



**Ngati Tahu-Ngati Whaoa
Te Haerenga Whakaoranga Koura**

A Journey of Koura Restoration



Ngati Tahu-Ngati Whaoa koura group

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MIHI - GREETING

E Te Atua Kaha Rawa, nga whakawhetai ki a koe mo nga rauemi kei a matou tonu. Ko te inoi, awhinatia to matou mahere whakaora me te tiaki i era kei te anga atu ki te ngaro, ina hoki te koura waimaori.

I homai ki te hunga tangata te kaitiakitanga o tenei whetu ao, kahore ki nga atua ke e kore nei o ratou tauoranga. No reira manakitia matou te Iwi o Tahu Matua, me ratou e whakahaere ana e awhina ana i tenei Mahere Whakaora Koura. Amine.

Mai i te tiro a-Maori, kei te piri hono tona iwi kite whenua me tea o tuturu. Ko te tirohanga, he wahanga tuturu tatou, te hunga tangata, o tenei ao taiao. Ko tenei te putake o te kaitiakitanga.

Na te tikanga o nga mahi koha-kai, me te whakamana rahui, I awhinatia ai te taiao me te atawhai o nga rauemi.

Na roto I nga mahi whakatapua o nga kaimahi taiao o te Runanga Whakawhirinaki o Ngati Tahu-Ngati Whaoa, I piki ai te aro mo nga kaupapa whakaora.

Kaore ano e ngaro te awhina o NIWA. E mohio ana te Runanga ki te tautoko o enei mahi rangahau. Na tenei i taea ai e matou te haerenga mai i tetahi wahi matauranga.

Kei te mihi atu matou ki te hunga ka panuitia tenei mahere, me te tumanako ka mahi tautoko ratou ki te whakaruruhau i tenei taonga te koura waimaori. Nga mihi hoki ki te iwi, me etahi atu I mahi huihuinga ngatahi, mo te whakapainga o tenei rauemi.

Ki te Atua, to tatou Kaiwhakaora, te kororia, te nui, te kaha te mana, aiane, a ake ake, Amine

Tena tatou katoa
TH Fraser

Almighty God, we thank you for the resources that we still have. We pray that you help us with our restoration plan to restore and conserve, those that are heading toward depletion, especially the freshwater crayfish.

You gave humanity guardianship of this planet, and not other gods that do not exist. Therefore, bless our tribe Tahu Matua and those administering and helping with this koura restoration plan. Amen.

From a Maori perspective, its people are closely connected to the land and nature. Guardianship is based on the view that we, as humanity, are an integral part of this natural world.

Traditional food-gathering practices, and authorising temporary bans, helped to care for the environment and the preservation of resources.

Through the dedicated endeavours of the environmental staff of the Ngati Tahu-Ngati Whaoa Runanga Trust the interest in restorative programmes has escalated.

The assistance of NIWA has not gone unnoticed. The Runanga recognise the support given via research. This has enabled us to come from a place of knowledge.

We recognise those who may read the plan and hopefully act in supporting the protection of fresh water crayfish, which is a treasured species. Thank you to those of the Tribe, and others for working together as a collective, for the betterment of this resource.

To the only God our Saviour be, glory and majesty, dominion and power, both now and forever. Amen.

Greetings to all
TH Fraser

WHAKAMIHI - ACKNOWLEDGEMENTS

This project was enabled through the Ministry of Business, Innovation and Employment (MBIE) funded Cultural Keystone Species (CKS) programme led by the National Institute of Water and Atmospheric Research (NIWA).

This plan was part of the koura specific component of the bigger CKS project. Without the support of Erica Williams, Sue Clearwater, Ian Kusabs and Kelly Ratana the study or “closer look at the koura-kind” would not have been as comprehensive had we not had your support. Nga mihi aroha ki te iwi o Ngati Tahu-Ngati Whaoa, sincere acknowledgements to everyone who has participated in the development of this Koura Restoration Plan. You have been fondly dubbed “the koura group”. Thank you for making this a fun journey where we’re all learning together and I look forward to more mahi in the future. Last but not least acknowledgement must go to Johlene Kelly who has worked tirelessly for our Runanga in the mahinga kai space.

E waka eke noa – A journey we can all embark on.



image credit : Lexus Wharekawa

KUPU WHAKATAKI - FOREWORD

Nga mihi mahana ki a koutou katoa.

As an iwi we have had growing concerns for a number of years around the declining number of koura found in our waterways. Whanau members were realising that tuna and pest fish numbers were increasing and koura numbers were drastically decreasing. This prompted our Runanga to embark on the mahinga kai journey, starting with a scoping report in 2014, leading through to the recent NIWA CKS programme. This research enabled our people to come together to focus solely on koura. During the course of nearly two years we have been able to interview our people to collect korero and gather at our marae for wananga to get a “close encounter of the koura-kind”. Our ropu has flourished as we’ve grown in whanaungatanga and manakitanga while learning about the life cycle and habitat of koura, spot-lighting for koura with Sue Clearwater and gathering bracken with Ian Kusabs to make and set tau have been an absolute highlight. To our next generation of Kaitiaki – kia kaha, kia maia, kia manawanui this is a life-long journey to protect the treasures that we have been entrusted with.

Evelyn Forrest

Environmental Manager
Ngati Tahu-Ngati Whaoa Runanga Trust Trustee

WHAKATAKINGA – INTRODUCTION

This koura restoration plan is designed to support the ongoing development of our understanding of koura in our rohe¹, as a first step towards restoring the health and wellbeing of our koura populations and the connection between our iwi and this taonga (treasured) species.

This plan has not been undertaken in isolation and links strongly with our Iwi Environmental Management Plan “Te Aranga ake I te Taimahatanga” including our values (pou), aspirations, goals and actions, particularly for wai (water) and more broadly mahinga kai (resource gathering practices and all that they encompass). Te haerenga whakaoranga koura (this plan) uses this wider framework and provides more detail specific to achieving koura restoration. We also recognise that positive outcomes for koura are likely to provide benefits to our wai or waterways and other mahinga kai species.

Our specific aspirations for koura captured in this plan are:

- Koura are common throughout our rohe and are easily available for our iwi, particularly our tamariki and rangitahi to recognise, understand and interact with;
- Koura are available for some harvest by our iwi to ensure our tikanga and kawa associated with this taonga species is alive and well and passed between older and younger generations and within whanau;
- That our people are engaged with koura as one of our taonga mahinga kai species and are actively involved in restoration activities;
- That these restoration activities encourage affirmation and learning of our kawa and tikanga associated with koura;
- To raise awareness within our iwi, our community and other stakeholders regarding issues and impacts that have caused a decline in koura abundance and distribution;
- To provide direction and information about what we believe are practical steps, options and tools to address these issues and impacts;
- That the direction and options set out in this plan are embraced by all to achieve an overall increase in the distribution and abundance of koura in our rohe within the next 20 years.

This plan also has strong connections to other threads of our work specific to mahinga kai that our iwi have completed such as the Nga Tohu o te Taiao project, the Ngati Tahu-Ngati Whaoa mahinga kai booklet and various other environmental projects. Figure 1 on the next page illustrates the connections between this mahi.

1. We use the Maori word rohe throughout this document to indicate the extent of our current tribal boundaries as recognised through Treaty of Waitangi processes. The area within the rohe boundary is where we have mana whenua and can be referred to as our takiwa (region) or our whenua (lands).

Ngati Tahu - Ngati Whaoa Iwi Enviromental Management Plan “ Te Aranga Ake I te Taimahatanga”

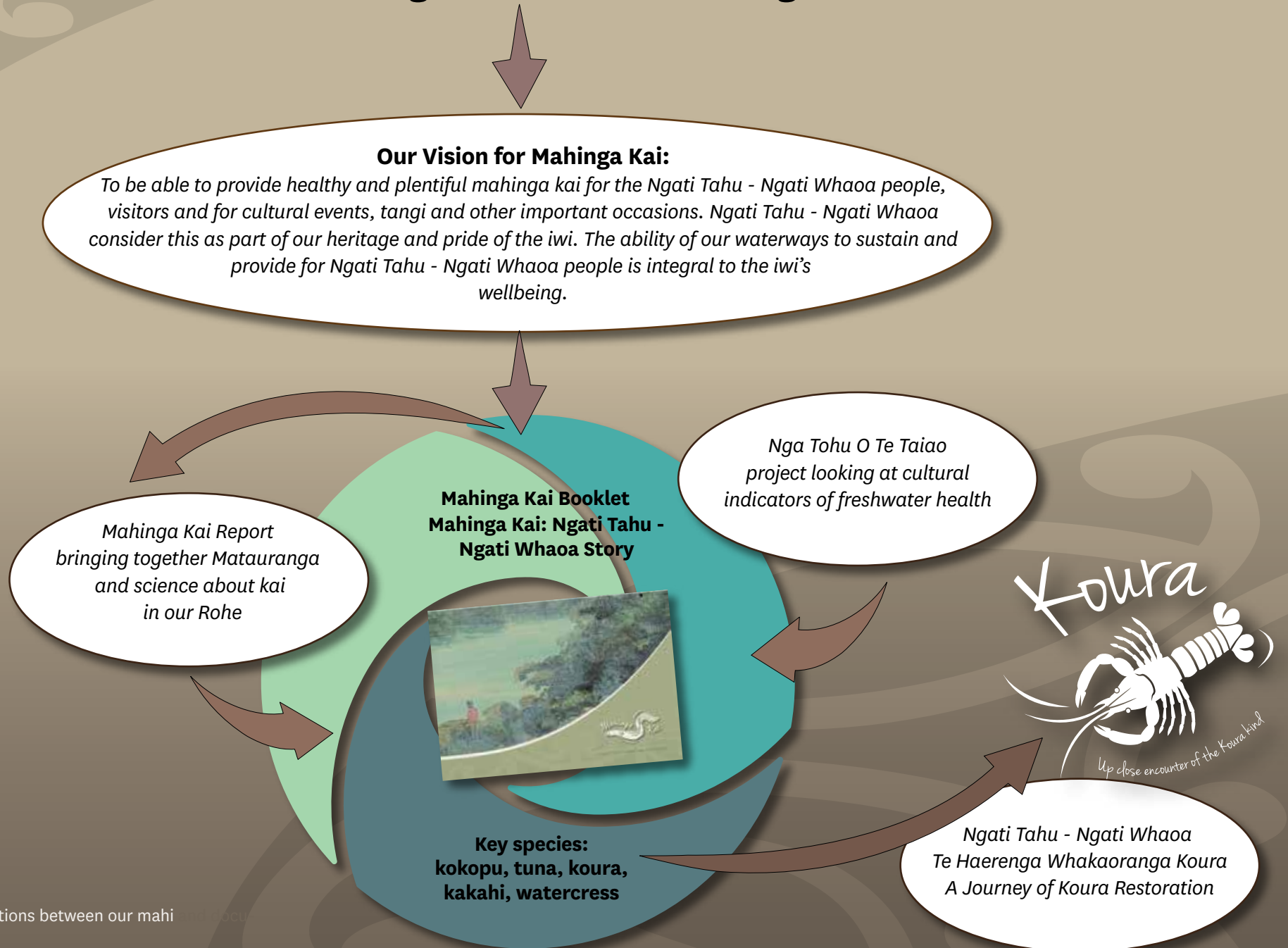


Figure 1: Connections between our mahi

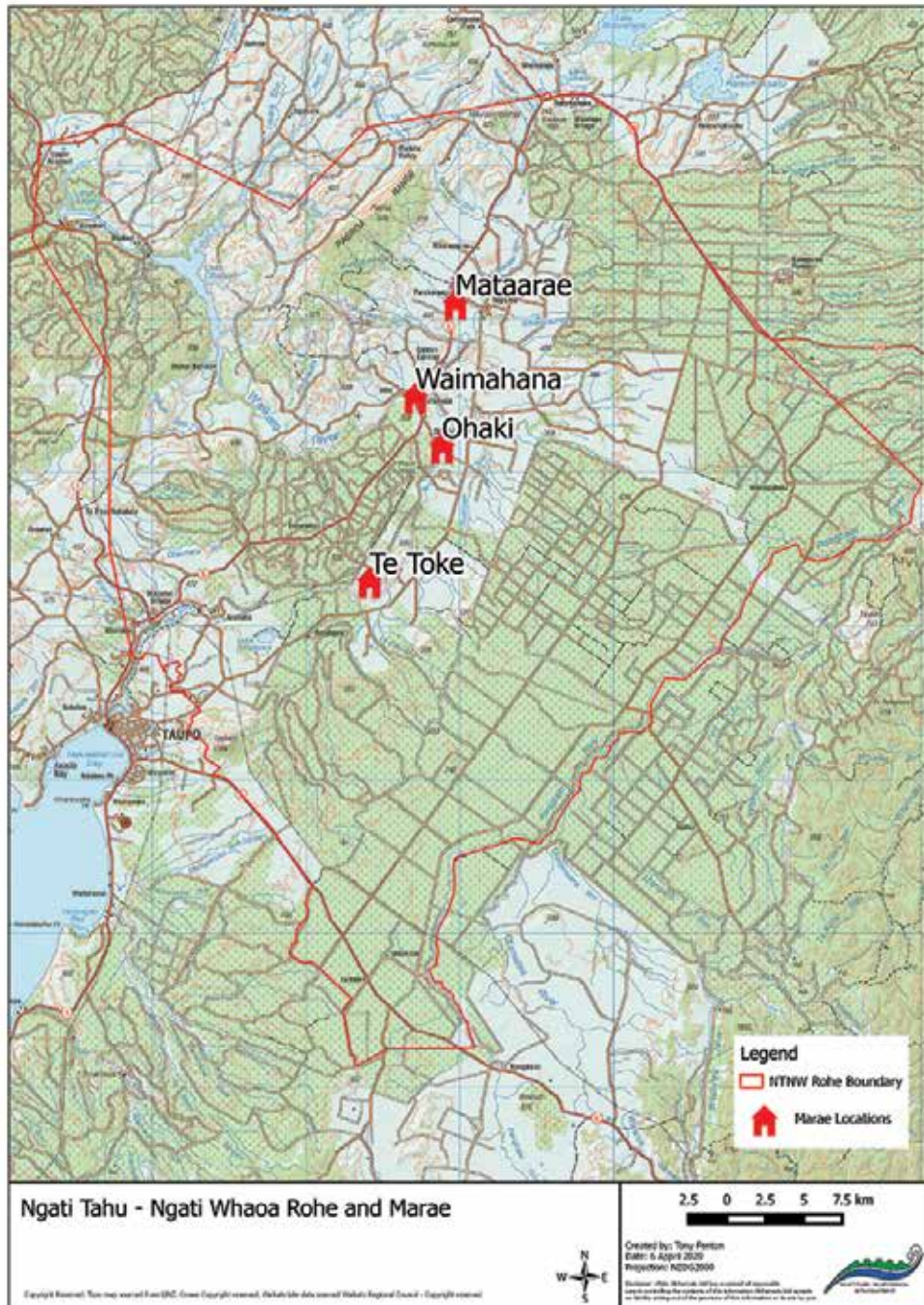
TE WHAINGA O TENEI MAHERE – PURPOSE OF THIS PLAN

This plan is intended for restoration of koura within the rohe of Ngati Tahu-Ngati Whaoa. These boundaries are defined by our pouwhenua which describe the geographical marker points of the lands and waterways in which Ngati Tahu-Ngati Whaoa are recognised as an iwi with mana whenua.

From Te Waiheke o Huka in the south, we extend east to our pouwhenua at Ngapukereru beyond the Te Awa o Rangitaiki, then northward across the plains of Kaingaroa to Wairapukao and further on to Pekepeke. From here we extend to our northern pouwhenua at Maunga Kakaramea, turning west to the Paeroa Range and on to Orakei Korako on the banks of Te Awa o Waikato, the birth place and principal kainga of Ngati Tahu-Ngati Whaoa. From Orakei Korako we extend further west to Pohaturoa, an ancient pa site. Three of our four marae are located adjacent to Te Awa o Waikato and one is on a tributary of the awa – the Mangahoanga stream.



Mataarae Marae and the Mangahoanga stream



Map 1 shows the extent of our rohe and the location of our marae.

This plan seeks to provide our people with information and options to actively engage in koura restoration within our rohe. We wish to ensure koura will still be present for future generations to recognise, connect with and enjoy. We see this document as capturing the key themes of what might be possible, what we need to consider along the way and how we might achieve our goals in the most effective and efficient manner.

Restoration means a range of things to different people and can be as simple or as complex as anyone wishes it to be. The guiding principle of this plan is to encourage participation and to encourage our people and others to “give it a go”. The plan is also for use by other individuals, agencies and entities to provide information on our history and aspirations in relation to koura and how we hope to achieve these. We hope others share our vision and may take the opportunity to work with us towards their restoration in our rohe.

*“MA PANGO MA WHERO, KA OTI TE MAHI”
“WITH YOUR SHARE AND MY SHARE THE WORK WILL BE DONE.”*

I PEHEA TE WHANEKETANGA O TENEI MAHERE - HOW THE PLAN WAS DEVELOPED

To develop this plan, all the information that has been previously gathered by Ngati Tahu-Ngati Whaoa Runanga Trust which specifically relates to koura has been collated, and supplemented with additional interviews with iwi members. The additional interviews were focused on asking questions specifically relating to koura.

