NIWA
Taihoro Nukurangi

A survey of wild kai consumption in the Te Arawa rohe

NIWA Client Report: HAM2010-096
August 2010

NIWA Project: HRC08201

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Contents

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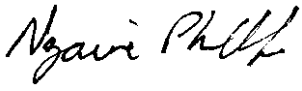

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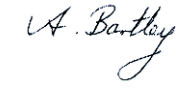


Executive Summary

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. Human health may be threatened either by the consumption of food (especially fish and shellfish) contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001). This research, funded by the New Zealand Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming. As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined, and pathways of potential contaminant uptake by tangata whenua investigated by analyzing relevant food-chain components.

Three Maori communities were involved in this research: Te Arawa: centred around the Te Arawa / Rotorua Lakes and Maketu coastal area; Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and Te Runanga o Arowhenua: centred on South Canterbury. The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts on the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

This report documents the results of the above research programme, specifically investigating the level of kai consumed by Te Arawa, whose whanau have resided in the Rotorua area for centuries. The lakes of the region were and remain taonga (treasures) for Te Arawa and are the foundation of their identity, cultural integrity, wairua, tikanga and kawa. For centuries the lakes have also been the mainstay of their economy as they and their margins were an important source of freshwater fish, waterfowl, and plants[1].

[1] For a detailed account of the traditional history of Te Arawa, see D M Stafford (1967) *A History of the Te Arawa People*, Auckland, Reed Books

On 18 December 2004, the Crown and Te Arawa signed a Deed of Settlement for Te Arawa Historical Claims and Remaining Annuity Issues over 14 lakes; Lakes Rotoehu, Rotomä, Rotoiti/Te Roto-Whaiti-i-kite-ai-a-Ihenga-i-Ariki- ai- a Kahumatamomoe, Rotorua / Rotorua-nui-a Kahumatamomoe , Ökataina / Te Moana i kataina a Te Rangitakaroro, Ökareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngähewa, Tutaeinanga, Ngäpouri/Opouri and Ökaro/Ngakaro.

With respect to the research design drawing on the earlier work of Bebbington (1999), importance of kai to whanau was examined using standard interview techniques according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

All of those interviewed for this research expressed a strong relationship with the lakes and the wider terrestrial and marine surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship. Two thirds of the participants spent their childhood in the middle of the North Island while 15.8% specifically identified Rotorua as the place where they spent their childhood.

A large variety of wild kai continues to be regularly collected, gifted, purchased and/or consumed. While whanau made use of many species, the centrality of koura and whitebait as a critical food source in the Rotorua Lakes is well known and is reflected in the initiatives to restore populations of taonga species. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in Rotorua Lakes region. Consistent with a kai gathering lifestyle:

- 42% grew their own vegetables;

- of the 42%, 21% of those who grew vegetables also grew fruit.

Having determined that all of respondents do consume different types of kai:

- 38% of respondents said they now only eat kai on special occasions; while

- 25.5% eat kai less than once a month; and

- 10% only eat kai 1-3 times per month.

In other words 73% eat kai 1-3 times per month or less. Of concern when reviewing the complete list of species and the frequency with which each was consumed, some respondents identified six species as being extinct (i.e., no longer present in the areas they gather kai from) – kakahi, cockles, koura, morihana, seaweed and tuatua.

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were then used as the basis for a sampling programme which examined contaminants in sediment and kai. Kai was gathered from 11 of the 14 waterbodies listed. The most highly used area was the coast as 52.4% said they gathered from Maketu followed by lakes Rotoiti (17.5%) and Tarawera (12%). There was no gathering by participants from lakes Rerewhakaaitu, Okareka, and Tikitapu.

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered. With respect to abundance, 56% felt that "fewer" stocks were available today, specifically, 22% of respondents believed that across all species gathered there were now a "lot fewer" available while another 33% believed that abundance was "slightly fewer".

There are little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation we assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats in the lakes, especially Rotorua. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, we can conclude that all respondents still consume kai awa, kai roto, or kai moana. In comparison to historic levels, the following conclusions can be drawn:

- The quantities available are substantially lower than historic levels and the levels desired by whanau who wish to engage in mahinga kai practices. The species that possibly approach

adequate abundance are mussels, which respondents confirmed were available and often sourced from the supermarket or takeaway.

> *You don't go out and get any watercress anymore, your river has become Pak'n Save (Informant M).*
>
> *I mean, we have got to the stage we are feeling directed to go to supermarkets and buy from there, it is more convenient (Informant E).*
>
> *We get our bulk food from the supermarket, whether that's vegetables, it's fish, seafood. Everything comes from the supermarkets. It is totally different today. We have no control over that. We aren't able to go out and get koura like how we did - it is a thing of the past (Informant E).*

- For almost every species, the majority of respondents believed that the abundance of populations was declining.

- The majority of kai species are now only consumed on special occasions.

- The quantities of kai consumed have steadily decreased:

    - from approximately 241g historically;

    - to about 94.1g in the mid twentieth century;

    - to approximately 36.2g today (which is similar to the average New Zealand consumption rate).

Part of the reduction in quantities consumed can be attributed to environmental degradation. A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining. In the 1930s, a number of factors were blamed for the decline in whitebait catches including: excessive take by whitebaiters; predation by sea birds, herrings, eels, trout; draining of swamps, backwaters, and creeks; or damage to estuarine spawning grounds by stock. By the 1990s a number of native fish species had disappeared from waterways or were in decline. A combination of factors was attributed to these losses including: afforestation, sedimentation and flooding, wetland drainage, river modifications, sewage, water abstraction (irrigation), and pollution arising from adjacent land uses. All of these changes directly and indirectly impact cultural practices, principles and tikanga associated with food gathering:

- Young people are growing up not learning the basic knowledge associated with kai species, fishing, boating and gathering.

- Whanau are "losing the taste" of kai.

From 30 down there wouldn't be a huge interest in it because it is not something that they have grown up with, but certainly from my age up, like, you know, if my grandmother was to - if you were to put a plate of koura in front of her, I think she would almost eat the shell from it. You know, that is the sort of level of delicacy it is for her, whereas if I were to put it in front of my son, he actually wouldn't be that impressed with it (Informant J).

- Kai generally was known to be good for health. There is a feeling that the younger generation don't know this, or if they do, they don't practice it.

- Fish and seafood is purchased more now, but often as fish and chips.

- Water quality is a concern for parents and therefore they are reluctant to let kids explore/play in aquatic environments unattended.

- Parents feel their children have missed something not growing up in an active hapū gathering environment.

- The context within which fundamental cultural practices such as whanaungatanga are learned has been impacted.

Finally, the result of these environmental perceptions is uncertainty as to whether or not kai is contaminated from within the urban environment.

Despite the level of environmental change and the potential for contamination, it also needs to be acknowledged that lifestyles today leave little time for fishing activities.

Changes to the health of the lakes and consequently the relationship of Te Arawa with the lakes have resulted in a range of health and wellbeing implications for Te Arawa whanui. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between the lakes and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

- 63.1% of respondents indicated they knew where to get advice about contamination issues.
- Only 26.4% (and two specific age groups – those in their 40s and 70s) did not know where to go to obtain information.

This study has confirmed that the lakes are integral to the cultural identity of the whanau of Te Arawa. It has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of kai awa, kai roto and kai moana in the behaviours of whanau and hapu resident in the Rotorua Lakes Area. The results clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal, that kai awa, kai roto and kai moana are vitally important to whanau and hapu in Rotorua Lakes. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

1. Introduction

1.1 Background

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. In the aquatic environment, contaminants transported by the air and in the water are highly likely to be deposited in sediments, where in turn, fish and shellfish are exposed. Contaminants are generally stored in the lipids of biota and can be biomagnified up the food-chain. Human health may be threatened either by the direct consumption of fish and shellfish contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001).

Concerns about the potential accumulation of contaminants in fish and other wildlife, which commonly form a component of indigenous peoples' diets, and their consequent potential effects on human health, has led to a worldwide proliferation of studies examining the effect of environmental contaminants on fish, wildlife and communities. For example, leading international indigenous contaminant research programmes, e.g., the Northern Contaminants Programme (NCP) and the Effects on Aboriginals from the Great Lakes Environment (EAGLE) Project were established in response to concerns regarding the exposure of humans to elevated levels of contaminants in the traditional subsistence diets of indigenous peoples. Research to date has shown that certain indigenous communities have elevated contaminant levels due to exposure through their traditional diet (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999; Van Oostdam et al., 2003). In addition, fish and wildlife are used as indicators of the health of the ecosystems.

The impact of environmental contamination on the resident "wild kai", and in turn, on Māori iwi/hapū consuming them, has not been investigated to date. A recent review of wild food in New Zealand identified gaps in knowledge of contaminants in non-commercial wild-caught foods, especially in terms of consumption levels (and hence exposure) (Turner et al., 2005). A resulting draft position paper identified a need for information and education on contaminants in kai (NZFSA 2005). In response, the National Institute for Water and Atmospheric Research (NIWA), in conjunction with Tipa & Associates and iwi research partners, Ngāti Hokopu ki Hokowhitu, Te Arawa Lakes Trust and Te Runanga o Arowhenua initiated a programme of research to investigate the contaminant levels and risk to Maori health associated with 'wild kai' – food gathered from the sea (kai moana), rivers (kai awa), and lakes (kai roto). This

research, funded by the Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

1.2 Research Rationale

Traditionally, Maori had their own knowledge systems of how the environment contributed to health and well-being. Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming.

As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined.

While it could be argued that contamination of wild kai has the potential to directly impact the physical health of Maori, the impacts of contamination and/or loss of an important cultural activity on wellbeing are also explored during the course of the project. Maori associate their well-being as individuals and as members of whanau, hapu and iwi, with maintaining the health of the natural environment (Durie 1994, 1998, Panelli and Tipa 2007, 2008). Maori strongly believe that the whenua and tangata are inextricably intertwined, and when one of these becomes unbalanced, the other equally suffers (Harmsworth and Warmenhoven 2002; Sims and Thompson-Fawcett 2002). Therefore, the sustainability of the natural environment and the long-term well-being of Maori are seen by some Maori as one and the same thing (Panelli and Tipa 2007). This is consistent with conceptualisation of wellbeing proposed by other indigenous communities (Adelson 2000, Greiner et al., 2005, McLennan 2003, McLennan and Khavarpour 2004, McGregor et al., 2003). Customary and recreationally gathered "wild kai" resources are therefore of significant cultural, recreational and economic importance in both traditional and contemporary Maori society (Waitangi Tribunal 1983, 1984, 1987, 1988, 1989, 1991, 1992, 1995, 1998)[2].

The majority of the international research in the area of contaminants in the traditional diets of indigenous peoples has primarily focused on the levels and health effects of exposure to heavy metals and organochlorine contaminants through the consumption of marine fish and mammals in peoples from the northern hemisphere, i.e., the Inuit

[2] The evidence submitted to the Tribunal by Iwi, and the summary reports from the Tribunal itself provide a graphic depiction of the significance of gathering kai for whanau, hapu and iwi.

people of northern Alaska, Canada and Greenland (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999). Research to date has shown that certain Inuit communities have elevated contaminant levels (e.g., mercury, lead and chlordane) due to exposure through their traditional diet (Van Oostdam et al., 2003).

It is unlikely that contemporary Maori communities have been exposed through their diet of "wild kai" to the levels of organochlorine contaminants as high as those observed in indigenous populations residing in the northern hemisphere (due to occurrence of large mammals in the customary diet of Inuit). However, the impact of environmental contamination on the resident "wild kai" and, in turn, on Māori iwi and hapu consuming them, has not been investigated to date. In addition, while existing consumptive advice is available for some species of relevance to Māori, this advice is based on average national consumptive patterns and doesn't account for potentially higher consumption rates of specific traditionally harvested foods by Māori, with its concomitant elevated exposure risk. Māori utilise kai from rivers, lakes and the oceans (as well as the land).

This research aims to identify and communicate the risks posed by the presence of environmental contaminants in the kai moana, kai roto and kai awa to the Maori communities that gather these resources. Major outcomes of the research will be development of a generically applicable risk assessment framework, and Maori-targeted risk communication strategies. It is envisaged that the research will be of interest to the wider Maori community, non-Maori, public health providers, as well as indigenous peoples worldwide for whom fish and shellfish constitute a major part of their diets.

1.3 Research aim

The overall aim of our research project is:

> *To determine to what extent locally available kai moana, kai roto, kai awa, and the associated aquatic environments pose a health risk to tangata whenua.*

Successful frameworks for undertaking research in a manner that is culturally acceptable, and which ensures the protection of intellectual property rights, were developed between NIWA and Ngāti Hokopu and Te Arawa during the HRC and FRST funded programmes 'The Revitalisation and Enhancement of Matauranga

Hauora of Aquatic Environments (C01X0226)' and 'Sustainability and Management Framework for Te Arawa Lakes' Customary Fisheries (CO1X0305)'.

Memoranda of Understanding between NIWA and Ngāti Hokopu ki Hokowhitu, Te Arawa and Te Runanga o Arowhenua have been established to formally record the expectations of conduct between NIWA and the respective parties with respect to the present research.

Three Maori communities were involved in the overall research:

- Te Arawa: centred around the Rotorua Lakes.
- Ngāti Hokopu ki Hokowhitu: centred around Whakatane.
- Te Runanga o Arowhenua: centred on South Canterbury.

These communities were selected on the basis of previous contact (and research projects underway) with key researchers. Permission was obtained and confirmed by a sub-contractual agreement.

The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

There are four main stages to the research project:

1. Objective 1: The first stage involves interviewing key informants and undertaking a survey to identify what kai moana species are harvested and eaten by iwi/hapu members from Ngāti Hokopu, Te Arawa and Te Runanga o Arowhenua, and the aquatic environments they are currently sourced from.

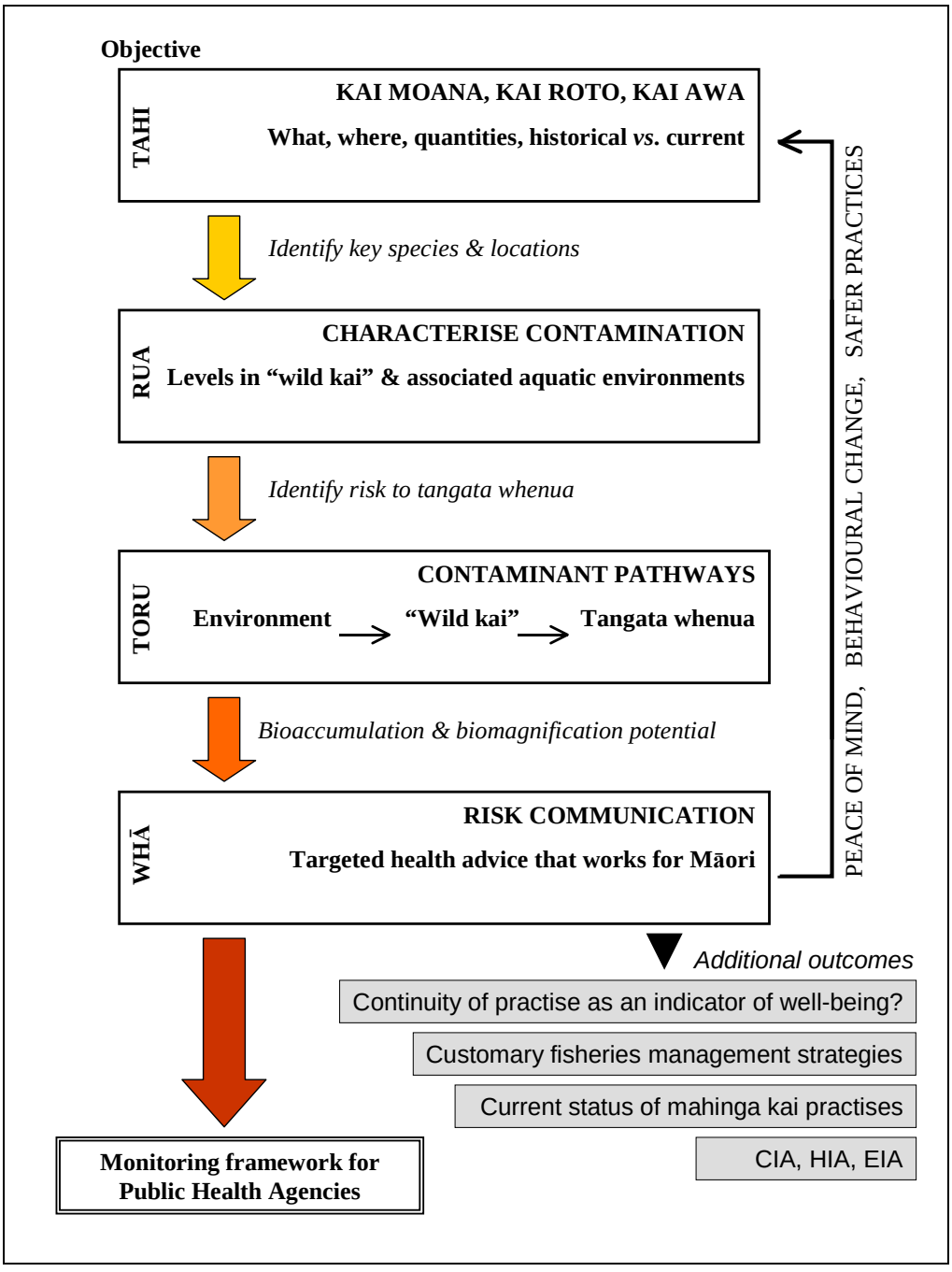
2. Objective 2: The second stage identifies the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori.

3. Objective 3: This stage establishes potential pathways of contaminant bioaccumulation via the food web utilising methyl mercury as an example of a bioaccumulative contaminant.

