



Wai Ora Lake Ōkātina Fisheries Project - Final Report May 2019



Ngāti Tarāwhai Iwi Trust



TE ARAWA LAKES TRUST



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Ngā mihi

Unuhia, unuhia te pou,

te pou mua,

te pou roto,

te pou te wharaua.

He aturangi mamao i heke,

heke iho i o ra,

takiki whara,

te ara o Ngatoro.

He ara whano ki te po,

te po nui,

te po roa,

te po matirerau,

he po whaiariki!

E ko taku waka a Te Arawa,

nga hue i te Parata,

Kia eke! Eke hohoro,

Eke Tangaroa,

Hui e! Taiki e!

Tēnā ra koutou i roto i nga āhuatanga o te wā. E mihi ana ki a rātou kua pahure ake nei i te mata o te whenua, arā, rātou kua wehe ki tua o te ārai. Waiho ake i muri nei tātau te hunga ora e mau nei e pupuri nei i ngā taonga i tuku iho. Tātau te hunga ora ki a tātau, tēnā tātau katoa.

Tēnā koutou katoa e te whānau o te kaupapa nei, te rangahau kōura, e oreore ana kia takatū te kōkiri i te kaupapa tiaki wai Māori. Me mihi hoki ki Te Poari o Wai Māori, ka tika. Nā koutou te pūtea tautoko i homai kia tutuki te wawata a te iwi, ara kia ora pai ai o tātau wai.

We gratefully acknowledge the contribution time and experience from all those who have contributed to this project and in particular the expertise and knowledge of Dr Ian Kusabs and our kaumatua Willie Emery.

We acknowledge and thank Te Wai Māori Trust for the valuable support that we have received which enabled us to undertake this work.

Special thanks to our contributors:-

Dr Ian Kusabs (Kōura Technician and Adviser), Joe Butterworth (Technician), Willie Emery (tohunga mahi kōura, Kōura Technician and Adviser) Ken Raureti (Kaiawhina), Mikaere Van Der Leeden – (Kaiawhina), Pirimi Malcolm (tohunga mahi kōura), Rikihana Te Rangi (tohunga mahi kōura), Ngā tamariki o Te Wharekura o Ngāti Rongomai (Kaiawhina), Manu Malcolm (Ngāti Tarāwhai), Tere Malcolm (Ngāti Tarāwhai), Tarewa Rota (Ngāti Tarāwhai), Tame Malcolm (Ngāti Tarāwhai), Cyrus Hingston (Project Coordinator, Ngāti Tarāwhai), Deliah Balle (Project Manager, TALT), Elva Conroy and Nicki Douglas (TALT support)

Executive Summary

The Lake Ōkātina Taonga Fisheries Project is a joint collaboration between Te Arawa Lakes Trust and Ngāti Tarāwhai Iwi Trust to undertake baseline kōura assessment using traditional Tau Kōura methods on Lake Ōkātina. Lake Ōkātina is one of fourteen lakes within the Rotorua region and is located 30 minutes from the Rotorua city centre on State Highway 30.

The Lake Ōkātina Taonga Fisheries Project enabled local hapū members to actively participate in kōura monitoring under the expert guidance of local expert, Dr Ian Kusabs, supported by Joe Butterworth and environmental experts from Te Arawa Lakes Trust.

This project sought to provide the hapū of Lake Ōkātina with a knowledge base about kōura species within the Te Arawa lakes – via a baseline assessment project and ongoing monitoring and to identify ways in which mohiotanga māori, tikanga and kawa can be used to monitor taonga fish species within Ōkātina and the streams and tributaries feeding into Ōkātina. This knowledge and these skills will support them to fulfil their role in future as the hunga tiaki of the Lake and waterways.

Our taonga fish species, which include kōura, kākahi and koaro, are indicators of lake health. Prior to arrival of trout and other exotic species the Te Arawa Lakes teemed with food prized by Māori. These foods consisted of: *kākahi, Kōura, Inanga, Toitoi, Kokopu*. Of these the most famous was the kōura¹.

It is envisaged that to understand the full extent of the abundance and distribution of the range of species on Lake Ōkātina and its tributaries there will be a programme of work over a number of years. This project has successfully covered the first part of the journey which was to assess how things are (e.g. the current state of our taonga fish species via physical monitoring) and how things used to be (via koeke interviews and wānanga) to guide where and we focus future mahi; Kia whakatōmuri te haere whakamua.

The key to achieving this for the long term and ensure intergenerational transfer of knowledge was to engage hunga tiaki of these lakes and waterways in the monitoring project and learn from our koeke through wānanga attended by hapū and iwi members.

Key findings from the Lake Ōkātina Fisheries Project are;

1. The combination of western scientific knowledge systems and hapū traditional knowledge provides a 'kete'² of knowledge and understanding that can inform decision making by hapū, iwi and others.

¹ Kōura – a cultural perspective – Cyrus Hingston, Researcher for Lake Ōkātina Fisheries Project 2018/19

2. Kōura numbers, size, weight and their health compared to other Lakes is known and provides a baseline from which to monitor kōura moving forward.
3. Traditional methods of kai gathering were as much for collecting kai as they were mechanisms for measuring abundance and the health of species; they were designed to catch all sizes and could be adapted to catch in quantities that were required. In a contemporary setting they make the perfect method for monitoring a range of species as well as the full life cycle of the kōura.
4. The ongoing practice of making, preparing and setting the tau kōura enables the telling of historic events and encounters, the sharing of whakapapa and the practice of observing nature and its health. Cultural practices will continue to be a means of keeping traditions and whakapapa strong.
5. In a contemporary setting the revival of all of these cultural practices as the skills and capabilities of hunga tiaki will also contribute to the revitalization of te reo o Te Arawa, te reo o ngā wai³, and the enhance the ongoing transfer of intergenerational knowledge such as whakapapa and the understanding of the sites of significance on the landscape.
6. The ongoing practice of tau kōura and the active participation of hapū and iwi in the role of hunga tiaki will ensure the ongoing survival and enhancement of the taonga species in Lake Ōkātina.
7. Critical success factors include: clearly outlining the roles and responsibilities of the Partners, ensuring the networks of experts, hapū leaders and TALT are well utilized and widening the opportunities for capacity building throughout the life of the project.

‘Te mā o te wai e rite ana kia kite i nga tapuwae ā te kōura’⁴

² Tane retrieved the “Kete o ngā wānanga from Te Toi a ngā Rangi. Kete is a term frequently used to describe a repository of knowledge/matauranga.

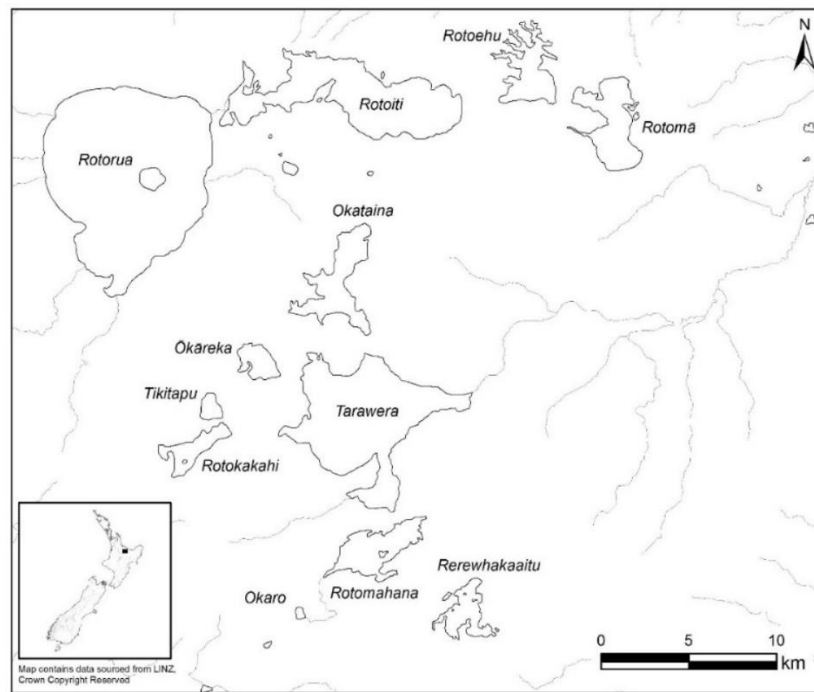
³ This delivers to the expression of “Waiata” in the Te Tūāpapa io ngā Wai framework.

⁴ Outcome stated in Te Tūāpapa o ngā wai o Te Arawa – Te Arawa Cultural Values Framework

Introduction

The traditional name of Lake Ōkātina is Te Moana-i-kātina-a-Te Rangitakaroro which means “The ocean where Te Rangitakaroro laughed”. Te Rangitakaroro and his warriors were resting when one member of his group referred to the lake as an ocean and this was seen as a great joke by the rest of the group. Their laughter echoed around the lake and now remains enshrined in its name.

Lake Ōkātina is largely surrounded by regenerating native vegetation. The Lake is 1080 ha and the catchment area is 6290 ha. It sits at an elevation of 311 m and has an average depth of 39m with the deepest point at 79m.



Te Arawa Lakes Trust is the post settlement governance entity that owns the lake bed of Ōkātina. Te Arawa Lakes Trust owns a total of 14 Te Arawa Lake beds. The hapū and iwi associated with the lake are Ngāti Tarawhai, Ngāti Rongomai and Tuhourangi.

The Te Arawa Lakes Trust was established with the enactment of the Te Arawa Lakes Settlement Act 2006, and was previously the Te Arawa Māori Trust Board (established in 1924).

The Te Arawa Lakes Trust has the role of the restoration of the mauri of the Lakes and to provide cultural advice with the respect to the Te Arawa Lakes.