Two iwi wananga were also held to help reconnect our iwi with koura, learn about their lifecycle, their habitat needs and what is impacting on them in our rohe. These wananga also allowed us to practice our harvest techniques including netting and making and deploying tau koura. From these wananga we formed a small advisory group of our people who have provided input and feedback on this plan.



Hui Nani

SOUTHERN
TR. RESPONSE A.P.

TE WHAKATAKOTORANGA O TE MAHERE - HOW THE PLAN IS SET OUT

We have developed the plan in five parts to create a pathway for our koura journey – our haerenga.

TUATAHI - PART ONE

Provides background information and is an overview of our people and our relationship with our awa. It also provides information on our mahinga kai journey and how we see our mahinga kai as an expression of our values – how it all fits together for us.

TUARUA - PART TWO

Covers the importance of koura to us as an iwi as well as their role in aquatic ecosystems. We've also summarised what information we know on the recent and current distribution of koura in our rohe.

TUATORU - PART THREE

Captures what we know about koura and their preferred habitat, lifecycle and diet. We identify what we know about why koura have declined, the key issues causing this decline and their relative impacts on our koura populations.

TUAWHA - PART FOUR

Presents our ideas for restoring koura in our rohe and the tools that we can use to address the issues and impacts to achieve our aspirations. This section includes goals and actions as well as identifying who might be part of the various threads of mahi (work).

TUARIMA - PART FIVE

Is a “how to” section and captures some of the most important things our people and others may need to think about when undertaking koura restoration work.

As our work progresses, up-to-date information on our mahi and progress on actions can be found on the website of Ngati Tahu-Ngati Whaoa Runanga Trust: www.tahu-whaoa.iwi.nz

TUATAHI: NO HEA TE KAUPAPA – PART ONE: BACKGROUND

Part one provides an overview of our people and our relationship with our awa. We chart our story of our mahinga kai journey so far including how we see our mahinga kai as an expression of our values – what it means to us and how it all fits together.



TO MATOU IWI ME TO MATOU AWA - OUR PEOPLE AND OUR RIVERS

The origins of Tahu Matua, our eponymous ancestor can be traced back to his arrival on the shores of Aotearoa in 1250AD. His migration took place more than a century prior to the arrival of the Arawa, Matatua and Tainui waka which historians accept arrived in Aotearoa circa 1350AD.

Tahu Matua entered the central North Island plains from the east, forging Te Awa o Rangitaiki and establishing the rohe's easternmost boundary point at Ngapuketuru. Tahu Matua then navigated the central North Island on a journey of discovery and set out into the wider plateau to the east and west of Te Awa o Rangitaiki, finally settling with our tupuna (ancestors) on the banks of Te Awa o Waikato at Orakei Korako - the ukaipo (birthplace) of our iwi.



Kohatu at Orakei Korako

We are a river people who have occupied the lands adjacent to and extending beyond Te Awa o Waikato and into Te Awa o Rangitaiki for more than 750 years. We have always utilised Te Awa o Waikato, its tributaries and historically had both permanent and temporary kainga, cultivations and food harvest areas from near Taupo to below Atiamuri. Our ancestor's movement along the river was in response to seasonal changes and harvest times and they capitalised on the micro-climates and diverse soils across our rohe to find winter and summer safe areas.

Our ancestors cultivated and harvested seasonal food and during winter many people resided at the geothermal areas throughout the rohe to make the most of the natural warmth. During the summer months our iwi would use trails up the Pueto and Torepatutahi streams to cross into the upper Rangitaiki catchment and would harvest from permanent gardens along Te Awa o Rangitaiki as well as source flax, mahinga kai, birds and later, pigs. Trade routes established on other trails along Te Awa o Waikato also hold significance as resting places, pa or battle sites. Movement throughout the rohe was also in response to various inter-tribal conflicts and the intermittent presence of war parties.

Food was often cooked in the various ngawha (hot springs/pools) and there were larger settlements at key locations which had suitable areas for habitation. These included Ohaki and Orakei Korako.

Up until the contact period with Europeans, kokopu, eels, koura and birds provided the staple protein diet for our people. Harvest also included materials used for weaving and medicine and a range of other activities.

Although our people have resided in the upper reaches of Te Awa o Waikato for over 750 years, the available oral and documented accounts inform us that Ngati Tahu-Ngati Whaoa rights to mahinga kai within our rohe span back at least four hundred years. Some mahinga kai places were used in common with other tribes, while, harvest from other sites was considered a slight that could result in death. Our ancestors also were active resource users and utilised constraints such as rahui (a temporary restriction) as a means to manage the food resources in the area.

Tributaries of Te Awa o Rangitaiki are also known to hold significance for our iwi including the Whaeo and Otamatea Rivers, Flaxy Creek and streams such as Waikaukau, Otangimoana, Mangatiti, Waitaruna, Waitamawahine and Pekepeke.

Our rohe encompasses parts of both Te Awa o Waikato and Te Awa o Rangitaiki. Both are resources of great cultural, historical, traditional and spiritual significance to our people. Our relationship with nga awa (both rivers) and our respect for them, gives rise to our responsibilities to protect them and all they encompass. This relationship also confers our ability to exercise our mana whakahaere in accordance with long established tikanga to ensure their wellbeing.



Orakei Korako prior to creation of Lake Ohakuri (ca ~1930)
Image credit: Whites Aviation Ltd: Photographs Ref: WA-62646-G Description:
Alexander Turnbull Library.



People on waka – Te Awa o Waikato near Broadlands
Image credit: 2-V464 Sir George Grey Special Collections; Auckland Library

TO MATOU WHAINGA MAHINGA KAI – OUR MAHINGA KAI JOURNEY

Our mahinga kai haerenga began with our tupuna and has, in various forms, continued through until the present day. Recently, the affirmation and recognition of the significance of our awa to our people has been recognised through Treaty of Waitangi settlement processes. This new era of co-management has provided us with enhanced opportunities to engage in a range of mahi including gathering information on mahinga kai, beginning the process of restoration of our waterways and enabling us to revitalise our cultural practices.

To date, much of our mahinga kai mahi has focused on gathering information to establish knowledge of our present status and using this to guide our pathway forward. Aspects of our mahi have included collation of both matauranga (knowledge) from our people as well as science based information on our taonga species and issues affecting them. We undertook surveys of our streams to establish distribution of our taonga species and we are currently undertaking restoration projects and engaging our people through wananga and other activities.

One aspect of our journey has been our participation in the Nga Tohu o te Taiao project (NToTT). The NToTT project aimed to develop knowledge, tools and processes for setting freshwater limits for mahinga kai within the National Objectives Framework for freshwater². Our participation enabled us to expand on our collation of Ngati Tahu-Ngati Whaoa matauranga and develop tools to express our values under key themes.

We interviewed iwi members and grouped all of the information we gathered from our people under several key themes – tikanga (protocols), kaupapa (principle/intent), tangata (people), tuku iho (handed down), whakakitenga (observation), take (issue) and tohu (sign/state). From these themes we produced a mind map for each mahinga kai species, including one for koura (Figure 2).



Mahinga kai app launch 2017

² The National Objectives Framework (NOF) for freshwater provides a management framework for setting different values for a particular freshwater lake, river or stream. The NOF for freshwater is the mechanism for achieving the National Policy Statement for Freshwater management (2011) which requires councils to set freshwater objectives and limits in their regional plans. For more information see <https://www.mfe.govt.nz/publications/fresh-water/freshwater-reform-2013-and-beyond/message-ministers>



Figure 2: Ngati Tahu-Ngati Whaoa Koura Mind Map



Koura from Te Awa o Waikato tributary



Whanau at koura wananga, 2020

Using the information from the mind map and the key themes for koura and tuna, we developed our version of the logic wheel (Figure 3 page 20). The logic wheel enabled us to clearly articulate our approach to mahinga kai and aligns with the values (pou), actions and aspirations that we have in our Iwi Environmental Management Plan – Te Aranga ake I te Taimahatanga. The logic wheel has its foundation in the key values held by our people including: kaitiakitanga, manakitanga, matauranga maori, whanaungatanga and mana whakahaere – all of which are strongly linked to mahinga kai.

Kaitiakitanga encompasses both knowing and accessing our taonga including koura, plants and animals, land, water, and geothermal resources. It supports our ability to practice kaitiakitanga through rahui and by influencing the current rules and regulations. It is about having our resources present and able to maintain their own mauri. A key to practicing kaitiakitanga for our people is to understand the challenges in maintaining the mauri of that resource. This plan helps us to understand these challenges for koura.

The practice of **manakitanga** is essential to the mana (authority and prestige) of the people. It embodies the concepts of tautoko (supporting each other), whanau (families keeping connected, marae (iwi members remaining a part of the wider community and grounded in our central meeting places), as well as a collective iwi identity. Manakitanga is also fundamental to our iwi-specific principles relating to our customary use and traditional associations.

Manakitanga is expressed as the desire of our whanau to gather kai like koura, with the intention to feed our own whanau, share with other whanau, provide for our kaumatua who can no longer gather kai themselves, and contribute to our marae for our manuhiri during times of need or for functions. This is in contrast to the concept of obtaining commercial gain from these activities.

Matauranga Maori is essential to both manakitanga and kaitiakitanga, as it is the knowledge base on which these practices are founded. For our people, this encompasses elements of *tuku iho* (intergenerational transfer), *ahi ka roa* (maintaining home fires and association), *tikanga* and *kawa* (traditional practices and protocols) and *te puna matauranga* (the combined knowledge and experience of our people). It includes the gathering of *korero* as well as research. Matauranga Maori provides us with a pathway to inform management methods and improve the health and well-being of our *mahinga kai*.

Our knowledge and stories have developed over time with changes to our environment and way of life. It is important to collect these stories of our people, to understand where we have come from, where we are going, and how our people have adapted. The stories gathered from our people have given us important insight into the life and times of our *iwi* and the landscape changes that have occurred, which is demonstrated in the *korero* (conversations/discussions) shared by *whanau* surrounding the locations and practices associated with *koura*.



Sharing our matauranga, Koura wananga 2020

There is knowledge and skill that needs to be passed from generation to generation, so it is not lost over time. Many of our people still hold practical knowledge, for example, how to set *hinaki* (nets), where to fish and how to fish by the moon, which they are still practicing themselves. The desire to pass this knowledge on will ensure not only that cultural practice is maintained, but so too is the ability of our people to gather for sustenance.

Whanaungatanga links these korero together and underpins kaitiakitanga, manakitanga and matauranga Maori. For our whanau, this value centres on the relationships and connectedness between people, place and taonga. There is a strong sense of whanaungatanga when thinking about mahinga kai such as koura. It embodies spending time together as a whanau – parent and child, koroua (elder) and mokopuna (grandchild). Gathering kai provided a good way to spend time together, but also to foster and grow what manakitanga, kaitiakitanga and whanaungatanga mean to us as Ngati Tahu-Ngati Whaoa. The concept of intergenerational transfer of knowledge, practice, skills and tikanga was essential in our mahinga kai practices, but also fostering inter-whanau relationships. The sharing of kai and activities built our collective iwi identity which remains today. The contributions and understanding of all these core values, collective knowledge and desire to maintain the health and well-being of our mahinga kai, linked by the whanaungatanga amongst our people puts us in good stead to show innovation and leadership by example. Unfortunately, there is some evidence that all of these values are beginning to erode.

“Generation of gatherers may have changed, it’s more that whanau don’t go out like they used to. It was an annual occurrence, more than one whanau would go out together – the culture has died, we just don’t do it like we used to”.

Valerie Moengaroa 2019

Many of the issues impacting our ability to practice manakitanga, kaitiakitanga, and whanaungatanga within our rohe are linked to **mana whakahaere**, or the ability for our whanau to manage and influence decisions about our mahinga kai and resources. This value for our whanau encompasses our ahi ka roa (maintaining home fires, continuing associations) as well as elements of tuku iho (the legacy we were left and, in turn, leave for our children’s children). Additionally, this encompasses our modern context and relationship with the Crown under co-governance, co-management and co-planning relationships.

Development of our logic wheel provided an opportunity to reframe the korero of our whanau and better understand our collective key values in order to direct the outcomes sought by our iwi. These are the values that shape us as an iwi and are applied across all our intentions, korero and mahi. They provide an inter-linked framework for us to influence the management of our resources, raise awareness of our kaupapa and enable us to make a difference to our taonga species and resources. Although in this instance we have placed mahinga kai at the centre of the wheel, any of our taonga species or resources could be put at the centre of this framework and the same values and their enactment would apply.



Koura wananga 2020

**Ngāti Tahu Ngāti Whaoa
Logic Wheel**

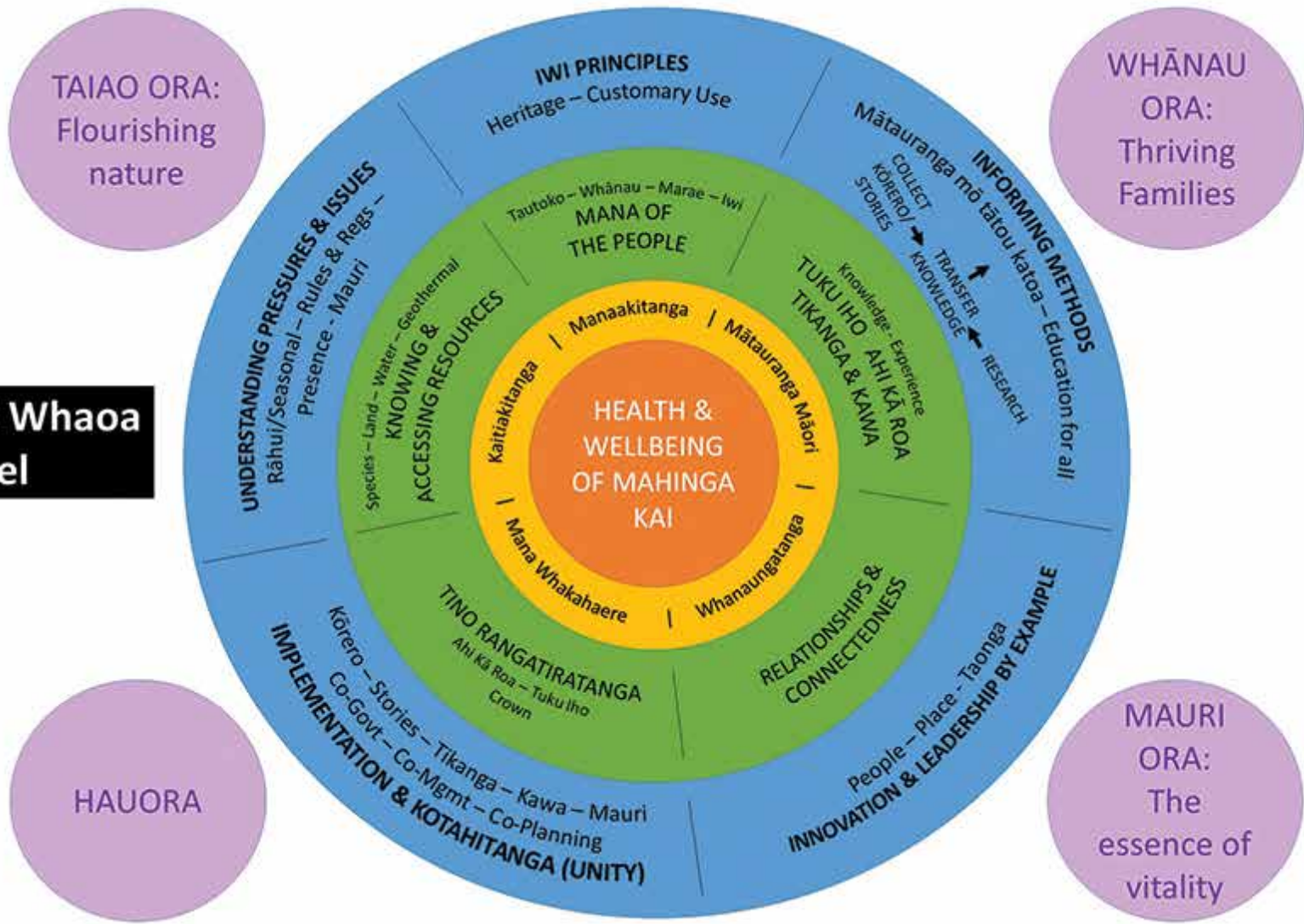


Figure 3: Ngāti Tahu-Ngāti Whaoa Mahinga Kai Logic Wheel

We are very grateful to Waikato-Tainui who provided us with their logic wheel framework to use as a foundation to build our version.

TUARUA: HE TAONGA TE KOURA - PART TWO: IMPORTANCE OF KOURA

In part two we provide information on the importance of koura to us as an iwi as well as their role in aquatic ecosystems. We also provide information on where they were present historically as well as what we currently know about their distribution and abundance.