4. Objective 4: This stage identifies the potential health risks associated with the collection and consumption of contaminated “wild kai”, and develops risk consumption advice specifically targeted at Maori, that will take into consideration both the benefits and risks associated with eating kai moana, kai roto and kai awa.

Figure 1 provides a graphic representation of the identified research priorities, the objectives, and possible outputs.

Figure 1: Research priorities, the objectives, and possible outputs.



The first objective of the research (to provide a description of the kai moana, kai roto and kai awa collection, processing and consumption patterns of iwi/hapu members) is clearly a precursor to Objectives 2–4. This first stage identifies:

- What types of kai have been collected and/or eaten in the last 2–3 generations (e.g., species, life-stage, abundance)?
- Where were/are they harvested from and when (e.g., location, ecosystem, season, time of day, life-stage)?
- How is kai moana stored and processed for consumption?

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by whanau in and around the Rotorua Lakes and the potential effects of environmental contamination on their physical, spiritual and cultural well being.

To elicit the data needed we included methods that have been used previously with hapu around New Zealand. This consisted of focus groups and hui, followed by interviews. For this objective it was important to assemble a group of willing participants with knowledge and experience of kai gathering in the takiwa (area) and rohe.

1.4 Report Structure

This report has been divided into a number of sections:

Section 1: Sets out the background and the aims of this study.

Section 2: Describes the methodology that was used.

Section 3: Provides some information on Te Arawa and their rohe in the Central North Island, in particular around the Rotorua Lakes.

Section 4: Outlines international developments within which the research is situated, specifically:

4.1 indigenous communities and participatory approaches to management and research;

4.2 contemporary wellbeing research, and implications for this study;

4.3 international observations of the impact of changing diets;

4.4 effects of contaminants on health;

4.5 Maori conceptualisations of health and wellbeing.

Section 5: Introduces the empirical analysis by outlining the quantitative research results; specifically with respect to contemporary patterns of gathering. This chapter is informed by the Kaimoana Consumption Survey.

Section 6: Based on the results, develops a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It provides a brief comparative analysis by discussing the contemporary patterns alongside historic traditional patterns. It pulls together the qualitative and quantitative research results and identifies main themes that are then discussed in the context of international literature.

Section 7: Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

2. Methodology and Data Analysis

There is growing recognition of the significance of aquatic habitats and the resources found within them that sustain indigenous communities. Yet this recognition has not been accompanied by investigations to increase understanding of the specific contribution of aquatic habitats and resources to the health and wellbeing of communities depending on these resources.

Drawing on the earlier work of Bebbington (1999), importance to whanau was examined according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

This section of the report outlines the methodology employed, but starts with a description of the Maori community studied.

2.1 Study area

This report details the results of one case study: Te Arawa. Participants living in and around the Rotorua Lakes were recruited from Te Arawa whanui. Availability to take part in the research was the only exclusion criterion, although the preference was for key informants to be active kai gatherers. The study was undertaken under Ethics Approval MEC/07/07/088 and all participants gave written informed consent.

2.2 Methodology

The research team utilised two research methodologies to contrast the instrumental and hermeneutic role of aquatic resources as a source of kai awa, kai roto and kai moana. The first was a quantitative survey of wild kai consumption using a questionnaire, while the second incorporated participatory research techniques via a focus group and a series of qualitative interviews.

The survey followed once the interviews were complete. This was to ensure that the sites and species about which data was sought in the questionnaire were identified by the hapu, and not predetermined by researchers.

2.3 Quantitative survey - Kaimoana consumption survey

The Kaimoana Consumption Survey questionnaire was adapted from a range of other studies (including diet surveys, fish consumption surveys, traditional use surveys, surveys of the health of indigenous communities and perception/preference surveys). The survey questionnaire was approved as part of the Ethics Committee approval process, with minor modifications to reflect differences between the 2 iwi groups. The species and sites listed in the questionnaire were specific to the Rotorua Lakes area and are based on those identified during the interviews. The Te Arawa Lakes Trust reviewed and amended the survey to reflect the kai that is in their rohe.

2.3.1 Kaimoana consumption: quantifying importance of sites and species

We examined consumption using a food frequency questionnaire with frequency categories ranging from less than once per month to one or more times per day. Consumption is one of the principal means by which the importance of kai awa, kai roto and kai moana and the intimate and dependent relationship with aquatic environments from which they are sourced can be determined.

2.3.2 Existing estimates

Kaimoana consumption records in New Zealand are sparse. Estimates were derived using data from the questionnaire by calculating the amount consumed and the frequency of consumption.

2.3.3 Seasonal variation

Some species of kai awa, kai roto and kai moana are seasonal resources while others are open access. Seasonality is explained in historical literature recognising that tikanga and kawa was attuned and responsive to the life-cycle of the different species. Therefore, questions in the survey identified where possible seasonal patterns of contemporary gathering.

2.3.4 The impact of kai awa, kai roto and kai moana on whanau and hapu livelihoods

Arguably there is a need for a broader understanding of the importance of aquatic resources as a source of kai beyond the simplistic statements of mahinga kai that often

accompanies ecologically based descriptions of aquatic ecosystems. The questionnaire sought to address this need by analysing the complex relationship that whanau have with waterbodies found in their takiwa.

2.3.5 Other data

Other data gathered included:

1. demographic information, such as data on the prevalence of certain medical conditions, lifestyle factors including risk-related behaviours, and family history;

2. self-reported health status using generic, health-related quality of life questions;

3. kai gathering locations; and

4. perceptions held by whanau members about the importance of aquatic ecosystems and species, and their assessment of the health of these resources.

2.4 Qualitative methods

The qualitative methods used here address the first of the research objectives as stated in Section 1.3 above. Methods involved an introductory hui, a focus group session, follow-up interviews, informal discussions with many people and reviewing secondary data sources (documents).

2.4.1 Literature review

An examination of relevant literature was undertaken for four reasons

1. to provide a more comprehensive understanding of historical resource use and patterns of activity in the study community;

2. to gain an appreciation of the changes to the aquatic habitats over time, as perceived by Te Arawa participants;

3. to identify the changes over successive generations that have impacted on kai gathering behaviours; and

4. to address issues of concern with respect to waterbodies.

Qualitative data were collected from published and unpublished documents, from libraries, the Waitangi Tribunal (evidence to the Tribunal and reports from the Tribunal), statutory and iwi plans, and statutory planning documents. Internet searches also yielded further material.

2.4.2 Participatory methods

Before commencing working with Te Arawa whanui, an introductory presentation was given at a hui of Te Arawa at Te Papaiouru Marae and the participatory nature of the research was outlined. At the start of all interactions (focus group and interviews) the roles and obligations of participants and researchers were discussed.

Focus group - A focus group was convened in mid 2008 which was attended by approximately thirty participants. The participants were engaged in a guided discussion lasting 1–1.5 hours. The focus group followed the framework of questions presented in Box 1. This session focused on gaining a broad understanding of the spatial extent and description of aquatic resources from which kai awa, kai roto and kai moana were sourced, and the overall importance of each waterbody and species to whanau and hapu. Maps were used to record information about species, locations and other relevant information but given the numbers in attendance, map work was limited.

In depth semi-structured interviews - In the months following the focus group meetings, 13 follow-up interviews were conducted. The purpose of these interviews was to collect additional and more detailed data related to the location and types of kai collected and consumed, and factors that may have influenced gathering.

The questions used for the focus group were also used to guide the interviews that probed more deeply into the personal experiences, thoughts and feelings of the individuals. The intention was to identify and explore the diversity and complexity of relationships and gain a comprehensive understanding of the changes to aquatic environments and the emergent issues seen as potentially impacting health and wellbeing as perceived by different individuals. Interviews were carried out with 13 individual resident in and around the Rotorua Lakes. Each interviewee was identified by the Te Arawa Lakes Trust.

BOX 1: QUESTIONS AT THE FOCUS GROUP and INTERVIEWS

Species of kai

- What (species of kai) did you gather when you were young?
- What places can you remember visiting to gather kai when you were growing up?
- Did you collect year round or seasonally?
- Can you recall any places that you were told not to go to for kai?
- Were there any times / occasions that you were unable to gather kai?
- How long did it take to gather the kai that you needed?
- What (species of) kai do you gather today? What places do you use today?
- Do you gather kai year round or is it seasonal?
- What events / conditions etc. stop you from gathering kai?
- How often would you or someone in your whanau go out to gather kai?
- How long does it take to gather kai compared to when you were younger?
- What species / sites have you lost over the years? When and why did you stop using them?

Behaviours with kai

- Is kai shared? With whom? Has this changed over your lifetime?
- How was kai prepared? Has this changed?
- What methods are used to collect kai? Has this changed?

Condition of kai

- What quantities were taken when you were younger? What quantities are taken today?
- What was the condition of the kai when you are younger? How does this compare with what is taken today?

Observed and known changes

- What changes to the experience of gathering kai have you observed? How has this affected you and your whanau? How have you adapted to these changes?
- What changes to the habitats have you observed and how have these affected you?
- What sort of things would you like to see happen in the aquatic environment you associate with and why?
- Are you happy with your current level of access to kai that you value? What are the main barriers you face today?

Wider benefits of gathering kai

- What do you like about being able to go and gather kai?
- When you gather kai are you with other whanau or hapu members?
- What rules or beliefs do you follow with respect to gathering kai?
- Do you feel any special attachment to the places from which you gather your kai?

Health risks

- Do you know of any health risks associated with gathering kai?
- If you were told not to gather kai from an area because of the health risks would you still gather from there?
- What type of information would you need to help you decide whether to gather kai from an unsafe site?

There were four principal outputs: a map documenting the types, locations, and quantities of kai moana collected and consumed by those present; the transcripts from the interviews; a revised questionnaire for future use; and this report.

2.5 Qualitative data analysis

In summary, informants were interviewed and interacted with in different fora, and their written documents (both historic and contemporary) and submissions provided further context for interpreting their values, practices, activities and concerns. Accessing multiple sources of data was one of the methodological tools employed to ensure the validity of data collected.

Lincoln and Guba (1985, 224-225) contend that the role of data analysis is "to 'make sense' of the data in ways that will, firstly, facilitate the continuing unfolding of the research, and secondly, lead to a maximal understanding of the phenomenon being studied in its context. There were two aspects to the data analysis:

1. firstly to identify sites and resources to be sampled for analysis of contaminant levels; and

2. secondly, the analysis involved identifying, sorting and grouping data from very detailed individual transcripts to identify key themes. The methods of data collection resulted in a considerable quantity of raw data being gathered, and data from a variety of sources had to be systematically analysed.

Data were coded and categorised to enable similar themes to be distilled. Some of the themes had been established *a priori* based on key issues that had emerged while reading related literature and undertaking preliminary discussions when scoping the research topic and negotiating entry to the three communities. Principal categories that were identified represent the headings under which the research findings are presented in sections 5 and 6.

2.6 Quantitative data analysis

The questionnaire was constructed on Survey Pro 5 (Apian Software Inc) and all data were entered into this programme. The results that are reported in section 5 and discussed in section 6 have been produced using the Survey Pro reporting functions. Microsoft Excel was used to construct two of the graphs.

2.7 Summary of methods applied

The methods applied to enable us to understand kai gathering behaviours over different time periods are set out in Table 1.

Table 1: Methods used during the course of the research.

Pre-European	19th Century post	20th Century up to	Present day
Manuscripts		Interviews	Interviews
Cultural maps	Cultural maps		Review of literature
Historical texts	Historical texts	Evidence to the	Kai Consumption
	Evidence to the Waitangi	Photographs	Maps
Evidence to the	Paintings		Photographs

3. Study Group: Te Arawa

> *If you look at Rotorua – the name of Rotorua – if you follow that trail that is actually the history of the Te Arawa waka, eh. You see, when they came up and got to Rotoiti… and that is where Ihenga saw the lake and then called it the long narrow lake…. Then he came across here and he saw this big huge lake, Te Rotorua, the second lake, and he named it after his Uncle Kahu Mata Moemoe, who was Tamata Kapua's son, who was the kaihautu on the waka Te Arawa when it came across. So what you have there – and if you listen …Then you go down here and you go to the cockabullies of Okere, then you go to the Te Heke Heke of the Kaituna, to the rapids of the Kaituna…. at Maketu …where the waka of Te Arawa landed, eh. .. It's a journey of history… So you are taking the journey from here, all the way around there. And there is a lot. That is only one of many.. ... And they are memories that are buried now by sediment (Informant M).*

Te Arawa arrived at Maketu around 1350 (Stafford, 1967). Te Arawa is a confederation of iwi which are descended from the crew of the Arawa canoe. From Maketu the voyagers and their succeeding generations moved inland occupying the central part of the North Island. This means Te Arawa have resided in the Rotorua area for centuries and the lakes of the region were and remain taonga (treasures) for Te Arawa. They are the foundation of their identity, cultural integrity, wairua, tikanga and kawa. The numerous lakes of the Rotorua district as shown in Figure 2 are found in hill country approximately 80 kilometres south of Tauranga, and 50 kilometres west of Whakatane[3]. The lakes of the Rotorua district remain the centre of Te Arawa settlement. For centuries the lakes have also been the mainstay of their economy as the lakes and their margins were an important source of freshwater fish, waterfowl, and plants[4].

The Te Arawa Maori Trust Board was established in 1924, pursuant to Section 27 of the Native Land Amendment Act and the Native Land Claims Adjustment Act 1922, and operated under the Maori Trust Board's Act 1955. Fifteen hapu were represented on the Board as well as one seat allocated for Tumataunenga which acknowledged the returned serviceman of Te Arawa who served in the First or Second World Wars, totalling 19 representatives. Initial membership of the Board was based on ownership

[3] Historically attention has focused primarily upon the three largest lakes of the area; Rotorua, Rotoiti, and Tarawera. During the 1918 Native Land Court investigation of title to the Rotorua lakes, counsel for the applicants informed the court that he had only prepared the applications for Rotoiti and Rotorua, but that he would attend to the others in due time. However, the Court's inquiry was abandoned, and a settlement was negotiated that applied to Rotorua, Rotoiti, Tarawera, Rotoehu, Rotoma, Okataina, Okareka, Rerewhakaitu, Rotomahana, Tikitapu, Ngahewa, Tutaeinanga, Opouri, and Ngakaro. 'Minutes of the Rotorua Lakes Case: Application for Investigation of Title to the Bed of Rotorua Lake', 16 October 1918, p 137, cl 174, NA Wellington.

[4] For a detailed account of the traditional history of Te Arawa, see Stafford (1967).

of the 14 Te Arawa lakes, which surround the Rotorua district, and this remained the structure of the Board.

On 18 December 2004, the Crown and Te Arawa signed a Deed of Settlement for Te Arawa Historical Claims and Remaining Annuity Issues over 14 lakes; Lakes Rotoehu, Rotomä, Rotoiti/Te Roto- Whaiti-i-kite-ai-a-Ihenga-i-Ariki- ai- a Kahumatamomoe, Rotorua / Rotorua-nui-a Kahumatamomoe , Ökataina / Te Moana i kataina a Te Rangitakaroro, Ökareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngähewa, Tutaeinanga, Ngäpouri/Opouri and Ökaro/Ngakaro.

The settlement was made up of 4 components of a "redress package", one of which was the Cultural Redress recognizing Te Arawa traditional, historical, cultural and spiritual association with the lakes covered in the settlement, including the transfer of 13 lakebeds.

Te Arawa Lakes Trust (formerly Te Arawa Maori Trust Board) is the new governance entity to receive and manage the redress on behalf of Te Arawa, to ensure that the benefits of the settlement will be available to all registered members of Te Arawa, wherever they live.

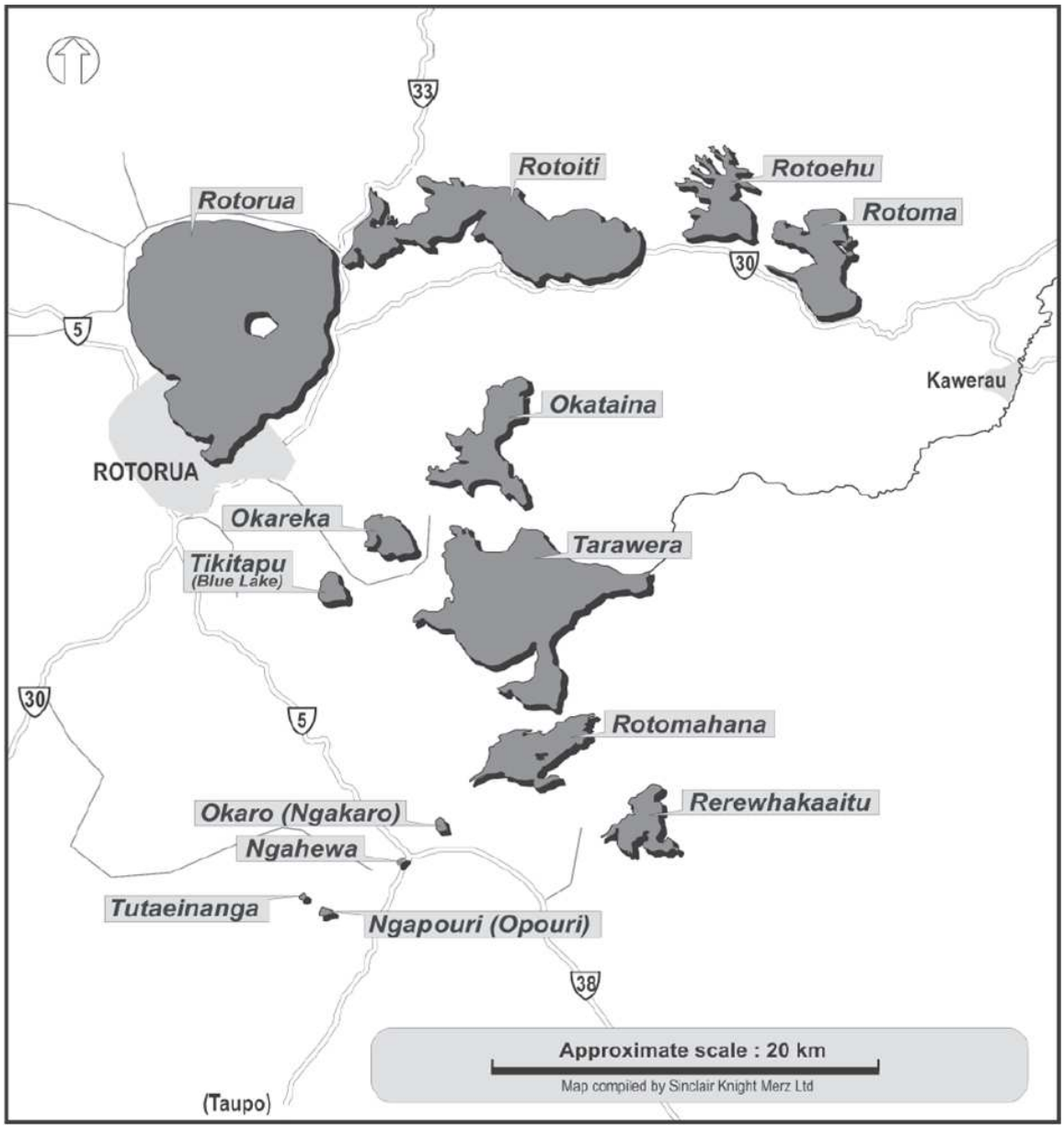


Figure 2: Map of the Te Arawa lakes.