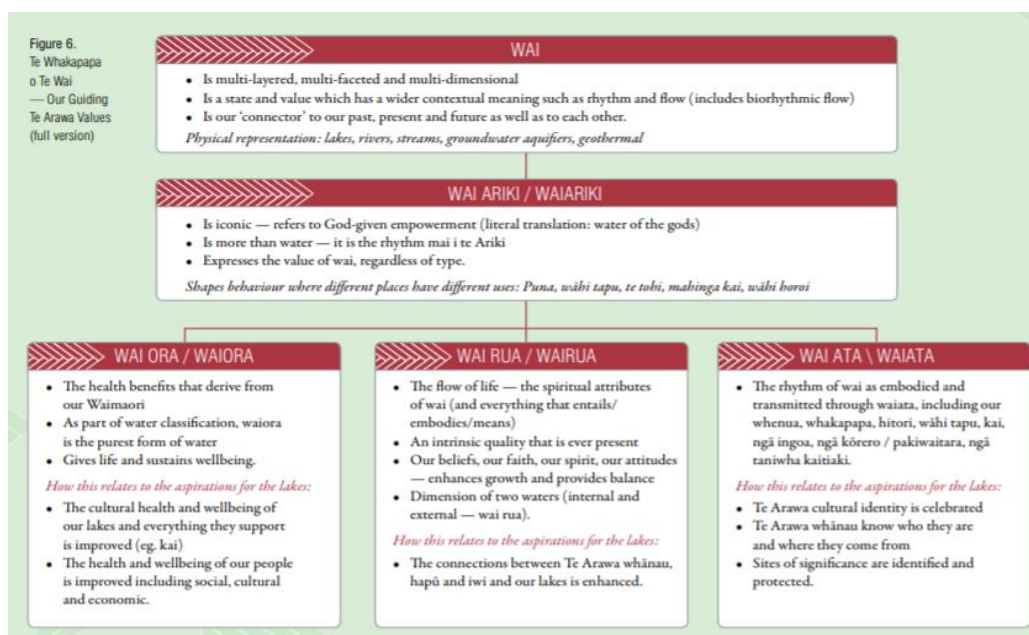
In order to ensure that the Te Arawa values were being appropriately represented by the Trust and to provide guidance to the agencies we partner with, Te Tūāpapa o ngā wai o Te Arawa framework was developed with Te Arawa hapū and iwi. The framework objective *is to show leadership in relation to the*

Te Arawa lakes for intergenerational benefit and to improve awareness and knowledge about the traditional relationship of Te Arawa with the lakes.

This is informed by two key principles;

1. Value the role that Te Arawa has to play - Te Arawa has a long standing physical and spiritual connection to the Te Arawa lakes since settling in the rohe. Example of this Principle in Action – Projects incorporating Mātauranga Māori.
2. Value Te Ao Māori - The Māori world view, culture and values are a core element of what it means to be Te Arawa. An example of this Principle in Action is the use of Mātauranga-based tools to measure and monitor the health of the lakes.

In order to express the relationship between Te Arawa and wai our own tradition framework of whakapapa is applied. It is clear that this is a framework that resonates with our values and describes how Te Arawa engages with our Lakes, puna, streams, awa, wetlands and geo thermal waters.



Te Tūāpapa o ngā Wai o Te Arawa – Whakapapa o te Wai

The Lake Ōkātina Fisheries project has enabled implementation of this Framework as it was envisaged; Applying mātauranga and Te Arawa values to the development, delivery and assessment of the project in real time.

Ngāti Tarāwhai Iwi Trust is one of a number of Te Arawa affiliates who have historical interest in Lake Ōkātina. Ngāti Tarāwhai has a long and enduring association with Lake Ōkātina, and acknowledges whakapapa connections to neighbouring iwi who claim an interest to the wider Ōkātina catchment. Ngāti Tarāwhai Iwi Trust has 1378 registered beneficiaries and constantly seeks to develop its

beneficiary capability through involvement in projects which will have a long-term benefit and add to collective well-being.

Ngāti Tararua have been actively engaged in the past several months with a number of neighbouring land owners and statutory bodies responsible for looking after our moana and whenua within and surrounding the Ōkātina catchment. They are currently part of a collaborative proposal being presented to landowners and statutory bodies for a community-led and pest eradication project. Ngāti Tararua seeks to improve water quality in Lake Ōkātina over time by restoring the forests and ecosystems that connect the land and water. These projects are inter-related for people, our lake and our lands. The first phase is for Ngāti Tararua and the Te Arawa Lakes Trust to partner in a lake monitoring project in particular. This will lead to the active involvement of our rangatahi in a training relationship with scientists and other experts in the field of conservation and water management.

The Bay of Plenty Regional Council is the Local agency with delegated authority for Water Quality monitoring and is also a Partner to the Te Arawa Lakes Trust on the Rotorua/Te Arawa Lakes Strategy Group who is responsible for overseeing the restoration of the Rotorua/Te Arawa Lakes. The Bay of Plenty Regional Council undertakes aquatic pest monitoring and control on Lake Ōkātina and monitor water quality. They have provided written support for this project.

It was anticipated that the benefits to the project could be;

- Enable Ngāti Tararua to demonstrate, in a practical way, kaitiakitanga of Lake Ōkātina.
- Build technical capability and knowledge within Ngāti Tararua.
- Provide practical ways to engage and connect whānau ki te taiao.
- Provide an opportunity for Ngāti Tararua and Te Arawa Lakes Trust to work together to achieve common goals.
- Inspire and empower Te Arawa whānui to take a lead in environment monitoring.

This report will outline the extent to which these benefits were delivered by describing the methodology, the response of hapū and iwi and the future opportunities this project enables.



Photo credit Cyrus Hingston Lake Ōkātina, Kaiwaka from Te Koutu Pa.

Me huri whakamuri, ka titiro whakamua⁵

This section of the report will focus on providing a simple “state of environment” report and outline the historical assessment of kōura species within Lake Ōkātina and the historical distribution followed by the current abundance of kōura within Lake Ōkātina.

Part 1 – History

The historical assessment undertaken by Cyrus Hingston was as a result of wānanga with hapū and iwi members, interviews with koeke and review of numerous publications and reports both historic and contemporary.

The report focusses on the numerous species present in Lake Ōkātina in pre-European times and up to the early 20th Century. The cultural research component has identified the extent of the activities associated with harvest and protection of kōura in Lake Ōkātina and across the wider Rotorua/Te Arawa Lakes.

In the Native Land Court over 150 individual fishing grounds on Rotorua Lake alone were identified by claimants as belonging to them. Incidents and stories relating to various tauranga ika were recorded and give an idea of their cultural significance.⁶

The cultural research also noted the methods applied to ensure the long term sustainability of the kōura (and other fisheries).

Rahui was one method of protecting a food stock’s sustainability. Through observation and experience, Māori realised that the fishery required nurturing. Access to fishing stocks would sometimes be curtailed or prohibited to allow koura the time to rejuvenate and give the population time to rebuild. Overfishing was prohibited and / or, at times certain types of fishing – tau koura or dredging would be prohibited – allowing only the taking of koura through ruku or rama koura. Females with eggs would be put back as would the young. In such a manner sustainability would ensue.⁷

At this time the only threats was the intrusion of other people into the assigned or allocated fishing grounds. Fishing grounds were allocated based on whakapapa or rights won through conquest or significant events. However this was more a threat to hapū themselves losing their access to the kai. The act of kaitiakitanga was so strong that the sustainability of the kōura was not an issue.

⁵ In order to plan for the future we must look to the past; Mahire Whakahaere <https://goo.gl/r7Wtt1>

⁶ Koura – A cultural perspective, Pg 1, Report of Cyrus Hingston for WaiOra Ōkātina Project

⁷ Koura – A cultural perspective, Pg 1, Report of Cyrus Hingston for WaiOra Ōkātina Project

*Taunga ika - fishing grounds were valuable possessions and their ownership jealously guarded and defended. Taunga ika were given names by their owners and marked by tumu (posts), or found using prominent landmarks to ensure they were known as belonging to a certain person, whānau or hapū.*⁸

The issue of threats to the kōura (and other species) arose with the introduction of exotic fish such as Carp, White Fish and Trout to the Rotorua Lakes, by the Auckland Acclimatisation Society in the 1870's. Legislation was developed to support the introduction and fees set to collect funds for the management of this new fishery.

*Many complaints made by Māori that the **trout were so numerous that they destroyed the koura and other native fish...the trout caught weighed perhaps 18 – 20lbs...***

'The various streams leading into the lake and the lake itself are absolutely teeming with fish at the present time. The koura, inanga and carp are fast falling prey to the larger fish, and shags innumerable may be seen hovering about the mouths of the various streams on the lookout for the smaller fry'.

The impacts were devastating for hapū and iwi as their food source was removed, their access to their Lakes were altered and there were arrests made as hapū members sought to fish the new species as a replacement food source.

The effects of this issue are well documented in the Te Arawa Lake Settlement Act historic account as it formed the basis of the almost 70 year negotiation with the Crown for the return of the Lakes and the protection of those taonga species.

The learnings from the cultural research component are;

1. the matauranga applied by Te Arawa hapū and iwi to ensure a sustainable fishery was adequate to support the needs of the hapū and iwi despite there being over 150 allocated fishing grounds,
2. there was tikanga associated with the maintenance of the fishery and this was applied rigorously
3. the introduction of exotic species impacted not only the fishery but the cultural practices and access of hapū to their taonga species,
4. despite the impact of modern man, technology, invasive species and pollution, Koura has somehow managed to survive but not to the extent previously experienced by hapū and iwi.

⁸ Koura – A cultural perspective, Pg 1, Report of Cyrus Hingston for WaiOra Ōkātina Project

Part 2 - Present

The physical monitoring of the kōura was undertaken using tau kōura (traditional Māori fishing method)⁹ and aim of the study was to provide baseline information on the kōura population in Lake Ōkātina. It should be noted that when the monitoring of kōura using the Tau kōura was undertaken, when there were other species present, these were recorded and can form the baseline assessment for future reference but the reports is specifically focusses on kōura as the subject species.

Two tau kōura were deployed, each composed of 10 whakaweku (dried bracken fern; *Pteridium esculentum*, bundles), with c. 10 - 12 fern fronds per bundle, which were attached to a bottom line (a 250-m length of sinking anchor rope) (Table 1). Whakaweku were set in depths ranging from 9 m to 28 m (Fig 1).

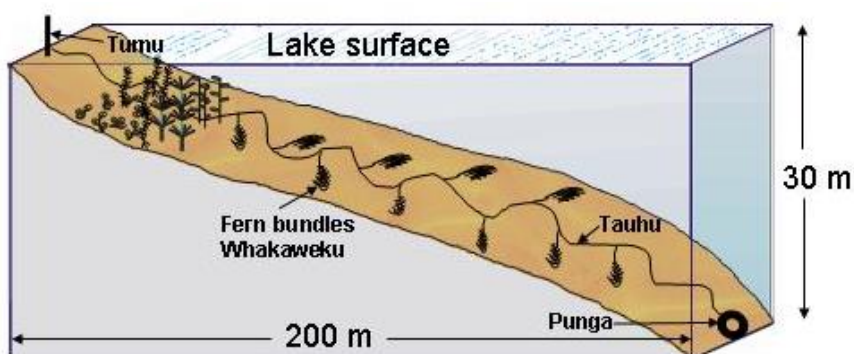


Figure 1 Schematic diagram of tau kōura.

