemorations celebrate the reign of Kiingi Tuheitia who was crowned in 2006. The celebrations take place at Tuurangawaewae Marae, the principle marae of the Kiingitanga. It is the major tribal event of the year and attracts iwi from across the motu who support the Kiingitanga. Poukai is the annual circuit during which Kiingi Tuheitia visits marae affiliated to the Kiingitanga to discuss tribal matters. This gives the people of the marae the opportunity to express their support of the movement and its leadership.

As kaimahi and a tribal member, it was important to attend these events to gain a better sense of who Waikato-Tainui are as a people. I was able to witness their strong commitment to the Kiingitanga, which was evident in the roles that each whaanau, marae, hapuu, and iwi played in hosting these events every year. My engagement was made simple as I was also a participant in the kaupapa, which allowed for koorero to occur naturally.

As a kairangahau, I felt accountability and a sense of responsibility to conduct myself in a manner that was respectful. I did this knowing, that not only my reputation was at stake but also that of my whaanau, marae, and tuupuna.

CONCLUSION

The development of the tohu – the raakau preservation technique, was identified, guided, and formulated by Waikato-Tainui, in order for the tohu to align with tribal values and aspirations. By following Whakapapa, Te Reo o Waikato-Tainui, Tikanga Maaori, Rangatiratanga – the four principles of kaupapa Maaori research – I was able to:

- position myself within the tribe as a tribal member
- appreciate Te Reo o Waikato-Tainui, by attending tribal events and hui
- participate in those initiatives that allow tribal members to reconnect their ancestral relationship with their tupuna awa and cultural identity
- conduct myself in a manner that was respectful to my own whaanau and marae

The principles were vital to understanding the values and aspirations of Waikato-Tainui from the perspective of a tribal member, which then helped me as a kairangahau to better develop a tohu that would be of benefit to the tribe.

The development of the raakau preservation technique framework is currently underway. This information will be made available in due time.

Waiata-a-ringa (action songs) at Poohara Marae, te tira hoe o Waikato 2015.
Photo: Waikato Rauapatu River Trust



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

Edson S 1983. Miracles do happen! The recovery by instalments of the Pukete carving. *NZ Archaeological Association Newsletter* 26: 221–227.

Evans JA, Te Awamutu District Museum 1994. *Uenuku: a Tainui taonga at the Te Awamutu District Museum*. Te Awamutu, New Zealand: Te Awamutu District Museum.

Harmsworth GR 2002. *Coordinated monitoring of New Zealand wetlands, phase two, goal two: Maori environmental performance indicators for wetland condition and trend*. Palmerston North, New Zealand: Manaaki Whenua – Landcare Research.

Smith LT 2012. *Decolonizing methodologies: Research and indigenous peoples*. 2nd edn. London & New York: Zed Books.

Puke W 2011. *An assessment of the potential impact that any expansion and development of the Ruakura Estate might have on cultural values and manawhenua*. Hamilton, New Zealand: Tainui Group Holdings, Chedworth Park, NaMTOK Consultancy.

Waikato River Authority 2016. *Vision and strategy for the Waikato River, 5-year annual report*. Hamilton, New Zealand: Waikato River Authority.

Waikato-Tainui Te Kauhaunganui Inc. 2013. *Tai tumu, tai pari, tai ao: Waikato-Tainui Environmental Plan*. Hamilton, New Zealand: Waikato-Tainui Te Kauhaunganui.

Waikato-Tainui Te Kauhaunganui Inc. 2015. *Ko te mana maatauranga: Waikato-Tainui Education Strategy 2015–2020*. Hamilton, New Zealand: Waikato-Tainui Te Kauhaunganui.

Waikato Raupatu River Trust 2015. *Te tira hoe o Waikato participant resource journal*. Hamilton, New Zealand: Waikato Raupatu River Trust.

Te Kauhaunganui o Waikato Inc. 1995. *Whakatupuranga Waikato-Tainui 2050*. Hamilton, New Zealand: Waikato-Tainui.

Websites

Tai tumu, tai pari, tai ao – Waikato-Tainui Environmental Plan:

www.wrrt.co.nz/wp-content/uploads/EBook_FINAL_EP_Plan_sp.pdf

Uenuku, The Atua of the Rainbow – carving can be seen at the Te Awamutu Museum:

www.tamuseum.org.nz/exhibition/uenuku-a-tainuawamutu-museum

Kaupapa Maaori Research:

www.rangahau.co.nz

Dates for Poukai:

www.waikatotainui.com/tribal-paanui

Inside look into the Kiingitanga:

www.maoritelevision.com/tv/shows/kiingitanga

Whakaptupuranga 2050:

www.waikatotainui.com/wp-content/uploads/2013/10/WhakatupurangaWT2050.pdf

Te Ture Whaimana – The Vision and Strategy:

www.waikatotainui.com/environmental-management-plan/c-11-the-vision-strategy-for-waikato-river

Image related credit

Uenuku 2085 Te Awamutu Museum Collection. Photo: Brian Brake, © Raymond Lau

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7.2 WAITAKI RESTORATION

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Restoring wetlands: rūnanga implementation of an integrated aquatic restoration programme across multiple spatial scales

Understanding the cultural context and delivering cultural opportunities

Determining the range of initiatives needed to deliver outcomes sought by whānau

Monitoring, reporting, and communicating restoration success

Summary

Want to learn more?



RESTORING WETLANDS: RŪNANGA IMPLEMENTATION OF AN INTEGRATED AQUATIC RESTORATION PROGRAMME ACROSS MULTIPLE SPATIAL SCALES

Background

The impetus for this case study was concern that, over the last 150 years, the takiwā (region) of one rūnanga (iwi authority) in the South Island of Aotearoa New Zealand has been altered and degraded by resource use and development. The focus area is the North Otago region and the Waitaki district in particular. To Ngāi Tahu, the Waitaki River is sourced from a stream known as Ngā Roimata o Aoraki (the "Tears of Aoraki") that feeds into Lake Pūkaki. The catchments of interest lie in the takiwā of Te Rūnanga o Moeraki, which is one of the 18 papatipu rūnanga (authority of Ngāi Tahu people over the land, sea, and natural resources) as defined

in the Te Rūnanga o Ngāi Tahu Act 1996. The takiwā extends over a large spatial area, from the Waitaki River in the north to the Waihemo River as its southern boundary and inland to the Southern Alps. The marae (meeting house) is located in Moeraki township.

Although Ngāi Tahu were active in a number of resource management forums and had multiple initiatives underway, the issue was the extent to which these initiatives effectively informed and shaped contemporary resource management decisions. An integrative and strategic process that has been developed and trialled by rūnanga is shown in Figure 1. This process has two parallel streams:

- Understanding the cultural context – identifying the opportunities tangata whenua (indigenous people) want to see delivered in catchments to help direct targeted whānau (family) engagement in appropriate resource management forums
- Documenting the causes of changes being experienced by tangata whenua – examining the nature and extent (or scale) of alterations to valued environments, determining the consequent impact on whānau, and identifying the continuing threats to the state of the cultural landscape.

Previous page: Dewatered stream. Photo: Kyle Nelson



Kia tuohu koutou, me he mauka teitei, ko Aoraki anake; If you must bow your head, then let it be to the lofty mountain Aoraki. Looking across the waters of Lake Pūkaki towards Aoraki. Photo: Shutterstock 1251638

UNDERSTANDING THE CULTURAL CONTEXT AND DELIVERING CULTURAL OPPORTUNITIES

Values and aspirations

The development of the integrated planning framework started with the articulation by whānau members of the linkages between cultural values and the principles of restoration. This articulation sets a high level strategic direction. Once completed, it was then a straightforward task to map the aspirations of whānau, which is a spatial depiction of their vision for the catchment. For example, Figure 2 details some of the aspirations whānau have for the Waitaki River catchment.

Once the opportunities sought by whānau were mapped we focused the analysis on particular values. For example, mahinga kai (food gathering sites) is a value that lies at the heart of Ngāi Tahu culture and identity. From historic records we know that of more than 30 species, over half were freshwater fish species, with the remainder a mix of plants, birds, and marine species gathered across 160 sites in the Waitaki catchment. Approximately 70% of the sites in the Waitaki sustained tuna (freshwater eels), which was the most commonly gathered food source. Tuna remain a taonga (treasure) that whānau want to see restored at sites across the catchment (Figure 3). Understanding the significance of a species to tangata whenua and its historic range, ki uta ki tai (from the mountains to the sea), enables the identification of potential sites to be restored and where a species could be reintroduced.