Implementation of this project saw NIWA and its subcontractors working with representatives of Te Arawa Lakes Trust. The Trust had two champions - individuals who helped facilitate the focus groups and the interviews.

> *All these lakes are historical to this country. The history of these lakes is actually the history of this country (Informant M).*

4. International developments relevant to the research

Consistent with the need for the present research to be examined in a context of international literature and academic thought, this section seeks to position the research design and data analyses within contemporary writings from four related areas:

- indigenous communities and participatory approaches to management;
- contemporary wellbeing research, and implications for this study;
- international observations of the impact of changing diets and effects of contaminants on health; and
- Maori conceptualisations of health and wellbeing.

4.1 Indigenous communities and their participation in management

This research sought to utilise participatory research methods. Participation is seen as a means of affording affected parties the opportunity to articulate their interests, enhancing the quality of information available to decision makers; enhancing the potential for support of decisions by enabling early and meaningful involvement; and affecting one's destiny as the opportunity to participate in decisions is a key element of self-empowerment and self-actualisation (Fenge, 1994). In the context of this research project, in addition to collecting environmental contamination data, the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana are examined, and empirical data collected for use by whanau and hapu.

Participatory approaches to environmental management received emphasis initially in the Brundtland report (WCED 1987) and in Agenda 21, at the 1992 ‘Earth Summit’. Perhaps the greatest significance of these fora lay in the acknowledgement that sustainable development would require new approaches to environmental management, and that effective environmental management would need to be differentially negotiated within individual states, even within individual communities. In effect, this research will also result in a range of cultural values and perspectives of particular aquatic locations being documented and available to each Maori community to inform local processes of management should they so choose.

Pimbert and Pretty (1997) contend that new partnerships and connectedness between different interests is required in environmental management and argue that

participatory processes must be locally grounded which will likely require different solutions for different places. This research will facilitate new participatory processes between environmental managers, public health managers, science agencies and Maori. Despite the increase in participatory initiatives, Pimbert and Pretty (1997) also warn that the call for peoples' participation risks becoming a catch-cry and part of the conventional rhetoric without delivering meaningful outcomes for participants. This warning reinforced the desire of the researchers to deliver a meaningful and effective process for application by Maori and outputs such as those listed in Figure 1 for use by Maori and resource managers.

The drive for greater participation has been paralleled by a concerted drive by indigenous communities to reassert their customary and Treaty rights to access and use land and water resources and greater recognition of the knowledge held within communities including indigenous communities (Western et al, 1994, Pinkerton 1989, 1992, Notzke 1994, Berkes and Folke 1998). Although a range of terms are used, often interchangeably, Berkes (1999) defines indigenous knowledge as that knowledge held by indigenous peoples and traditional ecological knowledge as a subset of that – a practical knowledge of species and beliefs regarding human interaction with the ecosystem. Menzies and Butler (2008) list the attributes of traditional ecological knowledge as cumulative (from long term intergenerational interaction), dynamic (informed by a customary lifestyle but not unchanging), providing a historical understanding of change, local, holistic (viewing all elements as interconnected), embedded (in a unique matrix of local, cultural, historical and traditional elements), moral and spiritual. In order to understand the changes to the diets of successive generations of Maori, the research team was dependent on key informants being experienced and knowledgeable (with indigenous knowledge and/or traditional ecological knowledge) about kai gathering.

Sadly, Maori, like other indigenous communities have witnessed the destruction of valued environments and their alienation from the resource bases upon which their cultures and identities are constructed (Berkes 1991, 1994, 1999). Documenting the changes that have been experienced in the Rotorua Lakes region and the impacts on whanau and hapu, including a profound sense of loss, was therefore vital.

The growth of interest in the knowledge held by indigenous communities is related to the wider shift within resource management to an ecosystem based management approach (Menzies and Butler, 2003) and recognises that indigenous communities understand the way species interrelate and how ecosystems work as a whole. It recognises that indigenous communities have a well developed understanding of the local environment and their own impacts on local ecosystems. The data collected via the interviews and questionnaire confirmed the proposition of Berkes (1999, page 33)

that the "use of traditional knowledge may benefit development by providing more realistic evaluations of local need, environmental constraints and natural resource production systems".

Initiatives involving the incorporation and/or application of indigenous knowledge are emerging around the world as resource managers seek to engage with indigenous communities. New Zealand has also experienced the drive for greater participation, including greater recognition of the beliefs, values and practices of Maori. In 1991, the Resource Management Act 1991 became the governing legislation for resource use in New Zealand (Davis and Threfall 2006). Two sections are of particular relevance.

Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including "the relationship of Maori and their cultures and traditions with their ancestral lands, water, sites, *wahi tapu* and other *taonga*" (section 6(e)). Gathering from tribal lands and waters, species that are often accorded the status of "taonga", clearly falls within the gambit of section 6(e) and is thus a matter of national importance.

Pursuant to section 7(a) decision-makers are required to have particular regard to *kaitiakitanga*. The Act presently defines kaitiakitanga as:

> *The exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

The responsibilities of Tangata Kaitiaki are to protect the integrity of resources (including the kai species identified by informants). This requires Maori to focus on long term environmental results, which are likely to include healthy ecosystems with abundant populations of valued kai species that are able to sustain cultural uses well into the future. Despite these encouraging and potentially enabling provisions, often there is little guidance given to managers and regional bodies seeking to meet the obligations to indigenous communities (a challenge Maori confront in New Zealand). This research seeks to produce outputs that will guide both Maori and non-Maori resource managers.

4.2 Contemporary wellbeing research: implications for this study

For indigenous communities food is not just a resource for sustenance as many might understand it in western contexts (Slocum 2007). Rather, Panelli and Tipa (2007,

2008) argue, that food needs to be understood in a wider cultural context that interweaves complex indigenous cultural and environmental relations.

Panelli and Tipa (2007, 2008) contend that to identify these relationships primarily by a particular bio-physical character (e.g., forests, coasts and waterways) misses the range of spiritual, physical, social, material, cultural, economic and political relationships that might be involved in any one case. The complexity of these relationships must be appreciated before the significance of an 'individual' phenomenon or activity (such as food or food gathering) might even begin to be approached (let alone the cultural or health implications of such things). They further contend that to consider kai gathering without this contextual understanding would diminish its cultural value and the rich dimensions that underpin whanau and hapu experiences of identity and well-being. The results of the Kai Consumption Survey reported in subsequent sections of this report support the proposition that individual experiences of interviewees vary as lives are influenced by a complex combination of: cultural beliefs, values and uses; a history of colonization, loss of lands, alienation from their lands, waters and resources; and contemporary interactions with a dominant non-Maori world that is based primarily on capitalist, western values (Panelli and Tipa, 2008). The range of perceptions, preferences and the experiences of members of Te Arawa that emerged from the analysis of data collected for the present research are set out in sections 5 – 7 of this report.

Indigenous communities have traditionally been resource users and developers (O'Regan 1984, Notzke 1994). They used natural and physical resources for subsistence (physical survival) and sustenance (spiritual survival). Internationally there are calls to recognize and protect cultural knowledge and practices that are 'fundamental for food security and well being' (FAO 2007). Gombay (2005: 418) explains the significance of this stance, and when describing the Inuit argues that when they:

> *hunt, fish, or gather food the material and immaterial worlds blend together, with layer upon layer of meaning and understanding. The getting of country foods is about understanding the land in which one lives. It is about building an awareness and knowledge of one's place in the natural world ….*

The gathering, exchange and consumption of kai are also significant cultural activities for Maori. Complex associations with the environment and mahinga kai have developed over centuries and include social, economic, psychological, spiritual and physical dimensions that are an intrinsic part of health and well-being of whanau members. Diversity is wide (as evidenced by the individual variation from the survey results) but this is considered acceptable within whanau and hapu. The data collected

helps explain how sourcing kai from lands and waters reaffirms firstly, connectedness with the lands and waters to which one has whakapapa, and secondly ensures continuity of practices initiated and valued by tupuna. In the Maori context, kai gathering practices also enable social and environmental responsibilities to be fulfilled. To be denied the opportunity to manaaki visitors to one's home and marae would have consequential adverse effects on the health and well-being of Maori – a point that may be experienced beyond the individual and whanau level.

4.3 Maori conceptualisations of health and wellbeing

Durie (1994) introduced *Te Whare Tapa Whā* - a four sided house - or the four cornerstones of health; these being: *hinengaro* (mental well-being), *wairua* (spiritual well-being), *whanau* (family well-being) and *tinana* (physical well-being) which was subsequently adopted by the Ministry of Health (2006). Durie (2004) then proposed a second conceptualisation, *Te Pae Mahutonga*, which he contends represents the fundamental components of health promotion - *Mauriora*, *Waiora*, *Toiora* and *Te Oranga*. He explains that: *Mauriora* is dependent on a secure cultural identity; *Waiora* refers to healthy air, land and water environments which requires a balance between use and development and protection; *Toiora* focuses on personal behaviours and responsiblities; and *Te Oranga* recognises that health promotion (in particular increasing well-being) requires increased participation by Maori in societal affairs.

Another conceptualsation, by Pere (1997) emphasises reciprocity and interconnection between individual selves and wider social interests. In this sense, each experience of well-being would vary from place to place reflecting *whenua* (earth), *turangawaewae* (standplace), *whanaungatanga* (kinship), *whanau* (family), *wairua* (spirit), *hinengaro* (mind, heart), *whatumanawa* (feelings) and *tinana* (body). This conceptualisation by Pere helps explain connections between specific understandings of *whenua* and the social and cultural relations developed in particular places.

Panelli and Tipa (2008) explain how many Maori express a strong affinity for the earth and adhere to basic principles regarding their relationship with other aspects of creation and quote Crengle (2002) who explains all parts of the environment are related to one another and exist within a mutually inter-dependent whole. Deriving economic or social benefit from resource utilisation (recognised as contributors to wellbeing), must be carefully balanced.

Initiation of the current research programme and exploring the contribution of kai gathering to health and wellbeing is predicated on the belief that understandings of health and well-being can be enhanced by explicit conceptualisations that align spiritual, social and cultural elements in connection with bio- physical bases.

4.4 Effects of contaminants on health

While some agencies and researchers contend that people everywhere are exposed to chemical contaminants in the environment, international studies confirm that the majority of exposure to contaminants comes from food, with the consumption of contaminated fish identified as the largest single source of exposure in Canada (Health Canada 1997). Of concern, fish constitutes a significant dietary source of protein for many populations worldwide, especially indigenous communities.

Traditionally, the diet of many indigenous communities (including Maori) consisted of fish, game, waterfowl, and plants sourced from local lands, waters and coasts. Contemporary diets, in contrast, are likely to be a combination of traditional food items and more easily accessed commodity or convenience foods. Despite the change to convenience foods, traditional foods continue to underpin cultural identity for many indigenous communities. Delormier and Kuhnlein (1999) explain how changes experienced by Eastern James Bay Cree have affected diet, traditional food use, and nutrition. They contend that the reduced use of traditional food by younger generations, changes in fish consumption as a result of contamination, and increased incidence of obesity, diabetes, and cardiovascular disease within communities, represent particular socio-cultural concerns. Exploration of these issues and the longer term impacts has necessitated examination of the current diet and food consumption patterns of the Cree. The nature and extent of the risk that Maori confront in New Zealand is unknown but this research attempts to assess the risk.

If food is a major route of human exposure to many persistent toxic environmental contaminants the present research hypothesised that the consumption rates of aquatic species by Maori could represent a significant risk of exposure given their potential higher rates of consumption of these foods. The information gathered through the interviews and the questionnaire therefore had to enable the research team to establish whether there were any correlations between the contaminant levels measured in the participants' tissues (hair) (a separate component) and the fish or shellfish species they consumed in the past year. While such a relationship could not be considered as defining a direct cause:effect relationship, it would increase our understanding of the possible exposure risk to tangata whenua. We have also developed a model of potential contaminant accumulation pathways between participants and the kai they consume and calculation of relative risk, based on measured contaminant levels in kai species, their associated environments and consumers. Furthermore, the data had to enable the research team to assess the levels of contaminants in the respective fish and shellfish species consumed, by identifying important species and harvesting locations. These data were subsequently used to develop a sampling plan for kai species and associated environmental parameters. The results of these strands of research are to be presented elsewhere.

In risk management, the focus is on ensuring that mitigation strategies are culturally appropriate yet rarely are Maori perspectives or knowledge explicitly included in determining the hazards or health outcomes to be considered in the risk assessment. In the absence of explicit procedures to apply health risk assessment in Maori communities, the data derived from the questionnaires and interviews will contribute to the development of a health risk assessment model. Again using data gathered from this stage, we will develop Maori-focused guidelines with respect to the consumption of wild sourced kai and will also explore the appropriateness of existing information dissemination tools for effectively communicating risk.

5. Research results

In this section of the report we start by providing a description of the contemporary mahinga kai practices of whanau and hapu across the Rotorua Lakes region that has been extracted from secondary data sources, interviews with whanau members and the Kai Consumption Survey.

5.1 Background of participants

All respondents to the Kai Consumption Survey were Maori residing in the Rotorua Lakes region. All of those interviewed for this research expressed a strong relationship with the lakes and the wider terrestrial and aquatic surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship.

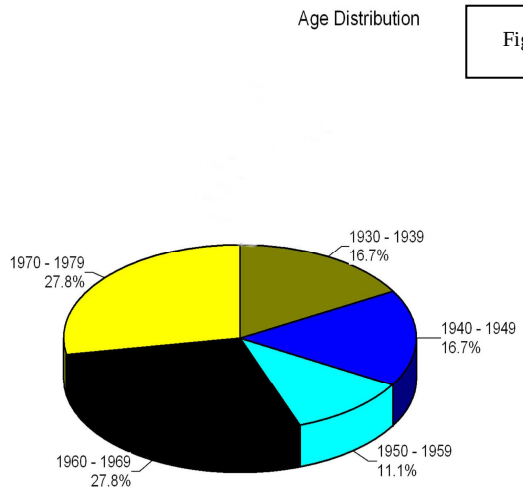


Figure 3

Only a limited number of participants have completed the survey to date (Figure 3):

- 5 are aged 20-29 years
- 5 are aged 40-49 years
- 2 are aged 50-59 years
- 3 was aged 70-79 years
- 3 was aged 80-89 years

Of the 18 participants 8 were female and 10 were male, and 1 did not answer the question.

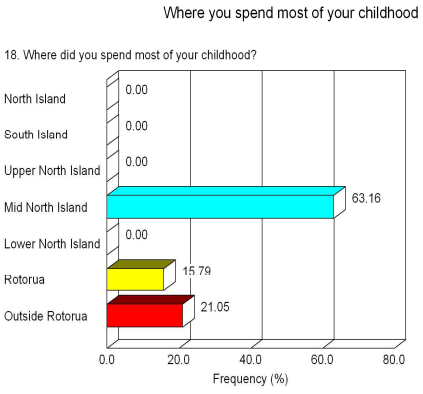


Figure 4

Two thirds of the participants spent their childhood in the middle of the North Island while 15.8% identified Rotorua as the place where they spent their childhood Figure 4).

The most explicit strands of the relationship with the lakes, are whakapapa, birthplace/wāhi whenua, childhood experiences, livelihood, recreation and kai gathering. Cultural values, principles, and tikanga such as kaitiakitanga, manaakitanga, mana and tino rangatiratanga help describe the importance of kai gathering for individuals and provide common bonds and experiences that provide a sense of common identity that connects them physically and spiritually to the lakes region.

5.2 Patterns of kai consumption

5.2.1 Introduction

A large variety of kai continues to be regularly collected, gifted, purchased and/or consumed. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in Rotorua Lakes region. The range of species that are consumed are listed in Table 2.

Table 2: A list of foods that are still consumed today by Te Arawa living in the Rotorua Lakes region.

Toheroa	Morihana	Gurnard	Lampreys	Crayfish	Whitebait
Tuatua	Pipi	Snapper	Mutton birds	Oysters	Trout
Watercress	Cockles	Moki	Eel	Pupu	Kina
Puha		Shark	Flounder	Seaweed	Paua
		Tarakihi	Hapuka	Freshwater crayfish	Mussels
			Mullet	Trevally	Butterfish
			Kahawai		Freshwater mussels
			Kingfish		

We would also have rotten corn, and that was after harvesting, and we used to put the rotten corn into bags .. so that the rats would not get into the bag and make a hole, otherwise we'd lose all our rotten corn. And the rotten corn would be hanging off a huge willow tree which was sort of flowing over the Ohau Channel, and we would be getting rotten corn at a different time of the year (Informant E).