Harvesting was achieved by lifting the shore end of the rope and successively raising each whakaweku while moving along the tauhu (bottom line) in a boat. A kōrapa (landing net) was placed beneath the whakaweku before it was lifted out of the water. The whakaweku was then shaken to dislodge all kōura from the fern into the kōrapa and then then returned to the water. The kōura were then collected and all kōura were counted and assessed on the following;

- shell softness (soft or hard),
- those kōura >12 mm OCL assessed for sex and reproductive state (presence of eggs or hatchlings),
- orbit carapace length (OCL) of each kōura was measured
- a power regression equation was used to estimate kōura wet weight (g) from OCL (mm)
- Common bullies were counted.

⁹ <https://goo.gl/8PNhkU> - NIWA summary sheet on Tau Koura Monitoring

After processing, all kōura and common bullies were returned to the water in close proximity to the tau kōura. Catch per unit effort (CPUE) was defined as the number of kōura per whakaweku and biomass per unit effort (BPUE) as estimated wet weight (g) of kōura per whakaweku (Table 1).

Table 1 Mean CPUE ($n \pm SD$) and biomass ($g \pm SD$) for kōura captured in two tau kōura (each composed of 10 whakaweku) deployed in Lake Ōkātina, August 2018 to May 2019.

Date	Mean CPUE ($n \pm SD$)		Mean BPUE ($g \pm SD$)	
	South	North	South	North
27 August 2018	4.4 (2.5)	3.6 (2.3)	51.9 (42.9)	22.7 (20.8)
23 November 2018	8.9 (2.6)	24.6 (12.3)	65.0 (26.3)	480.3 (345.4)
13 February 2019	10.5 (8.9)	19.0 (9.0)	171.7 (135.6)	165.1 (83.1)
23 May 2019	29.5 (8.4)	11.9 (5.9)	654.4 (240.6)	130.3 (105.7)
	13.3 (11.5)	14.5 (10.9)	235.8 (283.1)	193.3 (239.4)

The summary of findings are reported by Dr Ian Kusabs are;

1. tau kōura was successfully used to sample the kōura population in Lake Ōkātina,
2. the Lake Ōkātina kōura population was characterised by moderate numbers of medium-sized kōura with a mean OCL of 24.5 mm, the fourth lowest in the ten Te Arawa lakes where kōura have been recorded,
3. Lake Ōkātina ranked third in terms of kōura CPUE (13.9 kōura whakaweku-1) and second in terms of BPUE (213.5 g kōura whakaweku-1).¹⁰

It is recommended that the kōura are retrieved again in August 2019 to ensure a full sample size is collected to make up for the sample in August 2018 not being in the water for a sufficient period of time.

Summary

Both of these research components have contributed to a deeper understanding of the kōura population and the relationship between the hapū and iwi and the traditions and practices used to ensure the sustainable management of this species in the past and for the present and future. These 2 research components have provided a baseline dataset for future decision making that the hapū and iwi may engage in.

¹⁰Dr Ian Kusabs - Final Report

Ongoing monitoring of this population will be essential to check the impact of exotic fish and may give early indications of pest fish populations establishing.

As far as it known there are not Catfish in Lake Ōkātina, despite this pest fish being discovered in Lakes Rotoiti and Rotorua in 2017 and 2018 respectively. It is clear from recent research that the Catfish are impacting kōura populations in these lakes. It will be essential to manage this threat to ensure that Catfish or other pest fish do not get introduced to Lake Ōkātina.

There are trout present in Lake Ōkātina and it is difficult to know without any previous baseline study whether there is an impact in the present day. Based on the historical account it is clear that there has been some impact as the Lakes have gone from being abundant with kōura.

The use of traditional methods which were well deployed has a role in the sustainable management of these taonga species. The project has confirmed that the use of this traditional method of harvesting kōura is the most effective way for hapū and iwi to monitor the kōura, also start to look at the other species in the Lake and in the next section we explore the reinvigoration of the relationship between Lake and the people of Ngāti Tarāwhai through the use of this method.



Photo credit Cyrus Hingston Bundles of Whakaweku being deployed into Lake Ōkātina

Kei maunga Taratoa he mahinga waka me o ratou tau kōura – mahinga kōura...'¹¹

This section will focus on the engagement of the hapū in the project and the wider benefits as a result of this research project at Lake Ōkātina.

Benefit to hapū and iwi

This project utilised a physical monitoring method which is based on Mātauranga Māori and also utilised a traditional method of fishing. This project has enabled hapū members to reconnect with their lands and waters by getting whānau to be onsite and assisting with the monitoring. The research component has enabled the collation of historical accounts through interviews and the practice wānanga to exchange information and knowledge, tell stories and share skills and expertise.

There was a combination of wānanga at marae and monitoring on Lake Ōkātina. In order to extend the skills and experience of the hapū members, they were also invited to undertake monitoring on other Lakes by Ian Kusabs.

The wānanga and monitoring exercises were well attended across the life of the project with 170+ participants engaging in a range of activities across a number of locations during this project. The activities that hapū and iwi members were able to engage in for the project were;

- Wānanga to exchange information and knowledge
- AGM reporting back
- Participation in planning and organising project delivery
- Wānanga to learn new skills – making of whakaweku
- Harvesting using tau koura for monitoring purposes
- Measuring, sexing, weighing koura

Results of the engagement were intergenerational knowledge transfer, sharing of mātauranga māori and science, physical connections were made between hapū members with each other, the Lakes, and their marae (Table 2) alongside the collection of data and establishment of the baseline monitoring data for the koura.

The critical success factors in this model of engagement are;

- utilising the wider networks, including engagement with Kura Kaupapa Māori,
- involving key leaders in the hapū and
- enabling the access of hapū to experts in this mahi.

This combination has proven successful and it is recommended that this is applied in future as more projects are developed.

¹¹ Waione P68, Ngati Ahipurakau – Mikaere Heretaunga

Table 2. Participation of hapū members in various engagement opportunities in the Ōkātina Baseline monitoring project.

Date	Type of engagement Wānanga/ Monitoring	No. of attendees by generation				Activity taking place	Location
		Tamariki	Rangatahi	hi Auau/	Koeke		
7/07/18	Wānanga	2	4	16		Introduction to Project, understand interest in participation, structuring of Project format.	Waikohatu Marae
9/07/18	Wānanga		4	7		Construction of whakaweku, site selection and setting tau	Lake Ōkātina
27/08/18	Wānanga and Monitoring	4	7	8		Monitoring, capturing data, education sexing, health and size	Lake Ōkātina
27/10/18	Wānanga		3	9		Presentation of monitoring data, next steps	Waikohatu Marae
2/11/18	Monitoring		1	3		Monitoring, capturing data	Lake Ōkātina
01/12/18	Wānanga (AGM)			40		Presenting preliminary research	Hinemihi Marae
13/02/19	Monitoring		1	3		Monitoring, capturing data	Lake Ōkātina
10/03/19	Wānanga			30		Project update, site visit, research findings	Lake Ōkātina
15/03/19	Wānanga and Monitoring			7		Repairing whakaweku, re-location and monitoring	Lake Ōkātina
19/04/19	Wānanga Rangatahi		12	4		Project learnings, education koura environment, sexing, data collation	Waikohatu Marae
25/05/19	Wānanga			8		Project learnings, research findings, next steps	Waikohatu Marae

The Milestone reports have noted the various activities, information sharing, knowledge transfer and deepening of connection taking place through the wānanga and monitoring phases. The following excerpts provide an insight into the specific details of the activity;

The first wānanga took place on Saturday 7 July at Waikohatu Marae and focused on the methodology of monitoring using tau koura.

The wānanga was well attended with 22 people, including koroua and rangatahi. Tau koura experts Ian Kusabs and Joe Butterworth presented video footage of the tau koura process, the behaviour of koura, water quality monitoring on Lake Ōkātina and tau koura data taken from a number of other Te Arawa Lakes. It was noted that there has been very little monitoring undertaken on Lake Ōkātina to date, thus emphasising an exciting milestone for Tarawhai and experts involved.

Ken Raureti, member of the Komiti Whakahaere (Te Arawa Fisheries Committee) updated whānau on the Proposed Bylaws and the projects alignment to the current efforts of the Komiti and TALT to protect our taonga fish species around the Te Arawa lakes.

Following the presentations, whānau shared their history and traditions using the tau koura, materials used, matauranga around site selection and present day limitations i.e tau koura on foot becoming more difficult in areas due to rising lake levels and steeper slopes. Discussion then ensued around whānau participation, logistics and the setting of dates for the monitoring to take place.

*The second wānanga, 9th July, focused on the construction of the whakaweku, the materials used and the matauranga around the selection of sites. It was therefore decided at the first wānanga that this would coincide with the field trip of setting the tau koura. Attendees were able to apply the matauranga gained from the first wānanga to construct the whakaweku and also to understand the importance of site selection when using tau of this size (11 whakaweku or bundles) 200m in length. The two sites were chosen based on historical sites/depth /protection sees location of tau koura sites wānanga #2 below.*¹²



¹² Update report for WaiOra Okātina Project August 2018

We had a good day out on the lake. There were 10 tamariki in all and 8 adults, another 5 parents came for half an hour - listened to the korero Ian gave about koura, measuring and identifying them and left before I could get their names. All the students would have loved to have got out on the water. Joe Butterworth says he should be able to get two more boats so that they can come out to observe.” – Cyrus Hingston, Ngāti Tararawai



There were only 3 of us involved in the monitoring this time. Ian, I and Mikaere van der Leeden as we only had the one boat.

Conditions were calm and sunny (ideal for boating but not mahi koura). The koura try to escape the ferns when they hit the light coming out of the water so we lost a few while I was dragging up the kawenga. (I was too slow but once got the hang of it didn't lose too many. The koura that we picked up at Otangimoana (southeast Ōkātina) were in deeper water. We consistently gathered larger and more numerous koura there than we did at the tau at Kaiwaka (Northeastern end of Ōkātina).