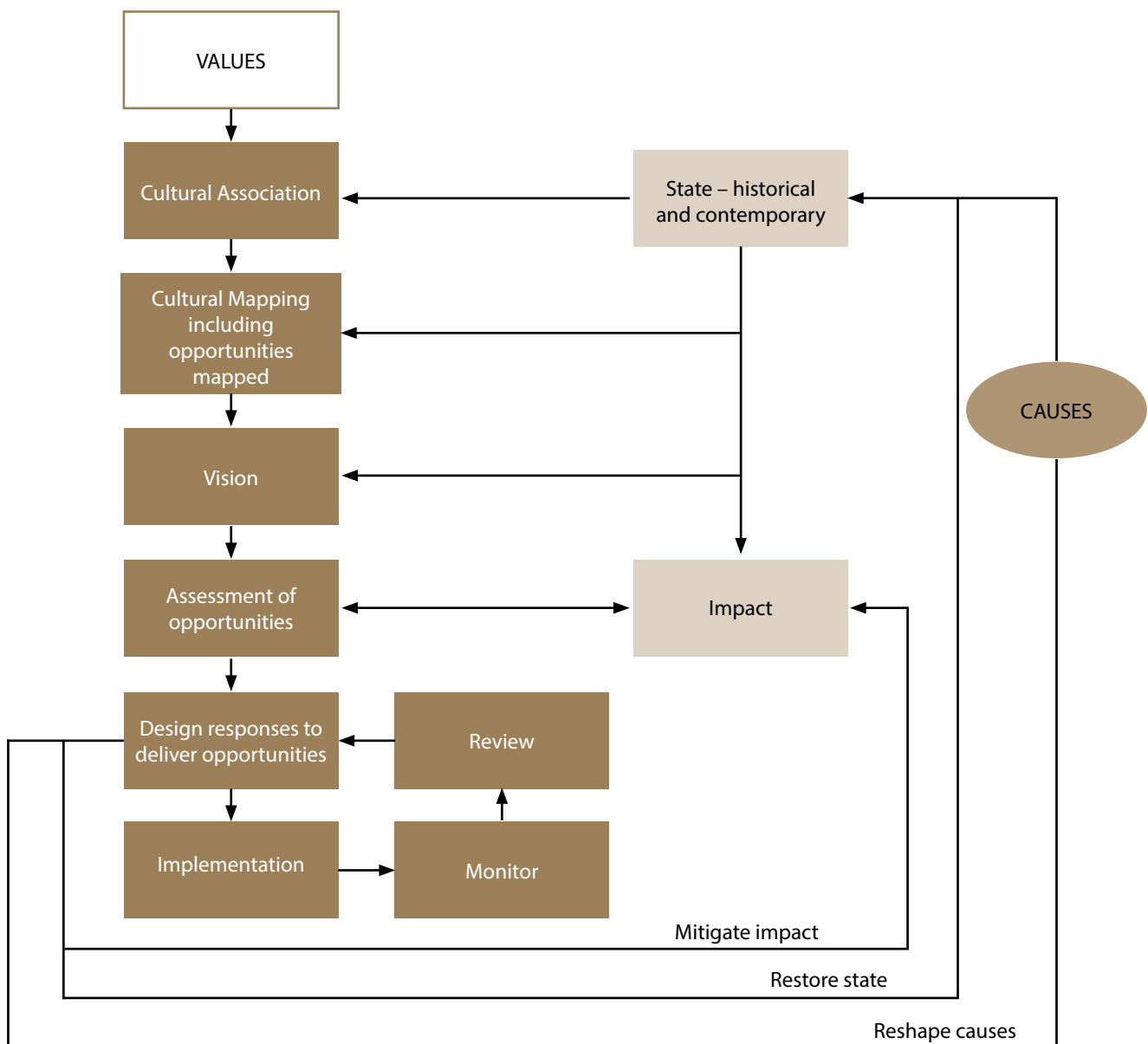
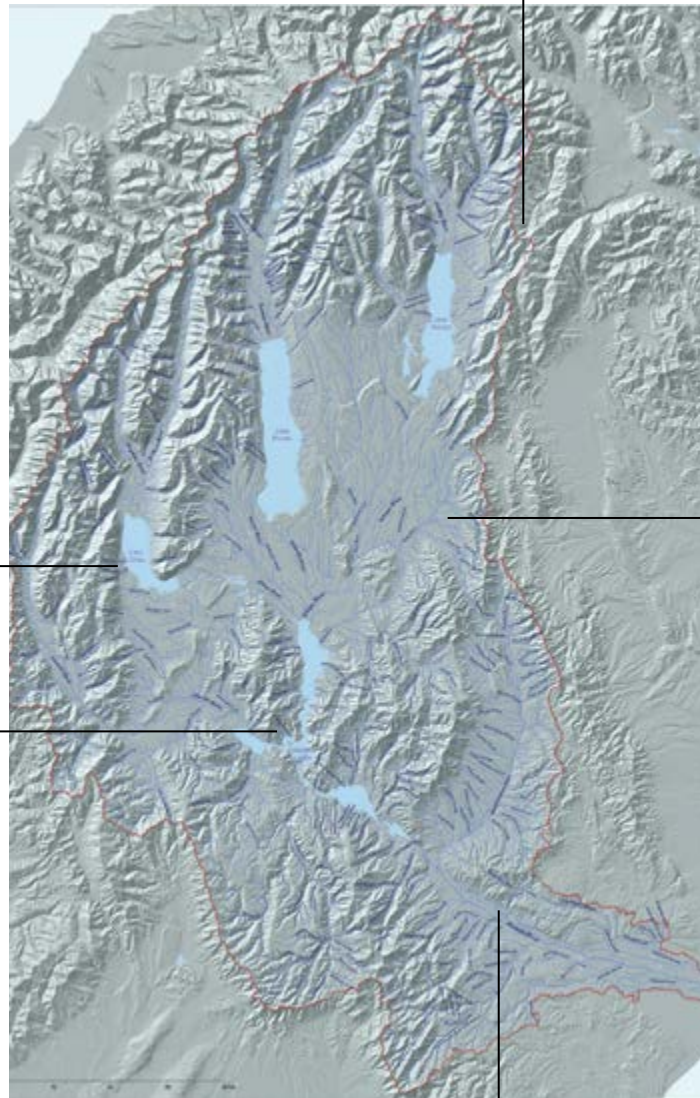


Figure 1. An integrative planning framework developed by tangata whenua to strategically inform aquatic restoration efforts

- OVERALL**
- To protect the mauri (life force) of the Waitaki catchment
 - Implement a co-governance regime for the Waitaki catchment
- Improve access
 - Protect rock art
 - Provide services at nohoanga (dwelling place)
 - Secure role in monitoring, compliance, and enforcement
 - Implement native fish reserves
- Implement at least 1 economic development opportunity
 - Develop a mahinga kai centre
 - Restore and enhance taonga species (native plants and animals of cultural significance)
 - Hold all tuna quota

AHURIRI

- Protect repo (wetlands)
- Develop as a (braided river) model catchment
- Complete willow removal



ABOVE THE UPPER WAITAKI LAKES

- Protect unique water quality
- Protect undisturbed flow of rivers into upper Waitaki lakes
- Protect wetlands and tarns, especially Irishman's Swamp

UPPER WAITAKI LAKES AND THE STREAMS OF THE MCKENZE BASIN

- Reintroduce weka (woodhen)
- Restore and enhance taonga species
- Restore minimum flows in the Tekapō and Pūkaki Rivers
- Joint venture
- A business at Pūkaki

MID WAITAKI

- Continue restoration of the Ahuriri Arm of Benmore customary fishery
- Implement native fish reserves
- Improve water quality at recreational areas e.g. Sailor's cutting

LOWER WAITAKI

- Protect harakeke (NZ flax) and raupō (koarearea) reserves for cultural use
- Implement a robust elver catch and relocate programme
- Restore pā harakeke (harakeke varieties selected for weaving)
- Undertake rock art tours
- Relocate elvers and use to restore populations in North Otago and South Canterbury
- Implement mātaimai (seafood) reserves
- Restore wetlands along the lower river for mahinga kai
- Protect puna (spring) and rongoa (traditional medicine) species, especially those on the north bank
- Aquaculture in any new canals
- Enhance īnanga (whitebait) habitat at the mouth

Figure 2. Whānau aspirations for the restoration of the Waitaki River catchment (from Tipa 2014)

Impacts, threats, and changes experienced by whānau

Understanding environmental changes, their impacts, and ongoing threats is a prerequisite to moving to proactive engagement in aquatic restoration. The changes and impacts identified by whānau were also recorded and visualised on a timeline.

Wānanga (learning), hīkoi (walks) and hui (gatherings) provided opportunities for facilitated discussions to identify and examine the cultural impacts of these changes. Water was first expropriated in the 1800s as settlers claimed springs for their livestock and diverted flows to supply farms and towns. Fences to control livestock, European concepts of private land ownership, and the placement of reserves in the lower catchment in the 19th century all impacted on Ngāi Tahu access to mahinga kai and constrained the mobility on which their mahinga kai-based economy had depended.

Without doubt, one of the most significant changes in the Waitaki catchment has been the construction of the Waitaki Hydro Power Scheme, which consists of eight power stations from Lake Tekapō to Lake Waitaki. Meridian Energy owns and operates six of these stations from a control centre in Twizel, generating energy from water flowing from the Southern Alps out to the sea. Genesis Energy Ltd owns and manages the other two stations. In the last 20 years, land use change, in particular land use intensification, continues to have further significant impacts on the waterways of the Waitaki.

Assessing impacts and cultural opportunities

Any assessment of the impacts, changes and the contemporary state of a catchment must be undertaken within the context of whānau aspirations for the takiwā. While the impacts experienced at a particular site can be quite localised, the environmental impacts on a particular taonga species need to take into account the life cycle and habitat requirements of that species, which may encompass a much broader spatial area. In the example used here, we engaged scientists to help assess biophysical impacts on the site and taonga species, while whānau members undertook cultural assessments. Figure 4 provides an example of the changes that whānau identified as having impacted a specific taonga species (in this case eels) and helps illustrate how direct impacts on tuna populations can have flow-on impacts on cultural landscapes, cultural practices, and ultimately the cultural wellbeing of whānau and hapū (subtribe).

A dewatered stream adjacent to a historic reserve granted to Ngāi Tahu in the 1860s. Photo: Kyle Nelson



Photo (right) shows a stream located next to a nohoanga created under the Ngai Tahu Claims Settlement Act 1998. Because of its significance to Ngāi Tahu is to be restored. There remain however sites of significance suffering from what whānau perceive to be inappropriate management (Photo previous page), while Figure 4 illustrates how the environmental impacts ultimately impact the wellbeing of whānau and hapū.



A site in the Willowburn, adjacent to a nohoanga that is to be part of the catchment restoration. Photo: Kyle Nelson

² Discover Waitaki. <https://www.meridianenergy.co.nz/assets/Uploads/Discover-Waitaki-Nov-15.pdf>

VALUES

Ecological values include:

- Top predator in the food chain
- Connectivity between marine and freshwater ecosystems
- Should be a large component of the freshwater fish biomass in areas without large natural barriers



Economic values include:

- Iwi-owned commercial tuna quota
- Important kai source for whānau and marae communities
- Tuna traded between whānau, hapū, and iwi



Socio-cultural values include:

- Important kai source for whānau and marae communities
- Education includes whakapapa (genealogy) of tuna, stories, practices of gathering and processing, species names
- Important in kaihaukai (tribal feast) and for exercising manaakitanga (hospitality)



IMPACTS

Stressors include:

- Declining water quality, decreasing water quantity, loss of habitat, loss of fish passage, loss of ecosystem connectivity over fishing

Access impacts include:

- Loss of physical access
- Legal impediments to access
- Loss of materials for harvest, e.g. constructing hīnaki (eel basket)

Whānau health impacts include:

- Not gathering and eating tuna
- Eating contaminated tuna

Cultural impacts include:

- Loss of tikanga (cultural practices)
- Loss of mātauranga (knowledge)
- Loss of te reo (language)

Economic impacts include:

- Cost of buying substitute foods
- Distance now necessary to travel to harvest tuna

Figure 3. The value and significance of tuna (freshwater eels) as a mahinga kai and taonga species

Photos: John Clayton and Erica Williams

Environmental and cultural assessments undertaken by whānau can utilise the outputs of the cultural mapping exercises, aerial photographs, and conceptual diagrams (e.g. Fig. 4). A variety of cultural assessment tools are currently in use by tangata whenua as it cannot be assumed a single assessment method will meet all whānau needs. The complexity of issues at a site mean a range of tools and assessments will be needed. Figure 5 shows the aspirations of whānau for a significant cultural landscape, Takiroa Wetland, in the Waitaki River catchment, where assessments have been undertaken by both biophysical scientists and Ngāi Tahu, who applied a Cultural Health Index.