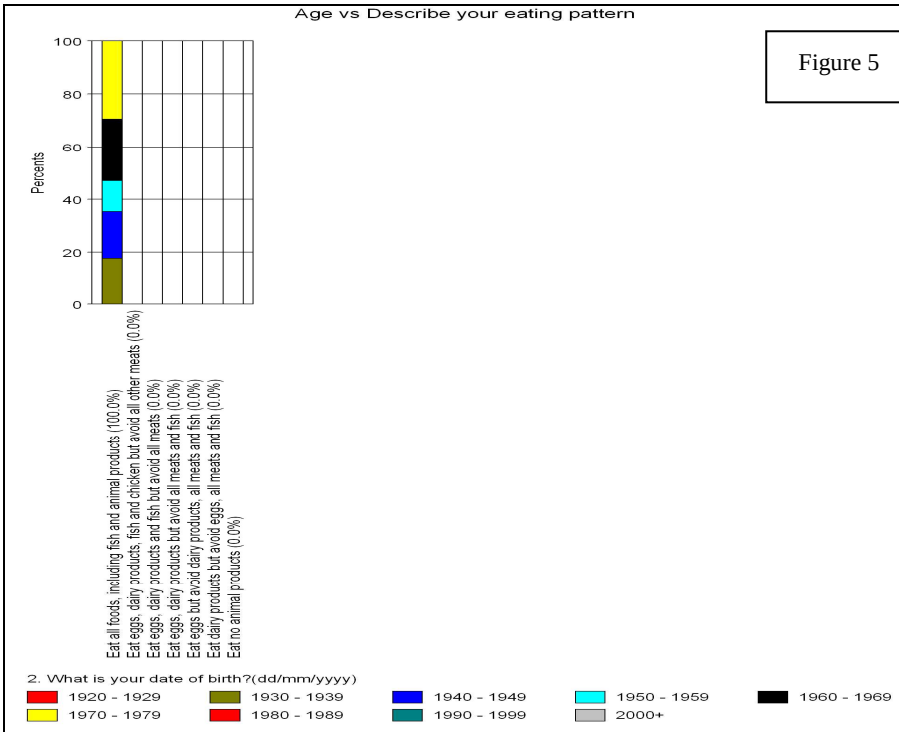


Figure 5

All participants eat all foods, including fish, meat and all dairy products (Figure 5).

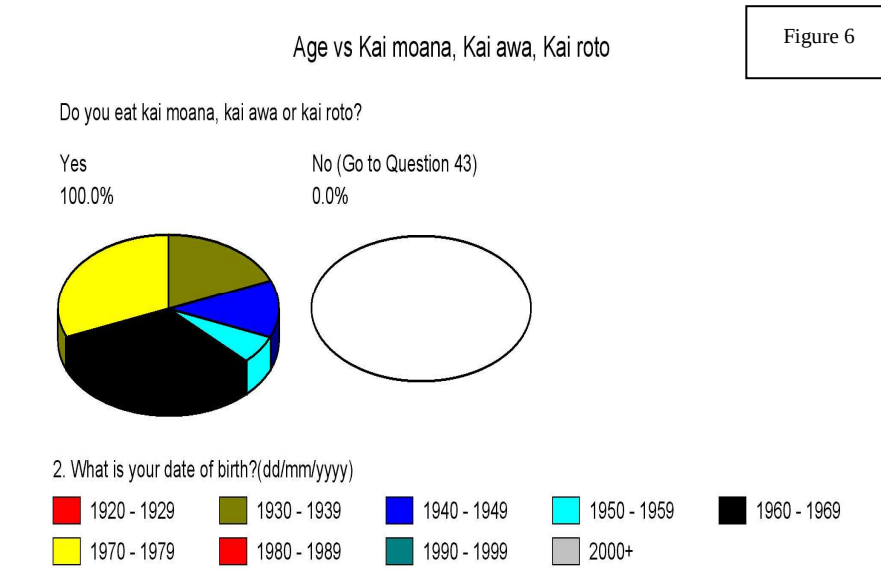


Figure 6

All participants eat kai moana, kai awa or kai roto (Figure 6).

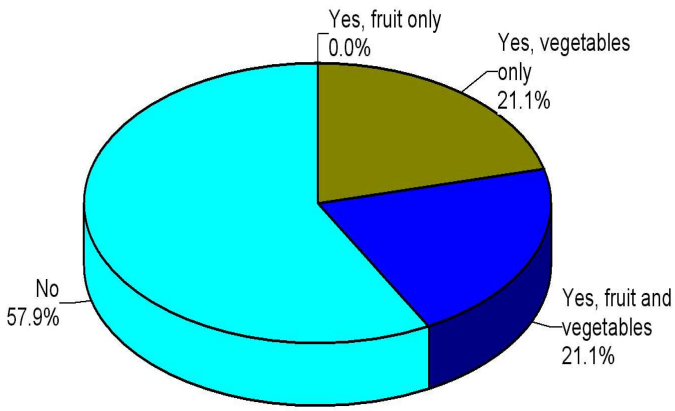


Figure 7

Consistent with a kai gathering lifestyle:

- 42% grew their own vegetables.
- Of the 42%, 21% of those who grew vegetables also grew fruit (Figures 7).

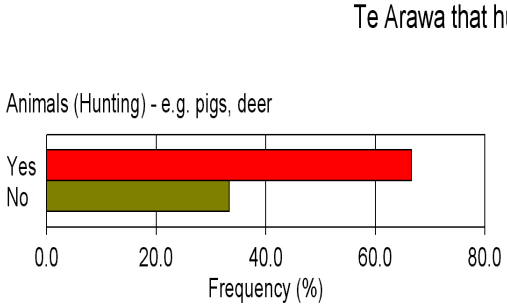


Figure 8

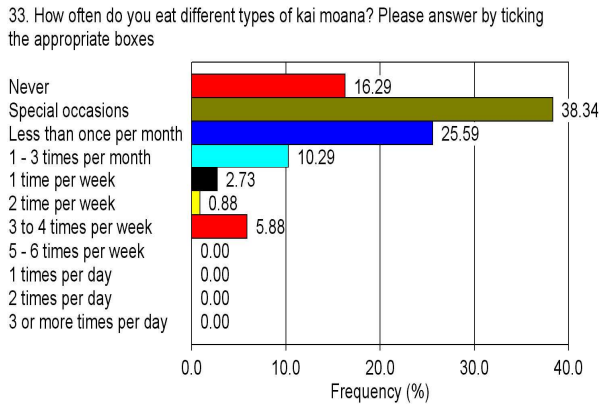
Approximately 66% of respondents hunted.

Yeah, we hunted a lot. Yeah, we hunted a lot but it was mostly at Tarawera, all those sort of things we hunted there. But the lakes were pretty good - those lakes were always pretty clean. The Rotokakahi was always clean – it's still clean but it's starting to – the weed is starting to blanket it now…especially Tarawera where we used to go hunting. You could go in there – we used to go in there and get some watercress for our tea, you know, to cook up with our tucker, you know. Not any more. I don't know why. But I think DOC, I think, poisoned a lot of them. The streams – we used to get a lot of it and it was beautiful watercress from Tarawera (Informant C).

I mean, even our parents - we owned gardens, we grew our own vegetables, our own fruit. We had sections - three acre sections, two acre sections, one acre sections - huge sections. We would have our chooks, we would have everything. Our parents - I know my father was disgusted when he first saw baked beans and spaghetti and everyone was eating that, and he's saying "what's the matter with people, don't they know how to use a spade anymore?" You know, and that is what they were so used to - using their hands to create work and then producing food (Informant E).

How often do you eat different types of kai moana

Figure 9



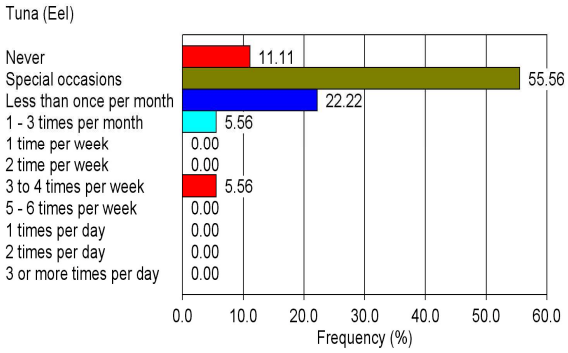
Having determined that all of respondents do consume different types of kai:

- 38% of respondents said they now only eat kai on special occasions; while
- 25.5% eat kai less than once a month; and
- 10% only eat kai 1-3 times per month (Figure 9).

In other words 73% eat kai 1-3 times per month or less.

Amount of Eel consumed

Figure 10

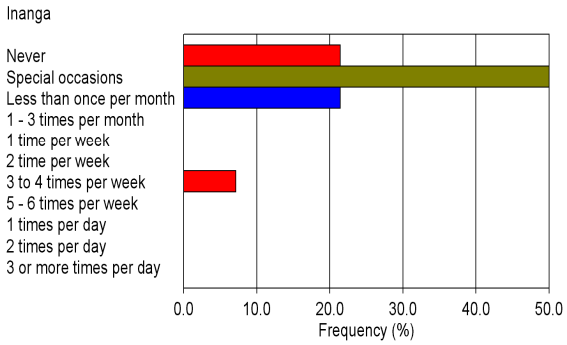


Figures 10 - 15 illustrate how often the various species are consumed:

- Only 5% of those eating eel have this food 1-3 times per month in contrast to 56% who eat eel on special occasions.
- It was of concern therefore that 57% of the respondents believed that there were now "fewer" eels present.

Amount of whitebait consumed

Figure 11



For whitebait, 50% of the respondents indicated they consumed these species at special occasions while another 20% have it less than once per month and another 20% **never** consume whitebait.

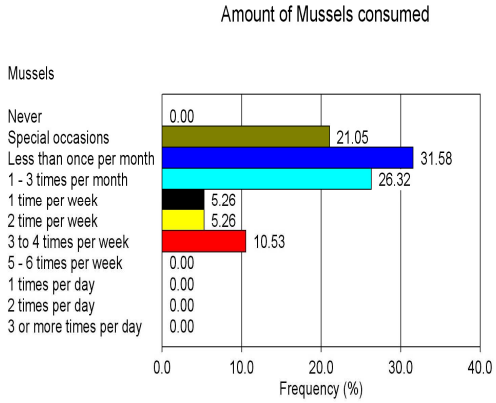


Figure 12

Marine mussels are consumed weekly – specifically once or twice per week by 10.5% and 3-4 times per week by another 10.5%.

Respondents observed that mussels can now be easily accessed from supermarkets.

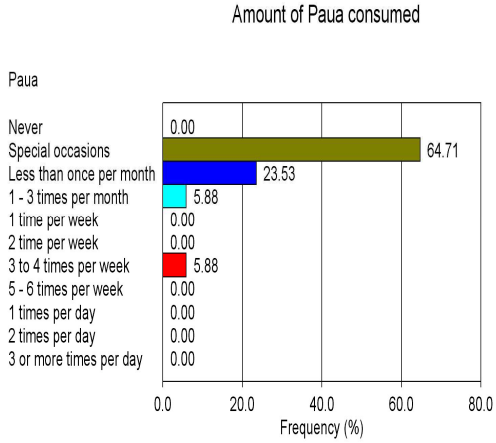


Figure 13

64.7% of respondents only eat paua on special occasions and other 23% less than once per month.

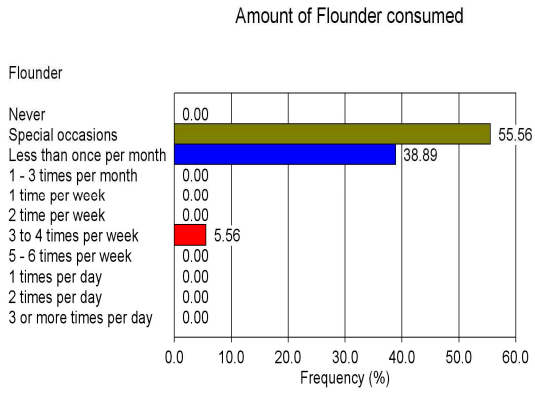


Figure 14

As with the other species flounder (55.5%) was consumed mainly on special occasions.

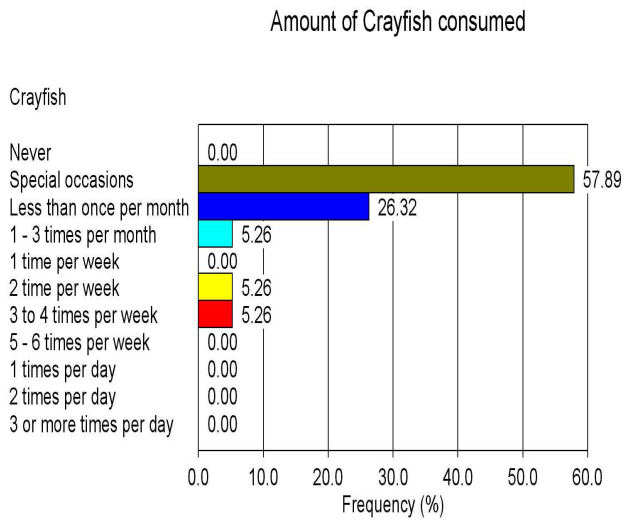


Figure 15

Similarly crayfish was mainly consumed on special occasions by 57.9%.

As whanau explained -

> *We took kai from the river in the way of eels and kakahi and trout. Of course, trout being an introduced species, we made full use of their being available (Informant A).*

Of concern when reviewing the complete list of species and the frequency with what each was consumed, some respondents identified six species as being extinct (i.e., no longer present in the areas they gather from) – kakahi, cockles, koura, morihana, seaweed and tuatua.

How respondents prepare their kai also has health implications. It was accepted that although many would prepare their own kai, others would purchase fish at take-aways, and supermarkets (as either fresh or tinned fish). Figures 16-20 illustrate the difference between age groups.

Figure 16

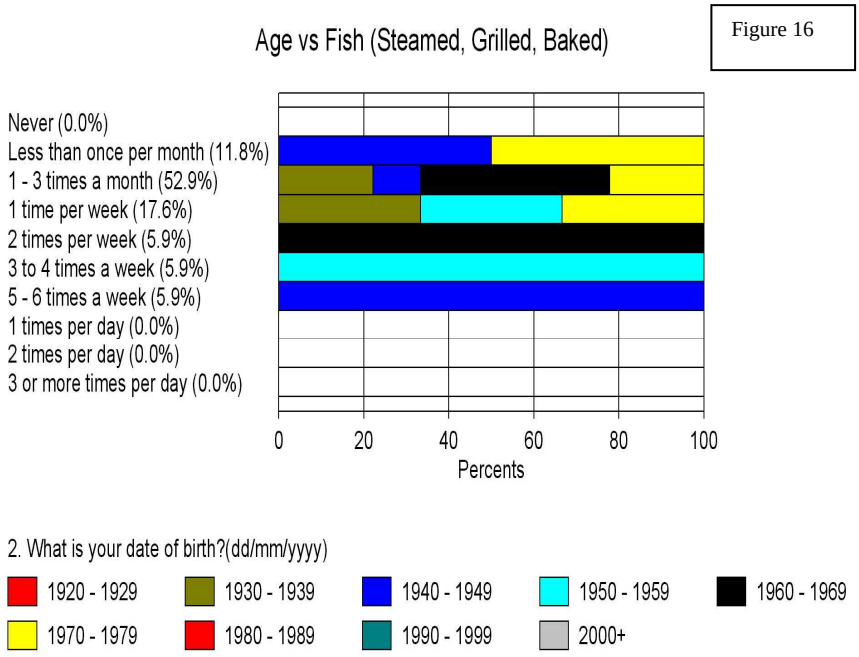
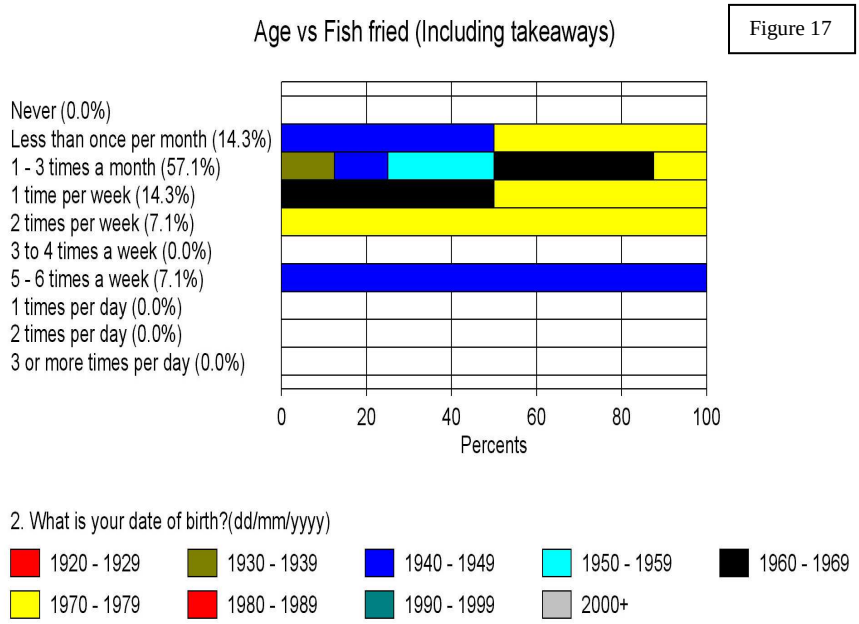


Figure 17



52.9% of respondents consumed steamed, grilled or baked fish 1-3 times per month while another 17.6% recorded consuming at least once per week. Another 17.7% eat fish more than once per week.