KOURA ME NGATI TAHU-NGATI WHAOA - KOURA AND NGATI TAHU-NGATI WHAOA

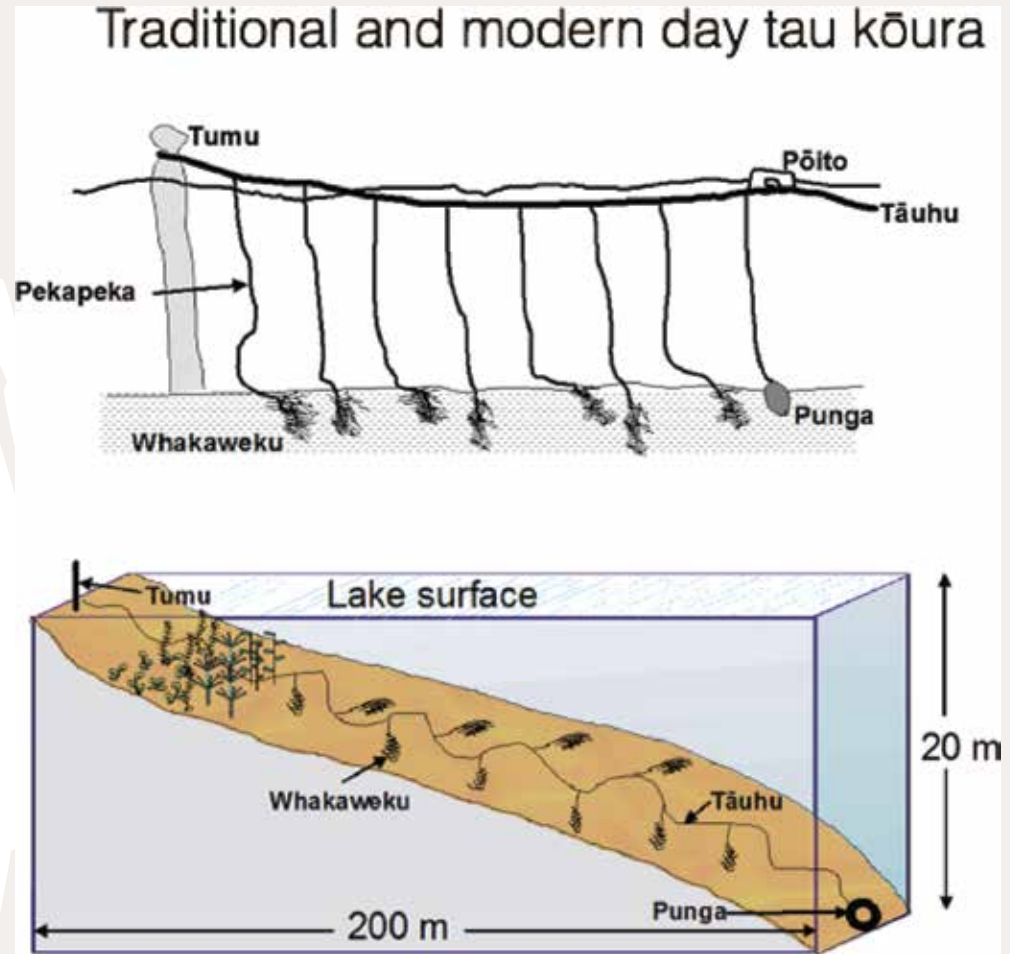
Koura are of interest to our iwi as part of our cultural identity, from a kai perspective as well as their important role as part of stream ecosystems. We view koura as an indicator of the health and wellbeing of our waterways, as well as providing a mechanism for us as an iwi to express and practice our cultural values and as part of the fabric of maintaining our cultural identity.

*“The mana of the iwi is upheld when we are able to provide for our whanau, kaumatua and marae, and successful catches and gathering kai continues to be a part of who we are as a people”
(Ngati Tahu-Ngati Whaoa Mahinga Kai story).*

Historically, koura were harvested as a supplementary food source to the much more plentiful kokopu. We usually caught koura at different sites to kokopu and their harvest was seasonal, usually between winter and the end of December and we sometimes harvested several times in one season.

Koura were mostly caught in the tributaries or the tributary mouths as the main stem of Te Awa o Waikato was too deep and fast flowing in most spots for koura to be present. Harvest did still occur in areas of the main river such as within wetland areas which were once prevalent along the margins of Te Awa o Waikato around Ohaki and Waimahana.

Our harvest techniques included placing bundles of flax, bracken and manuka into the harvest area and then lifting these the following morning. Koura that had taken refuge in the bundles were then collected. These are likely what is known today as tau koura or whakaweku. Bundles were placed in streams overnight before being raised in the morning and thrown to the stream bank.



Tau koura set up
Image credit: Ian Kusabs

Our ancestors also used pou koura which were a specific type of net made to capture koura. The net was similar to a hinaki but differed from those used to catch kokopu. The pou were 2.5-3 m in length to make them easy for carrying and were made of undressed harakeke with the mouth of the net made of manuka. The net was wide and open at the top and then tapered out around a metre before the end where it narrowed down to about 50 cm in diameter at the net bottom. The tapered net helped in capturing koura and the end was weighted down with rocks or something heavy to secure it in the stream. These nets were used up until around the late 19th century when European mesh and nets replaced traditional methods.



Hinaki being used for koura harvest

In more recent times (1950's onwards), other methods have included placing a piece of corrugated iron in the water and harvesting koura from beneath. Spotlighting is another technique using torches, car headlights or lanterns to find koura and then flicking them into a bucket. Others report using a sock with meat inside to encourage koura to latch onto the sock and once attached, transferring these to a bucket or commonly an old sugar bag. Old meat or sheep heads were often used as bait and for koura harvest in lakes were staked around the lake edge to encourage koura to visit. Nets or hands were then used to capture the koura as they swam backwards from the meat.

“There were an abundance of koura 50 years ago and we used to bundle flax and manuka and tie it up with rope, then we put meat inside it. The koura would go into the middle and couldn't get out. We would leave the manuka bundles in the creek overnight and shake them to get the koura out. We would make about 3 of them and catch up to 50 koura at a time. We had koura in the river and the creeks, more in the creeks – we catch koura with a net now or a dish or we use a sock and put a stone in it to sink the sock – then we slowly bring it up and are careful not to drop the koura”.

Colin Katene 2015

“We found koura in the river and under the rocks. We would catch koura to eat during the day. Other times we made a bundle out of fern and had meat to attract the koura, we would then flick them out of the stream at nighttime”

Rangimarie (Wharekawa) Ngamoutu 2015

Harvest of mahinga kai (including koura) was still necessary for iwi into the 1950's and 1960's to sustain people and provide food for whanau. Harvest became less common as people shopped at grocery stores or became disconnected from fishing spots as land was developed, or moved away from the rohe. Our whanau adhered to tikanga such as only taking enough kai for a meal or to share with whanau. Koura were not preserved as there was an abundance to return to when necessary. Fishers did not consume the catch when harvesting – the catch would be gathered and taken home to eat. These tikanga remain today.

Historically, koura were moved around by Maori, who introduced and liberated them in various places to provide an ongoing harvest source. Our iwi had specific places for harvest in creeks and streams, however, whether koura were liberated in these locations by our iwi in the past is not known.

Three historic places in the rohe contain the name koura. There is one within the Kaingaroa block (Kouratamamaemae), one off Karetoto Road and one down by the main Te Awa o Waikato (Orakei Korako). From korero gathered to date, it seems likely that koura were present at these places but that the name did not indicate specific korero relating only to koura.

*“We did fish for koura at Mangatoetoe stream. We would feel around under the banks. We would put a sock on your hand and the koura would cling to the sock or nip the sock and then you grab the koura. We would catch 6-12 at a time mainly in the Mangatoetoe stream”
Julie May Keremete (1930-1940) 2015*

There are many known historic koura fishing sites on Te Awa o Waikato, including Ongarahu Stream (Orakei Korako) and Mangamingi Stream, which are well documented. Sites known and utilised for koura harvest in recent times (1950 – 1970’s) include areas around Lake Taupo such as Acacia Bay and Wharewaka Point³, as well as tributaries of Te Awa o Waikato in the rohe such as Deep Creek and Mangahoanga, Mangatoetoe and occasionally Waiotapu. Harvest sites on the main stem of Te Awa o Waikato were behind Waikite Valley, along Tutukau Road and around Ohaki as well as harvest also occurred at lakes Rerewhakaaitu and Okaro.

3. Although Lake Taupo is outside our current rohe boundaries, our people did utilise these areas historically and in more recent times. During the 1950’s-1970’s many of our people were located in Taupo as a consequence of the drowning of Orakei Korako during the creation of Lake Ohakuri as well as a general movement away from the land. Harvesting within the lake at the time was not an indication that koura were not available within the boundaries of our current rohe but that it was closer to home. In more recent times as koura have declined in the rohe, our people have sought harvest from sites outside our rohe boundaries.

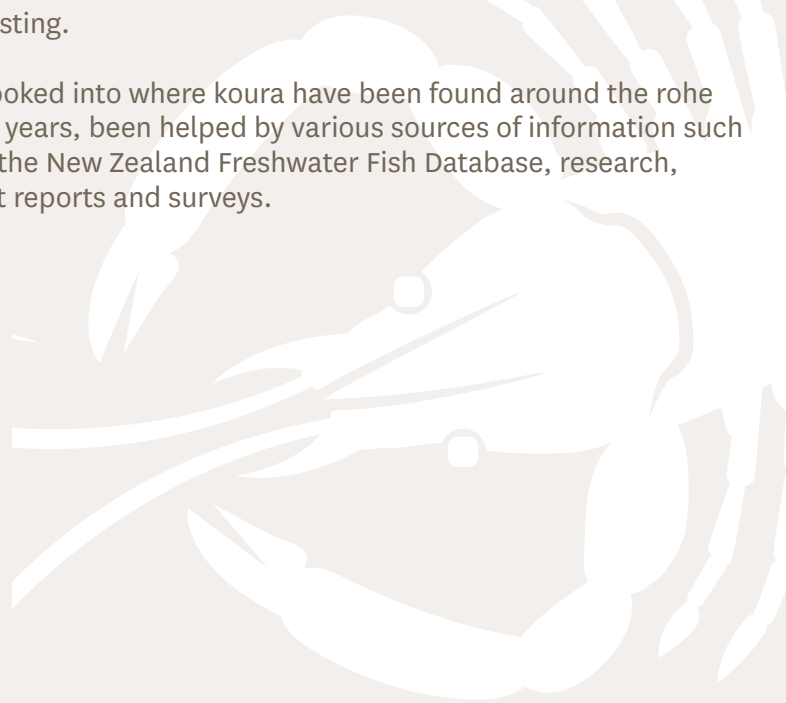
We also value koura for their fundamental ecological role in stream and lake ecosystems. They are omnivores (consume both animals and plants) and detritivores (eat organic waste), which helps in breaking down materials and making energy available to other organisms. Koura have also been called a keystone species. Keystone species are an organism that helps define an entire ecosystem. They have the ability to influence community structure, recycling of materials and release of nutrients from sediment in aquatic ecosystems, particularly at high densities. Koura are also prey for eels and other native fish. Their presence in our awa or waterways indicates to us that our mahinga kai is in balance, particularly if their abundance reflects that koura are breeding in sustainable populations throughout our rohe.



KEI HEA NGA KOURA I ROTO I O MATOU ROHE - WHERE ARE KOURA IN OUR ROHE?

It has been noted that changes to the abundance of mahinga kai and our environment were noticed by the 1980's and have continued to decline. Many of our whanau know of some koura populations that are still present in creeks throughout our rohe, but say very few remain in the main stem of Te Awa o Waikato. Koura are now considered by some of our whanau to be a greater delicacy than tuna. They have become relatively rare in recent times and their numbers are too low to sustain the desired level of customary harvesting.

As such, we've looked into where koura have been found around the rohe in the last 30-40 years, been helped by various sources of information such as iwi accounts, the New Zealand Freshwater Fish Database, research, resource consent reports and surveys.



Koura Image credit: NIWA

TE AWA O WAIKATO

From our work, we recognise that koura appear to have always been relatively in low to medium numbers within in Te Awa o Waikato in our rohe. Our work suggests that both extent and abundance have been declining since the late 1990's. A report by Clearwater et al. (2014)⁴ found the following:

- A review of published information on the hydro lakes of Te Awa o Waikato from the late 1980's until 2014, strongly indicated that koura densities decreased in the hydro lakes throughout the 1990's and have remained low or absent since;
- In previous surveys conducted throughout the early-mid 1990's koura were present throughout Te Awa o Waikato from Te Waiheke o Huka downstream to Lake Arapuni. During a survey in 1999 a marked and widespread decline in koura densities was noted;
- During surveys undertaken during 2014 for this report found that in over 80 km of the main Te Awa o Waikato from Te Waiheke o Huka to Atiamuri dam koura densities were very low or absent in the main stem of the awa including the hydro lakes of Ohakuri and Atiamuri. In fact koura distribution was primarily limited to 4.5 km of river from Te Waiheke o Huka to just downstream of Wairakei Geothermal Power station discharge. Over the rest of the survey (and 77 km of river) there were no koura found.



Collecting koura for the 2014 research project - Image credit :Ian Kusabs



4. Clearwater, S.J., Kusabs, I.A., Budd, R., Bowman, E.:(2014): Strategic evaluation of koura populations in the upper Waikato River. NIWA Client Report: HAM2014-076: Prepared for the Waikato River Authority, WRA14-204. September 2014: 70p.

In the tributaries of Te Awa o Waikato, we know of low numbers of koura being recorded at sites surveyed during the 1980's around Lake Ohakuri such as the Mangamingi and Orakonui, Lake Aratiatia, the Waiotapu catchment and within the Rotohouhou and Karapiti streams in the Whirinaki Stream catchment.

During the 1990's koura were recorded at Hardcastle Lagoon, on the main Te Awa o Waikato near Ohaki, and within the Rotohouhou and Karapiti streams in the Whirinaki Stream catchment and in the main Whirinaki stream itself. Again, most records referred to low to medium numbers of koura, with only one or several koura at each survey site.

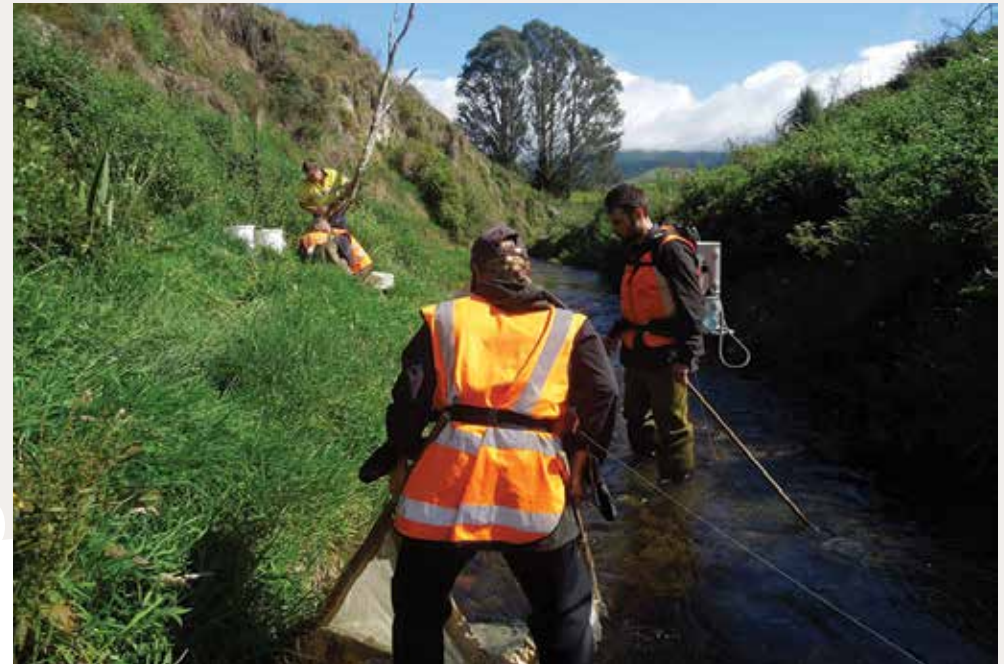
Between 2000 and 2010, we found koura records for Lake Ohakuri tributaries (Orakonui, Otawheta, Mangamingi and Kourawaikapu streams), for several survey sites in the Waiotapu catchment, within the Te Rautehuia stream near Wairakei and in the Torepatutahi catchment. Between 2010 and 2017 the only lodged records on the database are for the Whirinaki stream and location of Koura in the Ruatawiri stream.

We conducted our own surveys in 2017/2018 at many key sites of interest. We found koura present in low numbers (1-3 individuals) in the Mangahoanga, lower Mangatoetoe, Torepatutahi, Sexton and Waikokomuka streams. The only site where we found koura to be relatively common was likely due to there being a large waterfall downstream preventing predator access.

Although we have some information, many tributaries of Te Awa o Waikato have not been surveyed and the presence or abundance of koura in many areas remains unknown.

TE AWA O RANGITAIKI

In developing this plan, the information about the distribution of koura in the upper Te Awa o Rangitaiki is scarce. It is unclear as to why koura are not widely documented in Te Awa o Rangitaiki, specifically in those tributaries of interest to Ngati Tahu-Ngati Whaoa. It seems logical to assume that comprehensive fisheries surveys have not been undertaken previously in these areas contributing to the lack of information.