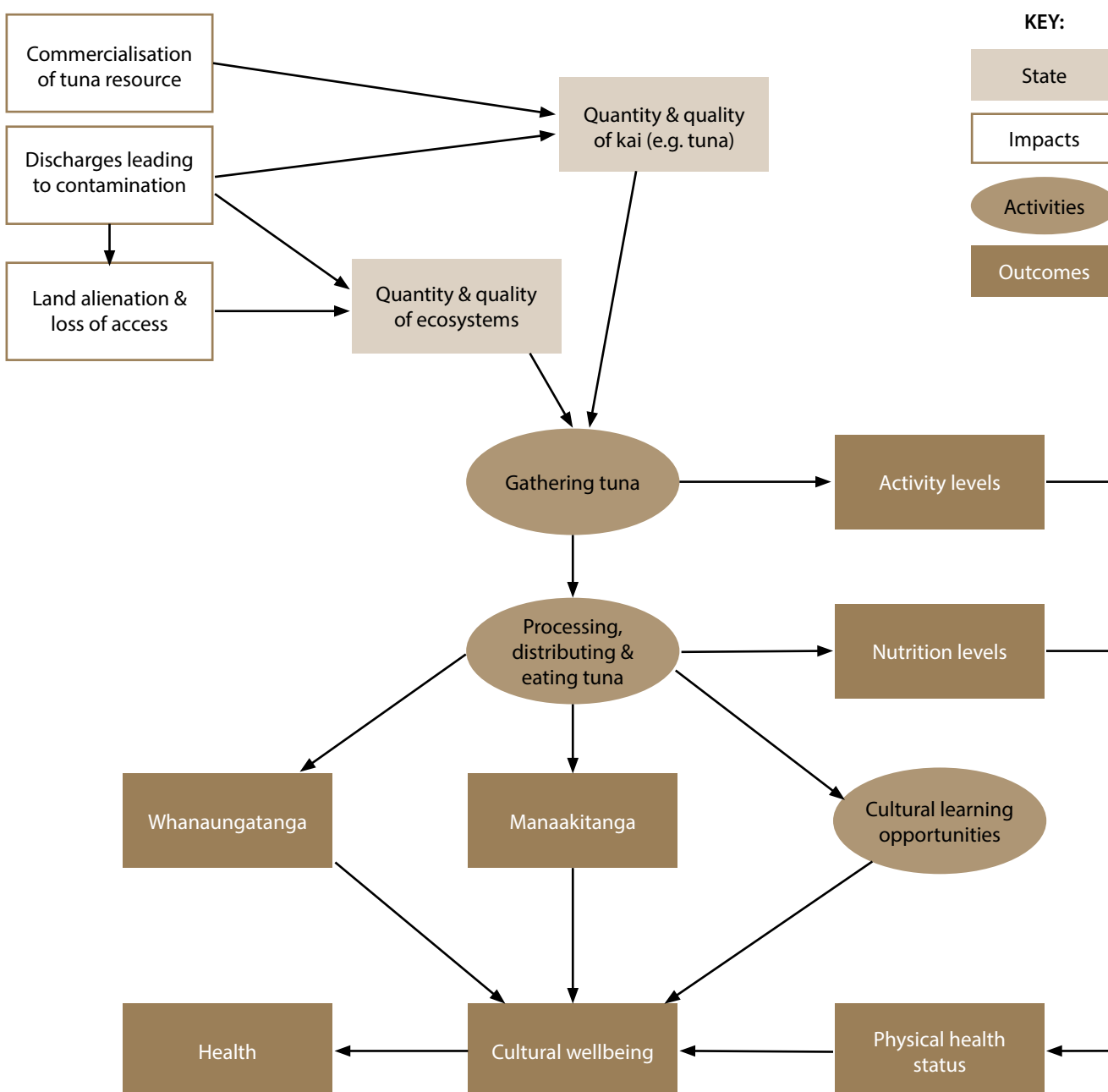


Figure 4. An illustration of the impacts of environmental change and mahinga kai and cultural wellbeing (Tipa 2011, adapted from Donatuto 2008)

FRANCIS PROPERTY (TAKIROA)

Description

Many taonga including:

- Spring-fed channels and swamp. Modified, but good ecological values; large stands of harakeke (uncommon in valley) and pūrei (carex) common. Watercress and other macrophytes abundant in channels. Recent restoration planting at downstream end on southern side
- Birds of note: mallard, paradise shelduck, pukeko, welcome swallow
- Fish (NIWA): shortfin eel, longfin eel
- Cultural landscape includes rock art, rock shelter, nohoanga, pā (fortified place)
- A highly significant site

Perceived threats

- It is a working farm
- Permission is required to access
- Since 2000 this place has been destroyed. "I am sad cos I saw it pre cows"
- Contamination from farming
- Risk of grazing within fenced area



Figure 5. Cultural health assessment of Takiroa Wetland (Tipa and Associates, 2015)

Values and Opportunities sought

- This area is to be abundant with watercress
- Tuna are present. There is to be no harvesting
- Raupō and harakeke is to be present and good quality. It is valued as a pā harakeke. Restore access for cultural use
- Deep water channel is to be maintained
- The sound of birds – unseen but heard. Populations are to be protected
- Springs at the base of the terrace that feed the stream are to be protected
- Manage the stream and wetlands as a native fish reserve
- Good water quality is to be maintained
- Mix of wetland, stream, and springs is to be protected
- The appeal of the wetland is its proximity to Takiroa. The cultural landscape is to be protected
- Better fencing is to be erected. Stock are to be excluded
- The land between the wetlands and road should be retired
- Flows need to:
 - protect connectivity – 1) springs, wetlands and streams; 2) Stream to the mainstem Waitaki
 - allow restoration of the wetland/riparian vegetation/along the drainage channels

Site Status A-1 | Cultural use 3.5 | Health measure 3.5

This is a site of traditional significance that still sustains the cultural, beliefs and practices for which it is valued. It has above average mahinga kai value (on a 1-5 scale) and is rated above average in terms of stream health using 8 indicators assessed by mana whenua (indigenous people with primary rights and responsibilities over an area).

Looking upstream from the bridge below Takiroa



DETERMINING THE RANGE OF INITIATIVES NEEDED TO DELIVER OUTCOMES SOUGHT BY WHĀNAU

It must be stressed that undertaking assessments and collecting data are not the outcome. The data gathered need to be interwoven to inform the development of responsive restoration strategies that simultaneously consider species, habitats, access, learning opportunities, retaining cultural practices, and mitigating impacts:

- Understanding the significance of a **species** to tangata whenua and its historic range allows the identification of possible sites to be restored and, if necessary, sites to which species could be reintroduced. See Table 1 for some examples of initiatives underway for species historically found in North Otago.
- Restoration of species depends, in part, on the restoration of their **preferred habitats**. A number of strategies are being implemented across North Otago that will protect and restore valued aquatic habitats, such as Takiroa (see photo bottom of next page). The cultural landscape at Takiroa includes rock art, shelters, nohoanga, pā harakeke, trails, multiple springs, wetlands, and many taonga species (plants, fish and birds).
- Use of the sub-catchments in the Waitaki River catchment by Ngāi Tahu depends on access to the river, and specifically to those sites whānau prefer to use. This has led to Ngāi Tahu negotiating with agencies and landowners for improved access. An example is one landowner 'opening up' a 2-kilometre reach of a waterway valued as a mahinga kai.
- Engagement in mahinga kai practices created opportunities for experiential learning in which **knowledge of ecosystems, species, and cultural practices and protocols** was shared. If mahinga kai is to remain an integral part of Ngāi Tahu cultural identity, the need to source a variety of data (of different media including photos, paintings, survey maps, mental maps, journals, diaries, and catch histories for species, etc.) to complement the knowledge still held within whānau and hapū is reinforced. This has led to the implementation of a programme of regular hīkoi (walks) and wānanga (learning). Taihoro Nukurangi–NIWA has been a key collaborator in many tuna management initiatives and has facilitated tuna wānanga across New Zealand. As part of the programme, a comprehensive resource on the freshwater fish species of the Waitaki has been prepared for the Waitaki Tuna Wānanga.
- To understand ecological knowledge one must participate in the processes of hunting, fishing, gathering, and processing of kai, for example, whānau have expressed a desire to learn how to extract specialty foods. Wānanga play a vital role in **retaining cultural practices**.
- When faced with significant resource consent applications, the papatipu rūnanga have prepared Cultural Impact Assessments to inform their interaction and negotiations with developers to **mitigate impacts**.

Looking downstream from the bridge at Takiroa



Table 1. Taonga species historically taken from North Otago and restoration actions underway

| Taonga Species | Restorative Actions | Collaborations |
|--------------------------|---|--|
| Tuna | <ul style="list-style-type: none"> • Prioritised fish passage as an issue: <ul style="list-style-type: none"> - Trap and transfer of elvers and relocate above the Waitaki dam - Trap adult migrants and relocate below the dams • Prioritised protection of riparian wetlands • Identified and secured aquatic sites to enhance • Wānanga held to introduce whānau to mātauranga and science of tuna • Advocated for flow and allocative regimes that maintained connections between mainstream, tributaries, wetlands, etc. <ul style="list-style-type: none"> - Flow regime in two rivers modified - Allocation limits set in two rivers, and clawed back in another - An allocation for mahinga kai proposed in regional plan | <ul style="list-style-type: none"> • Meridian Energy Ltd • NIWA |
| Weka | <ul style="list-style-type: none"> • A weka reintroduction programme has been initiated in Otago. The benefits of this programme to Ngāi Tahu whānau are being monitored | <ul style="list-style-type: none"> • Department of Conservation • Te Rūnanga o Ngāi Tahu • Private landowners |
| Koarearea (raupō) | <ul style="list-style-type: none"> • A wānanga is planned to trial the process of extracting and using the pollen • Wetlands to be protected as a pā raupō were identified and agreement reached with the landowner | <ul style="list-style-type: none"> • Private landowners |
| Harakeke | <ul style="list-style-type: none"> • Secured a pā harakeke and initiated restoration (removed exotics, sourcing and growing seeds) • Using seeds from the pā harakeke to re-establish the cultivar elsewhere | <ul style="list-style-type: none"> • Private landowners • Meridian Energy Ltd • University of Otago |
| Indigenous fish | <ul style="list-style-type: none"> • Relocations of taonga native fish species to other catchments have been trialled | <ul style="list-style-type: none"> • Department of Conservation |
| Indigenous plants | <ul style="list-style-type: none"> • Restoration plans are being implemented at a number of sites • Whānau engagement in planting days | <ul style="list-style-type: none"> • Landcare groups • Private landowners |

The cultural landscape that encompasses the Takiroa Wetland (white box). Photo: New Zealand Aerial Archaeology



A key step for whānau is to assess their capacity to engage in restoration, which ultimately dictates their role and the extent to which they will lead a particular initiative. For example, having noted that land-use change and land use intensification are of concern to

Ngāi Tahu, Te Rūnanga o Moeraki has committed to a relationship with one of the irrigation companies in North Otago via a negotiated consent process (summarised in Table 2).