Those who eat fish 5-6 times per week were all in their 60s while those eating it 3-4 times per week were all in their 50s.

Today convenience foods can be purchased from a variety of sources and is available:

- as tinned fish;
- as fresh fish available in the deli of a supermarket; and
- as fish and chips at a takeaway store.

The graphs at left confirm that:

- Fried fish is consumed frequently and by 28% of respondents at least once per day.

- 57% eat fried fish at least 1-3 times per month.

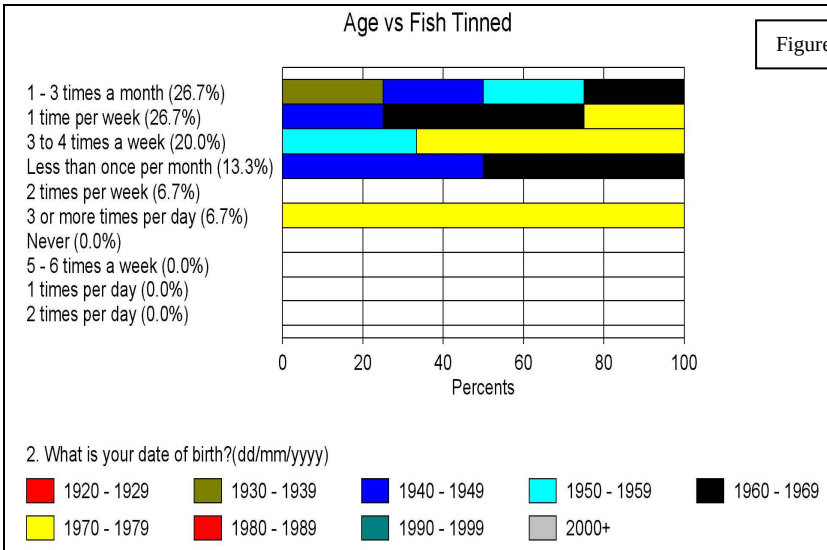


Figure 18

Interestingly Kaumatua consume fried fish and tinned fish 1-3 times per month. In contrast those aged in their 30s were all weekly consumers of tinned fish.

We wanted to determine how dependent whanau were on kai. A question therefore asked if kai moana was the main source of food for the whanau.

37% of informants agreed with this statement (21% agreeing strongly). Those who agreed were aged 40 years and older. In contrast those aged in their thirties were either neutral or disagreed.

In fact 36.8% spread across four age groups disagreed or strongly disagreed – in other words, despite the historic dependency of the lakes for sustenance, kai was not the main source of food for their family.

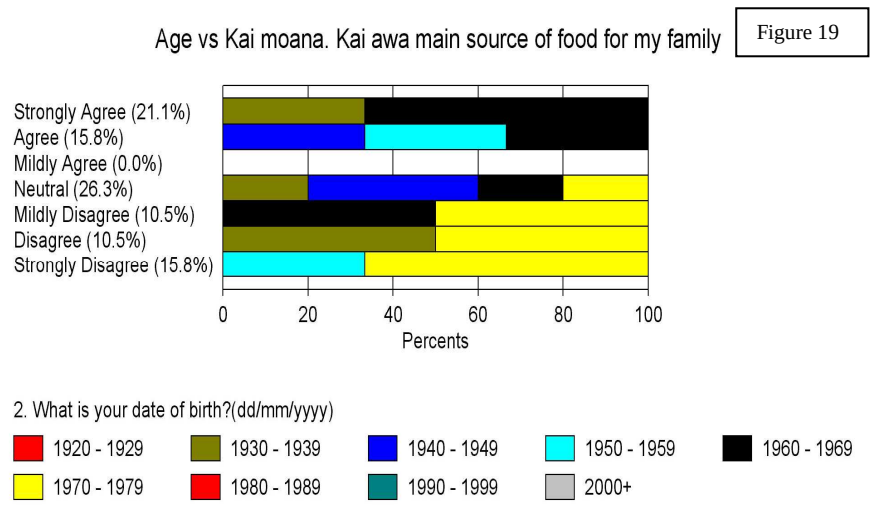


Figure 19

Questions sought to identify changes from a traditional kai dominated diet to a western style diet (Figure 20). It was of concern that 30.8% of respondents eat meat pies, pasties, quiche or savouries at least weekly, and all are aged in their 30s and 40s.

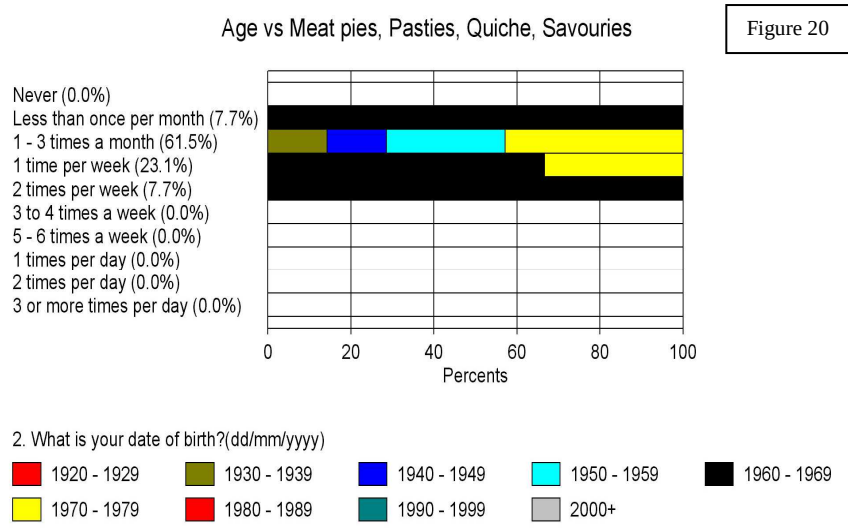


Figure 20

5.2.2 Estimates of the quantity of kai consumed

This research investigates the risk of contamination from eating wild sourced kai. A key consideration is the amount of kai that they are actually consuming, along with the levels of contaminant present. We calculated consumption rates by examining:

- the frequency or number of times they consume kai; and
- the quantity per sitting.

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week. From the data collected we also know that they consumed approximately 219g of fish per sitting[5].

5.2.3 Sites at which kai gathering and other activities are undertaken

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were used as the basis for a sampling programme which examined contaminants in sediment and kai species. Figures 21 and 22 below confirm kai was gathered from 11 of the 14 waterbodies listed. The most highly used area was the coast as 65.05% said they gathered from Maketu followed by lakes Rotoiti (21.04%) and Tarawera (14.39%). There was no gathering by participants from lakes Rerewhakaaitu, Okareka, and Tikitapu.

[5] This is discussed more fully in section 6.3.1

Figure 21

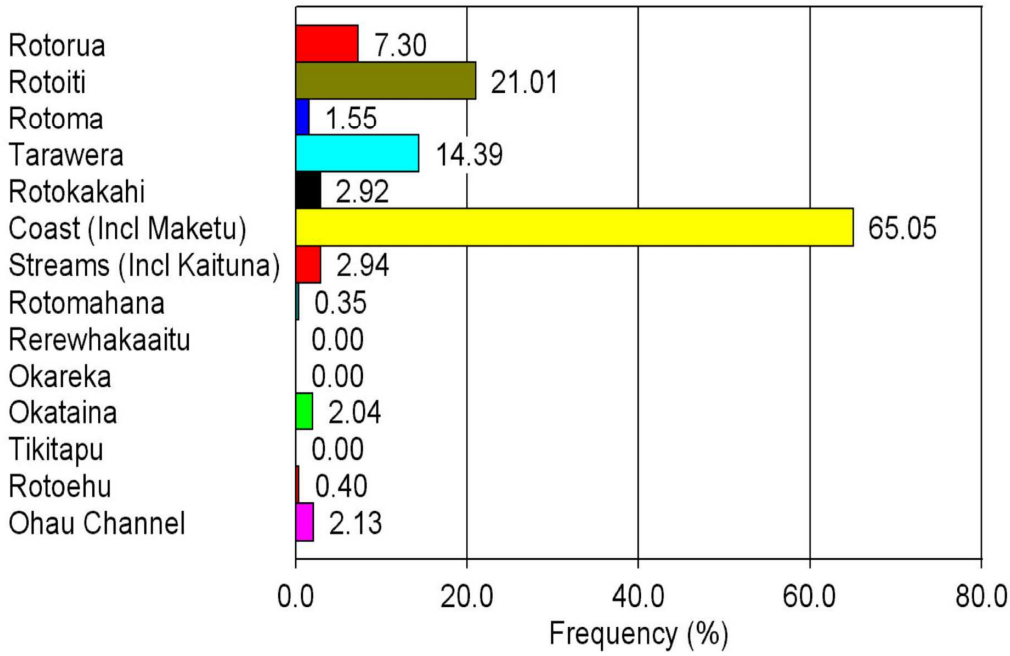
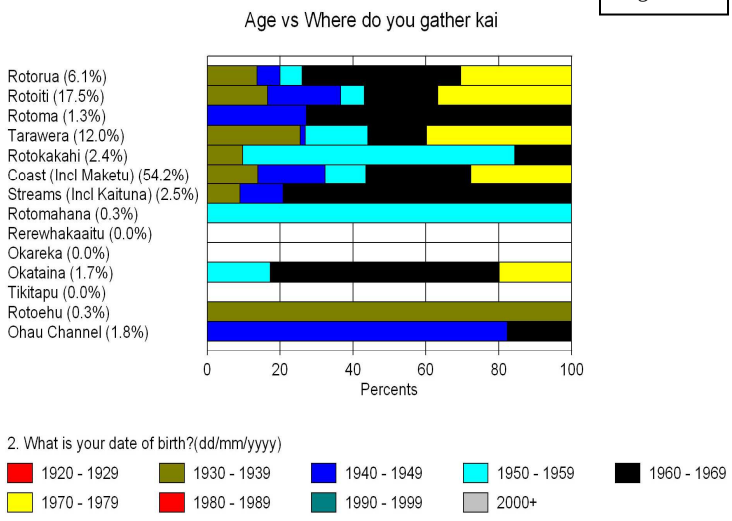


Figure 22



Of the sites listed in the Figures at left (Figure 22):

With respect to ages:

- those that gathered from Rotoehu were in their 70s.
- those that gathered from Rotomahana were in their 50s.
- all age groups were represented amongst the gatherers in Lakes Rotorua, Rotoiti, Tarawera, and the coast.

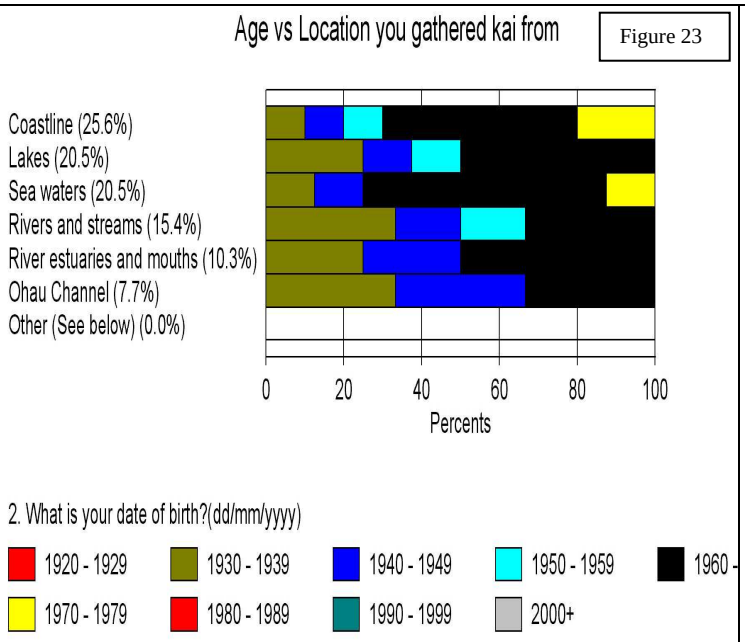


Figure 23 suggests that those in their 30s prefer kaimoana or marine species as gathering occurs at the coast or at sea. This result could also be a reflection of their mobility and possibly access to boats.

In contrast kaumatua gather from all habitat types.

In Figure 24 we show where each of the species are gathered. Most freshwater species are gathered from a range of sites (other than kakahi). Many more coastal species are gathered than freshwater species, although some species (inanga, eels) are gathered in both areas. Figure 25 shows the proportion of individuals that gather each species. Trout, koura, pipi, mussels, kahawai, cockles, snapper and kina are gathered by at least 70% of participants.

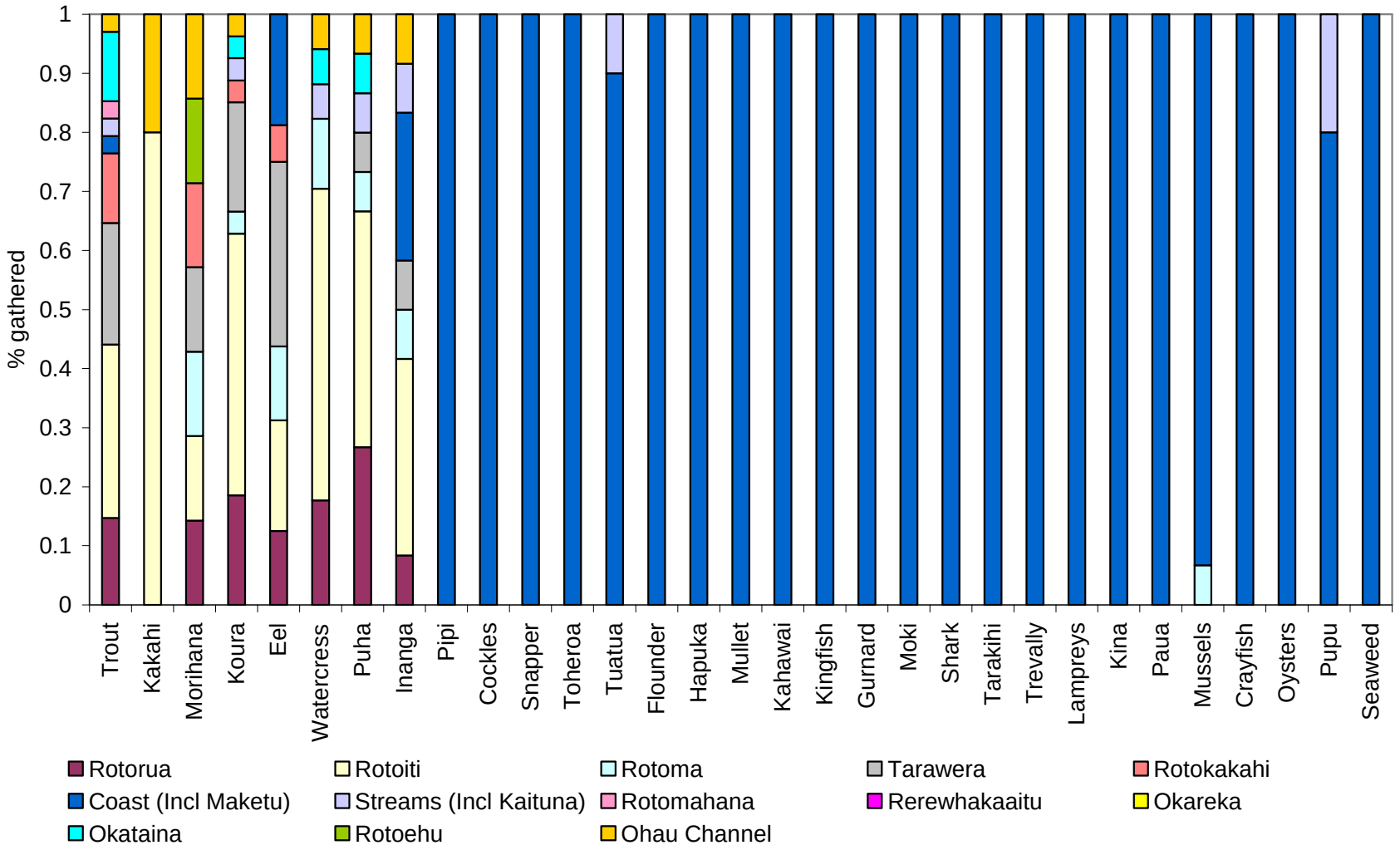


Figure 24: Relative proportions of sites from which the different species of kai were gathered.