Ngati Tahu-Ngati Whaoa Mahinga Kai surveys 2018



TUATORU: NGA PEHITANGA – PART THREE: IDENTIFYING THE PROBLEM FOR KOURA

Our whanau have long practiced harvest of koura in our rohe and hold a great deal of knowledge about what's impacting on their abundance and distribution. In part three we present our knowledge and supplement this with information from other sources and research. For a more detailed account of the research we have drawn on, see the section “Panui i tua atu – Further Reading” at the end of the plan.



TO MATOU MOHIOTANGA MO TE KOURA - WHAT WE KNOW ABOUT KOURA

There are two species of koura in Aotearoa. They are sometimes known by the name keewai in the South Island. Both species are endemic (found nowhere else in the world) and each occupies a different geographical area. Our koura are *Paranephrops planifrons* which differ from our south island neighbours *Paranephrops zelandicus* by being smaller and having pincers which are less hairy. Where each species is found is shown in Figure 4.

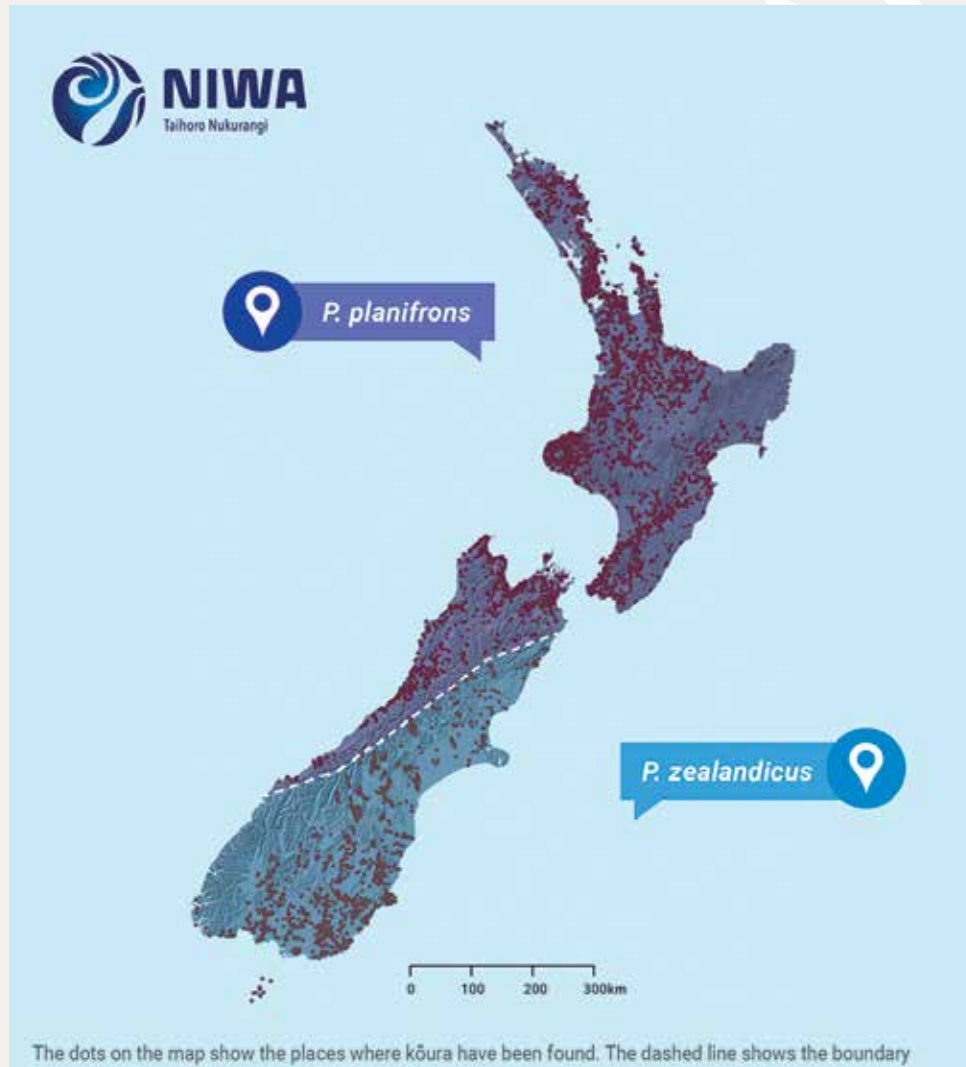


Figure 4: Distribution of koura in Aotearoa - Image Credit: NIWA

Koura move by walking along either the stream or lake bed. They swim by flicking their tail which causes them to move backwards and which is often a response to being disturbed or when they are fleeing from predators. Given koura aren't great swimmers like many fish, it can take them a long time to colonise streams or move upstream to new areas. They are also at risk of being swept downstream during high flows and rainfall events. Research into koura suggests there can be some small genetic differences between populations in different catchments given they are poor dispersers and don't travel large distances between tributaries to breed.

Our people know koura are generally nocturnal (active at night) and seek cover during the day. They can be found in lakes, wetlands, rivers, streams and ponds. We know that koura enjoy living in areas where there is cover such as fallen logs, undercut banks, tree roots, overhanging vegetation and aquatic plants. They prefer areas where there are clusters of debris such as leaves, wood and fern fronds and areas of stream beds which have cobbles rather than sand or pebbles. Koura can also burrow in mud into stream or lake beds and banks for shelter and cover. All of these types of habitat provide areas where koura can hide and find refuge from predators.



Koura habitat - Image credit: Johlene Kelly

Our whānau experience tells us that they prefer areas where the water is slower flowing nearer stream banks and in pools. Research also tells us that koura abundance is less in larger streams (6m or wider). Stream flow will increase with stream size and therefore smaller streams often have more low flowing areas suitable for koura. For young koura who can't swim very well, these slower flowing areas are especially important where they coincide with other habitat such as overhanging vegetation which provides protection from predators. Increased or elevated stream and river flows from heavy rainfall events can pose problems for both young and adult koura. When there is suitable habitat they can "weather the storm" and take refuge until the flow drops otherwise they run the risk of being swept downstream.

Koura have their skeleton on the outside and moult (shed) their shells as they grow. "Soft" koura are those which have just moulted and they usually take a few days for their new shells to harden. It's important they have places to hide during this time as they can be vulnerable to predators – including other koura. The anatomy of koura is shown in Figure 5.

Although it's not easy to tell without testing, we understand koura need a certain level of calcium in the water to help with shell formation. Calcium levels in water are also linked to water acidity or pH. Koura have been found in waters across a range of pH levels, however they seem to prefer relatively neutral pH at around 7-8.5, which is common in many Aotearoa freshwater bodies.

Research also tells us that temperature is the primary driver of koura growth rates and koura dispersal – the warmer the water the higher the growth rate and greater movement throughout streams. In terms of what age koura live until, on average our koura (*Paranephrops planifrons*) have been known to live to around 7 years old in native forest streams but perhaps only reach 3-4 years old in pasture streams. How long koura live for is really dependent on the stream conditions where they are located.

The lifecycle of koura can be seen in Figure 6 on the following page.

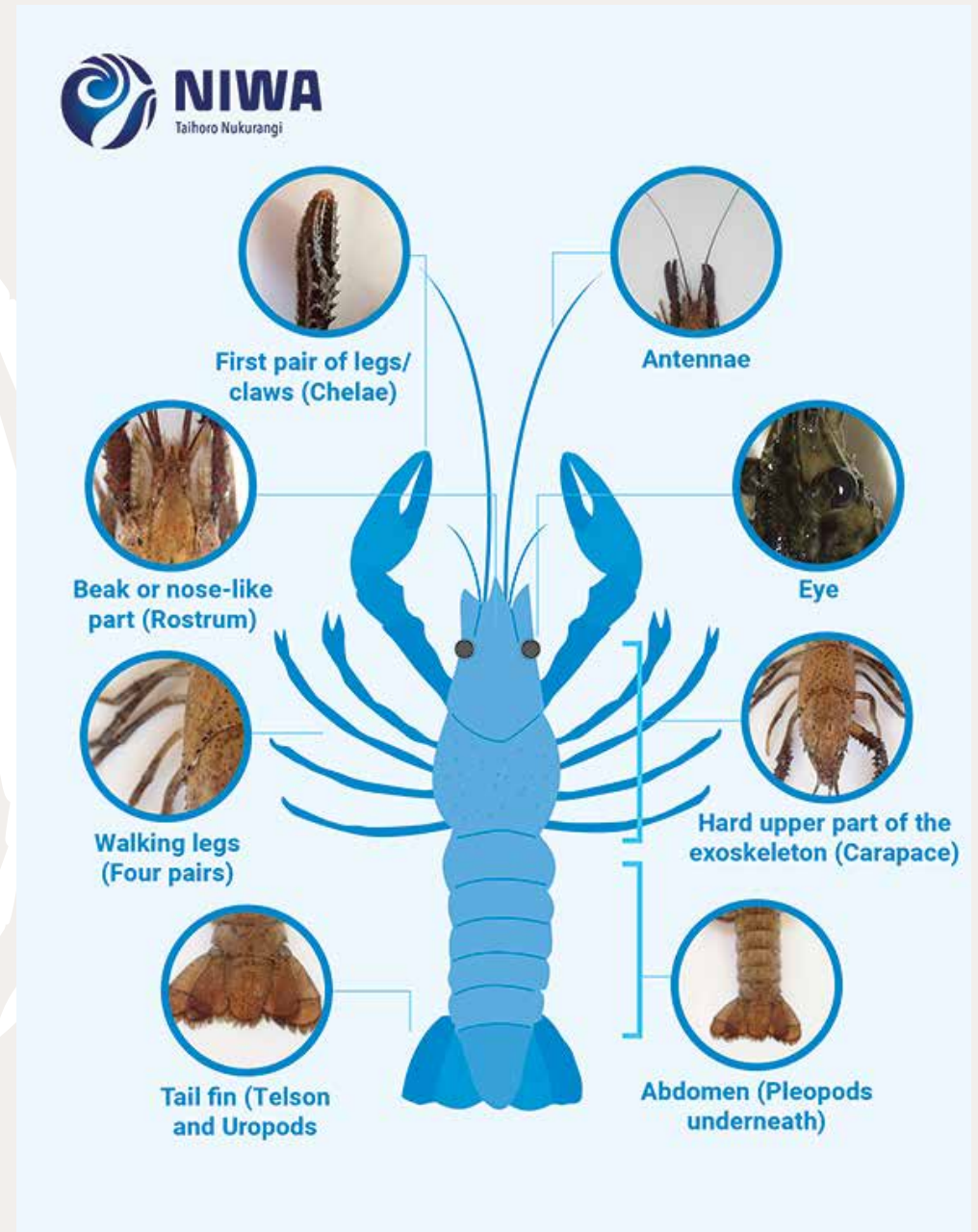


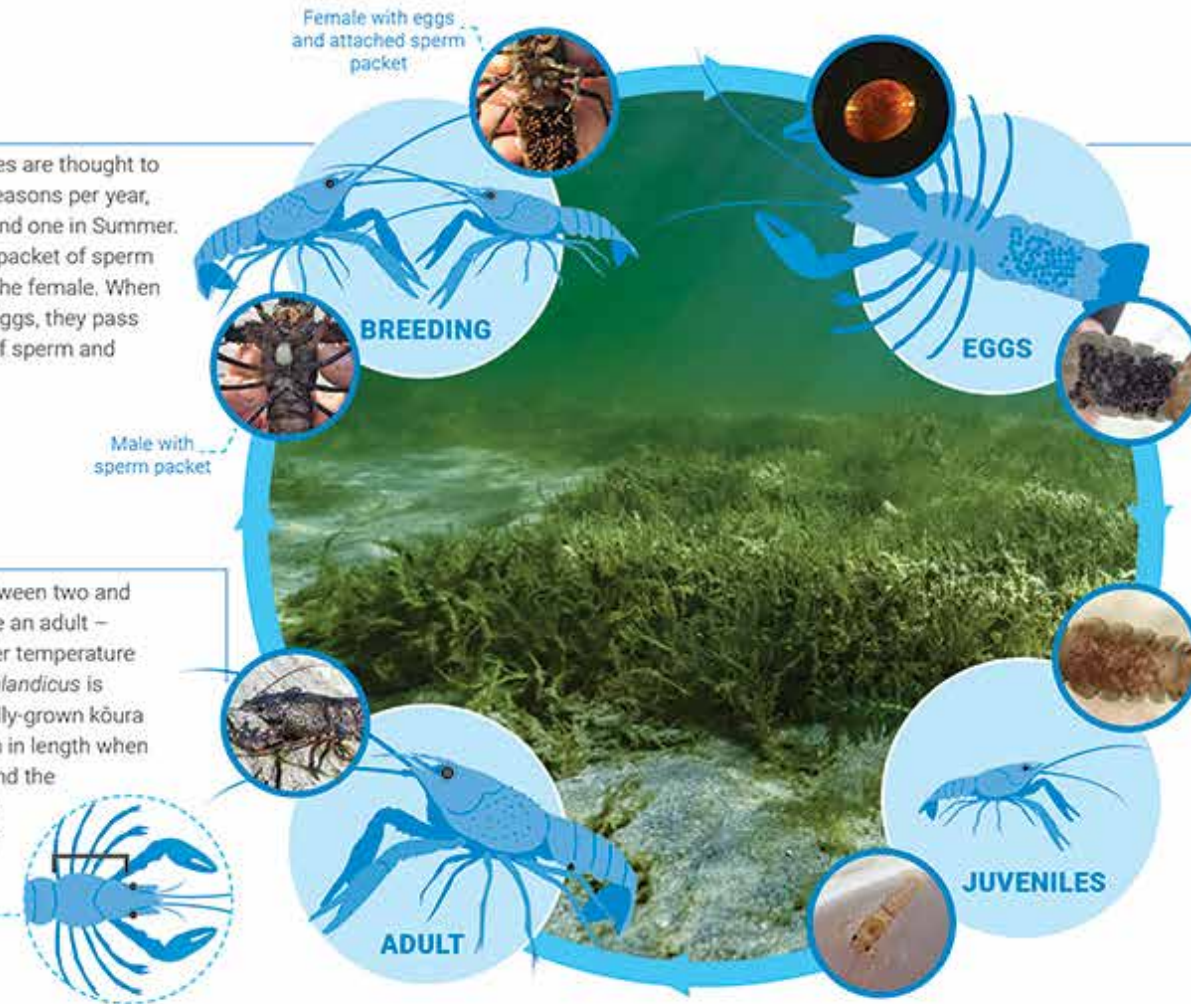
Figure 5: Koura anatomy - Image Credit: NIWA

Breeding

Kōura that live in lakes are thought to have two breeding seasons per year, one in late Autumn and one in Summer. Male kōura attach a packet of sperm on the underside of the female. When the female lays her eggs, they pass through the packet of sperm and become fertilised.

Adults

It can take kōura between two and four years to become an adult – seasonality and water temperature have an effect. *P. zealandicus* is slower growing. A fully-grown kōura averages 12 – 15 cm in length when measured from behind the eye to the end of the carapace (called the OCL measurement)



Eggs

A female can have anywhere between 20 – 320 eggs at a time, which are attached to hairs on the underside of her tail. The eggs can stay on the female anywhere between 4 and 15 months until they are fully developed into juvenile kōura – the time it takes can vary depending on the water temperature and species.

Juveniles

Juvenile kōura cling to their mother's abdomen using their rear legs until they are large enough to defend themselves and live alone.

Figure 6: Koura lifecycle - Image Credit: NIWA

“Not so many people are eeling or catching koura these days and there aren’t the numbers of koura around anymore, mainly caught koura in the Mangatoetoe Stream and there are still a lot of koura there now. We don’t take koura when their body is soft because they are breeding, we catch them in winter through until Christmas”

Colin Katene 2015

We know the females carry the eggs under their tail which hatch into small koura. The young koura stay attached to their mother for several months and continue to grow. They usually moult twice before leaving the safety of their mother.

Our people always knew that koura breed between autumn and the end of spring, as such our tikanga meant we never harvested during these times when the females were carrying eggs or young.

Koura eat almost anything from leaves, aquatic plants and stream insects to dead fish or animals and as such both are omnivores and detritivores (eat organic waste). Koura are also prey for eels, other native fish, introduced fish (trout, brown bullhead catfish) and water birds such as kawau (shags and kotare (kingfisher).



Koura development on female - Image Credit: Karen Thompson NIWA



TE MEA E PANGA ANA KI TE KOURA I TO TATOU ROHE - WHAT'S IMPACTING KOURA IN OUR AREA?

Our koura populations have continued to decline from previous generations. Our people have seen changes in te taiao (the environment) within our rohe which, in many cases, has resulted in degradation of our waterways. It now seems many of our streams have either no koura present or they are only present in low numbers. It leads us to believe that many streams in their current condition may now not provide suitable conditions for koura to thrive and koura may have actually been lost from many streams.

To help summarise changes to our awa, we've constructed a timeline (Figure 8) which captures significant events which have occurred over the past 100 or so years which are likely to have had an impact on koura as well as other mahinga kai species. Although many of these changes in isolation have not been the specific cause of koura decline, when added together over time, these changes have exerted pressure on our taonga species. Additionally, although some of these changes occur outside our rohe, either upstream or downstream of our whenua, they strongly influence our resources, including koura.

We know that there are a huge range of pressures on koura and these are summarised in Figure 7. To help guide us in our restoration of koura, we have identified several of these key issues which we think are primary drivers of decline and that are likely to have ongoing impacts on koura in our rohe. Again, in this section, we present knowledge from our whanau on these issues and provide supplementary information from other sources and research and discuss these key issues in more detail.