Table 2. Some of the agencies with which Te Rūnanga o Moeraki engages to restore aquatic habitats across its takiwā

| Agency | Location | Formalising the relationship |
|----------------------------|--|---|
| Meridian Energy Ltd | Waitaki Catchment Rock art across North Otago | Te Rūnanga o Ngāi Tahu and the three Waitaki rūnanga are signatories to a Relationship Agreement |
| Department of Conservation | Across North Otago | Te Rūnanga o Moeraki is one of four rūnanga in Otago that has a Memorandum of Understanding (MOU) with the Department |
| Irrigation Company | Waiareka Creek | Te Rūnanga o Moeraki has a MOU with one company |
| Irrigation Collective | From the Kakaunui River to the Waitaki River | This is yet to be formalised. A working relationship is evolving |
| Forestry Company | Trotters Creek to Waianakarua River | The relationship has grown since an encumbrance was placed on the forestry land in 1998 |
| Private Landowners | Across North Otago | This is often a personal relationship that is not formalised in an agreement |
| University of Otago | Across North Otago | Te Rūnanga o Ngāi Tahu has a MOU |
| NIWA | Across North Otago | Te Rūnanga o Ngāi Tahu has a MOU |
| Environment Canterbury | Waitaki | Te Rūnanga o Ngāi Tahu has a MOU |



Whānau members electric fishing during an assessment of Maryburn in the Upper Waitaki. Photo: Gail Tipa

MONITORING, REPORTING, AND COMMUNICATING RESTORATION SUCCESS

At the end of the day, whānau want to know if restoration endeavours are making a difference. This is inevitable, given that environmental restoration requires substantial effort and commitment. However, the long-term monitoring and evaluation programmes are generally not a priority component of such work programmes.

Many marae (Māori social and cultural centre), hapū (subtribe), and iwi (tribe) not only wish to contribute to fulfilling their own responsibilities as kaitiaki (guardian), but also wish to mainstream regional and national policy, monitoring, and planning. However, many groups are hampered by access to information, such as client reports produced for industry, water quality/quantity monitoring data, pest management plans, aerial photographs, and spatial data.

Environmental report cards are increasingly being promoted as effective public communication and engagement tools, and when used effectively, galvanise commitment and action. A report card assessing the Cultural Health of the Waitaki River catchment has recently been prepared in collaboration with whānau.

The presentation of a report card is important as it can directly impact its ability to communicate key messages. Colour can be used to quickly communicate ecological health, for example, the 'stop light' approach, where green is interpreted as 'go' or 'good', while red means 'bad' or 'stop'. Many combinations of numbers, colours, symbols, and graphics can be used when producing a report card. Using restoration as a learning context, posters are being used to convey information about the health of the catchment to whānau. These posters have been prepared for the marae.



A whānau member during an assessment of Temple Stream in the headwaters of the Waitaki catchment. Photo: Gail Tipa

SUMMARY

This case study presented an integrative planning framework that is enabling a rūnanga to move beyond reacting to environmental issues and instead to position them to manage lands and waters proactively within their takiwā. It is a relatively simple process of engagement that relies on the recording of the historic, current, and ideally, future experiences of tangata whenua. It provides a level of specificity that enables more effective collaboration with scientists, managers, resource users, groups, and landowners. It also provides a context within which to monitor implementation. The focus on providing "opportunities" is deliberate.

This case study also illustrates how it is possible to reconstruct the past and provide descriptions of the history and life ways of Māori, the changes they have experienced over time, the consequent impact of these changes on whānau and hapū, and how these have shaped contemporary behaviours. Such reconstructions help explain why particular landscapes and resources remain of particular cultural significance, and are the focus of restorative initiatives today.

Lower Waitaki River. Photo: GNS Photo Library



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

Donatuto J 2008. *When seafood feeds the spirit yet poisons the body: Developing health indicators for risk assessment in a Native American fishing community*. PhD thesis, Faculty of Graduate Studies (Resource Management and Environmental Studies), University of British Columbia.

Garibaldi A, Turner N 2004. *Cultural keystone species: implications for ecological conservation and restoration*. *Ecology and Society* 9(3): 1. Online URL: www.ecologyandsociety.org/vol9/iss3/art1

Tipa G, Nelson K 2013. *Bringing the past into our future - using historic data to inform contemporary freshwater management*. *New Zealand Journal of Social Sciences Online* 8: 1–2, 40–63, DOI: 10.1080/1177083X.2013.837080

Tipa G, Teirney L 2003. *A cultural health index for streams and waterways: indicators for recognising and expressing cultural values*. Ministry for Environment Technical Paper 75. ME number 475.

Nelson K, Tipa G 2012. *Cultural indicators, monitoring frameworks & assessment tools*. Report for the Wheel of Water Research Programme. Tipa & Associates Ltd, Otago.

Tipa G, Williams E, Nelson K 2015. *Cultural health assessment of the Waitaki Catchment – a report prepared for Environment Canterbury*. Tipa & Associates Ltd, Otago.

Williams E, Boubee J 2012. *Freshwater fish in the Waitaki Catchment*. A report prepared for training workshop at Te Rūnanga o Moeraki.

Williams E, Tipa G, Van Schravendijk-Goodman C, May K, Kitson J, Harmsworth GR, Smith H, Kusabs I, Severne C, Ratana K 2015. *Data management and knowledge visualisation tools for hapū and iwi to support freshwater management – a scoping study*. NIWA Client Report WLG2015-17 prepared for the Department of Conservation. January 2015. 58 p.

Useful website

Meridian Energy – Discover Waitaki: <https://www.meridianenergy.co.nz/assets/About-us/Our-power-stations/Hydro/Waitaki/Discover-Waitaki-12.14.pdf>

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7.3 HEI WHENUA ORA TE HĀKARI DUNE WETLAND

HUHANA SMITH (NGĀTI TŪKOREHE, NGĀTI
RAUKAWA KI TE TONGA)

Introduction

About Te Hākari

Changes to the wetland

Te Hākari Dune Wetland restoration project
The capacity for correction

Challenges for restoration of Te Hākari

Project outcomes to date

Conclusion

Wīwī – helping to recover the wetland's 'memory'

Want to learn more?

Historically, Māori culture has survived by being intimately coupled in a co-evolutionary sense with the wellbeing and survival of natural ecosystems – one goal cannot be achieved without the other. From the worldview of tangata whenua (indigenous people), therefore, ecological restoration efforts involve human intervention in a highly complex socio-cultural-ecological system.

We often hear ecological systems being described as a component of the wider 'natural landscape' – those places where living organisms and plants co-exist in a co-evolutionary relationship with each other and interact with soils, atmosphere, and hydrological features and processes. However, intrinsic to these are the 'cultural landscapes' – those places where humans have transformed natural areas, or where natural settings have shaped people's way of life. Humans have greatly influenced nature, so that it could be said that virtually all landscapes are cultural landscapes.

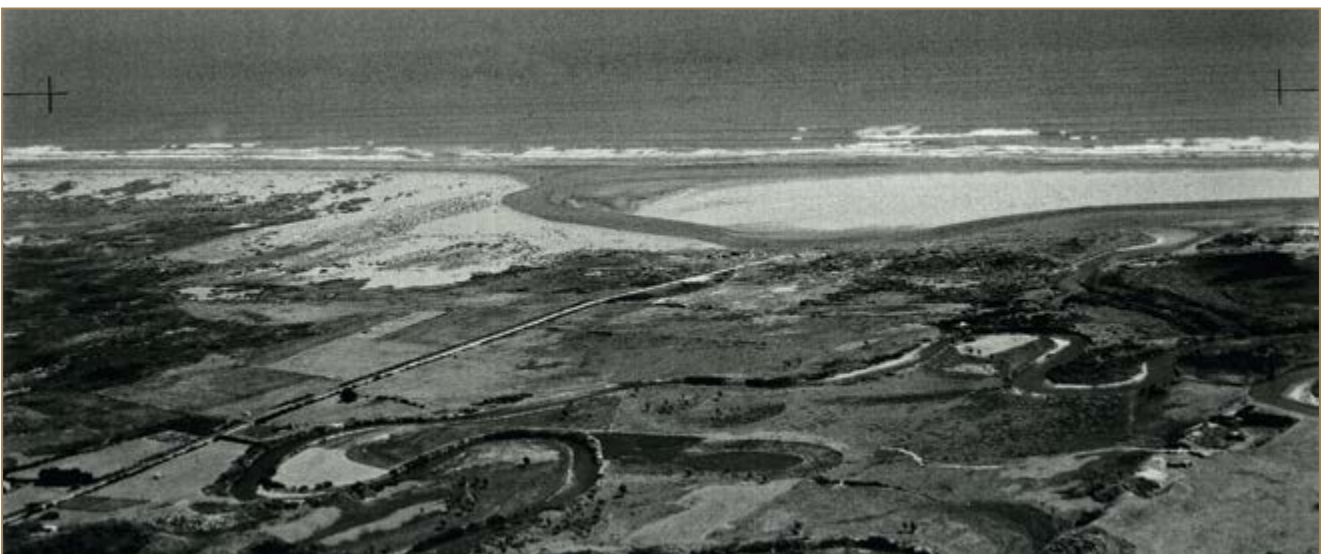
A cultural landscape can also be an ancestral landscape that refers to the activities of tūpuna (ancestors) and ensuing generations, whose influences and adaptations have shaped lands and waterways over time. The larger ancestral landscape of Te Hākari wetland, therefore, comes under the guardianship of

hapū (subtribe), Ngāti Te Rangitāwhia, Te Mateawa, and Ngāti Kapumanawawhiti ki Kuku, who affiliate to the iwi (tribe), Ngāti Tūkorehe, in the region of Kuku, Horowhenua. Ngāti Tūkorehe are also affiliated to, and politically aligned with, Ngāti Raukawa ki te Tonga.

The understanding of cultural landscape in the Kuku rohe (region) grew from lands and waterways that existed in hapū and whānau (family) ownership, which continues today for coastal areas retained in Māori title. Over generations, a range of close relationships and associations have accumulated among these natural and cultural entities, specifically, among people, land holdings, and freshwater, marine, and forest resources.

A repo (swamp) like Te Hākari Dune Wetland or coastal foreshore ecosystems, or a river ecosystem, or a forest, could be considered, with the people it sustained, to be a living being and be termed a taonga (treasure) because of the associations our people have accumulated with it. Hapū also inherited their mana (authority) for lands and waterways through their close associations with the intrinsic power that these natural areas produced. Such associations sustained their lives and contributed to their wellbeing and security.

The cultural or ancestral landscape of Te Hākari is bounded by the Tasman Sea and where it meets the Ōhau River and estuary; where prevailing north and north-westerly winds blow across adjacent sandy fore dunes.



Te Hākari Dune Wetland (on left side of road) adjacent to dunes and Ōhau Estuary, 1946. Photo: National Archives, Wellington

ABOUT TE HĀKARI

Te Hākari Dune Wetland was once part of an extensive coastal forest encompassing a series of lakes, lagoons, and dune wetlands located within an ancestral area along a coastal plain in southwest Horowhenua. Originally, it was hydrologically and ecologically linked to the dune lakes and wetland systems of Ōhine Lagoon, Lake Waitaha, and Ōrotokare Wetland at Muhunua just north of Waiwiri Stream. There are subsurface waterways beneath dune lakes and related spring systems. In recent years the coastal area has been mapped as having high-risk susceptibility to liquefaction, due to earthquake.