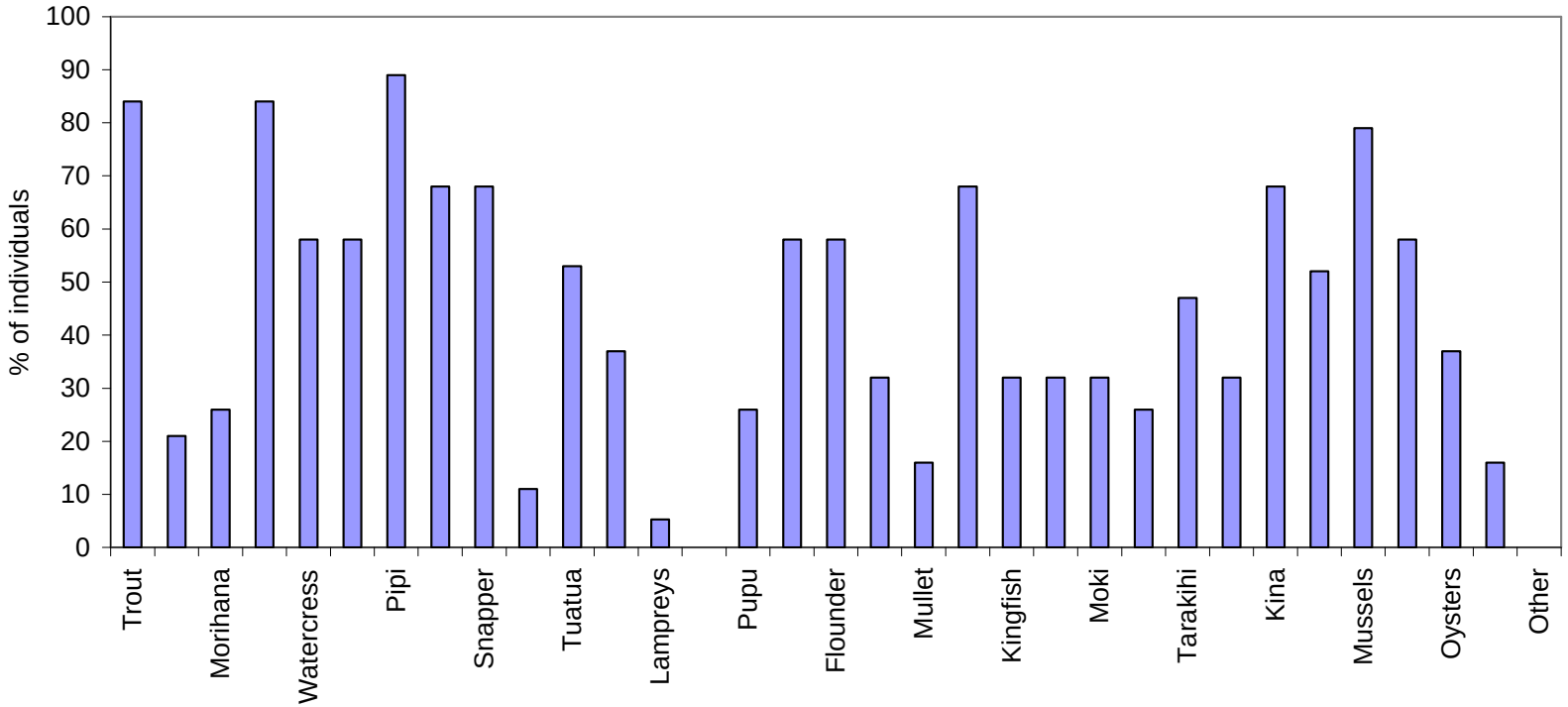


Figure 25: Percentage of individuals who gather each species.

5.2.4 Other sources of kai

This project is about the risk of exposure to contaminants as a result of kai gathering. If there are concerns about the safety of kai consumed, and people are consuming kai that has been gifted, it is important for them to know where the kai comes from.

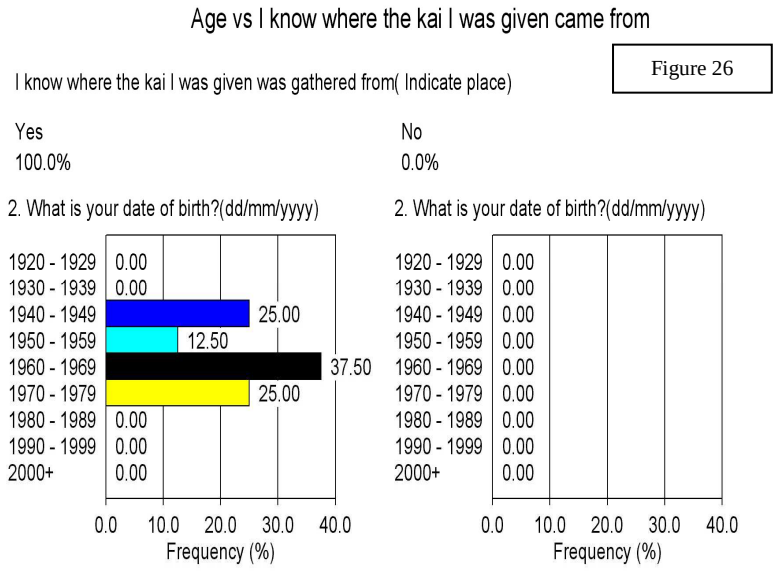


Figure 26

All respondents indicated that they did know the source of the kai they were gifted (Figure 26).

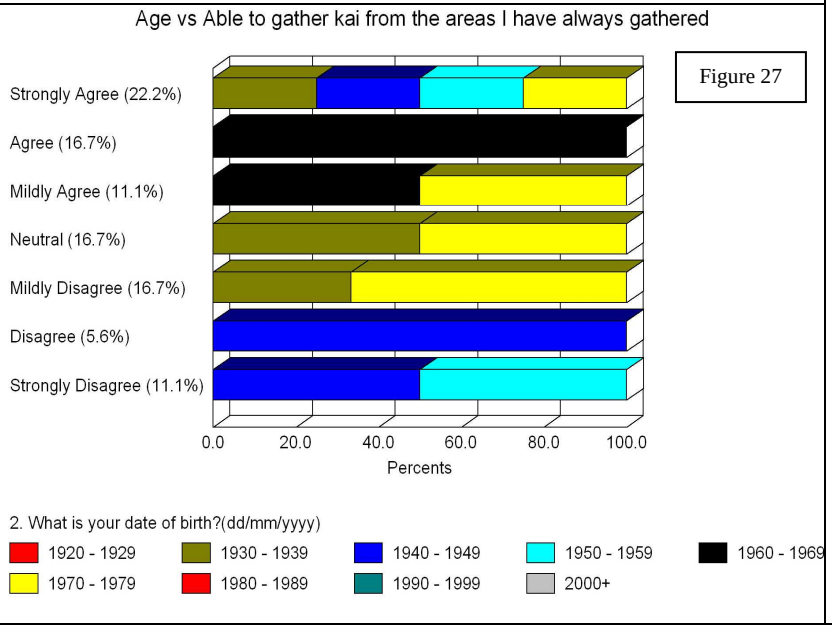


Figure 27

Assuming the sites whanau gather from would change if the condition of the site was degraded; respondents were asked if they were able to gather from the sites that they have always gathered from (Figure 27).

- 50% agree that they can.
- 33% say that they cannot.

No trends can be detected when looking at the respective age groups, although those aged in their 40s all agreed with the statement.

Tangata whenua have witnessed and experienced a range of changes to the local waterbodies and their relationship with them in the last few decades. One of the changes witnessed concerns the abundance of kai available. This is considered in the next section.

5.2.5 Perceived changes in the abundance of species that are gathered

If kai are to be promoted as a beneficial source of food, sufficient quantities of healthy stocks need to be available in order to sustain gathering. The Consumption Survey asked whanau to provide an assessment of the stocks of various species gathered and whether or no abundance had changed. Table 3 presents a summary of these results.

Table 3: Changes in the abundance of species (as a percentage of respondents)[6].

Species	A lot fewer	Slightly fewer	About the same	More abundant
Kakahi	22.2	44.4	-	11
Morihana	42.9	14.3	-	-
Cockles	25.5	50	16.7	8.3
Pipi	11.8	52.9	35.3	-
Toheroa	23.3	16.7	33.3	-
Tuatua	22.2	44.4	11	-
Lamprey	33	50.5	-	-
Mutton birds	50	25	-	-
Pupu	57.1	14.3	-	-
Eel	28.6	28.6	21	-
Flounder	18.2	45.5	0.1	-
Paua	36.4	45.5	9.1	-
Mussels	21.4	28.6	28.6	-
Crayfish	8.3	41.7	25	-
Oysters	27.3	36.4	27.3	-
Seaweed	25	25	-	-
Koura	7.1	35.7	25	-
Watercress	13	33.3	28.6	-
Puha	0	38.5	53.3	-
Hapuka	14.3	42.9	14.3	-
Mullet	16.7	33.5	33.3	-
Kahawai	9.1	27.3	36.4	-
Kingfish	22.2	22.2	22.2	-
Gurnard	11	44	22	-
Snapper	0	40	3	-
Moki	20	40	20	-
Shark	20	40	20	-
Tarakihi	9.1	36.4	27.3	-
Trevally	12.5	37.5	25	-
Whitebait	14.3	42.9	28.6	-
Trout	25	16.7	50	8.3
Kina	16.7	41.7	16.7	-

[6] Perceptions with respect to individual species are summarised in Table 8 with graphs included as **Appendix 1**

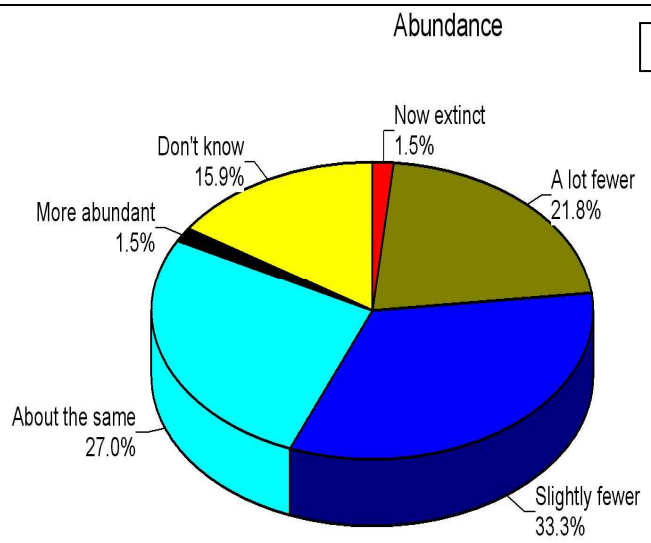


Figure 28

With respect to abundance, 56% felt that "fewer" stocks were available today, specifically, 22% of respondents believed that across all species gathered there were now a "lot fewer" available while another 33% believed that abundance was "slightly fewer"(Figure 28).

As stated earlier 1.5% believed that a number of species – including morihana and koaro were extinct (i.e., no longer present at those places previously gathered from).

5.2.6 Kai gathering behaviours

It cannot be assumed that all kai consumed is gathered by the respondents. Questions in the survey therefore asked about purchasing kai and sought to understand if it was shared within the whanau and wider community.

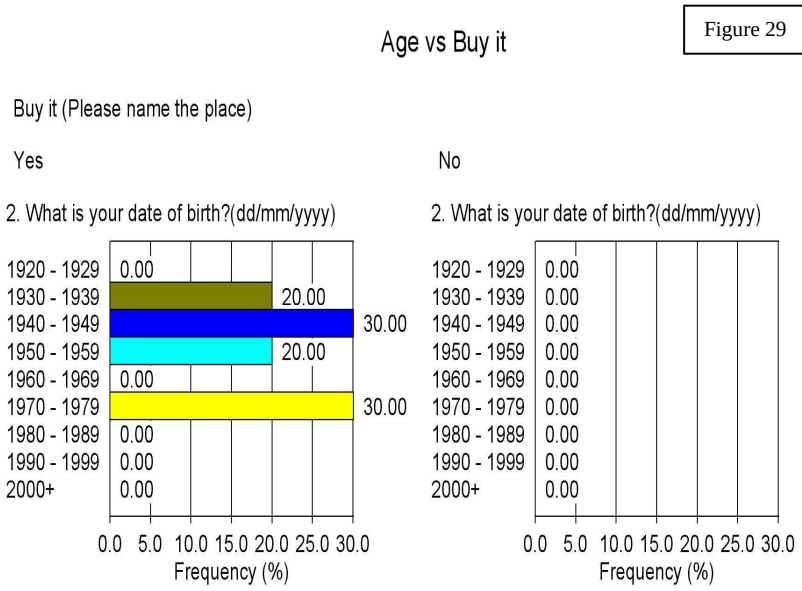


Figure 29

All respondents buy some of their kai (Figure 29).

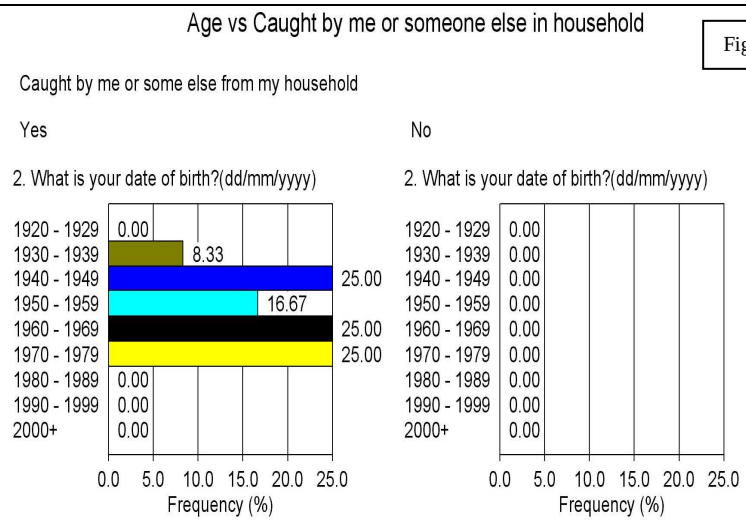


Figure 30

All respondents confirmed that they or someone in their household caught their own kai (Figure 30).

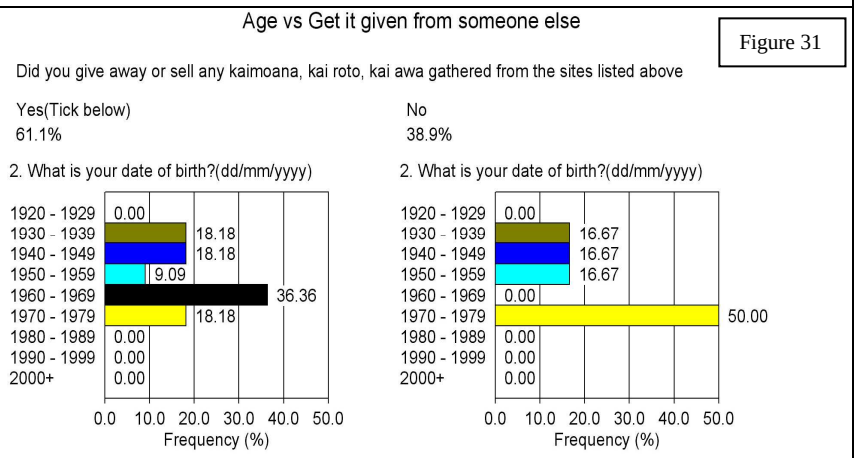


Figure 31

61% of participants said that they also were also given kai (Figure 31).

Aside from knowing how to gather kai, whanau need to know how to prepare the respective species.

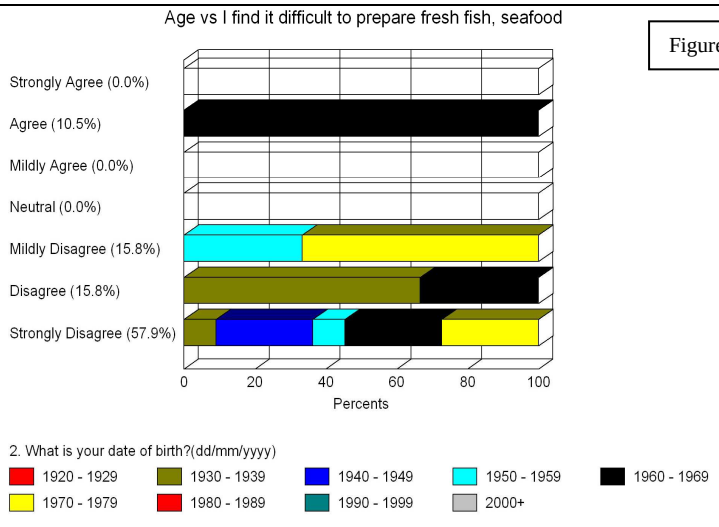


Figure 32

90% of respondents disagreed with the statement (58% strongly disagreeing) that it was difficult to prepare fresh fish and seafood. In other words 90% knew how to prepare their kai (Figure 32).

Of note however was the difference between generations, those that agreed with the statement – i.e., they find kai difficult to prepare - were all aged in their 40s.

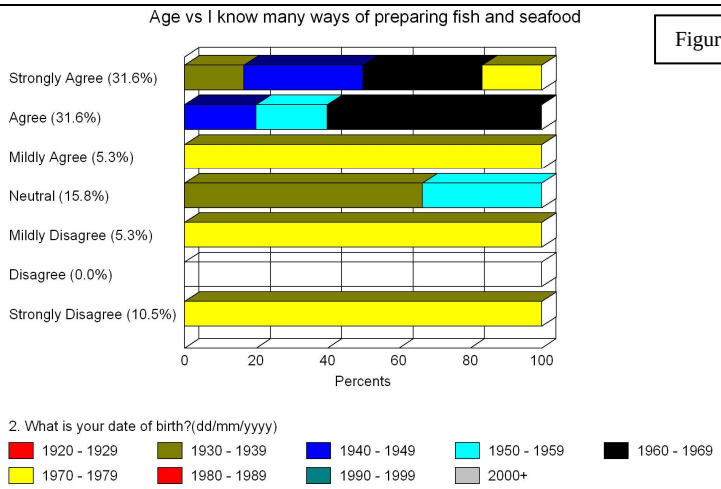


Figure 33

68.7% of respondents know many ways of preparing kai (Figure 33). In contrast, those aged in their 30s replied that they definitely did not know multiple ways of preparing kai.

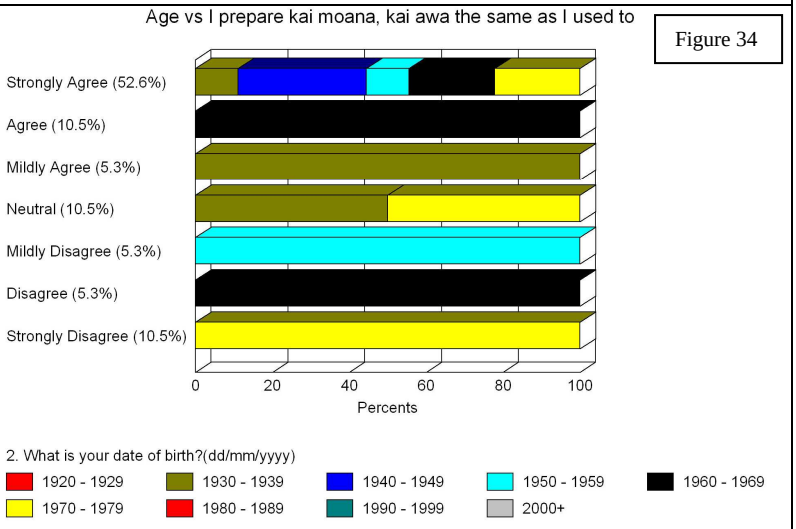


Figure 34

52.6% (across all age groups) strongly agree they prepare kai the same way that they have always done (Figure 34). In fact, 68% of respondents indicated they prepared their kai the same way as they have always done.