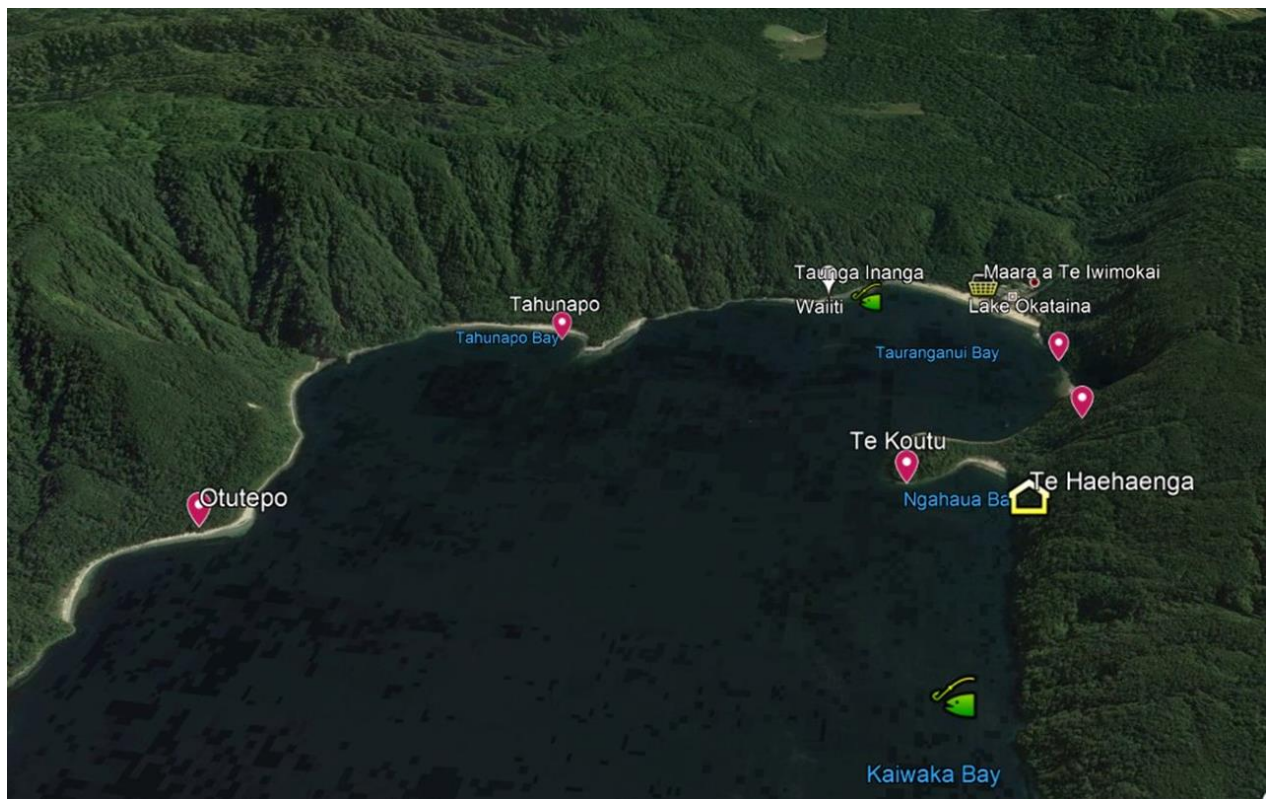
Mikaere and I helped reset the tau koura line that is at Kaiwaka. This needed to be done as the line was set too shallow. An extra 50 - 100m metres was added to the original tau line and then set into deeper water. The shallower the water is where the smaller (juvenile) koura live. We also counted koaro and dragonfly beetles that were caught in the ferns / kupenga.¹³



¹³ Report from Cyrus Hingston following monitoring in November 2018

As well as wānanga and monitoring, Ngāti Tarāwhai undertook research on the historical relationship and association of hapū and iwi with Lake Ōkātina and koura.

Cyrus has undertaken substantial research in the past 3 months which has included interviews with whānau, Papers Past, Digital NZ Archives and Native Land Court Minutes relevant to mahi koura and tau koura on Lake Ōkātina. The purpose of the wānanga held on 4th December at Hinemihi Marae was to present the information gathered and seek further input and stories from whānau. It has been interesting to note that the research to date has found that many whānau stories are based around surrounding lakes i.e Rotoiti, due to the isolation of Lake Ōkātina and that much of the traditions pertaining to the lake are historical. A key outcome of this project will see the building of matauranga and reconnecting of Tarawhai to their roto taonga.



Both the methods of research – wānanga and interviews - combined with the monitoring have enabled the transfer of knowledge from technical experts, kōura experts and holders of matauranga and hunga tiaki to hapū members and future generations.

This project enables our whānau to be more connected with their whenua, their roto and to each other. It builds our knowledge base, our capacity and our capability. This means that we will be more technically capable of continuing kōura monitoring ourselves.

The engagement of the hapū members in this project has heightened the interest of whānau in their participation as hunga tiaki of Lake Ōkātina and it is anticipated that they will continue the monitoring and expand the scope of the work undertaken to date.

The final stage of this project begins with a rangatahi wānanga on 16th April during the Easter holidays followed by monitoring in May and the final wānanga which we anticipate will also include a hapū sharing their work around the lakes in freshwater, cultural health monitoring and protection of our taonga species. We are very excited to be able to share the learnings and research we have gathered thus far!¹⁴

The final wānanga on 16th May 2019 provided the opportunity for the results of the research and monitoring programmes to be presented to the hapū and iwi.

As a result of this discussion following the presentations the hapū and Te Arawa Lakes Trust staff committed to 2 follow up actions;

1. A presentation of the findings to the wider Te Arawa iwi
2. Support to Ngāti Tarāwhai to submit a funding application independently of TALT to progress next steps in the setting of the baseline and research for Lake Ōkātina.

At time of writing this report the application as been made and a date set for the report back.

Benefit to Te Arawa Lakes Trust

Mahire Whakahaere

In 2014 the Mahire Whakahaere 2014 (Te Arawa Fisheries Plan) was finalised and implementation of this is underway.

The Vision for the Mahire Whakahaere is *Te Arawa taonga fishery is healthy, plentiful, sustainably managed, and Te Arawa have undisturbed possession and access to Te Arawa taonga fishery, mo ake, tonu atu.*

The Plan then envisages 5 key objectives and this project has been fundamental in delivering to three (3) of these objectives (Table 3).

¹⁴ WaiOra Okātina Update report March 2019

Mahire Whakahaere objective		Activity in Ōkātina Project
Objective 2	Obtain information on the customary fisheries in the Te Arawa lakes.	<ul style="list-style-type: none"> Establishment of baseline kōura population in Lake Ōkātina Research Project on History of koura in Te Arawa Lakes and Lake Ōkātina.
Objective 3	Promote customary fishing in the Te Arawa lakes	<ul style="list-style-type: none"> Teaching of tau koura method Construction and deployment of whakaweku from experts
Objective 4	Prevent the degradation and support the restoration of fisheries habitats in the Te Arawa lakes	<ul style="list-style-type: none"> Whānau sharing practices of rama koura Enhances the importance of keeping the Lake pest fish free Use the findings collected from this project to inform decision making about Lake Ōkātina in future

Table 3 – Benefits for Mahire Whakahaere

The Te Arawa Lakes Trust has also had the opportunity to demonstrate a role in supporting hapū and iwi projects to build capacity and capability to continue to fulfil their role as hunga tiaki of their respective Lakes.

Engagement Benefits

The combination of Ngāti Tarawhai leading this project in their traditional rohe, TALT providing a support role and having access to specific expertise in the associated species are all critical success factors. The roles and responsibilities of each Partner and contributor were clearly outlined at the beginning and largely these roles were adhered too (Table 4).

There were some challenges in the early 2019 when the coordination and research role for Ngāti Tarawhai started to fall to one individual. Equally the Report Writing role at TALT became the role of the Project Manager. While these occurrences did not impact on the project roll out and completion, the reports were delayed and there was a lack of continuity of information which made report writing challenging. A key learning is the need to bring those hapū members who are showing an interest into the wider team and build capability across a range of roles; not just monitoring and research but planning and organising.

Feedback from Ngāti Tarawhai has indicated that hapū and iwi members are in a position to take leadership roles in environmental matters and TALT support has provided the opportunity for this confidence to develop.

With these learnings in place TALT will continue with this model of engagement across future projects.

<p>PROJECT MANAGER (TALT-Deliah)</p> <ul style="list-style-type: none"> • Budget • Milestone monitoring • Update reports 		
<p>PEOPLE COORDINATOR (IWI-)</p> <ul style="list-style-type: none"> • Wānanga • Liaison to <ul style="list-style-type: none"> ○ Tarawhai ○ TALT ○ Techies ○ DOC ○ OSR ○ Rongomai ○ Tuhourangi ○ Pikiāo ○ Rangitihi 	<p>REPORT WRITER (TALT)</p> <ul style="list-style-type: none"> • Update reports • Final Report 	<p>RESEARCHER (IWI)</p> <p>Follow-up – literary, wānanga, interviewers</p> <p>Present to hapū/iwi on findings</p>

Table 4. Roles and responsibilities from Project planning hui

Te Tūāpapa o ngā Wai o Te Arawa

The Te Tūāpapa o ngā Wai o Te Arawa envisages that Te Arawa values and Te Ao Māori inform the approach taken to the restoration and improvement of the Rotorua/Te Arawa Lakes, are the taonga species they contain.

This project has been developed and delivered aligned with these principles and also to seek to deliver to Waiora, Waiata and Wairua. This aspect of the project is described in the Evaluation section of this report.

Benefit to wider Community and Aotearoa/New Zealand

Lake Ōkātina has an Action Plan develop in 2012. While it is not one of the Lakes funded under the Rotorua/Te Arawa Lakes Programme it is monitored for clarity, algae, phosphorus and nitrogen to provide the TLI (Trophic Level Index) – the indicator for Water Quality. Until this project Lake Ōkātina was not regularly monitored for taonga species however it has some actively management due to an incursion of the aquatic plant pests Lagrosiphon and hornwort. It is imperative that Catfish recently found in Lake Rotorua and Lake Rotoiti is not introduced to Lake Ōkātina.

The community aspirations outlined in the Action Plan for Lake Ōkātina are;

- The lake as clean as possible with good water quality
- The environment and current good water quality maintained

- Lake Ōkātina as a showcase for New Zealand flora and fauna with a healthy ecosystem that is free of pests
- Lake Ōkātina as a fishing destination
- Boat-users check and clean boats for weed before entering the lake
- The effect that visitors have on the lake managed, monitored and reported – with enough toilets available for any events held at the lake
- Local iwi playing a primary role in looking after the lake and land
- A programme in place to look after the lake
- Updated, easy-to-understand science information available.

This project aligns with the Action Plan set by BOPRC with input from the wider community.

This project will enable Te Arawa Lakes Trust and Ngāti Tarāwhai to present data to better inform decision making to further protect Lake Ōkātina. The wider community will have additional information which to consider when participating in decision making processes. Combined with the aspirations of the community outlined here and the information from this project, Ngāti Tarāwhai are well positioned to lead future discussions on the future management of Lake Ōkātina.