Te Hākari sits within ancestral lands retained under the ownership and kaitiakitanga (the exercise of guardianship) of local hapū of Ngāti Tūkorehe. A kawenata (covenant) established in 2002 in partnership between the then Minister for Conservation, Sandra Lee, with Tahamata Incorporation (mana whenua (indigenous people with primary rights and responsibilities over an area) and adjacent farm owners) encompasses an area of:

- 13.7 hectares (33.85 acres)
- a paddock on its southwest
- ephemeral wetland adjacent to the Tahamata Incorporation farm pine forest
- the larger wetland system itself
- Te Hākari Stream

Since ancestral occupation, the coastal lands and waterways have been retained by hapū on the southern side of the Ōhau River. There are shared responsibilities for the Waiwiri region (north of the Ōhau River) for affiliated tribes like Ngāti Kikopiri and Ngāti Hikitunga, and for neighbouring Muāūpoko, who also have responsibilities for areas bordering the northern Waiwiri region.

The lower reaches of the Ōhau River include the meander known locally as the 'loop', which is hydrologically linked to the tidal estuary, Te Hākari dune wetland and the larger system stretching southward towards the Waikawa River. The coastal, flood plain then extends inland to the Mangananao, Tikorangi, and Kuku Streams confluence that flows into the Ōhau River adjacent to older dune systems.

Our tūpuna depended on wetlands and coastal estuaries for food and as sources of material, e.g. fibre for making clothes. Over time they generated an intimate closeness with the environment and shaped and influenced the landscape, wetlands, and waterways through their actions. They lived, procreated, died, and sustained themselves by their seafaring, fishing, gardening, and housing skills using natural resources from the biodiversity rich wetlands, and coastal and estuarine regions. They entreated spiritual entities and their associated environmental properties.

What are kawenata?

A kawenata is a covenant under section 29 of the Conservation Act 1987 that, with the agreement of Māori landowners, can be put in place over an area deemed to be of high conservation significance. Kawenata are reviewable and can be set for an initial time period of 25 years. Their central purpose is to manage, preserve, and protect natural and historic resources, and to bolster the spiritual and cultural values of the interrelated region.

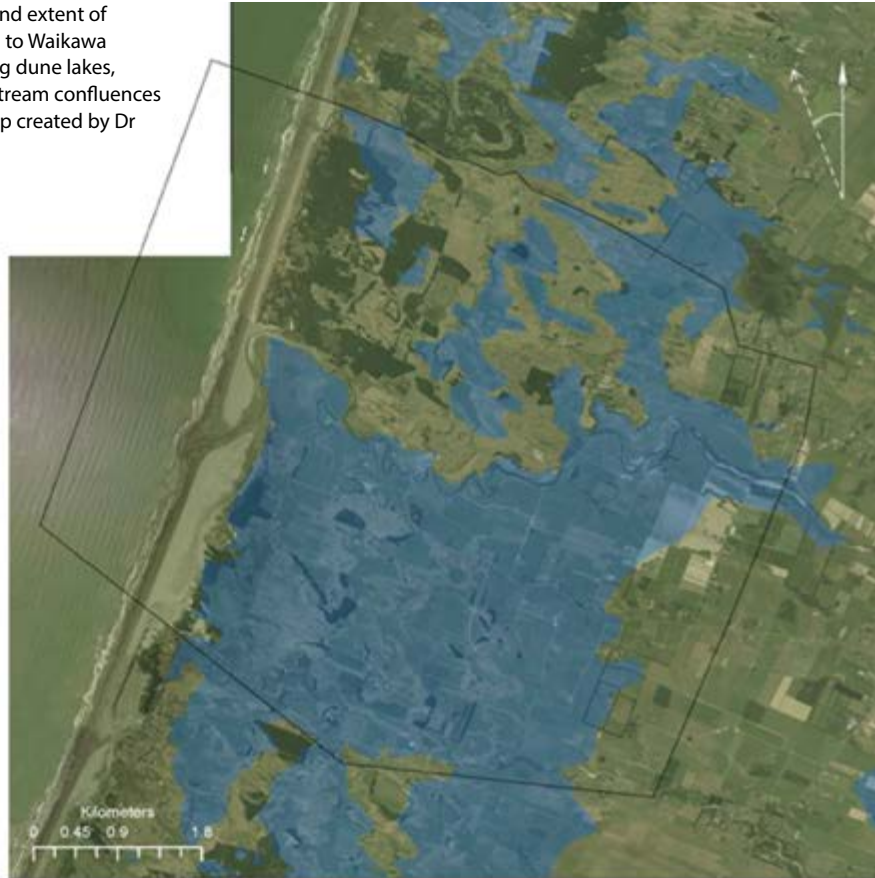
Benefits for Te Hākari:

- It acknowledges the mana whenua status of Tahamata Incorporation and its iwi and hapū shareholders
- It protects and enhances the cultural and spiritual values by recognising the historic, archaeological, and educational values associated with the land and its related water bodies. It maintains landscape amenity values of the land
- It provides for the public's recreational use and enjoyment of the land consistent with the objectives and consent of Tahamata Incorporation as a leading economic entity of Ngāti Tūkorehe

For more information about kawenata see:

www.doc.govt.nz/ngawhenuarahui

Pre 1840s wetland extent of Muhunua, Kuku to Waikawa region, including dune lakes, wetlands, and stream confluences (blue areas). Map created by Dr Anthony Cole



2009 waterways in Muhunua, Kuku to Waikawa region, including dune lakes, wetlands, and stream confluences. Map created by Dr Anthony Cole

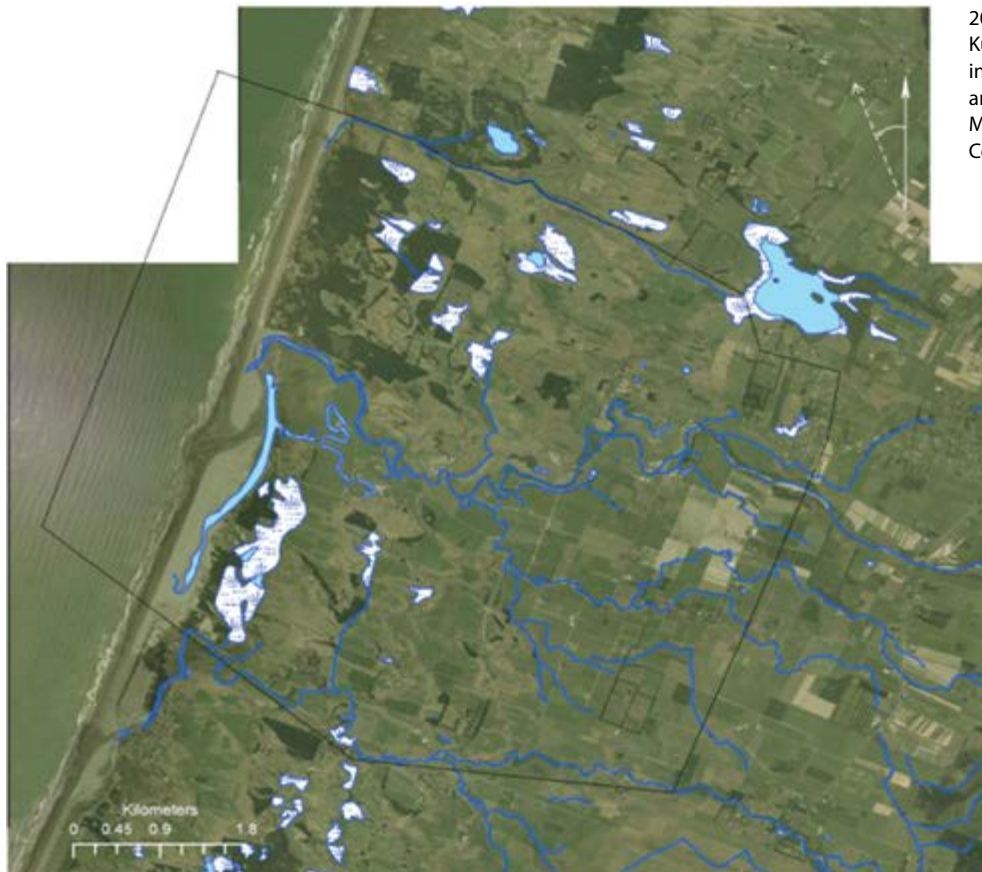









Table 1.
Some native plants found on fore dunes of Te Hākari

| Plant (common and Māori name) | Scientific/ botanical name | Image |
|-------------------------------|---------------------------------|---|
| Pīngao Golden sand sedge | <i>Ficinia spiralis</i> |  |
| Spinifex Kowhangatara | <i>Spinifex sericeus</i> |  |
| Tarakupenga Sand coprosma | <i>Coprosma acerosa</i> |  |
| Tauhinu | <i>Ozothamnus leptophyllus</i> |  |
| Rauparaha Shore bindweed | <i>Calystegia soldanella</i> |  |
| Māakoako Shore pimpernel | <i>Samolus repens</i> |  |
| Tidal ureure Glassworts | <i>Sarcocornia quinqueflora</i> |  |

All photos: Jeremy Rolfe

Table 2.
Important native animals found in Te Hākari

| Māori name/ common name | Scientific name |
|---|------------------------------------|
| Matuku Australasian bittern | <i>Botaurus poiciloptilus</i> |
| Matuku-moana White-faced heron | <i>Ardea novaehollandiae</i> |
| Kotuku | <i>Egretta alba modesta</i> |
| Kotuku Little egret | <i>Egretta garzetta immaculata</i> |
| Kotuku ngutu-papa Royal spoonbill | <i>Platalea leucorodia regia</i> |
| Banded kōkopu | <i>Galaxias fasciatus</i> |
| Giant kōkopu | <i>Galaxias argentus</i> |
| Tuatua, kahitua | <i>Amphidesma subtriangulatum</i> |

CHANGES TO THE WETLAND

"In 1914, the area in Kuku under bush was only one quarter what it had been in 1890. Trees were felled and burnt and the ashes sown with English varieties of grass e.g. cocksfoot, clover. Swamp drainage, an extensive and expensive undertaking, was not carried out in Kuku in the first part of this period. The fact that the swamp zones at the coast were owned by a group of impecunious*, easy-going Māoris helps to explain this lack of economic development."

John Rodford Wehipeihana (1964)

Coastal wetlands and dune lakes systems between the Waiwiri and Waitohu Streams have been severely degraded over the past 100 years.