5.2.7 Perception of the environment

Yeah, about 60 years ago, beautiful, high and wide and I guess you got the incoming tide from the ocean and the outflow and that, you know. Well, look, it's just quite natural, eh, how you got the Kaituna coming down, you know, and pushing up and you got the foreshore, both doing justice to the estuary and that's how it used to be (Informant K).

The lake was our playground that is all we had. Along Kotu during the summer and we never went anywhere else. We walked it, we swam it, we sailed it, we played in it (Informant M).

Maori experience environments and central to their continued interaction and utilisation of environments will be their perception of the good health of such areas. A number of questions in the survey asked for them to give an assessment of the condition of the sites from which they gather kai.

Figure 35

Responses were mixed when asked about the condition of sites (Figure 35), with:

- 52.7% believing sites to be in good condition while
- another 31% did not provide an assessment.
- Only 16% appeared to believe that sites from which they gather are not in a good condition.

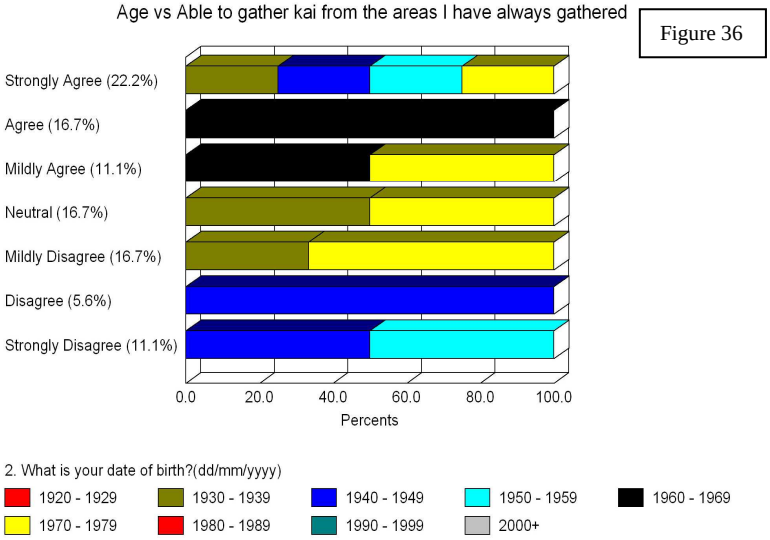


Figure 36

This is supported by the assessment by 50% of respondents who believe that kai could be gathered from the same sites that have always been accessed (Figure 36).

With respect to age differences those who believed they could no longer gather from the sites they have previously been able to were aged in their 50s and 60s.

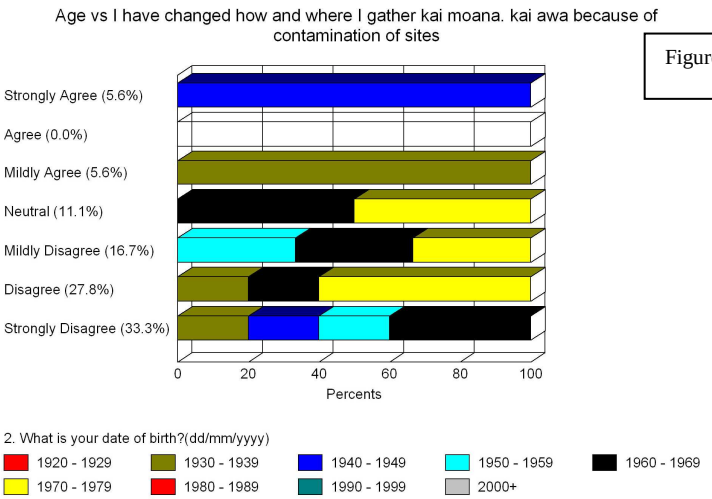


Figure 37

Responses were also mixed when asked about changing the sites they gather from as a result of perceived contamination at the sites (Figure 37):

- Only 11% agreed that they had changed their gathering behaviour.
- In contrast 77.8% across all age groups disagreed.

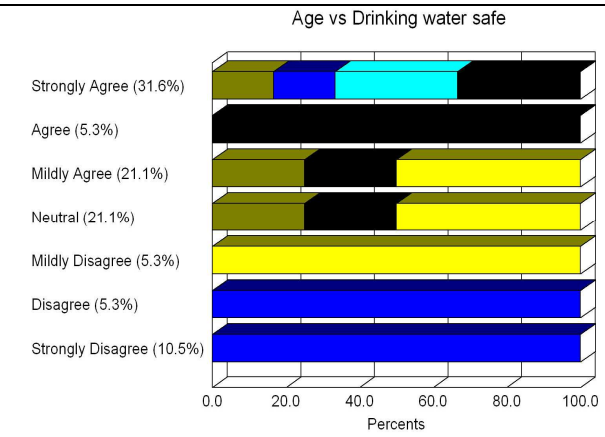


Figure 38

The majority of participants (58%) believed that their drinking water was safe (Figure 38). However, 21% did not comment.

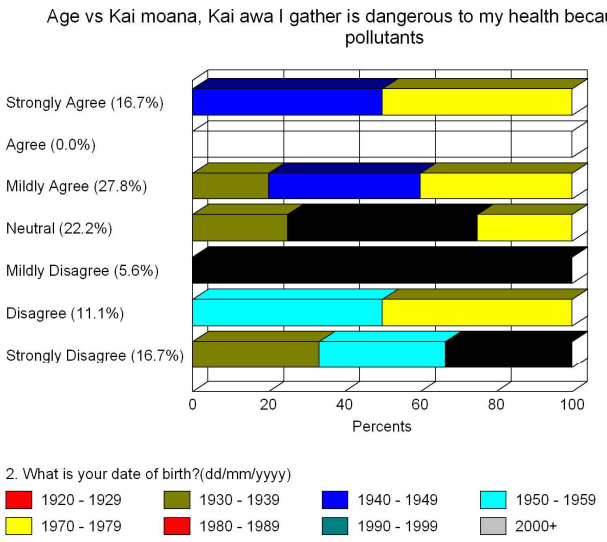


Figure 39

In relation to pollutants (Figure 39):

- 44.5% strongly disagreed with the statement that the kai gathered was dangerous to human health because of pollutants with (16.7 strongly disagreeing)
- However 22% did not provide an assessment.

With respect to age differences all respondents in their 60s agreed with the statement – that kai is dangerous because of pollutants.

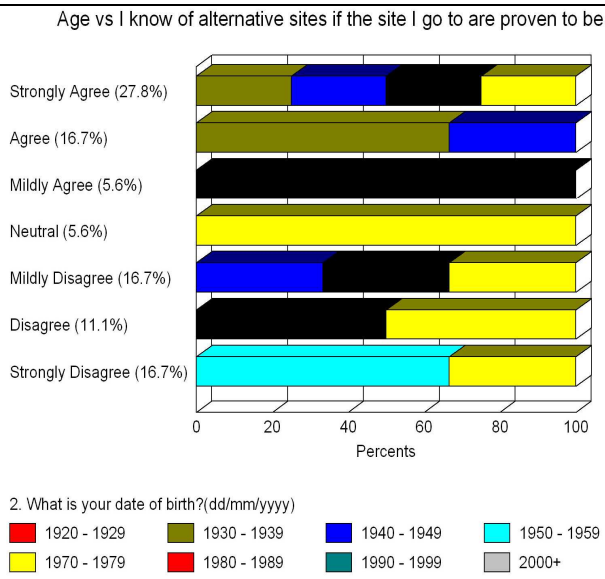


Figure 40

No clear trends emerged when asked if kai gathering was dangerous to the health of respondents because of pollutants or toxins.

However, if a site is contaminated then the expectation would be that alternative sites would be used.

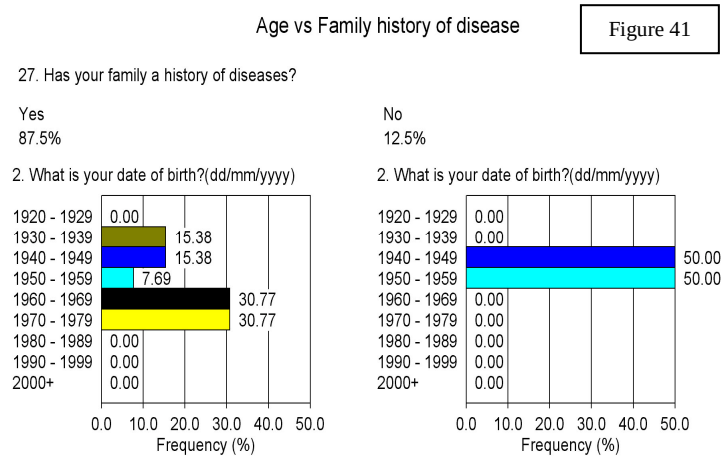
However only 50% knew of alternative sites that they could use (Figure 40). 27.8% strongly agreed with the statement that they would use alternative sites.

All respondents aged in their 70s knew of alternate sites.

5.2.8 Health of whanau members – Self Reported Rates of Diseases

Participants were asked to self report diseases prevalent in the family (Figures 41 and 42).

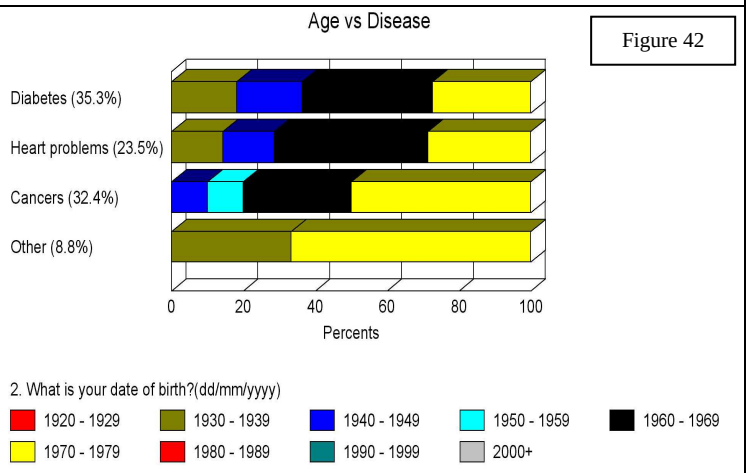
Figure 41



The lowest reported incidence of disease was among those in their 50s (at 7.69%) while those aged in their 60s and 70s each scored 15.38% which contrasts with a rate of 31% for those aged in their 30s and 40s.

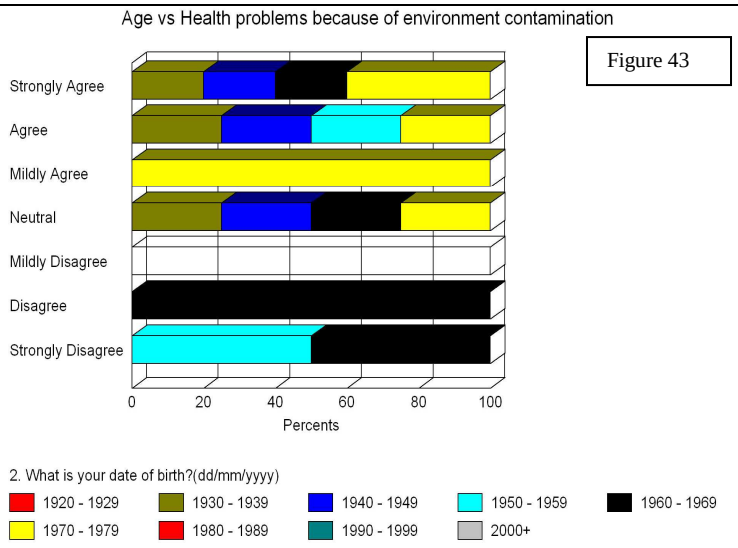
- 87.5% reported that there was a history of disease in their family.
- 35.3% of participants, across four age groups, reported a history of diabetes within their whanau.
- 32.4% of participants, across four age groups, reported a history of cancers within their family.
- 23.5% of respondents, reported heart problems (Figure 42).

Figure 42



Despite the prevalence of illness in their whanau (at above average rates) 84.2% of the individuals participating rated their health as good, very good or excellent (Figure 43). No one rated their health as poor.

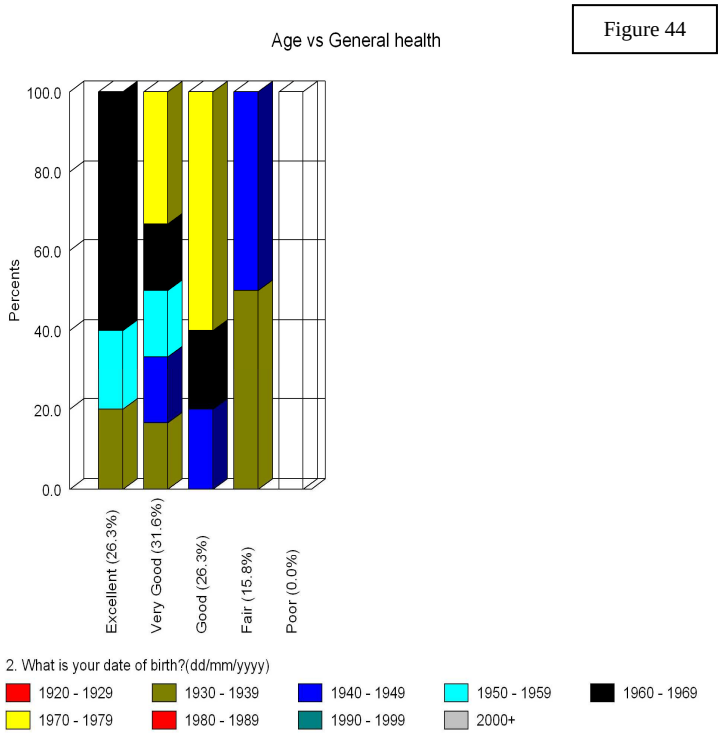
Figure 43



Two questions in the survey asked if respondents believed their health problems could be attributed to environmental contamination or more specifically water contamination (Figure 43).

With respect to environmental contamination, 61% of participants across most age groups agreed with the statement that health problems can be attributed to contamination.

Figure 44

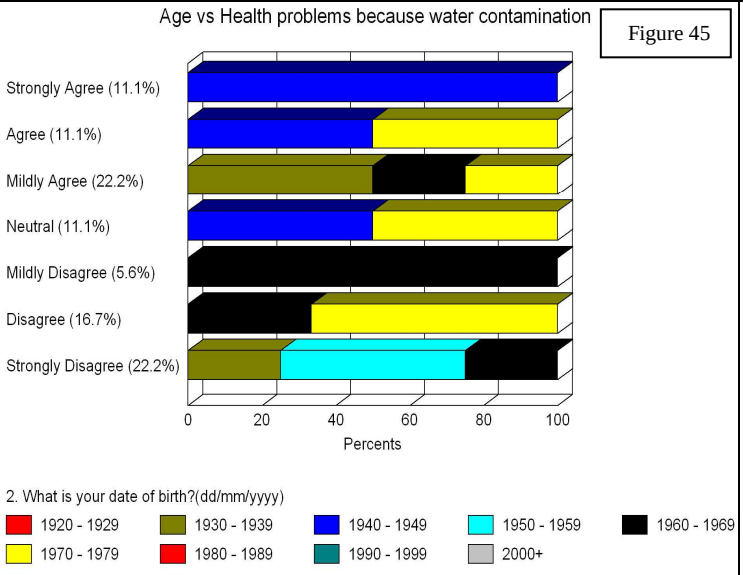


Other age group observations (Figure 44):

- The eldest participant considered their health as excellent.
- Those aged in the 70s and 60s were the only ones to rate their health as fair.
- The greatest variation was in the 70+ years age group with participants rating their health fair, very good or excellent.

As expected, the youngest participants (aged in their 30s and 40s) considered their health very good or good.

Figure 45



Interestingly 44.5% of participants disagreed with contaminated water being the source of their health problems while an equal number agreed.

The "casting vote" lies with the 11.1% who provided no comment (Figure 45).

5.2.9 Disseminating advice about contamination issues

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

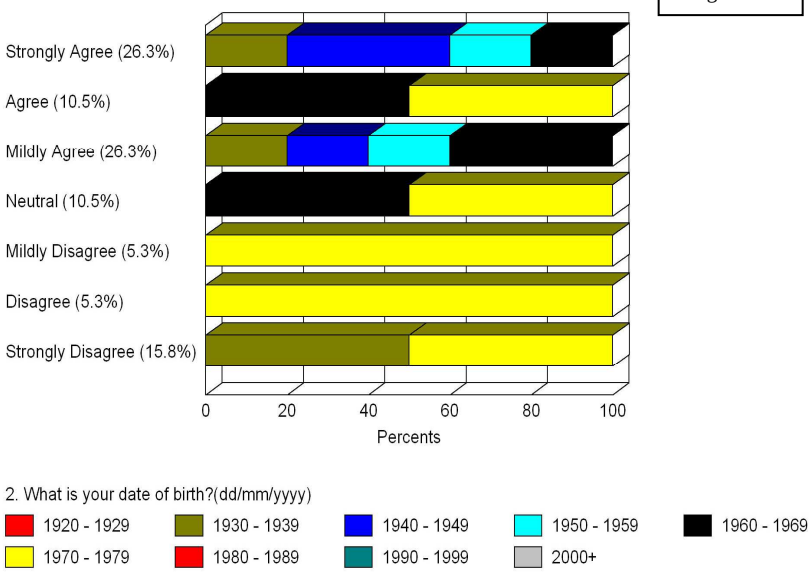


Figure 46

63.1% of respondents indicated they knew where to get advice about contamination issues (Figure 46).