This project has demonstrated the benefits associated with iwi-led monitoring of tāonga fish species which in turns contributes to iwi capacity building in freshwater fisheries and has provided a means of addressing key gaps in our knowledge about the abundance and distribution of taonga fish species. This was identified as a gap in the 'Understanding Taonga Freshwater Populations in Aotearoa' report.

Evaluation of Project

The evaluation of this project is against the Results Based Accounting approach and the Outcomes framework applied by the Te Arawa Lakes Trust.

The benefits described are taken as the Results and the Indicators are considered for each result or outcome.

Outcome/Result		Indicator	Measure	Feedback
<p>Te Arawa is well equipped for the journey ahead</p> <p>WAIKUA – the connection between Te Arawa whānau, hapū and iwi and our Lakes is enhanced</p> <p>WAIORA – The health and wellbeing of the water and the wellbeing of our people are connected.</p> <p>WAIATA – Our cultural identity is celebrated</p>	Enable Ngāti Tarawhai to demonstrate, in a practical way, kaitiakitanga of Lake Ōkātina.	<p>Participants in monitoring programme are Ngāti Tarawhai descent.</p> <p>Traditional relationship with Lake Ōkātina and koura is known</p>	# of participants of Ngāti Tarawhai descent participating in monitoring activity	<p>4 of monitoring team throughout project are Ngāti Tarawhai</p> <p>Ngāti Tarawhai recognise the need to develop Te Reo o Te Taiao</p> <p>Ngāti Tarawhai are working on an Iwi Management Plan</p>
	Provide practical ways to engage and connect whānau ki te taiao.	Ngāti Tarawhai hapū members can undertake tau koura monitoring, make whakaweku and know where and when to deploy these.	# of participants at wānanga who increase their knowledge as a result of the project	<p>Ngāti Tarawhai are working on an Iwi Management Plan</p>
	Build technical capability and knowledge within Ngāti Tarawhai.	<p>Rama koura and other methods for harvest are shared and used.</p> <p>Attendees at wānanga are Ngāti Tarawhai</p> <p>Ngāti Tarawhai are applying their expertise</p>	#participants contributing as hunga tiaki beyond project	
	Provide an opportunity for Ngāti Tarawhai and Te Arawa Lakes Trust to work together to achieve common goals.	Goals described by both organisations are achieved. Future opportunities to work together are explored	#increased engagement between Ngāti Tarawhai and TALT	
	Inspire and empower Te Arawa whānui to take a lead in environment monitoring	Iwi and hapū around Te Arawa seek to undertake their own projects Ngāti Tarawhai continues to engage in koura monitoring.	#increase in projects sought by hapū and iwi	Hunga tiaki wānanga and He Huihuinga Rotomoana sessions

Appendices

Appendix 1 – Dr Ian Kusabs – Final Report – Lake Ōkātina Kōura monitoring 2019

EXECUTIVE SUMMARY

Kōura or freshwater crayfish are an abundant macroinvertebrate in many of the Rotorua Te Arawa lakes and are considered a taonga species by Te Arawa iwi. The aim of this study was to provide baseline information on the kōura population in Lake Ōkātina.

The tau kōura, a traditional Te Arawa/ Ngāti Tūwharetoa harvesting method, was used to sample kōura in Lake Ōkātina. Two tau kōura each composed of 10 whakaweku (bracken fern bundles) were deployed at the northern and southern ends of the lake.

The tau kōura was successfully used to sample the kōura population in Lake Ōkātina, catching high numbers as well as a balanced sex ratio and a wide size range of kōura. The Lake Ōkātina kōura population was characterised by moderate numbers of medium-sized kōura with a mean OCL of 24.5 mm, the fourth lowest in the ten Te Arawa lakes where kōura have been recorded. Lake Ōkātina ranked third in terms of kōura CPUE (13.9 kōura whakaweku⁻¹) and second in terms of BPUE (213.5 g kōura whakaweku⁻¹).

1 INTRODUCTION

Kōura are the largest bottom living crustacean and an important ecological component of the Te Arawa lakes. They are also an important mahinga kai species for Te Arawa iwi (Hiroa 1921; Stafford 1996, Kusabs *et al.* 2015a) supporting customary fisheries in lakes Rotoiti, Rotomā and Tarawera. Freshwater crayfish are considered a keystone species in many freshwater ecosystems acting as predators, shredders, and detritivores (Nyström 2002). In addition, crayfish increasingly feature as indicator species because of their important role in aquatic ecosystem food webs and their iconic and heritage values (Reynolds and Souty-Grosset 2012).

Until recently, there was a lack of quantitative information on kōura abundance and ecology which made it difficult for iwi and government agencies to manage kōura populations in New Zealand lakes. However, the recent development and use of the tau kōura, a traditional Māori harvesting method (Fig. 1), for monitoring (Kusabs and Quinn 2009) and research purposes has greatly increased understanding of kōura populations in Te Arawa lakes. Kusabs *et al.* (2015b) found that kōura abundance and distribution in seven Te Arawa lakes was influenced by the combined effects of lake-bed sediments, lake morphology, and hypolimnetic deoxygenation. Furthermore, (Kusabs *et al.* 2015a) examined biological traits of Te

Arawa lake kōura and used this data to determine fisheries regulations as part of the sustainable management of kōura in Te Arawa lakes.

The aim of this study was to obtain baseline information on the kōura population in Lake Ōkātina in order to determine long-term population trends. In addition, it is envisaged that information collected on kōura biological traits will be of use to the fisheries manager - Te Arawa Lakes Trust (TALT).

2 STUDY AREA

Lake Ōkātina is located in the Central North Island of New Zealand within the Taupo Volcanic Zone (Fig. 1). It is a medium sized (10.8 km²), monomictic lake with an average depth of 39 m and maximum depth of 79 m. Ōkātina is an oligotrophic lake and in 2017 had a Trophic Level Index (TLI) of 2.7 (LAWA 2019). The lake is completely surrounded by native forest, which comprises 79% of its total catchment area of 6290 ha.

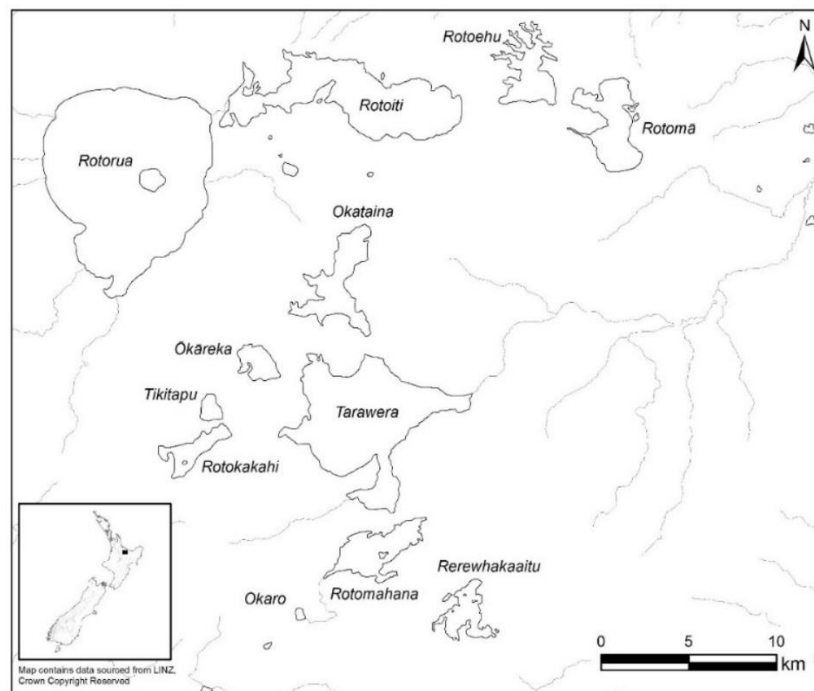


Figure 1 Map of the Rotorua Te Arawa Lakes region showing the location of Lake Ōkātina.

3 METHODS

3.1 Tau kōura construction and use

Kōura in Lake Ōkātina were sampled using the tau kōura (Fig. 1) a traditional Māori method of harvesting kōura in the Te Arawa and Taupō lakes (Hiroa 1921; Kusabs and Quinn 2009). Two tau kōura were deployed, each composed of 10 whakaweku (dried bracken fern; *Pteridium esculentum*, bundles), with c. 10 - 12 fern fronds per bundle, which were attached to a bottom line (a 250-m length of sinking anchor rope) (Table 1). Whakaweku were set in depths ranging from 9 m to 28 m (Table 1, Fig 3). Tau kōura were deployed in on 10 July 2018 and were left for approximately five weeks to allow kōura to colonise the fern before first retrieval on 27 August 2018, they were retrieved again on 23 November 2018 and 13 February 2019. Owing to decomposition, whakaweku were replaced with fresh bracken fern on 14 March 2019 and retrieved again on 23 May 2019.

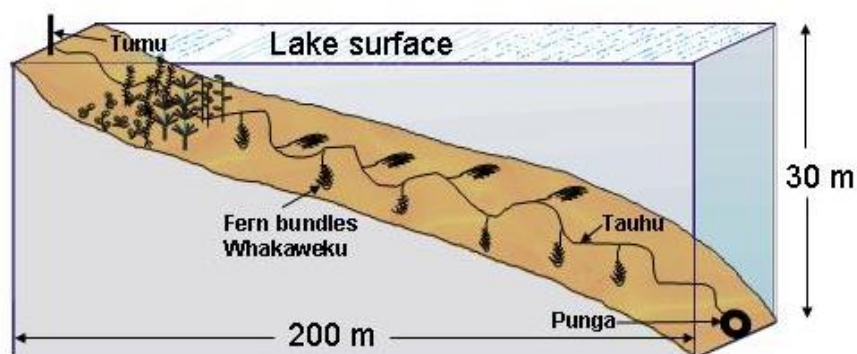


Figure 2 Schematic diagram of the tau kōura. The depth and length of tau are indicative and can be varied depending on lake bathymetry.

Table 1 Sampling site, grid reference and approximate location of kōura monitoring sites in Lake Ōkātina.

Lake	Sampling site	Latitude Longitude (Decimal degrees)		Water depth (m)
Ōkātina North	Site 1	38 07 00	176 25 45	9 - 28
Ōkātina South	Site 2	38 08 55	176 25 47	10 - 28



Figure 3 Lake Ōkātina showing the approximate locations and direction of the North (A) and South (B) tau kōura.