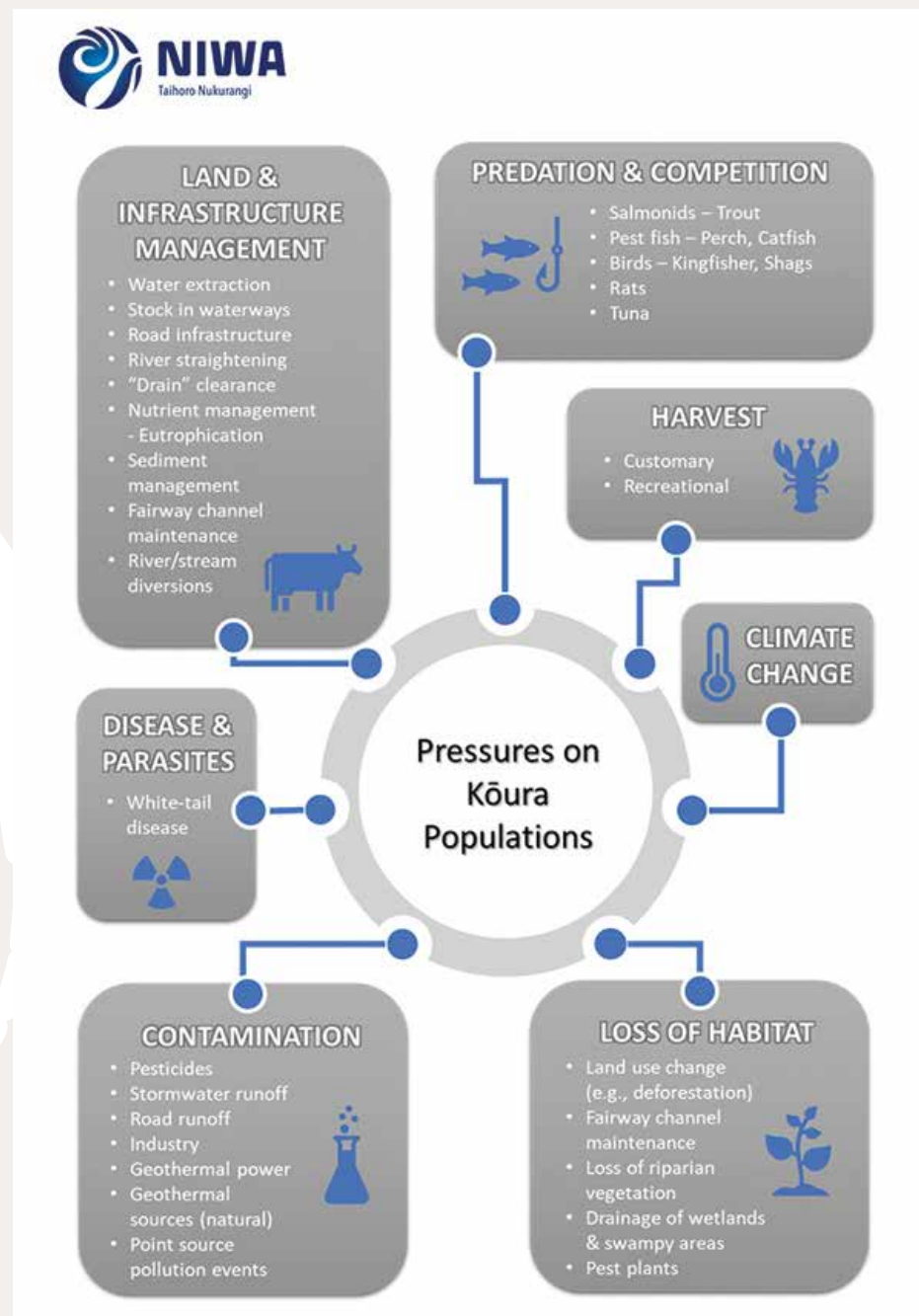
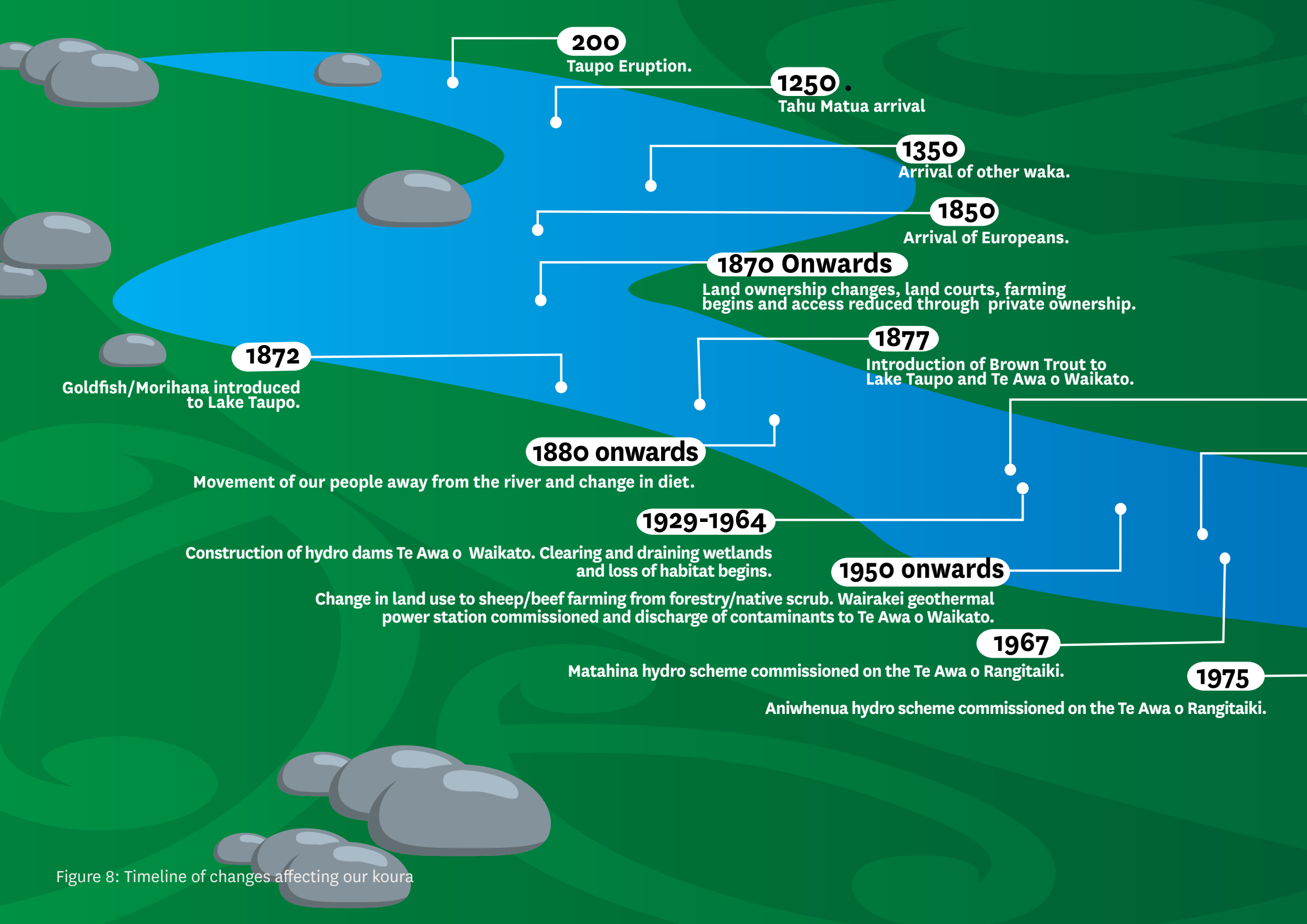


Figure 7: Pressures on koura populations - Image Credit: NIWA



200
Taupo Eruption.

1250
Tahu Matua arrival

1350
Arrival of other waka.

1850
Arrival of Europeans.

1870 Onwards
Land ownership changes, land courts, farming begins and access reduced through private ownership.

1877
Introduction of Brown Trout to Lake Taupo and Te Awa o Waikato.

1872
Goldfish/Morihana introduced to Lake Taupo.

1880 onwards

Movement of our people away from the river and change in diet.

1929-1964

Construction of hydro dams Te Awa o Waikato. Clearing and draining wetlands and loss of habitat begins.

1950 onwards

Change in land use to sheep/beef farming from forestry/native scrub. Wairakei geothermal power station commissioned and discharge of contaminants to Te Awa o Waikato.

1967

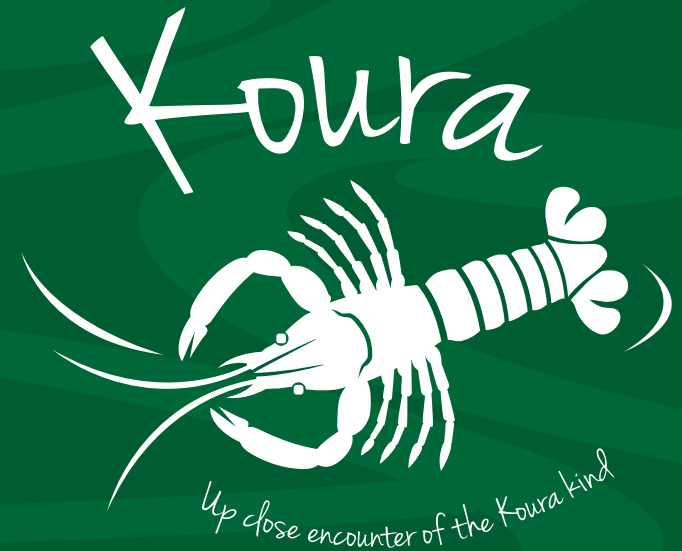
Matahina hydro scheme commissioned on the Te Awa o Rangitaiki.

1975

Aniwhenua hydro scheme commissioned on the Te Awa o Rangitaiki.

Figure 8: Timeline of changes affecting our koura

TIMELINE OF CHANGES AFFECTING OUR KOURA



1903

Introduction of Rainbow Trout to Lake Taupo and Te Awa o Waikato.

1960

Wide scale commercial harvest of eels begins in Te Awa o Waikato.

1980

Introduction of Gambusia to New Zealand
(unknown exact date of presence in Te Awa o Waikato)

1985

First sighting of Brown bullhead catfish in Lake Taupo.

1982

Wheao hydro scheme commissioned on the Te Awa o Rangitaiki.

1989

Ohaki geothermal station built - discharge of contaminants to Te Awa o Waikato.

1991

Te Runanga o Ngati Tahu Ngati Whaoa established.

1997

Large scale trap and transfer of tuna begins from Karapiro to Lakes Ohakuri and Atiamuri.

2001

Reconsenting of hydro dams on Te Awa o Waikato with introduction of increased level fluctuations.

2004

Wide-scale conversion of pine to pasture begins, land use intensifies.

KO TE NGARONGA O TE KAINGA – LOSS OF HABITAT

Our people comment on the effect of land-use change on all of our mahinga kai species, including koura. As pastoral land-use has increased and many farms have undergone intensification, many of our streams have extremely limited or completely lost their streamside (riparian) vegetation. Without streamside vegetation we lose the input of wood and leaves into the stream and also important features like tree roots which provide great habitat for koura. Sediment entering the water can also increase without streamside vegetation and this can happen in two ways; 1) by flowing across land during rainfall; and 2) by stream banks becoming unstable and collapsing in the absence of tree roots to stabilise them. Increased sediment can smother stream features like cobbles and aquatic vegetation – important habitat for koura and can also interfere with the gills of aquatic species (including koura) and affect their ability to breathe.

Streamside vegetation also assists in reducing stream water temperatures by providing shade and its effect is most pronounced in smaller streams where water heats up faster. Many aquatic species, including koura, have limited tolerances for water temperatures above 20-25°C. Although warmer water makes koura grow faster, their optimal temperature for growth is likely to sit between 15-20°C.

We know that wetlands can also be great habitat for koura however many of our wetlands have greatly reduced in extent by being drained for pastoral use and many of the remaining areas are small and disjointed and in poor condition, compromising their ability to provide optimum habitat and sustain healthy koura populations.

“When setting the hinaki I have noticed since the late 90’s that there are no koura in the hinaki. Before 1997 I would set the hinaki and catch 1 or 2 really big eels and heaps of koura. One time I half-filled a 20 litre bucket with koura. I haven’t caught koura for years in my hinaki”

Lindsay Skudder 2015

We know that stream management can also involve channelisation or straightening of streams and stream channels. It’s sometimes used as a management technique on farms or in towns to move water away from paddocks or roads and houses more quickly to help reduce flooding, and, in the case of farms to increase productive land for grazing. The practice often also results in compacted stream banks which are created during the straightening process. Straighter channels and compacted stream banks generally mean increased water flow and less area available to provide refuge areas for koura. Stream straightening is often coupled with the removal of streamside vegetation and instream wood and other materials to further reduce flooding risks, compounding the reduction in koura habitat.

Another technique sometimes used on farms to make management easier around streams is the draining or underground piping of small backwaters, seeps, springs or oxbows. These areas provide great places for koura to hide and in particular can be very valuable in providing habitat for juvenile koura.



Stream without riparian or streamside vegetation - Image Credit: Johlene Kelly

WAI HUANGA ME TE RAHINGA – WATER QUALITY AND QUANTITY

Pastoral farming has become more extensive in the rohe with many farms intensifying their use of the land through conversion from sheep and beef to dairy production. Intensification generally results in higher use of fertiliser to achieve grass growth, along with more effluent from stock (either directly from the animals or as waste from milking sheds) being applied to land. These practices contribute contaminants such as nitrogen, phosphorous and pathogens to our waterways which can occur via surface run-off during rain events, via groundwater and sometimes by stock having direct access to streams. Increased contaminants can result in decreased water quality. This often manifests itself through increased aquatic plant and algae growth clogging channels, decreased oxygen levels in the water when this growth decays, potential for hazardous algae blooms and a general decrease in water clarity. These impacts can be detrimental to koura by reducing habitat, and providing sub-optimal conditions for survival and reproduction.

We don't know how the development of geothermal power stations and their associated discharges to our awa have impacted on our mahinga kai, including koura. The Waikato River Independent Scoping Study⁵ highlights that contaminants such as arsenic, mercury and boron (which are part of both Ohaki and Wairakei geothermal power stations discharges or from natural sources) have accumulated in the sediments behind the hydro dams of Ohakuri and Atiamuri. The close association of koura with the river and lake beds may make them more vulnerable to accumulating various metals within their flesh. This can impact the health of koura, including their breeding capacity, and could potentially make them unsuitable for human consumption.

5. The Waikato River Independent Study provides an assessment of the health of Te Awa o Waikato and its catchment and recommends actions that could be undertaken to restore the river. Under treaty settlement terms, the Ministry for the Environment commissioned NIWA to prepare the report for the Guardians Establishment Committee, which was a precursor to the Waikato River Authority.

A lack of water can also impact koura. When we use the term water quantity we mean balancing out how much water is taken from both surface water (streams, lakes and rivers) and groundwater supplies for use by humans through activities such as farm irrigation, stock drinking, dairy shed use, industry and town water supply. We need to remember that groundwater aquifers supply surface water features such as streams so groundwater extraction can impact on the amount of water that is present on the land surface. If streams are depleted of water through lack of rain and/or groundwater extraction then koura habitat can be impacted. Water extraction can compound many common impacts including reducing water flow and quantity below normal levels, increasing stream water temperatures due to less water volume, increasing aquatic plant growth which can clog channels, increasing risk of predation (there is less water so koura and predators are closer together) and often decreasing water quality (e.g. concentrating nutrients in a smaller volume of water).



Ohaki geothermal power station

PATUTANGA - PREDATION

Koura have many predators in the waterways of our rohe. Introduced fish present within Te Awa o Waikato include brown and rainbow trout, brown bullhead catfish, rudd and gambusia. We know less about Te Awa o Rangitaiki however we do know that both brown and rainbow trout are present in the upper reaches of Te Awa o Rangitaiki that fall within our rohe. All these introduced species have the potential to either prey on koura or compete for habitat and food.

Although tuna have always been predators of koura, they were historically at much lower numbers in Te Awa o Waikato than in current times. We know that the number of tuna in our rohe has greatly increased as a result of the stocking of the hydro lakes of Te Awa o Waikato for commercial tuna harvest since the late 1990's.



Tuna harvest at Ngati Tahu-Ngati Whaoa wananga 2017

We have concerns about the combined effects of high tuna numbers coupled with other pest fish such as brown bullhead catfish, rudd and gambusia on koura. Despite the now-abundant tuna fishery, tuna abundance does not account for the loss of our customary koura fishery and the importance of these taonga to our cultural identity.

“What does it mean for us as an iwi when we are unable to put kai on the table because theres a lot of different things that put pressure on our mahinga kai, on our tuna, on our koura, which there are not a lot of. There are still some in the tributaries but because of the eel population and some of the pest fish it has put a lot of pressure on koura and even our people have said that our tuna are undersized..... It’s a loss of identity and so it’s a part of cultural erosion when you don’t have access to your natural resources so that you can grow and harvest the food and utilise those natural resources for that purpose then you will be dispersed to the four winds – you will have to move to wherever you need to go in order to survive in order to feed your family which is why our people have gone”.