At the time of ancestral occupation in the early 1820s, significant natural forest cover existed. The forest clearance in the coastal and inland district 100 years later was swift and relentless, as the areas were cleared and converted to pasture. The development of wetlands like Te Hākari was more constrained or protected by communal Māori ownership, but by the 1930s they too had fallen victim to agricultural pressures.

* Impecunious; relates to a 'cash poor' status

Important ahu otaota (shell middens) within the coastal landscape.
Photo: Huhana Smith

Table 3. Estimated percentage loss of native ecosystems in the Manawatu/Horowhenua region

| | |
|--------------------------------------|-------|
| Wetland loss since 1900 | 97.4% |
| Native forest cover loss since 1920s | 73.8% |

When first subjected to intensive drainage, Te Hākari dune wetland (like many other dune lakes in the wider district) became a captured, groundwater and rain-fed, enriched system, with a stream that flowed west to meet the modified course of the Ōhau River. By 1935, Te Hākari lagoon was greatly diminished in size, and choked with raupō and hornwort.

Decision-making and management of the system (with associated problems) has been historically led by non-Māori groups:

- Kuku Drainage District scheme (1927–1963) controlled inland streams and springs as part of a broader local drainage and waterways modification scheme
- Manawatu Catchment Board (1963) continued to control, modify and channel natural waterways
- Ōhau Manakau River Scheme (present day) this group is overseen by Horizons Regional Council who upgrade stop banks, extract gravel, and modify smaller waterways for flood control.

The last group has developed a wider environmental/ biodiversity protection focus as part of its activities, with designs for fish-friendly passes and the use of new technologies to mitigate and monitor flood risk.



TE HĀKARI DUNE WETLAND RESTORATION PROJECT THE CAPACITY FOR CORRECTION

In our highly fragmented modern natural/cultural landscape, the outcome of the wetland project for Te Hākari is highly significant. This refers not only to research on ecological restoration, but also suggests that a focus only on a species, and restoring only for that species (and its wider ecosystem) will ultimately founder if it fails to also acknowledge human relationships with the natural and cultural landscape, with place, and with the sacred realm. The implication of this for tangata whenua is unmistakable.

The restoration project for Te Hākari is grounded in a kaupapa (issue) and tikanga (values and practices) Māori epistemology of knowledge development. The hands-on project, underway since 2000, highlights how restoration of fragmented ecological systems is interdependently related to the healing of a community and its relationships with the natural and cultural landscape. For mana whenua (indigenous people with primary rights and responsibilities over an area), this is an essential related goal of ecological restoration in a broader cultural and system-wide context.

Central to the work underway for the wetland and wider coastal system has been the establishment of the Manaaki Taha Moana: Enhancing Coastal Ecosystems for Iwi and hapū (MTM) 2009–2015 research project.

This project explored kaupapa Māori approaches (approach underpinned by Māori values) to defining and valuing coastal ecosystem services of importance to iwi and hapū, and facilitated the appropriate uptake and communication of such knowledge so that it is 'heard' in decision-making processes. MTM therefore:

- identified those coastal ecosystem services that are important to iwi and hapū
- explored and activated ways of 'measuring' them alongside the traditional 'Western science' indicators of ecological health
- conducted research in such a way that tangata whenua were reunited with their natural and coastal environments
- gained understanding of aspects of customary and remaining local knowledge, and applied it in a different context from what our tūpuna might have faced in the past.

Since 2002, Te Hākari Dune Wetland has been well supported by Nga Whenua Rahui and Mātauranga Kura Taiao agencies through Te Papa Atawhai – Department of Conservation. Their objectives align with the concept of active kaitiakitanga, where hands-on projects are grounded in kaupapa and tikanga, whole-of-system, multiple-goal and action-orientated methodologies.



Processes of transformation to wetland forest from December 2002 (top) to August 2011 (bottom). Photo: Huhana Smith

CHALLENGES FOR RESTORATION OF TE HĀKARI

Impacts of environmental decline on integrity of cultural or ancestral landscape

Ideally, restoration projects led by mana whenua build on well-established oral narratives, whakapapa (genealogy), dialogue, and synthesis of research and other relevant information. The process of combining these different components into a new whole is based on the experience of hapū and iwi participants undertaking revitalisation of the fragmented ecosystems within their ancestral landscape. However, as much as there have been complex restoration challenges, there have been impacts on culture from multiple sources, including individuals, government and privately owned institutions.

Kaitiaki (guardian) working within the wider Te Hākari Dune Wetland restoration project often wondered both how well they were actually doing when dealing with such fragmented ecosystems and about the impact the project was having on their human condition. As key informants in our older generations die, knowledge, observations, and experience of place decline. This results in generations being increasingly separated from once intricate relationships to an ancestral place.

Key matters to consider for ensuring healthy water or waiora of Te Hākari Dune Wetland

- Sound research of the subsurface waterways. Research undertaken at Te Hākari (2004–2006) notes that water can be lost through evaporation from open water, transpiration from plants, flows out of drains and streams, and through groundwater outflow
- The water balance of a wetland describes the balance between the sources and discharges of water. These dynamic flows and water levels can vary substantially, both seasonally and from year to year. For example, a heavy rainfall event would cause water levels to rise temporarily. Alternatively, a seasonally depressed groundwater level may cause the wetland to dry because groundwater inflows decrease
- Groundwater-level monitoring provides information on how the wetland interrelates with the underlying water table, and how this relationship may change through the year. Monitoring data calculate the direction of groundwater flow around the wetland during the summer and winter seasons.

A strong relationship exists between the groundwater and wetland surface levels, suggesting that the wetland is vulnerable to nearby groundwater abstractions and to any contamination of groundwater by farming and nutrient pollutants in the recharge areas to the east.



PROJECT OUTCOMES TO DATE

Since allowing water to return to the wetland, the wet delta has become a significant, reinvigorated ecosystem interlinked with Te Hākari Stream, the wetland itself, the dune systems, the Ōhau River flowing to sea, and the subsurface water that flows under pressure into the ground depression, wetland itself.

Applying tikanga to, and getting it right for, Te Hākari Dune Wetland has included karakia (prayer), protocols for all researchers, and extensive rehabilitation work. Since first planting took place in September 2002,

hapū members, shareholders, and other interested parties have planted thousands of pioneer tree species into former cow-grazed paddocks. From 2003 to 2006 important hydrology research assessed subsurface water quality and the size of waterbodies beneath the wetland. Raising wetland water levels to a near natural contour since 2003 has transformed surrounding marginal pasture that was once cow pugged and nitrified. In particular, since restorative processes began with simultaneous pest control, efforts have resulted in rare birds like the matuku (Australasian bittern) breeding, and the reinstated wet delta region and Te Hākari Stream to the Ōhau River, are again teeming with inanga (whitebait).



Te Hākari Dune Wetland in 2002 (left) and after raising water levels in 2005 (right). Photo: Lawrie Cairns

CONCLUSION

Ecosystem revitalization, when drawn from local knowledge about place, relies on a promise of future wellbeing. Kaumātua (elders) and resource gatherers offered what they knew about place – particularly about Te Hākari Dune Wetland and the Ōhau estuary and coastline – based on their personal experiences and recollections. Their stories of encounters with local taniwha (spiritual guardians) or protocols observed about special places in the coastal estuarine and wetlands region, highlighted a value system that stressed respectful interactions with the natural and cultural environment.

Our tūpuna supported their activities with knowledge systems based on generations of understanding from talking about place, observing place, and developing place in a detailed way. These ways of knowing were prerequisites for maintaining a healthy environment and its customary knowledge rights, based on interactions with resources such as:

- shellfish gathering
- freshwater fishing for tuna (freshwater eels) and fish in streams, rivers and wetlands
- fishing activities at sea, and
- horticulture.

These essential activities made sense of their local world.

Because Māori values remain fundamental for forming principles and guiding philosophies for culturally based sustainable development, practical environmental projects help improve closer relationships with lands and waterways. Providing a space for our current generation to interact with their resources and to maintain active kaitiaki roles through the restoration of their wetland and coastline, means they can renew and enhance their understanding of the true significance of the cultural or ancestral landscape and the significant waterways and ecosystems with which they are dealing.



Rare and endangered matuku (Australasian bittern) feeding on inanga (whitebait) in Te Hākari Dune Wetland, October 2009.
Photo: Huhana Smith



WĪWĪ – HELPING TO RECOVER THE WETLAND'S 'MEMORY'

Wīwī (*Juncus edgariae*) is the common Māori name for a number of *Juncus* species that grow profusely in repo (wetlands), along stream banks and in other damp places. Wīwī is tolerant of a wide range of conditions and produces large quantities of microscopic seed that remain viable in the soil for years.

A healthy, revegetating fringe habitat rich with native sedges, rushes, and other appropriate wetland plants helps remove stock nutrients from water and can facilitate increases in the wider biology of the system. For example, frog numbers increase in shallow fringe habitat like those supported by wīwī, which in turn, attracts greater numbers of wading birds to feed. Reeds and rushes were also important resources for finishing off the inner linings of whare raupō (house made from raupō cladding and lining).

In the Te Hākari Stream area wīwī literally helped the dune wetland recover its memory with flushes of other rush and sedge species growing on the banks and into the former pasture area. The higher water levels led to increased sedge, local sea rush, and bulrush. Since this time, a new fish-friendly culvert has been installed, with Te Hākari Stream revegetated to estuary as part of the Kuku Ōhau Estuary revitalisation project funded by Te Papa Atawhai 2014–2017.



Wīwī in wet delta region surrounding Te Hākari Stream. Photo: Huhana Smith

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

Cooper R, Brooking R 2002. *Ways through complexities*. In: *Kawharu M ed. Whenua: managing our resources*. Auckland, Reed Publishing. Pp. 192–215.

Hardy D, Patterson MG, Smith H, Spinks A 2012. *Assessing the holistic health of coastal environments: research design and findings from cross-cultural research*. Manaaki Taha Moana Phase 1. Manaaki Taha Moana 6. Taiao Raukawa, Kuku/Massey University, Palmerston North. Pp. 34–38.

Loader P 2003. *Te Hākari wetland restoration: a case study*. Unpublished Masters thesis, Victoria University, Wellington.

Park G 2002. *Effective exclusion? An exploratory overview of Crown actions and Māori responses concerning the indigenous flora and fauna, 1912–1983*. Wellington: Waitangi Tribunal Report. 181 p.

Smith H 2008. *Hei Whenua Ora ki Te Hākari: reinstating the Mauri of valued ecosystems-history, lessons and experiences from the Hei Whenua Ora ki Te Hākari/Te Hākari Dune Wetland Restoration project, Ngā Māramatanga-ā-Papa (Iwi Ecosystem Services)*. Research Monograph Series No. 9. 33 p.

Smith, H 2009. *Ahi Kaa Roa: Mapping cultural landscape*. Final report to FRST on behalf of Te Iwi o Ngāti Tukorehe Trust.

Wehipeihana JR 1964. *Sequent economies in kuku: a study of a rural landscape in New Zealand*. MA (Geography), Victoria University, Wellington. 17 p.