3.2 Kōura collection and measurement

Harvesting was achieved by lifting the shore end of the rope and successively raising each whakaweku while moving along the tauhu (bottom line) in a boat. A kōrapa (landing net) was placed beneath the whakaweku before it was lifted out of the water. The whakaweku was then shaken to dislodge all kōura from the fern into the kōrapa and then then returned to the water. The kōura were then collected and placed into labelled (2 litre) plastic containers covered by lids to keep kōura shaded and calm before analysis.

All kōura were counted and assessed for shell softness (soft or hard) and those kōura >12 mm OCL¹⁵ assessed for sex and reproductive state (presence of eggs or hatchlings). Orbit carapace length (OCL) of each kōura was measured using vernier callipers (± 0.5 mm). A power regression equation previously determined (Hicks and Riordan unpublished data) was used to estimate kōura wet weight (g) from OCL (mm): Wet weight = $0.000648 \text{ OCL}^{3.0743}$

Common bullies were counted. After processing, all kōura and common bullies were returned to the water in close proximity to the tau kōura. Catch per unit effort (CPUE) was defined as the number of kōura per whakaweku and biomass per unit effort (BPUE) as estimated wet weight (g) of kōura per whakaweku.

3.3 Data analysis

The Kolmogorov-Smirnov test was used to determine whether the sample distribution was normally distributed. Differences between kōura CPUE and BPUE at the two sites were then assessed using the independent samples t-test which was performed using R version 3.3.3. The t-test is a hypothesis test that is used to compare the means of two populations.

4 RESULTS

4.1 Kōura abundance and biomass

A total of 1171 kōura were captured in Lake Ōkātina with a mean CPUE of 13.9 (SD 11.1) kōura whakaweku⁻¹ and a mean BPUE of 213.5 (SD 260.4) g kōura whakaweku⁻¹ (Table). The highest mean CPUE (29.5 kōura whakaweku⁻¹) and mean BPUE (654.4 g kōura whakaweku⁻¹) were both at the south site in May (Table 3). There were no significant differences in kōura CPUE ($t(39) = -0.481$, $P = 0.63$) or BPUE ($t(43) = -0.745$, $P = 0.46$) between the two tau kōura sites over the sampling period.

Table 2 Mean CPUE ($n \pm SD$) and biomass ($g \pm SD$) for kōura captured in two tau kōura (each composed of 10 whakaweku) deployed in Lake Ōkātina, August 2018 to May 2019.

Date	Mean CPUE ($n \pm SD$)		Mean BPUE ($g \pm SD$)	
	South	North	South	North
27 August 2018	4.4 (2.5)	3.6 (2.3)	51.9 (42.9)	22.7 (20.8)
23 November 2018	8.9 (2.6)	24.6 (12.3)	65.0 (26.3)	480.3 (345.4)
13 February 2019	10.5 (8.9)	19.0 (9.0)	171.7 (135.6)	165.1 (83.1)
23 May 2019	29.5 (8.4)	11.9 (5.9)	654.4 (240.6)	130.3 (105.7)
	13.3 (11.5)	14.5 (10.9)	235.8 (283.1)	193.3 (239.4)

4.1.2 Kōura size and sex ratio

The mean OCL of all kōura collected in Lake Ōkātina was 24.5 ± 6.9 mm (± 1 SD) with individuals ranging from 6 to 45 mm OCL (Table 4; Fig. 4). Female kōura were larger than male kōura, with a mean size of 25.5 ± 6.9 mm (± 1 SD) for females, compared to 24.1 ± 6.4 mm (± 1 SD) for males. Two size

classes were identified as cohorts in Lake Ōkātina from the May 2019 samples (Fig. 6). The young-of-the-year (YOY) cohort ranged from 8 to ~18 mm and the age 1-year class was ~19 to 26 mm. Numbers were too low to reliably identify year classes above these ages.

The overall ratio of female to male kōura in Lake Ōkātina was 50%, with the percentage of females caught over the sampling period ranged from 33.8 to 59.8% (Table 4).

Table 3 Mean OCL ($n \pm SD$) and range (mm) and percentage of females (n = number of kōura sexed) for kōura captured in two tau kōura (each composed of 10 whakaweku) deployed in Lake Ōkātina, August 2018 to May 2019. (n) = number of kōura sexed.

Date	Mean OCL ($n \pm SD$)		OCL Range (mm)		Female to male % (n)	
	South	North	South	North	South	North
27 August 2018	22.3 (6.8)	18.8 (4.5)	11 - 39	12 - 31	47.5 (40)	52.8 (36)
23 November 2018	19.3 (5.3)	27.7 (7.1)	6 - 38	10 - 45	55.4 (89)	33.8 (151)
13 February 2019	25.8 (5.0)	21.0 (5.3)	16 - 38	9 - 36	46.1 (102)	51.4 (185)
23 May 2019	29.1 (5.1)	21.6 (6.7)	14 - 45	6 - 41	59.8 (291)	46.3 (160)

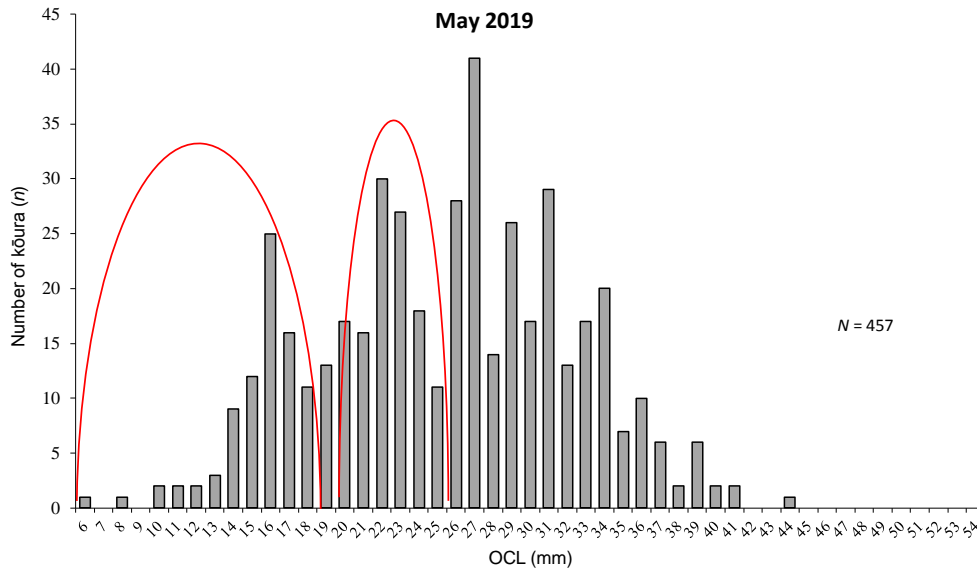


Figure 4 Length frequency distribution of kōura captured on two tau kōura (each composed of 10 whakaweku) deployed in Lake Ōkātina, samples collected 23 May 2019. The young-of-the-year (YOY) cohort and the age 1-year classes are outlined in red.

4.1.3 Egg-bearing females and moulting kōura

Egg-bearing kōura were recorded in Lake Ōkātina in October, August and May but none were collected in February (Table 5). Female kōura bearing hatchlings or eggs ranged in size from 24 to 42 mm OCL. Kōura in soft shells were present on all four sampling occasions, with the highest percentage recorded in May (15%) (Table 5).

Table 4 Number of kōura sampled, mean percentage of breeding size females with eggs or young (defined as >21 mm OCL) and mean percentage of kōura with soft shells, in samples collected from two tau kōura (each composed of 10 whakaweku) deployed in Lake Ōkātina, August 2018 to May 2019. (n) = number of kōura sexed.

Survey date	Number of kōura sampled	% Breeding size females with eggs	Range breeding size OCL mm	% Soft shells
27 August 2018	80	53.8	25 - 39	10.0
23 November 2018	240	18.6 (11)	25 - 41	7.9 (19)
13 February 2019	291	0	-	5.5 (16)
23 May 2019	457	28.3 (212)0	24 - 42	14.9 (68)

5 Discussion

The tau kōura was successfully used to sample the kōura population in Lake Ōkātina, catching high numbers as well as a balanced sex ratio and a wide size range of kōura. The Lake Ōkātina kōura population was characterised by moderate numbers of medium-sized kōura with a mean OCL of 24.5 mm, the fourth lowest in the ten Te Arawa lakes where kōura have been recorded. Lake Ōkātina ranked third in terms of kōura CPUE and second in terms of BPUE in the 14 Te Arawa lakes where kōura monitoring has been undertaken (Fig. 9).

The mean CPUE of 13.9 kōura whakaweku⁻¹ and mean BPUE of Kōura CPUE (13.9 kōura whakaweku⁻¹) and BPUE (213.5 g kōura whakaweku⁻¹) were similar to neighbouring Lake Rotoiti CPUE (17.8 kōura whakaweku⁻¹) and BPUE (246.5 kōura whakaweku⁻¹) (Fig. 9). However, the Lake Rotoiti kōura data was collected from March 2017 to February 2018; it will be interesting to see if this changes now that brown bullhead catfish are well established in this lake.

It is recommended that the tau kōura in Lake Ōkātina be retrieved again in August 2019. The low number of kōura collected in August 2018 was almost certainly due to the insufficient 'soak time' of 4 - 5 weeks, which did not allow kōura enough time to colonise the whakaweku. A short (4 to 6 week) soak time is adequate in summer but at least 2 months is required in winter when water temperatures are cooler and kōura are less active.