Roger Pikia

TE MEA E PANGA ANA KI TO TATOU WHAKAMAHI ME TE WHAKAHAERE KOURA I TO TATOU TAKIWA - WHAT'S IMPACTING OUR USE AND MANAGEMENT OF KOURA IN OUR ROHE?

TO TATOU HONONGA KI TE KOURA - OUR CONNECTION WITH KOURA

Many of our traditional mahinga kai harvest sites require access through private land such as forestry or farms. Sometimes access is restricted for various reasons including health and safety, fire danger or general operational requirements for forestry or farming operations. Restricted or limited access to mahinga kai harvest sites results in two things, firstly, we cannot harvest kai as our tupuna did and so our association with our taonga species and te taiao is unable to be maintained, impeding our ability to practice and share our tikanga and kawa associated with this resource.

Secondly, not being able to harvest kai impacts our ability to act as kaitiaki, and to understand the state and trends as we see them and enable effective decision-making for our taonga. These two things combined reduce our ability to pass our matauranga to younger generations and sustain our cultural practices.



Capturing koura



Ngati Tahu-Ngati Whaoa Wananga 2019

“The fishery is very important to whanau, hapu, marae and iwi. The river used to be relied on heavily for kai but not so much anymore. It was also a way of keeping tikanga alive through fun activities “.
Sonny Mita/Albert Katene - 2013

The scarcity of koura throughout our rohe also compounds these issues. It is now uncommon to capture koura while fishing and actually specifically fishing for koura is rare. Harvest is now focused on tuna which are plentiful and relatively easy to catch primarily due to the trap and transfer programme. Changes in lifestyle of our people have also further contributed to a disassociation with koura and their harvest. Many have moved away from the land and there is now a reduced need to harvest kai to feed our whanau when in this modern era supermarkets provide this for us. This in turn compounds the ability to keep practices alive by sharing knowledge and practicing harvesting of kai with whanau.

“There were annual gatherings that have ceased like lamb tails, potato harvesting and koura gathering – these don’t happen in whanau like they used to, so is not clear as to what the change as far as koura is”.
Valerie Moenagaroa 2019

NGA APUTA I O MATOU MATAURANGA – GAPS IN OUR KNOWLEDGE

Although we have focused on gathering as much information as we can on koura, we still have some large gaps in our knowledge. Some of these gaps are important to fill as they will help us move into the future and towards achieving our aspirations for koura. For instance, knowing the extent of koura distribution and abundance in our wider rohe is critical to help inform where we might work and invest resources. This will also help to identify potentially large-scale opportunities. Making sure we are continuing to come from a place of knowledge will ensure our approach and work has the greatest chance of success and is making sure we are using our iwi resources widely.



Learning about koura, Ngati Tahu-Ngati Whaoa Wananga 2020

TUAWHA: WHAKATIKA - PART FOUR: APPLYING THE RIGHT TOOLS TO RESTORE KOURA

Part four presents information on how we will work, where we will work and our ideas to date for restoring koura in our rohe. We discuss the tools that we can use to address the issues and impacts we have identified that are affecting koura, and how we might use these tools to achieve our aspirations. We include goals and actions as well as identifying who might be part of the various threads of the mahi.



ME PEHEA TA MATOU MAHI - HOW WILL WE WORK?

Underpinning any of our mahi is the ability to bring many threads together to achieve a range of outcomes for our people. The enhancement of koura through increasing their distribution and abundance provides multiple outcomes including ensuring this taonga species will remain part of our culture and our stream ecosystems.



Wananga with Landcorp Farming, 2018

We believe in developing strong relationships with others by understanding each other's values and common interests. Many other agencies, groups, communities and individuals hold knowledge and may share our aspirations to enhance koura. In particular, we want to strengthen relationships with and support those people who work on the land, to play an active role in the restoration of our streams.

Our aspirations can be achieved by working with our existing partners as well as actively seeking collaboration through development of new relationships.

I HEA TA MATOU MAHI - WHERE WILL WE WORK?

We have over 2,200 km of Te Awa o Waikato tributaries within our rohe and 265 km of river network (main stem and tributaries) of Te Awa o Rangitaiki where we are able to undergo koura restoration activities. However, we believe we can make the most difference in the tributaries of our rivers rather than in the main stem of each river. In this regard, the initial focus of our restoration actions will be aimed at restoration of tributaries.



Te Awa o Waikato - Image Credit: Ministry for Primary Industries

PAEARU WHIRIWHIRI I NGA WAHI MATUA - KEY SITE SELECTION CRITERIA

During our wananga in preparation for this plan, we developed some important criteria to try to prioritise the tributaries within our rohe where we might work to enhance koura. These included prioritising:

- Streams where our people historically fished for koura which we can reconnect to;
- Waterways which flow through iwi land including land and whanau trust blocks as well as land owned by the Runanga on behalf of all iwi members;
- Streams which are close to marae;
- Areas where we can secure and maintain access;
- Areas that don't have high levels of geothermal activity;
- Sites with reduced numbers of predators, or the ability to exclude them;
- Sites with some existing habitat which can be further enhanced;
- Sites where koura already exist even at very low numbers (indicating that habitat and water quality/composition are already suitable).

In addition to the restoration of sites prioritised by these criteria, we also want to prioritise protecting sites which currently have good numbers of koura and potentially low numbers of eels to help the remnant populations we know of to thrive.

ETAHI ATU WHAKARO – OTHER CONSIDERATIONS

For each site or project we need to decide what our goals are and assess what we might need to do to achieve these goals. In addition to the criteria above, we need to consider that there are some key aspects of our current river systems that will need to be taken account of when making restoration decisions.

- In some instances things like dams along both Te Awa o Waikato and Te Awa o Rangitaiki are permanent structures and are unlikely to be removed. The operation of these dams results in large flow and water variations which impact on the health and safety of those sites, as well as the habitat preferred by koura such as the river banks and river margins which are often exposed by the ramping of the river levels for power generation;
- Our rohe features many natural geothermal areas which discharge contaminants and cause elevated stream temperatures which are not optimal for koura restoration;
- The existence of pest fish and other valued introduced fish such as trout also present issues that will need to be considered carefully when considering options for restoration of our koura populations.

Although we may not yet be able to address some of these issues, we do not want to limit our ability to aspire to a restored koura population. These considerations are here to ensure that we are realistic about the limitations they pose, and how we have incorporated them into our decision making when deciding where we might get the most out of koura restoration in our rohe.

HE AHA TA MATOU KA MAHI – WHAT WILL WE DO?

For each of the impacts in Tuatoru/Part three we have outlined goals and actions that will help address these impacts and achieve each goal. We've also identified who we might collaborate with to achieve a positive outcome. The following tables provide a summary of restoration actions that range from using high level policy and legislative measures through to “on the ground” actions. It's important to remember that we need to work at all levels to achieve positive outcomes for our koura.

WHAKANGATIA TE NGAROMIA NOHOANGA - ADDRESSING HABITAT LOSS

Providing suitable habitat for koura will assist in their persistence at sites where they already occur as well as help to increase existing populations. Increasing koura habitat provides areas for koura to hide (refugia) which also supports reducing predation. If suitable hiding areas are present, provided or enhanced, survival of koura, particularly juveniles is likely to increase.

	Goal	Actions to achieve the goal	Who might be involved?
1	<p>All tributary streams (Te Awa o Waikato and Te Awa o Rangitaiki) in our rohe are fenced to exclude stock and planted to provide habitat enhancement for koura.</p> <p>Riparian plantings are providing shade, bank stability and refugia, wood and material to streams to enhance koura habitat while also providing additional water quality benefits.</p> <p>Streams are left in their natural state and not straightened or modified.</p> <p>Seeps and wetlands left intact and fenced to exclude stock to allow for areas of slower flows and refugia for koura during floods and high flows.</p>	<p>Continue to advocate and participate for the robust implementation of Healthy Rivers regional plan change for Te Awa o Waikato to achieve water quality improvements.</p> <p>Participate in any regional plan review for the upper Te Awa o Rangitaiki to ensure stream management facilitates koura enhancement and mahinga kai in general.</p> <p>Actively participate in resource consents processes for both Te Awa o Waikato and Te Awa o Rangitaiki catchments to ensure the best outcomes for koura and mahinga kai in general are achieved through fencing and planting.</p> <p>Participate in industry forums to advocate for riparian retirement across all industry sectors.</p> <p>Use existing knowledge and other's expertise to establish which plants are the best for providing koura habitat.</p> <p>Use existing knowledge and other's expertise to establish which plants are the best for providing koura habitat. Identify which of those will thrive in our rohe's climatic conditions.</p>	<p>Our people, our land and whanau trusts, Ngati Tahu-Ngati Whaoa Runanga Trust, Te Arawa River Iwi Trust, Waikato Regional Council, Bay of Plenty Regional Council, District Councils (Taupo, Rotorua), research organisations.</p>

	Goal	Actions to achieve the goal	Who might be involved?
2	<p>All streams on Ngati Tahu-Ngati Whaoa whanau and trust lands are fenced to exclude stock and planted to provide habitat enhancement for koura and other mahinga kai species.</p> <p>Streams remain unmodified and protection of seeps and wetlands are incorporated into farm management.</p>	<p>Provide support and information to whanau and land trusts on legislative requirements, best practice and funding options to support this transition.</p>	<p>Our people, our iwi land and whanau trusts, Ngati Tahu-Ngati Whaoa Runanga Trust, Waikato Regional Council.</p>
3	<p>Exotic forest harvesting enhances koura habitat within managed forests.</p>	<p>Collaborate with forestry companies for options to implement or enhance existing harvesting practices to 1) protect existing koura habitats and 2) restore koura habitat within streams in managed forests.</p> <p>Collaborate with forestry companies to produce educational materials on best practice harvesting techniques to protect and restore koura specifically targeting subcontractors that are involved in the forestry lifecycle.</p>	<p>Ngati Tahu-Ngati Whaoa Runanga Trust, Kaingaroa Timberlands, Central North Island Forestry, Hancock's Forestry, PF Olson.</p>
4	<p>Achieve koura restoration in our natural lakes in the rohe (Ngahewa, Ngapouri, Tutaeinanga and Okaro)</p>	<p>Identify limitations and issues with koura restoration in our natural lakes.</p> <p>Utilise the 3 lakes interagency group and other stakeholder relationships to develop programs of work to address limitations and issues.</p> <p>Seek collaboration and funding to implement programs of work to restore koura populations in these lakes.</p>	<p>Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, research agencies such as NIWA and Universities, Te Arawa Lakes Trust, Department of Conservation, Fish and Game, Waikato Regional Council, private landowners.</p>

	Goal	Actions to achieve the goal	Who might be involved?
5	<p>The location of remnant koura populations are known within our rohe to provide a focal point for restoration activities.</p> <p>Remnant populations are enhanced by restoration of upstream and downstream areas to create connected refugia.</p> <p>Koura restoration is occurring at a large scale in key sub-catchments.</p>	<p>Increase our matauranga on koura locations within our rohe to inform where we will work (see “filling the gaps in our knowledge” section for further actions).</p> <p>Collaborate with stakeholders and landowners to establish working groups in key sub-catchments for koura restoration.</p> <p>Use artificial habitat such as fern bundles, coconut fibre bundles or other materials at restoration sites to provide cover to increase juvenile koura survival.</p> <p>Enhance long-term habitat at suitable sites in these sub-catchments by actively adding logs, rocks and vegetation to provide refugia from flow and predators.</p> <p>Also see “Filling the gaps in our knowledge” section - Goal 5. Initiation of a koura monitoring plan using Ngati Tahu-Ngati Whaoa mahinga kai tools.</p>	<p>Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, our iwi land and whanau trusts, landowners, communities, Waikato Regional Council.</p>
6	<p>Establish koura ponds at suitable sites in collaboration with our iwi land and whanau trusts or others.</p> <p>Koura ponds are providing a source of koura to restock areas where habitat has been restored</p>	<p>Undertake pond trial to assess feasibility of raising koura in ponds.</p> <p>If feasible, apply learnings to wider scale koura farming to provide a source to enhance wild populations, provide kai and act as an educational tool.</p>	<p>Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, our iwi land and whanau trusts, koura experts such as NIWA and other consultants.</p>

	Goal	Actions to achieve the goal	Who might be involved?
7	Our people are informed on biosecurity risks (e.g., disease) to koura, how to identify these and how this applies to restoration activities.	Information on biosecurity risks (including disease) and health are shared via wananga and a field identification sheet is developed.	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, as well as koura experts such as NIWA and other consultants.
8	Awareness of the issues and impacts affecting koura in our rohe are well understood and our wider community is engaged in seeking solutions and improving habitat.	Create resources and use available communication mechanisms (website, newsletters, kura (schools), wananga) to raise awareness of impacts on koura and explore solutions.	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, Regional Councils, District Councils, schools, community, stakeholders.

WHAKAPAI AKE TE WAI HUANGA ME TE RAHINGA – IMPROVING WATER QUALITY AND QUANTITY

Many of the goals and actions in water quality and quantity align strongly with those in the habitat section above. Some of the mechanisms to achieve improvements in both categories will have multiple benefits. Good water quality and sufficient water quantity are important for providing suitable conditions for koura to persist and thrive.

	Goal	Actions to achieve the goal	Who might be involved?
1	<p>Stock is excluded from all streams in the rohe to improve water quality. There is reduced faecal contamination and nutrients, improved stream bank stability and reduced sediment entering waterways.</p> <p>Heavy metal inputs to our awa from non natural geothermal sources are reduced and koura health and kai safety improve.</p>	<p>Continue to advocate and participate in the implementation of Healthy Rivers regional plan change for Te Awa o Waikato to achieve water quality improvements.</p> <p>Participate in “Healthy Environments – He Taiao Mauriora” regional plan change for all activities in the Waikato Region including soil, water allocation, geothermal and other resources to ensure stream management facilitates koura enhancement and mahinga kai in general.</p> <p>Actively participate in resource consent processes for both Te Awa o Waikato and Te Awa o Rangitaiki catchments to ensure the best outcomes of mahinga kai and koura are achieved through water quality improvements.</p> <p>Use existing relationships with energy companies to seek solutions to reducing heavy metal inputs as a result of geothermal power generation.</p> <p>Fence and plant waterways as per Goal 1 – Addressing habitat loss.</p>	<p>Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, our iwi land and whanau Trusts, Te Arawa River Iwi Trust, Waikato Regional Council, Bay of Plenty Regional Council, District Councils (Taupo, Rotorua), energy companies.</p>

	Goal	Actions to achieve the goal	Who might be involved?
2	Better understanding of the effects of heavy metals on koura health and reproduction as well as kai safety.	Seek partnerships with research organisations to undertake investigations within the upper Te Awa o Waikato to establish impacts of heavy metal accumulation in koura for both koura health and kai safety in the main stem of the awa and in geothermally influenced tributaries.	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, research agencies such as Universities, NIWA and GNS, Central Government, energy companies.
3	Water extraction (surface and ground) for irrigation or other purposes does not compromise minimum flows required to sustain mahinga kai including koura.	<p>Participate in “Healthy Environments – He Taiao Mauriora” regional plan change for all activities in the Waikato Region including water allocation to ensure water management facilitates koura restoration and persistence.</p> <p>Participation in any regional plan review for the upper Te Awa o Rangitaiki to ensure water management facilitates koura restoration and persistence.</p> <p>Actively participate in resource consents processes for both Te Awa o Waikato and Te Awa o Rangitaiki catchments to ensure the best outcomes of mahinga kai and koura are achieved through consent conditions promoting conservation of water and robust water allocation management.</p>	Ngati Tahu-Ngati Whaoa Runanga Trust, our iwi land and whanau Trusts Te Arawa River Iwi Trust, Waikato Regional Council, Bay of Plenty Regional Council, landowners, community.

WHAKAHEKE PATUTANGA - REDUCING PREDATION

Reducing predators aligns strongly with addressing loss of habitat. Increasing habitat provides more areas of refuge for koura to avoid predation. In addition to habitat, reducing predator numbers or excluding some or all species then koura will also have an increased chance of survival.

	Goal	Actions to achieve the goal	Who might be involved?
1	The transfer of elvers from below Karapiro dam to the hydro lakes of Ohakuri and Atiamuri is managed based on sound ecological evidence of effects.	<p>Advocate for commercial eelers and the Ministry for Primary Industries to provide sound ecological evidence on the likely effects of continued releases of large numbers of tuna into lakes Atiamuri and Ohakuri on Te Awa o Waikato.</p> <p>Continue to advocate to commercial eelers and the Ministry for Primary Industries for no elver transfer into Lake Aratiatia but ensuring the upper Waikato River catchment has sufficient tuna numbers to sustain iwi into the future.</p>	Ngati Tahu-Ngati Whaoa Runanga Trust, Ministry for Primary Industries, commercial eel fishers.
2	The transfer of elvers from below Matahina dam to the upper Te Awa o Rangitaiki is managed based on sound ecological evidence of effects.	<p>Work with the agencies involved in the elver transfer to better understand current management and identify any implications to koura.</p> <p>Participate in resource consent processes for the three hydro schemes on the Rangitaiki to participate in decision making regarding fish passage, elver transfer and potential impacts on koura in the upper Te Awa o Rangitaiki.</p>	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, Ministry for Primary Industries, Bay of Plenty Regional Council, commercial eel fishers.