Useful websites

Manaaki Taha Moana: www.mtm.ac.nz

A Ngā Whenua Rāhui article on the project: www.doc.govt.nz/news/stories/2015/june/a-legacy-of-lost-relationships

Author research

Huhana's PhD research thesis:

Smith SM 2007. *Hei whenua ora: hapū and iwi approaches for reinstating valued ecosystems within cultural landscape*. Unpublished PhD thesis. Te Pūtahi ā Toi, School of Māori Studies, Massey University, Palmerston North. <http://mro.massey.ac.nz/xmlui/handle/10179/2133>

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GLOSSARIES

NGĀ WHAKAMĀRAMA GLOSSARY OF MĀORI TERMS

Disclaimer: This glossary has been produced to support the reader in their understanding of Māori words used in this handbook. With the complex nature of the Māori language, one word can have different meanings depending on the context it is used in. This 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 were intending.

Waikato-Tainui (tribal people of the Waikato region) use double vowels instead of a macron, i.e. whaanau instead of whānau, hapuu instead of hapū, this style of writing does not change the meaning of the word.

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](#)

*Indicates definitions from Tai Tumu, Tai Pari, Tai Ao Waikato-Tainui Environmental Plan

| 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 |
| Awahi 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 |
| 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 |
| Hīkoi | To step, stride, march, walk |
| Hīnaki | Wicker eel basket Fyke net – used in this context as a method for kōura (freshwater crayfish) monitoring |
| Hongi | To press noses in greeting |
| 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 |

| K | | Kete | Handwoven basket |
|------------------------|--|------------------|--|
| Kai | Eat, food, dine | 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 |
| Kaihaukai | Tribal feast | Ki uta ki tai | Recognising the connections across landscape, people and ecosystems. Literally translated as "From the mountains to the sea" |
| Kaimahi | Worker | Koere | Bracken fern bundles used for kōura (freshwater crayfish) monitoring |
| Kāinga | Home, settlement, residence | 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 |
| Kaitiaki* | Caregiver, caretaker, guardian, the role of protecting and nurturing the māuri of all things and the surrounding inanimate environment | Kōiwi | Human bones, corpse |
| Kaitiakitanga* | The exercise of kaitiaki (guardian) roles and responsibilities. The exercise recognises the intricate balance and integral relationship between all natural resources | Korapa awa | A stop net made of shade cloth |
| | Sustainable resource management | Kōrari | Generic term for the flowers of the harakeke (NZ flax) |
| Kaka | Traditional form of the scoop net used to harvest whitebait on the lower Waikato River | Kōrero | Conversation, discussion |
| Kanohi ki te kanohi | Face to face, in person, in the flesh | Koroneihana | Coronation. The largest annual gathering of followers of the Kingitanga (King movement), celebrating the anniversary of the anointing of the Māori King or Queen |
| Kāo | No – used only as a negative answer to a question | Korowai | Cloak |
| Kapa haka | Māori performing group | Kuia | Elder woman |
| Karakia | To recite ritual chants, say grace, pray, recite a prayer, chant | M | |
| 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) | Mahau | Porch of the meeting house |
| Kaumātua* | Elders (male or female) | Mahi | Work, job, employment, trade (work), practice, occupation, activity, exercise, operation, function |
| Kaupapa | Topic, policy, matter of discussion, plan, purpose, scheme, proposal, agenda, programme, theme, issue, initiative | Mahinga kai | Customary and contemporary gathering and use of naturally occurring and cultivated foods |
| 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 | Mahinga mātaitai | Customary seafood gathering site, shellfish bed |
| Kāuta | Cooking shed, kitchen, cookhouse, house, shack, lean-to | Maimai aroha | Lament, expression or token of affection |
| Kawa | Protocols and customs | Māmā | Mother |
| Kawenata | Covenant, testament, charter, contract, agreement, treaty – any undertaking that binds parties in a permanent and morally irrevocable relationship | Mana | Authority, spiritual authority, protective power and prestige |
| | | Manaakitanga | The provision of sustenance, care, and support, particularly in the hospitality shown to manuhiri |

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|---------------------|---|
| 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* | <p>Traditional and contemporary gathering places that may contain a wharenuī (meeting house), wharekai (dining room), wharepaku (ablution block), whare (other houses or structures); may also include a papakāinga (communal Māori land)</p> <p>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</p> |
| 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 |
| 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 |

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| 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 |
| 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 | |
| Ngahere | Bush, forest |
| Ngā mihi | Acknowledgements |
| Ngāti | Prefix for a tribal group |
| Nohoanga | Dwelling place, abode |
| O | |
| Oranga | Health |
| 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 |
| Papakāinga | Original home, home base, village, communal Māori land |

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|------------------|--|------------------|---|
| Papatipu rūnanga | Uphold the mana (authority) of Ngāi Tahu (South Island tribal group) people over the land, sea, and natural resources | 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 |
| Papatūānuku | Earth, Earth mother and wife of rangi-nui – all living things originate from them | Rangi-nui | Atua (God) of the sky and husband of Papatūānuku (Earth mother) |
| Paru | Muds valued by Māori weavers for their dyeing properties | Raranga | To weave |
| Pā tuna | Eel weir, weir for catching eels | Raupatu | Confiscation, conquered, overcome. Often used in relation to forceful land acquisition |
| Pēpe | Baby, infant | Repo | Swamp, bog, marsh |
| Pepeha | Formulaic expression, saying of the ancestors | Reporepo | Swamp |
| Piupiu | Woven garment | Ringawera | Kitchen workers |
| 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 | Ritenga | Custom, customary practice, habit, practice, resemblance, implication |
| Pōtae | Hat | Rito | Growing shoot of the harakeke (NZ flax) |
| Pōtae taua | Mourning cap or wreath | Rohe | District, area, territory, vicinity, region (see takiwā) |
| Pou | Post, pole, pillar | Rongoā | Traditional medicine, remedy |
| Poukai | King movement gathering – hui (gathering) held on marae (gathering place) where people who support the Kingitanga (King movement) demonstrate their loyalty, contribute to funds, and discuss movement affairs | Rongo mā Tāne | Atua (God) of the kūmara and cultivated food |
| Pōwhiri | Welcome ceremony on a marae | Rōpū | Group, party of people, company, gang, association, entourage, committee, organisation |
| Puku | Stomach | Rūnanga | Tribal council, iwi authority |
| Puna | Spring, well, pool | T | |
| Pūtaiao | Science | Takiwā | District, area, territory, vicinity, region (see rohe) |
| R | | Take | Topic, subject, matter, issue, concern |
| Rākau | Tree, stick, timber, wood, spar, mast, plant | Taiao | Earth, natural world, environment |
| Rama kōura | Hand nets | Tangata kaitiaki | Resource manager |
| Rangahau | Research | 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 mechanisms such as maintaining ahi kā roa (long term occupation) or conquest |
| Rangatahi | Youth, younger generation | Tangaroa | Atua (God) of the sea and fish |
| 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 | Tāne mahuta | Atua (God) of the forests and birds |

| | | | |
|-----------------------|---|------------------|---|
| Taniwha | Powerful creature, leader, chief | W | |
| Taonga | Treasure – applied to anything considered to be of value including socially or culturally valuable objects, resources, phenomenon, ideas and techniques | Wāhi tapu | Sacred site, sacred place |
| Taonga species | Native birds, plants, and animals of cultural significance | Wai | Water |
| Taonga tuku iho | Heirloom, something handed down, cultural property | Waiora | Healing waters |
| Tāpau | Floor mat (see also tuwhara) | Waiata | Song |
| Tapu | Sacred, prohibited, restricted – a supernatural condition | Waikato-Tainui* | People who descend from or affiliate to a recognised Waikato-Tainui (tribal people of the Waikato Region) marae, hapū, or iwi |
| Tapu noa | To be free from the extensions of tapu (sacred), ordinary, unrestricted, void | Wairua | Spirit |
| Taruke | Fern bundles used for kōura (freshwater crayfish) monitoring | Wairuatanga | Spirituality |
| Taua | War party | Waka taua | War canoe |
| Tau kōura | Method of catching kōura (freshwater crayfish) | Wānanga | Seminar, conference, forum, educational seminar Tribal knowledge, lore, learning |
| Tāwhirimātea | Atua (God) of the winds, clouds, rain, hail, snow and storms | Wero | Challenge |
| Te Ika-a-Māui | North Island of New Zealand | Whaiora | Pursuit of wellness |
| Te Reo Māori | Māori language | Whakaaro* | Thought, opinion, plan, understanding, idea, intention, gift – philosophy |
| Te tira hoe o Waikato | The paddling crew of Waikato | Whakaaroaroa | To ponder, consider carefully, logic |
| Te Wai Pounamu | South Island of New Zealand | Whakakotahitanga | To unify, integrate, unite |
| Tikanga | The customary system of values and practices that have developed over time and are deeply embedded in the social context | Whakapapa | Genealogy, lineage, descent, layers of kin relationships Connections between and within flora/fauna species |
| Tohu | Sign, mark, symbol, indicators of an event | Whakaponotanga | Epistemology |
| Tohunga | Chosen expert, healer | Whakatauāki | Proverb, significant saying; where the person who said it first is known |
| Tohunga whakairo | Master carver | Whakatauki | Proverb, significant saying; where the person who said it first, is not known |
| Toi whenua | Customary designation for hapū (subtribe) holding ancestral rights to a particular area | Whakaweku | Bracken fern bundles used for kōura (freshwater crayfish) monitoring |
| Tūmatauenga | Atua (God) of war | Whānau* | Family unit, not always immediate family, and may include those that are family by marriage, adoption, fostering, or other close relationship |
| Tupuna/tūpuna | Ancestor/ancestors | Whanaungatanga | Relationship, kinship, sense of family connection |
| Tupuna awa | Ancestral river | Whānui* | Broad, wide, extensive |
| Tuwhara | Floor mat (see also tāpau) | Whare | House |
| U | | Whenua | Land |
| Uenuku | Atua (God) of the rainbow | Whetūrangī | To appear above the horizon (a star or the moon) |
| Urupā | Burial grounds | | |