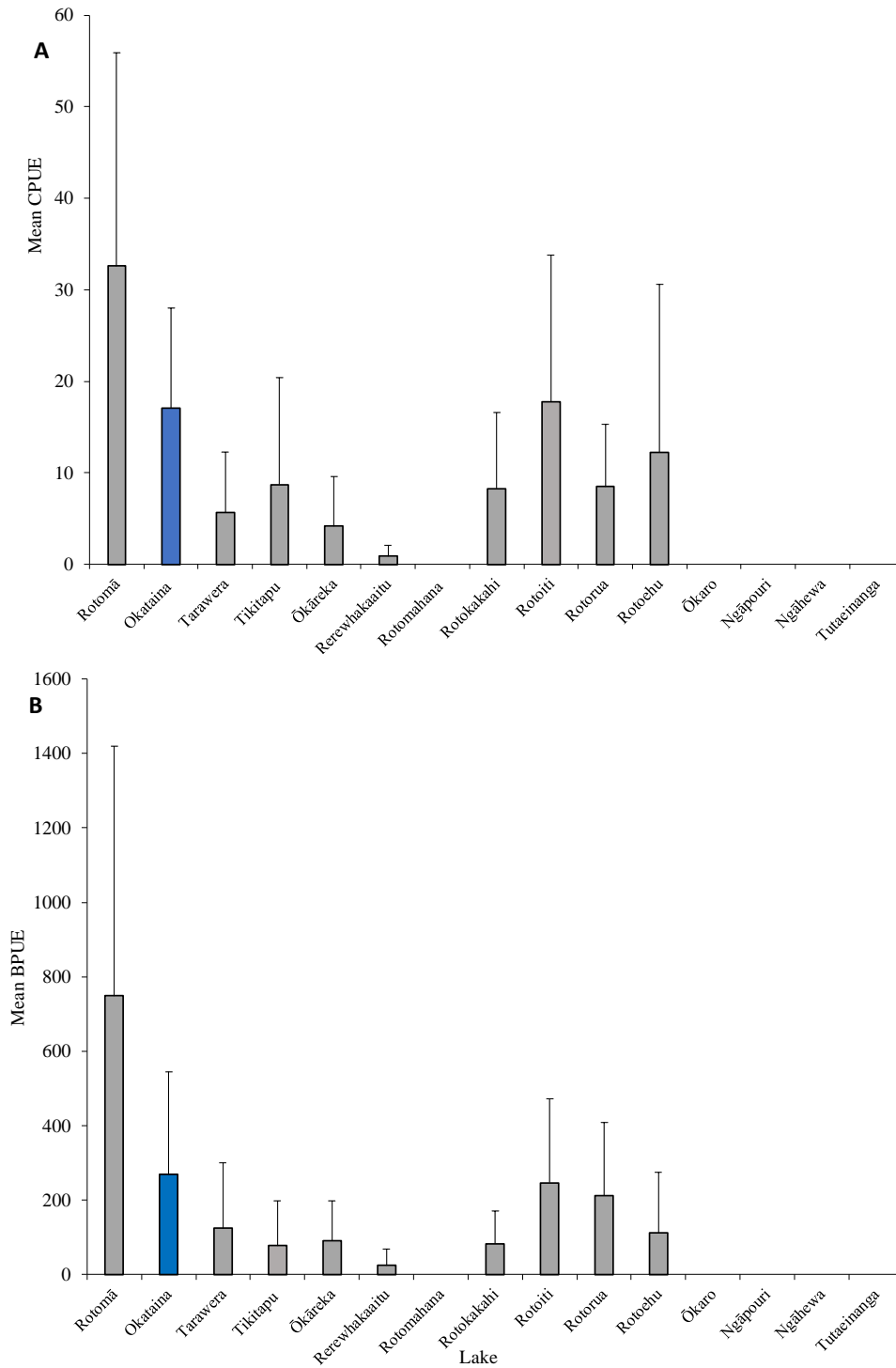


Figure 5 (A) Mean catch-per-unit-effort (CPUE; mm + SD) and (B) mean biomass-per-unit-effort (BPUE; g + SD) of kōura in 14 Te Arawa lakes. Lakes ordered in terms of increasing Chl-a concentration. Lake Ōkātina is highlighted in blue. See section 3.3. for details and source of kōura data.

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Appendix 2 – Koura – a cultural perspective – Cyrus Hingston

Koura – a cultural perspective

Prior to arrival of trout and other exotic species the Te Arawa Lakes teemed with food prized by Māori.

These foods consisted of:

kākahi

Koura

Inanga

Toitoi

Kokopu

Of these the most famous was the koura.

Taunga Ika / Tauranga Ika

Taunga ika - fishing grounds were valuable possessions and their ownership jealously guarded and defended. Taunga ika were given names by their owners and marked by tumu (posts), or found using prominent landmarks to ensure they were known as belonging to a certain person, whānau or hapū. Well known fishing grounds famous on Rotorua for the amount of koura found there included Te Manga at Waiteti, and Kaiora and Taramoa off Mokoia.

In the Native Land Court fishing grounds were identified as mahinga kai (or food cultivations) to support hapū and iwi land claims and state who had mana over a particular area. Having the ability to claim such mahinga kai whether they be cultivations, fowling or fishing plantations enhanced the evidence they gave when claiming specific areas of land.

‘...Kei maunga Taratoa he mahinga waka me o ratou tau koura – mahinga koura...’¹⁶

In the Native Land Court over 150 individual fishing grounds on Rotorua Lake alone were identified by claimants as belonging to them. Incidents and stories relating to various tauranga ika were recorded and give an idea of their cultural significance.

Pakanga

¹⁶ Waione P68, Ngati Ahipurakau – Mikaere Heretaunga

At Waiiti (near Tahunapo pa) Ōkātina, the battle for possession of Ōkātina began with an argument between Ngāti Tarawhai and Ngāti Kahuupoko over ownership of the taunga inanga (inanga grounds) found there.

At Mokoia, Tutanekai placed the heads of two chiefs he had killed on tumu (posts) to signify his ownership of the fishing grounds and as a warning to others.

Hauora killed the slave of another chief, Wahiao who was gathering koura on his own owner's grounds and dared to challenge Hauora's right to take its bounty. In the ensuing fight peace was only brought about by the intervention of Uenukukopako – the father of Hauora and grandfather of Wahiao.

Ngararanui and his tuakana Tawakeheimoa engaged in a wrestling match over the koura grounds called Te Manga which is found off Weriweri pa. Te Manga was said to be one of the best koura grounds on Rotorua. After Tawakeheimoa was beaten he moved to Kaikaitahuna to live away from his taina.

Mana & Manaaki

The ability to provide food and delicacies for guests was also a symbol of a person's and their people's mana - their prestige and authority. If a visitor of note travelled to another area they would expect to be treated with the delicacies native to that area by their hosts. To not be so treated would belittle the host and be an insult to their guests. To this end the host iwi would plan well ahead of any large occasion to ensure that they were well – stocked and could provide generous amounts of such delicacies as koura or inanga to enhance their mana.

They were a main source of sustenance and used as a means of trade with other iwi. On the arrival of tauiwi dried koura was sold as a delicacy to visiting Europeans¹⁷.

At the opening of Tamatekapua in 1873, over 500 rohe (roughly equivalent to 500 sugar sacks) of koura and inanga were gathered for the guests. In 1960 at the opening of Taurua marae, 30 sugar sacks of koura alone were caught from the surrounding lakes to feed their guests.

'He paraoa me te koura taku kai' - Te Amohau

The response of Te Amohau when asked if he would accept the mantle of kingship. Te Amohau knew that if he were to take on the kingship his ability to manaaki his guests would be greatly strained given the resources he had at hand.

Rahui & Mahi Tiaki

Rahui was one method of protecting a food stock's sustainability. Through observation and experience, Māori realised that the fishery required nurturing. Access to fishing stocks would sometimes be curtailed or prohibited to allow koura the time to rejuvenate and give the population time to rebuild. Overfishing was prohibited and / or, at times certain types of fishing – tau koura or dredging would be

¹⁷ (Mair 1918)

prohibited – allowing only the taking of koura through ruku or rama koura. Females with eggs would be put back as would the young. In such a manner sustainability would ensue.

Hi Koura

Koura were caught in the following ways, Paepae and Tau Koura were the methods used that obtained the most koura at one time.

1. Ruku Koura

Literally Koura diving or the gathering of koura by hand.

2. Paepae – the gathering of koura using a dredge – the process and dredge used had a similar action to that of a scallop dredge. Its construction and the method on how it was used is outlined below.

Ropes.—The main drag-rope is tied to the *pouwaenga*. The side ropes tied to the *punga* uprights are called *tangitangi*, the same name as the second set of uprights. They join the main rope about 4 ft. from the *pouwaenga*.

The net of the *paepae* has no special name. The one I saw had a $2\frac{1}{4}$ in. mesh. The opening of the net was fitted to the framework of the *paepae* and *whitiwhiti*. From this opening the net gradually narrowed down to a point about 10 ft. 10 in. away. To this point was attached a piece of rope 7 ft. long, which carried the *punga*, or *koremu* (the stone sinker).

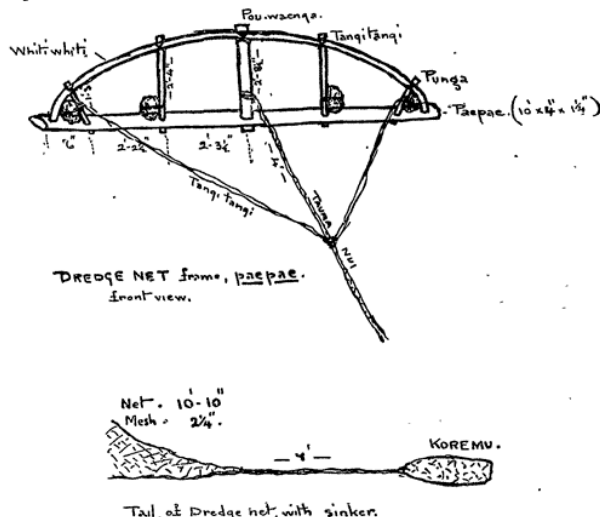


FIG. 2.—*Paepae*, or dredge-net.

I saw Ngati-Uenuku-Kopako at Mokoia Island with a *paepae* of which the arch, or *whitiwhiti*, was composed of thick, plain wire. The *paepae* bar was 10 ft. 8 in. long, and extra uprights were inserted between the *punga* and *tangitangi* uprights. These were called *whitiwhiti*, the same name as the arch.

Naming.—As in the case of other nets, good *paepae*, which caught large catches, were named after ancestors or near relatives.

Method of Dredging.—When collecting these notes we went hauling on the Moari grounds off Mokoia. The first procedure was to plant a long pole, called a *turuturu*, firmly into the bottom of the lake, on one edge of the rather shallow fishing-ground. A fairly long rope of *whanake* leaves was tied near the bottom of the *turuturu* before it was thrust down. It takes a skilled man to plant the *turuturu*. On touching bottom it is gently twirled with one hand, and gradually insinuated more and more deeply

3. Tau Koura (Koura Tau)

The method used has been described earlier, however the simplest explanation of the tau koura is that its operation is similar to a fishing 'long - line'. Rather than using baited hooks, bundles of fern would

be tied to a main rope that was secured by way of an anchor and a tumu, or post. The ferns would then settle to the lake floor.

After a period of time (6-8 weeks) , the bundles would be hauled to the surface and the koura that had set up residence in the fern be shaken loose.

The diagram below shows the traditional tau koura (A) and the modern tau koura (B) used today.