	Goal	Actions to achieve the goal	Who might be involved?
3	Data on commercial tuna harvest in both the upper Te Awa o Waikato and the upper Te Awa o Rangitaiki is provided to us in a useful way reported by hydro-lake to allow us to understand the fishery and make informed decisions that may influence koura and other mahinga kai species.	<p>Work with Ministry for Primary Industries to realign quota reporting to hydro lake boundaries in Te Awa o Waikato to assist our iwi in being able to better understand harvest and management.</p> <p>Investigate quota reporting in Te Awa o Rangitaiki and if required work with the Ministry for Primary Industries to ensure reporting assist us in understanding commercial harvest activities.</p>	Ngati Tahu-Ngati Whaoa Runanga Trust, Ministry for Primary Industries, Te Arawa River Iwi Trust, commercial eel fishers
4	<p>We understand what densities of tuna and catfish koura can survive with both singularly and jointly.</p> <p>We have knowledge on the potential impact of other introduced/pest fish on koura populations.</p>	<p>Actively advocate and participate in research projects to provide information on these questions.</p> <p>Seek opportunities for our iwi to build capacity and knowledge as part of any research work.</p>	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, research agencies such as NIWA and Universities.
5	<p>Predators (tuna, trout and pest fish) are prevented from accessing koura populations above either natural or artificial fish passage barriers where they don't already exist or are only present in small numbers.</p> <p>Fish passage restrictions are maintained in streams where koura are present upstream of the barrier to reduce predator impacts.</p>	<p>Consider the use of existing fish barriers when selecting restoration sites.</p> <p>Consider installing fish barriers to exclude predators as part of any large scale restoration for koura.</p> <p>Work with CNI/Kaingaroa Timberlands to establish sites where provision of fish passage (as required through the National Environmental Standards for Plantation Forestry), would not be beneficial for upstream koura populations.</p>	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, our iwi land and whanau Trusts, landowners CNI/Kaingaroa Timberlands, PF Olson, Hancocks Forestry, Waikato Regional Council, Bay of Plenty Regional Council, Department of Conservation.

	Goal	Actions to achieve the goal	Who might be involved?
5- cont		<p>Prioritise sites for koura restoration where there may also be isolated remaining kokopu populations where predators are absent and restricting fish access would also be of great benefit.</p> <p>Protect sites with koura populations that do not have predator access. Gather information about each site including landowners, potential threats and what processes could be put in place for protection. Work with the relevant landowners and agencies to implement.</p>	
6	No new species of pest fish establish in either Te Awa o Waikato or the upper Te Awa o Rangitaiki;	<p>Advocate for continued vigilance and public awareness on pest fish and weed threats and mechanisms for their spread.</p> <p>Participate in any review of Regional Pest Management Plan's for Waikato and Bay of Plenty Regional Councils to ensure threats to koura are adequately addressed.</p> <p>Provide our people with information on which fish and weed species are threats and how they can minimise the risk of spread during their fishing or restoration activities eg: wananga or creation of a field guide.</p>	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, Waikato Regional Council, Bay of Plenty Regional Council, Department of Conservation, Ministry for Primary Industries..

WHAKAPAI AKE I TO MATOU HONONGA KI TE KOURA - IMPROVING OUR CONNECTION WITH KOURA

Underlying all of our goals and actions is our desire to ensure a range of outcomes for our people, all of which will be achieved in the way that we work and the way we approach all of our mahi. However, alongside these overall principles, there are several specific goals and actions which will assist in facilitating these outcomes and relate to improving our connection with koura.

	Goal	Actions to achieve the goal	Who might be involved?
1	<p>Our people are re-engaged with koura and our tikanga and kawa associated with this resource are well known and understood.</p> <p>Our whanau are able to use their knowledge of koura tikanga and kawa to sustainably harvest koura from our waterways.</p>	<p>Use our knowledge to be actively involved in policy processes so that the upmost consideration is given to the protection and restoration of our environment and the taonga species within.</p> <p>Continue to support and encourage events that engage our people with practitioners and hands on learning opportunities.</p> <p>Continue to build and strengthen our relationships with research institutes and Central, Regional and local government agencies to engage in projects that enable learning opportunities of specific taonga species, their life cycle, habitat and threats.</p> <p>Continue to research and collate any information or korero that links our traditions to the management of resources.</p>	<p>Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, NIWA, GNS, Lincoln Agritech, Ministry for Primary Industries, other Central Government agencies, Regional and District Councils, Department of Conservation.</p>
2	<p>Our people are actively leading and participating in restoration activities for koura and their sense of connection and understanding of te taiao is enhanced.</p>	<p>Whanau and our people have access to information on koura restoration and use this to develop and initiate their own restoration projects.</p> <p>Our people are utilising and applying tools such as our Mahinga kai app and stream survey methodology as part of their projects.</p>	<p>Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, our iwi land and whanau Trusts.</p>

	Goal	Actions to achieve the goal	Who might be involved?
3	Our community and landowners are knowledgeable of Ngati Tahu-Ngati Whaoa's connection with mahinga kai, what it means to us.	The Runanga is able to record and share its learnings through documents such as this restoration plan as well as other planning and information documents. Initiate a joint iwi and community sustainable restoration project that enables some harvest of koura.	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, community, stakeholders.
4	Koura ponds provide a vital role in education and outreach to support our iwi (and others).	Continue to work towards establishing viable koura ponds. Use these ponds to develop an educational component to facilitate access for our people and others to learn how to protect and enhance our mahinga kai and taonga species such as koura.	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, Department of Conservation, learning institutes,

WHAKAKIA NGA APUTA I O MATOU MATAURANGA – FILLING THE GAPS IN OUR KNOWLEDGE

While we have a relatively good understanding of our koura populations in the Waikato, in Te Awa o Rangitaiki, we need to better understand the upper Rangitaiki catchment and its management. We also need to better understand the extent or remnant populations of koura within our rohe.

	Goal	Actions to achieve the goal	Who might be involved?
1	<p>We are well informed and understand issues associated with Te Awa o Rangitaiki, particularly in relation to mahinga kai.</p> <p>We are using this understanding to assist us in participating in management actions with the aim to improve koura populations in Te Awa o Rangitaiki.</p>	<p>Further develop relationships with management agencies and participate in Te Awa o Rangitaiki Forum.</p> <p>Seek out information that enables us to fully understand issues and current management in Te Awa o Rangitaiki that impacts on mahinga kai, particularly koura.</p> <p>Use this information to establish informed approaches to restoration and protection to achieve our iwi's aspirations for koura and other mahinga kai species.</p> <p>Gather further matauranga from our iwi on the awa.</p> <p>Visit sites of interest in the Rangitaiki catchment to better understand the awa, management issues and potential for restoration.</p>	<p>Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, Bay of Plenty Regional Council, other iwi groups with Te Awa o Rangitaiki interests, Energy companies, Forestry companies (CNI/Kaingaroa Timberlands), Taupo District Council.</p>
2	<p>We know more detailed information on koura distribution and abundance in our rohe.</p> <p>Koura assessments are showing us positive long term trends over successive years.</p>	<p>Work with other stakeholders, researchers, consultants and industry to incorporate recording of koura numbers and location in any monitoring or other activities which require stream surveys. Secure access to this information and continue to build a picture of koura distribution in our rohe.</p> <p>Seek opportunities to have Ngati Tahu-Ngati Whaoa mahinga kai tools (mahinga kai app, survey methodology) applied to compliment other monitoring methodologies.</p>	<p>Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, Waikato Regional Council, Bay of Plenty Regional Council, NIWA, Consultants, consent applicants, CNI/Kaingaroa Timberlands.</p>

	Goal	Actions to achieve the goal	Who might be involved?
2-cont		<p>Leverage relationships with Energy companies within the rohe to expand on our understanding of the spatial distribution of koura within our rohe.</p> <p>Utilise the Ngati Tahu-Ngati Whaoa mahinga kai app for our people to record details about koura when they are assessing streams.</p> <p>Establish joint initiatives with CNI/Kaingaroa Timberlands to find out where koura are present in the tributaries within Kaingaroa Forest to inform locations of opportunities for protection and potential restoration of koura populations.</p> <p>Initiate a koura monitoring action plan and monitor regularly to gauge the success of our (and others) actions. Our people are utilising and applying tools such as our Mahinga kai app and stream survey methodology as part of this plan.</p>	
3	Koura are being used as an indicator of stream health and improved stream habitat.	Work with relevant agencies to ascertain if this is feasible and how koura could be applied as an indicator in conjunction with our other existing tools such as our stream assessment methodology and mahinga kai app.	Our people, Ngati Tahu-Ngati Whaoa Runanga Trust, research agencies such as Universities and NIWA.

HE AHA TE AHUA O TE ANGITU - WHAT DOES SUCCESS LOOK LIKE?

We outlined our aspirations for koura in the introduction to this plan. Success for us links with achieving these aspirations and we look forward to seeing change over the coming years. Some key measures of success for us are:

- More of our people are familiar with koura and understand our tikanga and kawa associated with their harvest;
- More of our people are harvesting koura regularly;
- Our tamariki and rangitahi are just as familiar with koura as with tuna;
- Every year, streamside/riparian retirement and planting increases on streams that flow through iwi land;
- Every year streamside/riparian planting increases on streams which flow through private land across the rohe;
- The number of landowners taking action to facilitate koura habitat increases each year;
- Central and regional government are responsive to issues impacting koura and are actively seeking mitigation through commercial activities and resource consent processes to improve outcomes for koura in our rohe.

Regardless of the structured measurements of success documented above, we are conscious that how the fundamental principles of koura restoration success are measured is up to the individual or group doing the mahi. Often success is measured by learning what works and what doesn't, having fun and getting to understand our taonga species with our whanau. If everybody does a little, great things can happen. Many of the things that can be done to restore koura actually have benefit for our awa in general and reflect good land and environmental management principles – something that can be applied by us all in some way.



Tamariki at Ngati Tahu-Ngati Whaoa Wananga 2020



TUARIMA: WHAKATINANA - PART FIVE: RESTORATION IN ACTION

This section captures some of the most important things our people and others may need to think about when undertaking koura restoration work aligned with our actions from this plan.



Each site will differ from the other and will likely need different approaches to restore or enhance koura. The information in this section will help those who use this plan, firstly, to decide if their site is suitable for koura restoration; secondly, what might be required to achieve that restoration; and lastly, how to go about their restoration activities.

It's important to remember that restoration can be as simple as putting in some extra cover for koura or as complex as undertaking fencing, planting and structured habitat enhancement. What you do depends on what you want to achieve and what resources you might have available. It pays to have a good think about what your koura restoration might entail before setting out.

You don't necessarily need a lot of money to get started and although for larger projects there might be funding available from a range of sources, we encourage you to work with what you have.

One very important consideration before you think about starting any mahi is making sure everyone is safe when you are undertaking your project. Health and safety is a priority. Consider who will be involved, what their limitations might be, what type of activities you will be doing and what risks these activities might bring. Think about how you might reduce these risks and then share this korero together to make sure you all stay safe.

Remember that you can always look for additional information, talk to others and ask questions if you are unsure. You will find some helpful links for further information at the end of this plan.

The next part of this section provides things that you should think through when selecting a site, considering the restoration works you will undertake, and considerations for koura ponds. These are designed to provide a guide for planning koura restoration but are not the only things that need to be considered. You might find the Decision Support System diagram (Figure 9 on page 64) helpful in your decision making.

E PAI ANA TENEI TAIWHANGA – IS THIS A GOOD SITE?

Some key things you might like to consider before working at a site are:

1) *Do you have permission from the landowner to be at the site?*

There may be things the landowner might need to discuss such as health and safety and things which might affect the management of their land and the stream you wish to work in.

2) *Is the landowner happy with your continued access and with the restoration work you wish to do?*

The landowner might have some other considerations you need to think about in your mahi which need to be discussed before you begin. Building a relationship based on mutual respect and trust is important if you are not the landowner.

3) *Are koura already present in the stream (not necessarily at your site but either upstream or in close proximity downstream)?*

You might need to go out and spotlight first to establish if koura are present or you might already know from previously collecting mahinga kai at the site. If they are not present then perhaps the site is not suitable for some reason such as the composition of the water. In some cases no matter what you do to enhance the habitat then koura may not return or thrive here. Remember that koura don't move large distances (particularly not upstream) so if they are not already there they may be unlikely to return on their own.

4) *If koura are present, does the stream have some existing characteristics that would make it appeal to koura?*

Things that appeal to koura are the presence of slower flowing areas, undercut banks, cobbles or rocks, wood and leaves in the stream, stable banks which have tree roots present and aquatic plants. You might not have all of these however if not, what would it take



Koura -Image Credit: NIWA



Rudd and Goldfish at Ohaki wetland

to provide some of these? Changing the flow might be difficult if you have a site which is all fast flowing rapids but putting in some rocks, fern leaves and wood might be straight forward. You might want to think about what the bed of the stream looks like. If it consists of unstable pumice or sediment then it probably won't be great for adding rocks as they are likely to eventually be covered in fine sediment and not provide great koura habitat. Look for a site which has a good starting point where you might be able to capitalise on what is already there.

5) *What predators do you have at your site?*

Make an assessment of what other fish species you have in the vicinity of your site. Again, you might already know this from harvesting mahinga kai at this site or you might want to do a survey by netting or spotlighting. We all know tuna are throughout our streams however if you have other predators as well such as trout, brown bullhead catfish and rudd then koura restoration may be more challenging – particularly if you have multiple species in the one place.

6) *Do you have any barriers below your site that might stop fish access?*

Sometimes having barriers to fish movement might be beneficial for koura by reducing predator access. If there is a barrier such as a natural drop or even a perched road culvert downstream of your site then it might be beneficial to leave the barrier in place. It might already be helping stop other fish species accessing your site and provide you with an easier task in restoring koura.

7) *Have you considered talking to anyone else upstream or downstream of your site to see if they are also keen on koura restoration?*

Perhaps you can work with others to look at a wider area of restoration, share ideas and work together to achieve your goals. Although small scale projects will help restore koura, looking for areas at a catchment scale can also be beneficial to wider koura restoration.

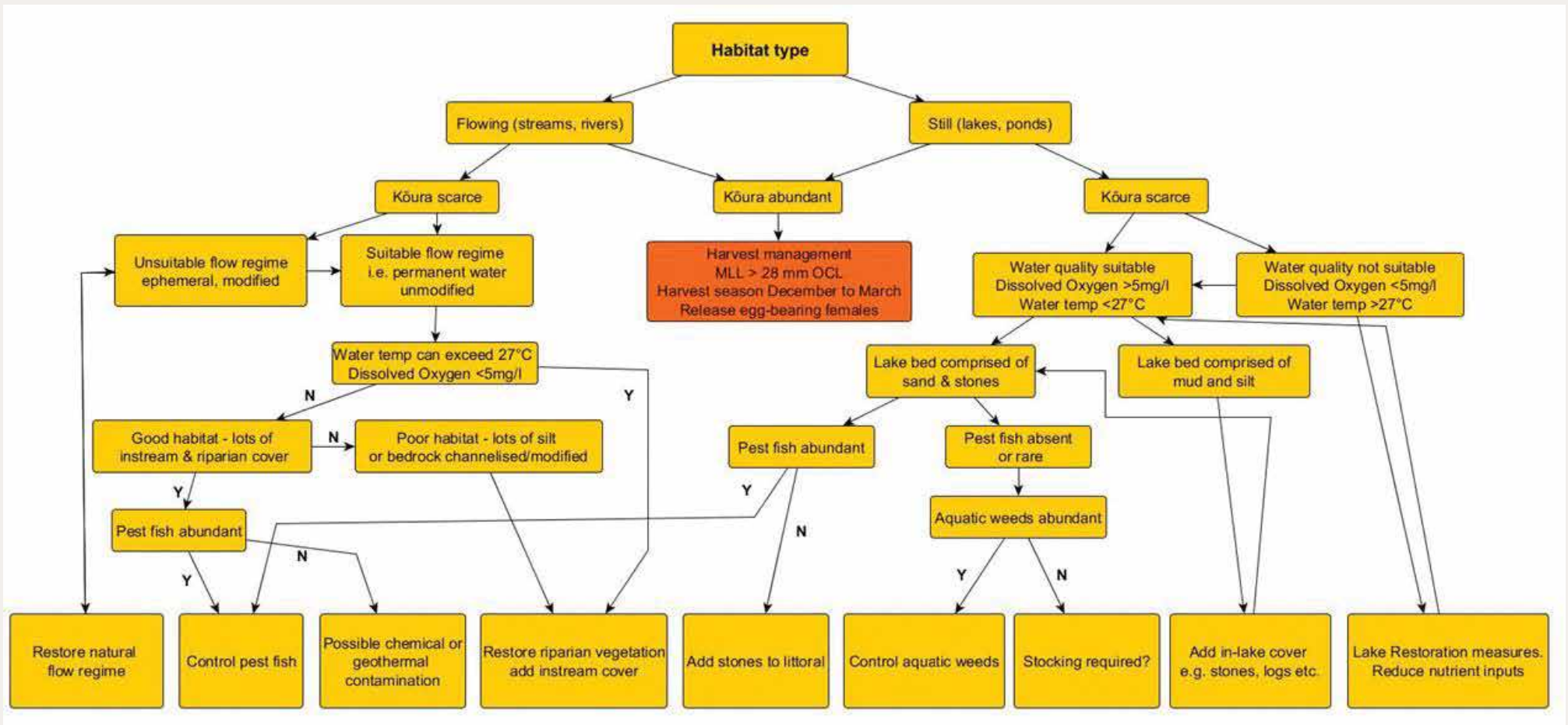


Figure 9: Decision Support System for assisting with koura restoration decisions - Image Credit: NIWA

TENA MO TE TAIAPA ME TE WHAKATO - WHAT ABOUT FENCING AND PLANTING?