LIST OF FLORA AND FAUNA SPECIES

| | A sample of Māori name(s) | Common names | Scientific Names |
|--|------------------------------------|---------------------------------------|--|
| Ngā ika Fish | Īnanga, ĭnaka, karohi, karohē | Whitebait, ĭnanga | <i>Galaxias maculatus</i> |
| | Kahawai | Kahawai | <i>Arripis trutta</i> |
| | Kanae | Grey mullet | <i>Mugil cephalus</i> |
| | Kōkopu | Giant kōkopu | <i>Galaxias argenteus</i> |
| | | Shortjaw kōkopu | <i>Galaxias postvectis</i> |
| | | Banded kōkopu | <i>Galaxias fasciatus</i> |
| | Kōaro | Kōaro, climbing galaxias | <i>Galaxias brevipinnis</i> |
| | Matamata, Ngā karu o Matariki | Whitebait, No. 1 whitebait | <i>Galaxias</i> spp. |
| | Morihana | Common gold fish | <i>Carrassius auratus</i> |
| | Piharau, kanakana | Lamprey | <i>Geotria australis</i> |
| | Porohe | Smelt, cucumber fish, No. 2 whitebait | <i>Retropinna retropinna</i> |
| | Tunatuna | Glass eel | <i>Anguilla</i> spp. |
| | Tuna | Long-fin eel Short-fin eel | <i>Anguilla dieffenbachii</i> <i>A. australis</i> |
| | | Brown bull-headed cat fish | <i>Ameiurus nebulosus</i> |
| | Bullies | <i>Gobiomorphus</i> spp. | |
| Ngā mātaītai Molluscs & bi-valves | Kāeō, kākahi | Freshwater mussel | <i>Echyridella menziesii</i> |
| | Kōura, kēwai | Freshwater crayfish | <i>Paranephrops planifrons</i> <i>P. zealandicus</i> |
| | Kūtai, kuku | Green-lipped mussel | <i>Perna canaliculus</i> |
| | Pipi | Pipi | <i>Paphies australis</i> |
| | Pūpū | Cat's eye | <i>Turbo smaragdus</i> |
| | Tuatua, kahitua | Tuatua | <i>Amphidesma subtriangulatum</i> <i>Paphies subtriangulata</i> |
| Ngā tipu taketake Native plants | Harakeke | New Zealand flax | <i>Phormium tenax</i> |
| | Kahikatea | White pine | <i>Dacrycarpus dacrydioides</i> |
| | Kānuka | Kānuka | <i>Kunzea ericoides</i> |
| | Kareaō, piritā | Supplejack | <i>Ripogonum scandens</i> |
| | Kauri | Kauri | <i>Agathis australis</i> |
| | Kiekie | Gigi bush, gigi | <i>Freycinetia banksii</i> |
| | Kōkihi, rengamutu, tūtāe-ika-moana | Native spinach | <i>Tetragonia</i> spp. |
| | Kōwhai, kō'wai | Kōwhai | <i>Sophora</i> spp. |
| | Kowhangatara | Spinifex | <i>Spinifex sericeus</i> |
| | Kōwhitiwhiti, poniu, panapana | Native watercress | <i>Rorippa</i> spp. |
| | Kuta, ngāwhā, paopao | Giant spike sedge | <i>Eleocharis sphacelata</i> |
| | Mānuka, kahikatoa | Mānuka, tea tree | <i>Leptospermum scoparium</i> |
| | Mapou | Mapou | <i>Myrsine australis</i> |
| | Mataī | Mataī | <i>Prumnopitys taxifolia</i> |

| | A sample of Māori name(s) | Common names | Scientific Names |
|---|---------------------------|----------------------------------|---|
| Ngā tipu taketake Native plants continued ... | Miro | Miro | <i>Prumnopitys ferruginea</i> |
| | Mouka, mātātā | Water fern Hen & chicken fern | <i>Histiopteris incisa</i> <i>Asplenium bulbiferum</i> |
| | Nahui | Nahui | <i>Alternanthera nahui</i> |
| | Nau | Cook's scurvy grass | <i>Lepidium oleraceum</i> |
| | Pānakenake | Pratia | <i>Lobelia angulata</i> |
| | Pīngao | Pīngao, golden sand sedge | <i>Ficinia spiralis</i> |
| | Ponga | Silver fern | <i>Cyathea dealbata</i> |
| | Puha | Sow thistle | <i>Sonchus</i> spp. |
| | Pūrekireki, pūrei | Carex, swamp sedge | <i>Carex virgata</i> <i>Carex secta</i> |
| | Purua | Purua grass | <i>Bolboschoenus fluviatilis</i> |
| | Rauparaha | Shore bindweed | <i>Calystegia soldanella</i> |
| | Raupō, koarearea | Raupō, bulrush | <i>Typha orientalis</i> |
| | Rimu | Rimu | <i>Dacrydium cupressinum</i> |
| | Tauhinu | Tauhinu | <i>Ozothamnus leptophyllus</i> |
| | Ti kōuka, kōuka, mauku | Cabbage tree | <i>Cordyline australis</i> |
| | Toetoe | Toetoe | <i>Austroderia</i> spp. |
| | Tōtara | Tōtara | <i>Podocarpus totara</i> |
| | Tūtae kōau | Native celery | <i>Apium prostratum</i> subsp. <i>prostratum</i> var. <i>filiforme</i> |
| | Tūtunawai | Swamp willow-weed | <i>Persicaria decipiens</i> |
| | Ūpoko-a-tangata | Giant umbrella sedge | <i>Cyperus ustulatus</i> |
| | Ureure (tidal) | Glasswort | <i>Sarcocornia quinqueflora</i> |
| | Wātakirihi | Common watercress | <i>Nasturtium</i> spp. |
| | Wharariki | Mountain flax | <i>Phormium cookianum</i> |
| | Wiwī | Rushes | <i>Juncus</i> spp. |
| | | Bulrush, three-square | <i>Schoenoplectus pungens</i> |
| | | Machaerina | <i>Machaerina rubiginosa</i> |
| | | Sand coprosma | <i>Coprosma acerosa</i> |
| | Restiad | <i>Sporadanthus</i> spp. | |
| | Rush | <i>Empodisma</i> spp. | |
| | Sedge | <i>Isolepis prolifera</i> | |
| | Shore pimpernel | <i>Samolus repens</i> | |

| | A sample of Māori name(s) | Common names | Scientific Names |
|--|----------------------------|---|---|
| Ngā tipu mai tāwāhi Exotic plants | Rākau Pākeha | European Alder | <i>Alnus glutinosa</i> |
| | | Alligator weed | <i>Alternanthera philoxeroides</i> |
| | | Blackberry | <i>Rubus</i> spp. |
| | | Crack willow | <i>Salix fragilis</i> |
| | | Grey willow | <i>Salix cinerea</i> |
| | | Gum tree | <i>Eucalyptus</i> spp. |
| | | Hornwort | <i>Ceratophyllum demersum</i> |
| | | Kikuyu grass | <i>Cenchrus clandestinus</i> |
| | | Macrocarpa | <i>Cupressus macrocarpa</i> |
| | | Pampas | <i>Cortaderia</i> spp. |
| | | Pine | <i>Pinus radiata</i> |
| | | Reed sweetgrass | <i>Glyceria maxima</i> |
| | | Wandering jew, wandering willy | <i>Tradescantia fluminensis</i> |
| | | Yellow flag iris | <i>Iris pseudacorus</i> |
| | | Yorkshire fog | <i>Holcus lanatus</i> |
| Ngā manu Birds | Kāhu | Swamp harrier | <i>Circus approximans</i> |
| | Kāruhiruhi | Pied shag | <i>Phalacrocorax varius</i> |
| | Kawau, kawau-tua-whenua | Black shag, great cormorant | <i>Phalacrocorax carbo</i> |
| | Kawau paka | Little shag | <i>Phalacrocorax melanoleucos</i> |
| | Kawau tūi | Little black shag, little black cormorant | <i>Phalacrocorax sulcirostris</i> |
| | Kiwi | Kiwi | <i>Apteryx</i> spp. |
| | Korimako, makomako | Bellbird | <i>Anthornis melanura</i> |
| | Kōtare | Sacred kingfisher | <i>Todiramphus sanctus</i> |
| | Kotuku | Kotuku, egret | <i>Egretta alba modesta</i> <i>E. garzetta immaculatae</i> |
| | Kotuku-ngutupapa | Royal spoonbill | <i>Platalea leucorodia regia</i> |
| | Kuru whengi | Spoonbill, NZ Shoveler | <i>Anas rhynchos variegata</i> |
| | Matuku | Australasian bittern | <i>Botaurus poiciloptilus</i> |
| | Matuku-moana | White-faced heron, blue crane | <i>Ardea novaehollandiae</i> |
| | Papango | Scaup, black teal | <i>Aythya novaseelandiae</i> |
| | Pūweto, putoto | Spotless Crake | <i>Porzana tabuensis</i> |
| | Riroriro | Grey warbler | <i>Gerygone igata</i> |
| | Ruru, ruru-koukou, koukou | Morepork, NZ owl | <i>Ninox novaeseelandiae</i> |
| | Tauhō | Silveryeye | <i>Zosterops lateralis</i> |
| | Tūi, koko | Tui, parson bird | <i>Prosthemadera novaeseelandiae</i> |
| | Weka | Woodhen | <i>Gallirallus australis</i> |

| | A sample of Māori name(s) | Common names | Scientific Names |
|------------------------------------|---------------------------|--|--|
| Ngā whāngote Mammals | Kiore | Rat | <i>Rattus</i> spp. |
| | Pekapeka | Short-tailed bat Long-tailed bat | <i>Mysticina tuberculata</i> <i>Chalinolobus tuberculatus</i> |
| | Tuatara | Tuatara | <i>Sphenodon</i> spp. |
| | | Common (brushtail) Possum | <i>Trichosurus vulpecula</i> |
| | | Ferret | <i>Mustela</i> spp. |
| | | Mouse | <i>Mus</i> spp. |
| | | Stoat | <i>Mustela</i> spp. |
| Ngā tuaiwi-kore Invertebrates | Anuhe, moka, mūharu | Windower caterpillar (native) | <i>Orthoclydon praefactata</i> |
| | Mokamoka harakeke | Flax notcher caterpillar (native) | <i>Tmetolophoto steropastis</i> |
| | Noke, toke | Earthworm (native) | <i>Megascolides maoricus</i> |
| | Noke, toke | Earthworm (native) | <i>Octochaetus multiporus</i> |
| | Pāpapa, tātaka | Ground beetle (native) | <i>Physolaesthus insularis</i> |
| | Toke tūtae tawhiti | Dung worm (exotic) | <i>Lumbricus rubellus</i> |
| | Toke momo rāwaho | Asian snake worm (exotic) | <i>Amyntas cortices</i> |
| | Toke momo rāwaho | Earthworm (exotic) | <i>Octolasion tyrtaeum tyrtaeum</i> |
| | Toke (Te Tai Tokerau) | North Auckland giant earthworm (native) | <i>Spenceriella gigantea</i> |
| | Wētā | Wētā | <i>Stenopelmatidae</i> spp. <i>Rhaphidophoridae</i> spp. |
| | | Daphnia | <i>Daphnia galeata</i> |

'Te Reo o Te Repo has captured the essence of our traditional tribal beliefs and incorporates the latest scientific research. The blend of maatauranga will be a spring board for future environmental biologists, it will aid in the never ending and ongoing research that must continue for us to maintain the healthy state of our wetlands and rivers.'

Rahui Papa (Ngaati Koroki-Kahukura)
Chairman of Te Arataura o Waikato-Tainui