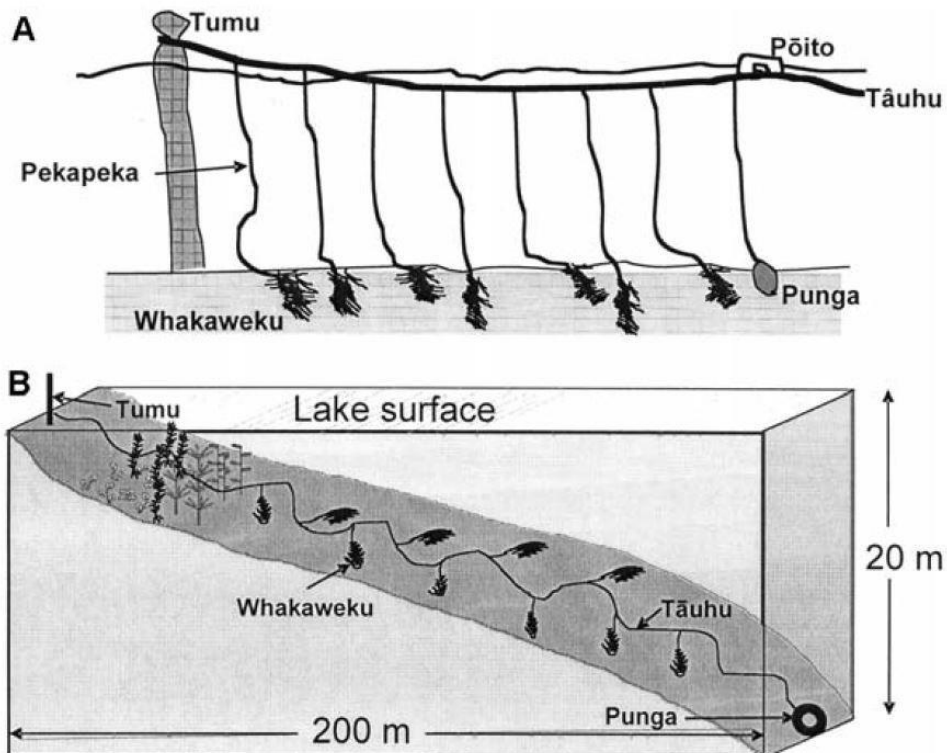


FIG. 2.—*Tau koura*. The *pelapelo*, with the stalk end of the fern bundle, being drawn up against the *koupa*, still submerged.



FIG. 2.—*Tau koura*. The *pelapelo*, with the stalk end of the fern bundle, being drawn up against the *koupa*.
[From p. 446.]

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FIG. 1.—*Tau koura*. Completely out of water by leverage against side. Note attitude of right foot, which is pressed on bar of *koupa*.



4. Rama Koura

Gathering koura at night using torches. Koura come in to the shallows and beach areas to feed at night. Using a torch and a scoop net the koura are scooped up from the lake waters into a larger basket. This method is still popular today for those whānau fishing for koura.

Introduction of Exotic Fish Species

From 1872 to the 1930's a concerted effort was made by European settlers to introduce exotic fish species such as Carp, White Fish (European Cisco) and Trout to the Rotorua Lakes District. The thinking behind their introduction being that it would provide: another food source, potential revenues from sport or game fishing and tourism, and create a 'little bit of home' in the new colony.

Funding was provided by the Auckland Acclimatisation Society to ensure that the introduction of these species was successful. Legislation was also put in place to support their introduction. At first local Māori were supportive of their introduction however this soon turned to alarm at the devastating effect on traditional native fish stocks.

Introduction of Exotic Species

1872 & 1873 Prussian Carp released into Lakes Taupo and Rotongaio by Captain Mair.

Second supply of carp introduced to Rotorua Lakes district: Tarawera, Rotokakahi and other places around Rotorua Lake district.

- | | |
|------|---|
| 1876 | Carp numbers increasing and thriving in hotter temperatures. |
| 1877 | Carp in plentiful supply in Rotorua Lakes with some weighing close to 2lbs. Chiefs forbid use of nets to ensure growth in population. |
| 1880 | Release of White Fish (European Cisco – Verdace) ova into lakes. |
| 1881 | Carp thriving in all lakes. |

- 1883 Auckland Acclimatisation Society import Rainbow Trout into New Zealand.
- 1886 Brown Trout released at Te Awahou, Waiteti and Ngongotaha. Trout at Utuhina escape from holding box when it capsized during Tarawera eruption.
- 1887 Fontinalis fry liberated into Utuhina and Tahunatara near Horohoro. 43 trout caught in one afternoon at Horohoro with trout weighing between 1.5 & 2lbs.
- 1892 Rainbow trout introduced into Lake Rotorua
- 1896 Complaints received by Auckland Acclimatisation Society regarding illegal catching, spearing, netting and selling of trout in Rotorua. "The offenders being mainly Māori."
- 1896 Percy Robinson appointed Ranger to Lake District by the Auckland Acclimatisation Society under the Animals Protection Act.
- Sep 1896 *Many complaints made by Māori that the **trout were so numerous that they destroyed the koura and other native fish...the trout caught weighed perhaps 18 – 20lbs...** thought that some steps might be taken to allow the capture of the trout and their sale by licence as a revenue for the society...the society could safely allow the netting of the trout; in fact he thought it would be advisable....*
- 1897 *Hatchery erected by H D Dansey in Rotorua. Paid for by Lands Dept.*
- 1897 ***Netting of trout in the lake is being carried out vigorously by the natives and large hauls are made nightly. Ngongotaha and Waiteti streams are teeming with fish and natives say they will destroy them all if possible as they are devouring the koura and inanga...***
- Jan 1897 ***At urging of AAS, 13 natives were arrested and charged under the Fisheries Conservation Act 1884, in using a net to catch fish.***
- Defence claimed that under Treaty of Waitangi which reserved the rights of natives their ancient rights to fish, the treaty being expressly referred to in the Fisheries Conservation Act 1877 as still in force. The evidence called for the defence proved that netting in the lake was an ancient custom, and***

*that the indigenous fish **the inanga, or whitebait** relied on by the natives for food has very **seriously diminished** since the advent of trout.*

Dec 1897 **Regulations for trout netting fishing and fishing outlined** with size of mesh nets and costs of licences to net fish described. **Māori living within one mile of either Rotorua or Rotoiti** were given a **discount from 3 pounds to 1 pound.**

Source: D S Stafford Records
D S Stafford Room
Rotorua Library

The cumulative effect of the introduction of new fish species added to the devastation of Māori way of life around the Lakes district. Fish stocks were decimated, traditional fishing grounds and the posts marking their ownership were removed by the local council and ownership of the Lakes, waters and fisheries were assumed by local government and central government alike.

Māori were arrested for netting trout that had ravaged traditional fish stocks such as koura, inanga and kokopu. Where ownership of the waters was customarily accepted as belonging to the Te Arawa people the control and management of them had effectively been taken out of their hands and into the hands of interest groups such as the Acclimatisation Society and the local Rod and Gun Club supported by laws and regulations passed down from government.

Sep 1896 Editorial HLC (Hot Lakes Chronicle)

*'The various streams leading into the lake and the lake itself are **absolutely teeming with fish** at the present time. The **koura, inanga and carp are fast falling prey** to the larger fish, and **shags innumerable** may be seen hovering about the mouths of the various streams **on the lookout for the smaller fry**. **Some of the fish** which have been seen **are of enormous dimensions**, and as it has been proved that they **afford no sport** to the 'general angler' it becomes a question of **how** we are going **to stop their depredations**.*

*At this juncture the secretary of the **Auckland Acclimatisation Society** having been informed of the destruction of the koura and the inanga by the lake trout, writes to the local secretary of the local society **asking for the opinion** of those having local knowledge **as to the advisability of allowing the netting of fish in the lake** – the streams to be **preserved for anglers as now**.'*

The following report taken from the Appendices to the Journal of the House of Representatives 1908 outlines the driving factors behind the actions taken by the local council.

Appendices to the Journal of the House of Representatives 1908

*While the **allegation** that Lake Rotorua is **overstocked with trout remains unproved**, there is **no doubt** that the trout have **caused a serious diminution** in the **quantity** of native crayfish or **koura**, and the **small varieties of fish which serve as their food**...Special attention has therefore been directed towards the **question of trout foods****

*...fresh water shrimps and whitebait have been brought up from the Waikato River and are doing well at the Hatchery...will probably **form a valuable fish – food** in time and will **take the place of koura***...*

*...During the year a **large amount of work** has been done **in clearing** the fishing resorts on **the lake shores** of stumps, logs, **koura posts***, and other obstructions which constituted a special menace to the **launches** frequenting these spots...*

*...The **shag is very abundant on the lakes**, and is **voraciously fond of young trout**, and what is a **more serious** matter, of **trout foods**...the white headed river shag is the most **destructive** to **trout fry**, the black coat shag lives mainly on **koura** as well as **toitoi**, **carp**, and other trout foods...*

*...In order to **keep the numbers of shags** within bounds a **reward of 1s per head** was offered...from 1st of July 1907 to the 31st March, 1908, **711 heads** were brought in from Lakes Rotorua, Rotoiti and Rotoehu...*

...active and valuable assistance and cooperation has been received from... the Rotorua Rod & Gun Club...

Lawrence Birks, B Sc Engineer in Charge

Summary

The introduction of exotic fish had a devastating effect not only on koura, but also inanga, toitoi, koaro, kokopu and other native fish. From a cultural perspective their introduction had a devastating effect on Te Arawa's way of life.

The above report from 1908 reinforces what the focus of the council and various interested stakeholders were in the lakes.

Consideration on the impact of these vested interests, their actions on traditional fisheries, local Māori, their way of life and cultural values were ignored in the pursuit of their own goals.

Another example of this bulldozing of values can be seen in the reference to a bounty being placed on shags (kawau). Following the invasion of Mokoia by Nga Puhi, Te Arawa placed great reverence on the kawau that lived around Mokoia and the Rotorua Lake. It was the kawau that raised the alarm when Nga Puhi attacked in the early morning light and were seen in the tragic aftermath mourning the many Te Arawa killed in the battle. The kawau were seen as manu tiaki from this time and considered tapu by Te Arawa.

Despite the impact of modern man, technology, invasive species and pollution, Koura has somehow managed to survive.

In our work as hunga tiaki having mana whenua, mana moana over the lakes of Te Arawa 'me mahi tahi tatau kia whai ake i te korero nei...

'Te mā o te wai e rite ana kia kite i nga tapuwae ā te koura'

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