Keeping stock out of streams, lakes and ponds by fencing and then planting around their edges helps improve water quality as well as habitat for koura and other species. Some of the key things you need to think about if you are going to be doing this type of work are listed below. Remember that there are lots of “how to” guides for fencing and planting and the ones that are relevant to our rohe are listed in the “Etahi atu mohiotanga - more information” section at the end of this plan.

1. *What type of fence do you need and how far from the waterway should it be?*

The type of fence will largely depend on the type of stock you have. It needs to be suitable to make sure your animals can't get into the riparian area. If you can, fence as far back from the waterway as possible as the larger the fenced riparian area the better for water quality and to allow the stream some room to move if it changes course slightly or during floods. How far you fence back from the stream will depend on your site.

2. *What about wet areas and seeps flowing into the stream or water way?*

If you are able, put your fence around these areas to exclude stock. These areas flow into your waterway so fencing helps improve water quality and they can provide some nice low flow areas for koura.



Planting riparian/streamside areas at Hardcastles Lagoon, Te Awa o Waikato

3. *Should I plant the fenced off area?*

This will depend if you have the resources to do this. Have a think about what's in the fenced off area already and what issues there might be such as weeds. We often have problems with blackberry in our rohe so there might be quite a lot of work in dealing with weed issues first before you think about planting.

4. *If I am going to plant, what plants should I use?*

Native plants are generally preferable as these also provide habitat and food for native birds, insects and other species. However, any planting is largely beneficial as it can provide shade and wood and leaf inputs to the waterway for koura. Just be sure that you aren't creating a bigger problem by planting trees which may be invasive in the longer term and require more mahi to keep them under control. You will find more guidance in the resources listed in the Etahi atu mohiotanga – More Information section at the back of this plan.

It's not just getting the plants in the ground you need to consider. You'll need to look after them for at least 3 years to make sure the weeds don't swamp them and they have room to grow.

TENA MO NGA HAROTO KOURA - WHAT ABOUT KOURA PONDS?

Raising koura in ponds has been done elsewhere in Aotearoa for both recreational and commercial harvest. This section is primarily aimed at those who already have a pond on your land which is linked to a stream which already has koura present. There may be an opportunity to use the pond to enhance your local koura populations. The following points outline what you should consider if you wish to start a koura pond.

1) *If you have koura in your pond, do you have constant water coming into your pond? Is your pond at least 0.5m deep in some places?*

A stagnant pond won't work for koura so you need some form of flow to make sure the water is remaining aerated and fresh. It can either be a stream flowing into the pond or that the pond is part of a wetland where water moves through or it is spring fed. Although you can have a variety of depths within your pond (shallow and deep areas), having a decent amount of water is essential to provide deeper areas for koura and to make sure the pond doesn't overheat. Shallow water heats up quickly.



Koura ponds near Dunedin, Keewai

- 2) *Has your pond got some logs and other habitat already in it for koura to hide?*

If not then you can put some branches or large logs in there to provide cover or you can enhance what you already have by adding more. You could also add some rock, fern fronds or any other vegetation. This provides refuge for koura to hide from predators (if they are present) and also provides cover for “soft” moulting and young koura to hide from predation by other koura.

- 3) *Is your pond already planted with lots of shade and some overhanging vegetation for koura to hide?*

If not then you can plant some plants around the edge which will provide some shade and leafy material into your pond. It will also provide hiding areas/refugia from predators both within the water (tuna, bullies etc) and from birds such as kawau (shags) and kotare (kingfisher). Native plants are preferable including grasses, manuka or other species as they can also provide habitat for native bird species and could be used for other purposes such as weaving or rongoa (medicinal plants).

In the absence of planting you can also use things such as shade cloth over a framework like what is shown in the photo below to provide cover and to also keep the water temperature down.



Potential to use artificial shading for koura ponds - Image Credit: Paul Decker

ETAHI ATU MEA HEI WHAKAROHIA - OTHER THINGS TO CONSIDER

While we are encouraging you to undertake restoration where you can, with what you have, there may be a few other key considerations:

- If koura are to be moved around sites for restoration there are likely some legislative requirements that should be investigated as part of the planning process (see: <https://www.fisheries.govt.nz/growing-and-harvesting/aquaculture/moving-freshwater-species/#releasing-freshwater-newarea>).
- We need to ensure koura are healthy before they are transferred so that there is no spread of harmful diseases (see Etahi atu mohiotanga – more information section).
- We also need to make sure we don't transfer any other unwanted organisms when moving koura (even upstream in the same stream system), such as weeds or other pest fish. We can do this by abiding by the check, clean, dry guidelines (see: <https://www.mpi.govt.nz/travel-and-recreation/outdoor-activities/check-clean-dry/>). Checking that our nets and all our gear are clean is important when we are surveying or harvesting across many sites, not just transporting koura. This will help us avoid introducing anything unwanted into another area of our rohe.

ETAHI ATU MOHIOTANGA – MORE INFORMATION

Want to know more? Here are a few websites with useful information.
General information about koura

<https://www.doc.govt.nz/nature/native-animals/invertebrates/crayfish-koura/>

https://niwa.co.nz/our-science/freshwater/tools/kaitiaki_tools/species/koura

Freshwater crayfish farming – a guide to getting started

<http://keewai.co.nz/wp-content/uploads/2016/07/Koura-Guide-Final-Version.pdf>

Restoring koura

<https://niwa.co.nz/freshwater-and-estuaries/management-tools/restoration-tools/guide-to-restoring-k%C5%8Dura-freshwater-crayfish-in-lakes-rivers-and>

Planting waterways and habitat restoration

<https://waikatoriver.org.nz/plant-selection-tool/>

<https://waikatoregion.govt.nz/assets/WRC/WRC-2019/6519-Plant-ID-Booklet.pdf>

<https://www.waikatoregion.govt.nz/environment/natural-resources/biodiversity/planting-guides/what-to-plant-in-the-central-volcanic-plateau-ecological-region/>

Wetland restoration

https://www.landcareresearch.co.nz/__data/assets/pdf_file/0013/41422/Chp_12_Native_fauna_2012.pdf

PANUI I TUA ATU – FURTHER READING

If you would like to take your reading and knowledge further, you might like to look at the following research papers or theses which have been used to provide information in this plan. These research papers may be available on line using the search engine “Google Scholar”. The theses are available on the University of Waikato website and the relevant links have been included.

Collier, K. J., Parkyn, S. M., & Rabeni, C. F. (1997). Kōura: a keystone species? *Water & Atmosphere*, 5(1), 18-20.

Hopkins, C. L. (1967a). Growth rate in a population of the freshwater crayfish, *Paranephrops planifrons* white. *New Zealand Journal of Marine and Freshwater Research*, 1(4), 464-474.

Hopkins, C. L. (1967b). Breeding in the freshwater crayfish *Paranephrops planifrons* white. *New Zealand Journal of Marine and Freshwater Research*, 1(1), 51-58.

Jowett, I. G., Parkyn, S. M., & Richardson, J. (2008). Habitat characteristics of crayfish (*Paranephrops planifrons*) in New Zealand streams using generalised additive models (GAMs). *Hydrobiologia*, 596(1), 353-365.

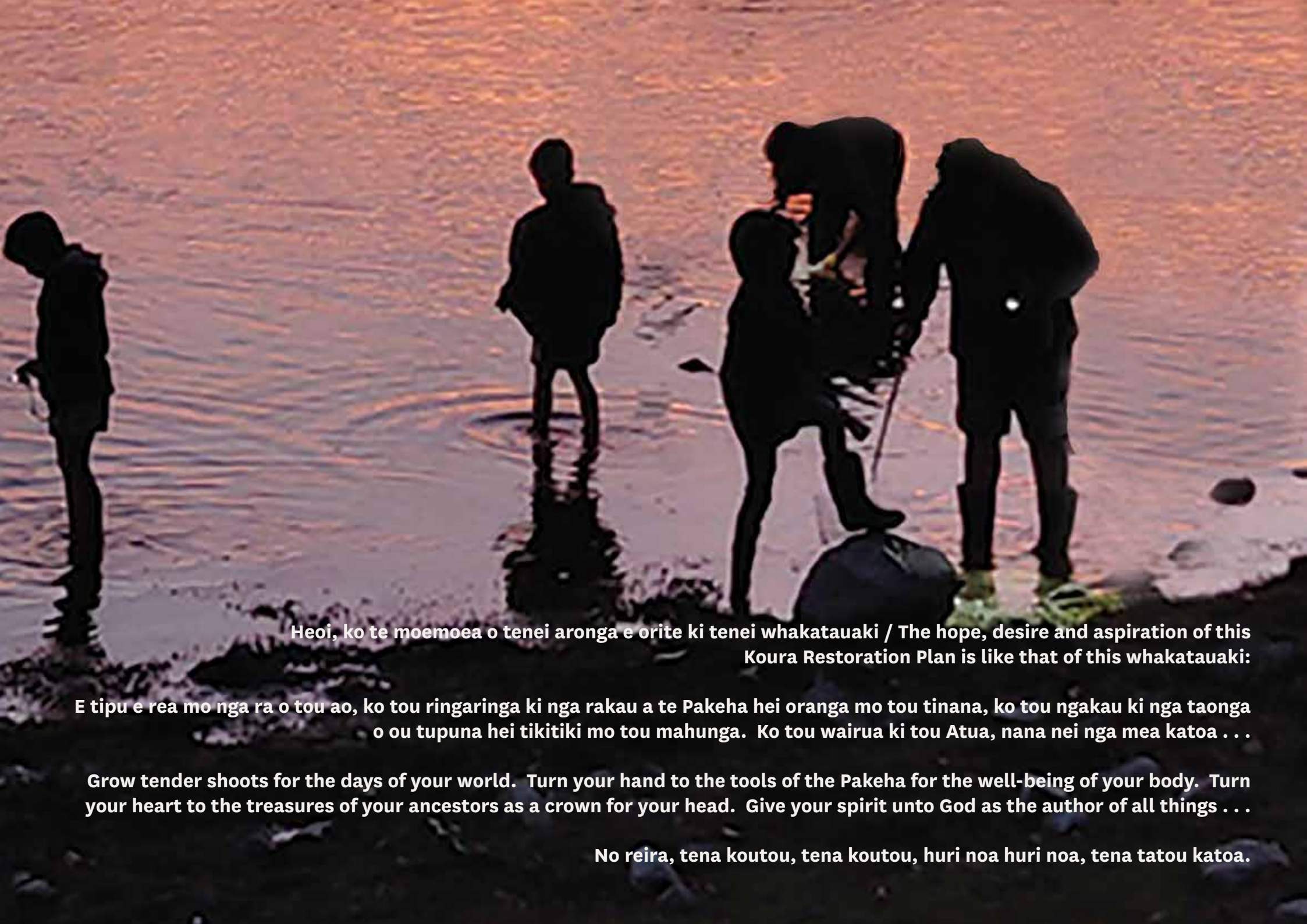
Kelly, J.M. (2019). Comparison of koura (*Paranephrops planifrons*) populations in Waikato hill-country streams with varying type and age of riparian planting and fencing. MSc Thesis <https://researchcommons.waikato.ac.nz/handle/10289/12934>

Kusabs, I. A., Quinn, J. M., & Hamilton, D. P. (2015). Effects of benthic substrate, nutrient enrichment and predatory fish on freshwater crayfish (kōura, *Paranephrops planifrons*) population characteristics in seven Te Arawa (Rotorua) lakes, North Island, New Zealand. *Marine and Freshwater Research*, 66(7), 631-643.

Landman, M. J., Van Den Heuvel, M. R., & Ling, N. (2005). Relative sensitivities of common freshwater fish and invertebrates to acute hypoxia. *New Zealand Journal of Marine and Freshwater Research*, 39(5), 1061-1067.

- Olsson, K., Stenroth, P., Nyström, P., Holmqvist, N., McIntosh, A. R., & Winterbourn, M. J. (2006). Does natural acidity mediate interactions between introduced brown trout, native fish, crayfish and other invertebrates in West Coast New Zealand streams? *Biological Conservation*, 130(2), 255-267.
- Parata, R.N., (2019): Quantifying relationships between koura (*Paranephrops planifrons*) abundance and micro-habitat features in Waikato hill-country streams. MSc Thesis. <https://researchcommons.waikato.ac.nz/handle/10289/13086>
- Parkyn, S. (2000). Effects of native forest and pastoral land-use on the population dynamics and trophic role of the New Zealand freshwater crayfish *Paranephrops planifrons* (Parastacidae). PhD thesis, University of Waikato, Hamilton, New Zealand.
- Parkyn, S. M., & Collier, K. J. (2004). Interaction of press and pulse disturbance on crayfish populations: Flood impacts in pasture and forest streams. *Hydrobiologia*, 527(1-3), 113-124.
- Parkyn, S. M., Meleason, M. A., & Davies Colley, R. J. (2009). Wood enhances crayfish (*Paranephrops planifrons*) habitat in a forested stream. *New Zealand Journal of Marine and Freshwater Research*, 43(3), 689-700.
- Riordan, P. (2000). Population dynamics, habitat analysis and food assimilation in the fresh water crayfish *Paranephrops planifrons* in a North Island stream. MSc thesis, University of Waikato, Hamilton, New Zealand.
- Smith, P. J., & Smith, B. J. (2009). Small-scale population-genetic differentiation in the New Zealand caddisfly *Orthopsyche fimbriata* and the crayfish *Paranephrops planifrons*. *New Zealand Journal of Marine and Freshwater Research*, 43(3), 723-734.
- NIWA (2020) Kōura – What does science tell us about NZ freshwater crayfish? NIWA Information Series 88. https://auso1.safelinks.protection.outlook.com/?url=https%3A%2F%2Fmcontent.com%2Fb96d0103d59682c6de14ae8ec%2Ffiles%2F0058490e-1ab4-474a-a4ef-e07ee59a6fcf%2FFINAL_Taonga_Species_Koura_LOW_RES.pdf&data=02%7Co1%7CKelly.Ratana%4Oniwa.co.nz%7C3ode1aa22d947de9f3008d7f6df4d64%7C41caed736aoc468aba499ff6aafd1c77%7Co%7Co%7C637249311244671692&data=02BlfdPx7C3TlKXNGE6YC9DppvgqkkVNpN36O17D1QTVw%3D&reserved=0
- Williams, E., Crow, S., Murchie, A., Tipa, G., Egan, E., Kitson, J., Clearwater, S., Fenwick, M. 2017. Understanding taonga freshwater fish populations in Aotearoa-New Zealand. NIWA Client Report 2017326HN. September 2017: 228. <https://auso1.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwaimaori.maori.nz%2Funderstanding-taonga-freshwater-fish%2F&data=02%7Co1%7CKelly.Ratana%4Oniwa.co.nz%7C3ode1aa22d947de9f3008d7f6df4d64%7C41caed736aoc468aba499ff6aafd1c77%7Co%7Co%7C637249311244671692&data=wMPniZnOnF67UJxGoVBNW6ELHsNDa%2BtntCOuoDXkrU%3D&reserved=0>
- Egan, E., Woolley, J.M., Williams, E. (2020) Climate change vulnerability assessment of selected taonga freshwater species: Technical report. NIWA Client Report: 2020073CH. March 2020: 86. Available via the Te Wai Maori website (<https://auso1.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwaimaori.maori.nz%2F&data=02%7Co1%7CKelly.Ratana%4Oniwa.co.nz%7C3ode1aa22d947de9f3008d7f6df4d64%7C41caed736aoc468aba499ff6aafd1c77%7Co%7Co%7C637249311244671692&data=RkSA4N%2F2kCti8pPqRRJYFXxyL3wg9ISSIZtn5MvpkkNc%3D&reserved=0>) .





Heoi, ko te moemoea o tenei aronga e orite ki tenei whakatauaki / The hope, desire and aspiration of this Koura Restoration Plan is like that of this whakatauaki:

E tipu e rea mo nga ra o tou ao, ko tou ringaringa ki nga rakau a te Pakeha hei oranga mo tou tinana, ko tou ngakau ki nga taonga o ou tupuna hei tikitiki mo tou mahunga. Ko tou wairua ki tou Atua, nana nei nga mea katoa . . .

Grow tender shoots for the days of your world. Turn your hand to the tools of the Pakeha for the well-being of your body. Turn your heart to the treasures of your ancestors as a crown for your head. Give your spirit unto God as the author of all things . . .

No reira, tena koutou, tena koutou, huri noa huri noa, tena tatou katoa.

Koura



Up close encounter of the Koura kind



NGATI TAHU-NGATI WHAOA

RUNANGA