Only 26.4% (and two specific age groups – those in their 40s and 70s) did not know where to go to obtain information.

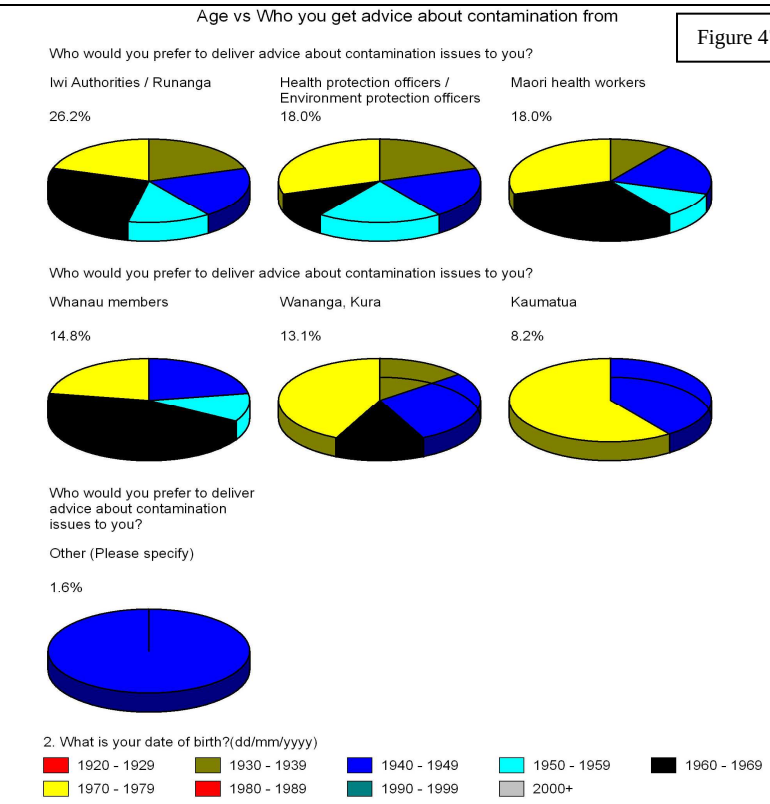


Figure 47

There is a slightly higher preference for iwi authorities/runanga to deliver the information (26.2%), although HPOs/EPOS, Maori health workers, whanau members and whananga were also considered important (Figure 47).

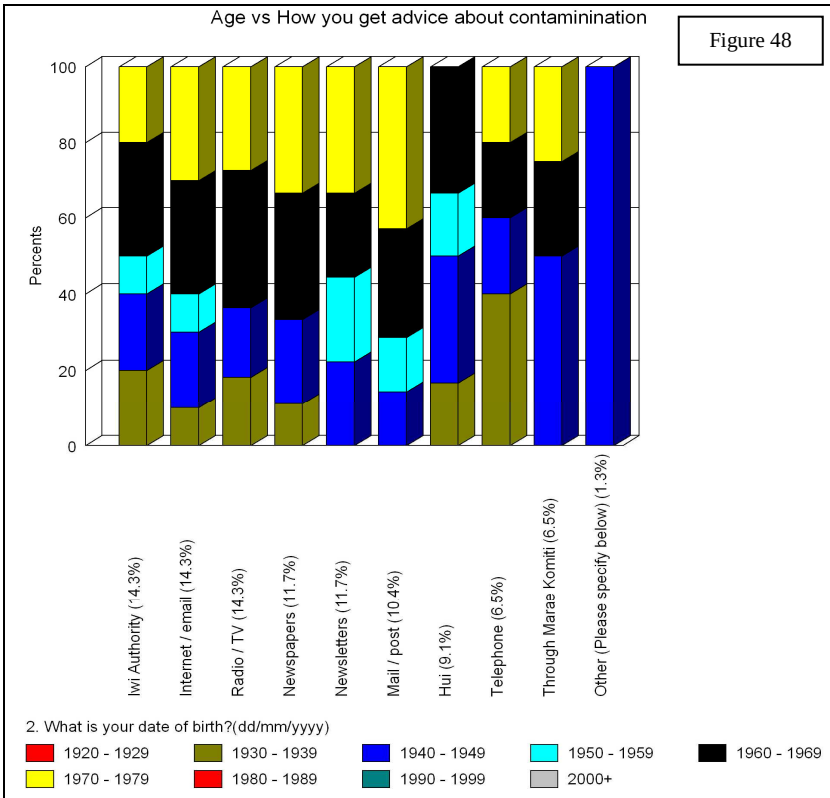


Figure 48

Similarly there was no clear preference with respect to the means of communicating contaminant information, which in fact suggests that a range of media should be used. About 9 different media were supported evenly (Figure 48).

However, when reviewing the means of communicating we need to be cognisant of the equipment needed by whanau.

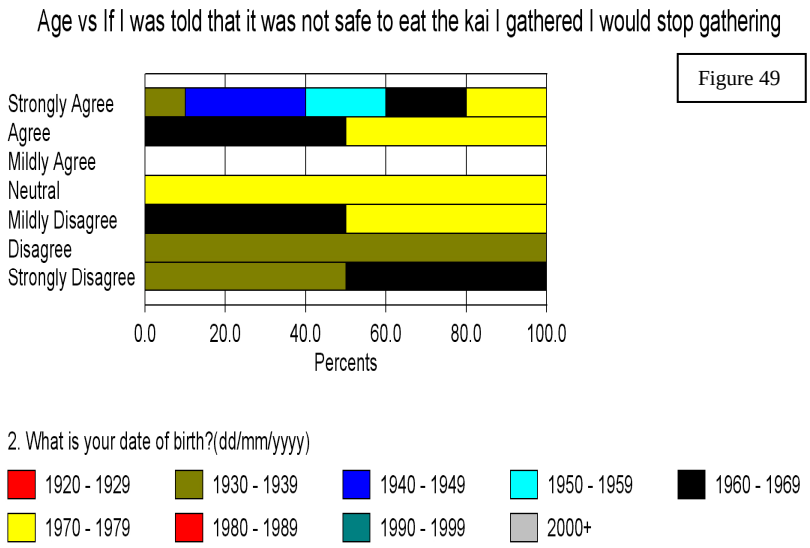


Figure 49

The final result (Figure 49) concerns the long-term outcome of this programme and the need to communicate health risk. Importantly, 63.6% of respondents (across all age groups) indicated they would stop gathering kai if advised that kai was not safe.

In the section that follows we discuss the implications for Te Arawa of the results presented in this chapter.

6. Discussion - understanding the socio-economic-cultural importance of kai to whanau and hapu

> *Indigenous relationships to the land are based in cultural practices. Harvesting of traditional foods is a central, material part of this relationship. A key problem for indigenous peoples occurs when, because of the practices of competing world views such as those often held by colonial states, practising these material connections becomes difficult. Problems ensue. These problems include issues related to health and well-being, and a disruption of well-established life-ways. (Fediuk and Thom, 2003, p 1)*

The discussion in this chapter compares traditional and contemporary consumption patterns of kai gathering, processing and consumption, the health of significant sites, and summarises environmental change over the last 160 years to identify drivers of the transitions from a traditional kai based diet to a western diet. Insights, firstly, concerning the impact of dietary changes and secondly, the ongoing risk of exposure to contaminants and the impacts of this risk on the health and wellbeing of whanau are discussed in the wider political / social / cultural context in order to give a more complete reporting of cultural-environment relations.

From the histories of Te Arawa and written manuscripts, descriptions of lifestyle heavily dependent of kai gathering emerges. The resources available from these lakes were crucial for sustaining the livelihoods of Te Arawa whanui prior to European settlement. Kai gathering was the basis of an economy and culture before contact with Europeans. In this chapter we distinguish kai gathering in three time periods:

- pre European settlement through until late nineteenth century using mostly information sourced from secondary sources;
- twentieth century up until the 1970s and 1980s – using information sourced from interviews with members of Te Arawa whanui; and
- the present - using information obtained from:
    - the interviews with members of Te Arawa whanui;
    - the kai consumption survey; and
    - monitoring reports of EBoP, research reports and statutory plans.

6.1 Structure of this chapter

Te Arawa have continually asserted their right to have their mahinga kai and cultural practices protected. However, many whanau in Rotorua Lakes have witnessed the degradation of valued habitats and experienced significant barriers to gathering kai. They continue to express their concerns in a variety of forums. This chapter follows the format of Chapter 5 and discusses:

- patterns of kai consumption;
- estimates of the quantity of kai consumed;
- sites from which kai is gathered;
- perceived changes in the abundance of species;
- kai gathering behaviours;
- perception of the environment;
- health and wellbeing of whanau members; and
- disseminating advice about contamination issues.

6.2 Traditional patterns of gathering

> *At 1840, Lakes Rotoehu, Rotomā, Rotoiti, Rotorua, Ōkataina, Ōkareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngāhewa, Tutaeinanga, Ngāpouri, and Ōkaro were rich in resources. These included extensive indigenous fauna and flora that provided food, shelter, and economic resources for Te Arawa as well as the means to provide for manuhiri (visitors) and others in the district. The lakes were also primary transport routes for the area. To Te Arawa, the lakes were taonga, and their relationship to the lakes and environs was and continues to be the foundation of their identity, cultural integrity, wairua, tikanga and kawa.*

The evidence of Captain Gilbert Mair, before the Native Land Court during its 1918 inquiry, explained the significance of aquatic resources, (as apart from birds and rats), that the Rotorua district was seen to be unsuitable for cropping. This resulted in fishing assuming greater importance to Te Arawa. Mair listed the various species of

fish caught in the Rotorua lakes including: kakahi (a kind of freshwater mussel), kokopu, koaro (fish similar to small trout), koura (freshwater crayfish), and inanga (whitebait)[7].

Rights to water fowl were held by particular hapu, and were sustainably managed. Kawa (shags) and seagulls, which nested on the lakes' margins, were also managed as were plants such patches of raupo growing along the lake shore[8]. Overall, the list of food items, materials, and other resources relied on by Central North Island Māori including Te Arawa to sustain themselves is substantial. Listed below are some that have been referred to in written text and statements –

Fish and crustacea including:

> eels of different kinds, koura (freshwater crayfish), inanga or whitebait, kōaro, kokopu, kakahi (freshwater mussel), karehe (freshwater pipi), toitoi (common bully), ngorungoru, pahore, mataitai (foodstuff from the sea, generally).

Birds including:

> ducks, kaka, kiwi, kakapo, kukupa and kereru (pigeons), tui, taiko (petrels), mutton birds, matuku (bitterns), kahu, weak.

Other fauna including:

> kerewai (a green beetle, found in manuka scrub), kiore (rats), and [as a later introduction] pigs.

Plant products including:

> flax, kakaho, raupo, paopao (another type of reed), kiekie, toetoe, aruhe (fern root), putere (raupo root), mānuka [used for medicine and also for constructing koneke and shelters], tahara, mingimingi, kaponga bark [for medicine], tutu and koromiko [for medicine], makaikai/maikaika tubers (a kind of potato), kohekohe, pukeatea, rewarewa, mangeao, puriri, wharangi, kotukutuku, makomako, kaponga-mamuka, tawhero, mawa, kawakawa, piripiri [these last 13 all having medicinal uses], ti kouka shoots, berries (tawa, hinau, titoki, makomako, kotukutuku, rohutu, poporo, karaka, miro, tutu), young fern fronds (moku, paretao and pikopiko), rarauhe (bracken),

[7] Evidence of Gilbert Mair, ibid, pp 191–196
[8] Evidence of Wiremu Maihi Ereatara, ibid, p 306

tāwhara fruit and flowers [both used for food], huahua, tupakihi, tawhara, puha, watercress, and [cultivated] kumara, hue (gourds), and taro.

Timber including:

totara, puriri, tanekaha, pohutukawa, white pine.

Other materials such as:

paru [for dyeing fibre], kokowai (red ochre), sulphur [used for medicinal purposes].

Other natural resources:

water, geothermal resource [both with multiple uses including spiritual].

Another comprehensive description of the species sourced from the Rotorua Lakes area is provided by Makereti in “Old Time Maori” (originally published in 1938).

Table 4: Species traditionally gathered from across the Rotorua Lakes region sourced from the writings of Makereti (1938).

SPECIES				
Koeaea (whitebait)	Kokopu (*Galaxias*)	Upokororo (grayling)	Eel	Koura (crayfish)
Inanga/smelt (*Retropinna retropinna*)	Tamure (schnapper)	Trevally	Kahawai	Kumukumu (gurnard)
Kingfish	Mangopare	Pepeke	Kapeta	Parore
Mangotara	Koheriri (horse mackeral)	Kutorotoro (sandfish)	Tutahuna	Tarakihi
Mango (shark)	Hapuka (groper)	Kanae (mullet)	Warehou (sea bream)	Moki
Manga (barracuda)	Tuangi (cockles)	Kuku (mussels)	Karengo (*Laminaria*)	Rimurehia / rehia – edible seaweed
Paua (*Haliotis*)	Kina (*Echinus*)	Tio (oysters)	Pipi	Kotukutuku (*Fuchsia excorticata*)
Aruhe (bracken fern)	Poporo berries (*Solanum aviculare*)	Hakeke (*Polyporus*) – an edible fungus	Kakahi (freshwater mussel, *Echyridella menziesi*i)	Toitoi (*Gobiomorphus gobioides*)
Kumara	Tutu – the berries of the puho (*Coraria ruscifolia*)	Harore (*Agaricus adiposus*)	Kiore – rat (*mus esculens*)	Pig
Para twahti, para reka or para (*Marratia fraxinea*)	Berries of the karaka tree (*Corynocarpus laevigata*)	Pungapunga – pollen of raupo (*Typha sp.*) koreirei – roots of the raupo	Many different bird species	Potato
Tawa berries (*Beilschmiedia tawa*)	Ti kouka or whanaka (*Cordyline australis*)	Puwha (*Sonchus oleraceus*)	Tawhara – part of the kiekie (*Freycinetia banksii*)	Fruit of the Hinau tree (*Elaeocarpus dentatus*)
Taro	Fruit of tumingi (*Cyathodes acerosa*)	Roots of pohue (*Convolvulus sepium*)	Te korito – heart of Nikau palm (*Areca sapida*)	Fruit of the Makomako (*Aristotelia racemosa*)
Young fronds of the fern Moku (*Asplenium bulbiferum*)				

Makereti (1938) also describes how the respective species were gathered.

Shellfish

Shellfish was an important food, and many species were found in the sand of the beach when the tide was out. The varieties are too numerous to mention. All shellfish were collected by women and not by men.

Kuku, mussels, were taken from the rocks by hand and collected in baskets.

Paua (Haliotis)… is taken from the rocks by hand, and the inside is taken out and beaten to soften it before it is cooked on hot coals or in a hangi.

Kina (Echinus)... is generally eaten raw. It is usually collected at the same time as the paua.

Tio, oysters of two kinds, were found on the coast. One kind is rather small and has a rough and crinkled shell, and is found on rocks. The other is much larger, and has a comparatively smooth shell, and lives in mud. The Maori did not care a great deal for oysters, as he did for other shell-fish.

Pipi grows all over New Zealand, generally in sand banks or in sandy mud, and was a favourite food.

Freshwater fish

Koura …..They used the paepae, a dredge net, and also whakaweku, bunches of fronds of raurahe (bracken) sunk to the bottom of the lake, or tau, bunches of fern tied to a post.….Our people also ruku koura, that is, dived for crayfish, going to the bottom of the lake and bringing them up between both hands.

Inanga (Retropinna retropinna) was taken in great quantities in most of our lakes with the kupenga, or seine net. They were also taken in an oval hoop net with a long wooden handle which went right across the net, and also in a small conical scoop net. The fishers who used these small nets waded near the shore. But the big net was generally used in the old days in Lake Taupo and Lake Rotorua, Lake Rotokakahi, and other lakes...

Toitoi (Gobiomorphus gobioides) is a small fish caught in the lakes, and like inanga was taken in nets…. Toitoi was also called titarakura and other names.

Pahore was another small fish found in the lakes like the toitoi.

Koeaea or whitebait was much thought of, and it is one of the nicest of all small fish….

Kokopu (Galaxias) was an important food among the people who lived inland..… The kokopu was generally taken on dark nights in summer and autumn….. Its flavour was not unlike whiting, and there were about six varieties.

The upokororo or grayling, of which there were the tirango, kutikuti, and rehe, were caught in traps when they were going up rivers after a flood while the water was still dirty. The upokororo was also taken in nets and by other means.

The Maori sometimes caught the patiki or flounder with a spear. The spear was made with a point at the end which was barbed. It was not unlike the spear used for catching birds.

Kakahi, the fresh-water mussel.

Eels were taken in a hinaki, eel trap, set at a pa tuna (eel weir), and with a bob, spear, or even with the hand..…

Marine species

The mango (shark) was taken, not only to eat, but for the teeth. The teeth of the mako shark, or some of its species, were used as ornaments and as cutting implements.

There were also hapuku (groper), tamure (schnapper), kanae (mullet), warehou (sea bream), moki, kahawai, kumukumu (gurnard), and other fish.

Sea crayfish were also taken by diving. Men and women were clever at the work of ruku koura, that is diving for crayfish among the rocks of the sea.

Kahawai (Arripis salar) was caught by trawling.

Hapuku (groper), another favourite fish, was also caught by trawling.

Kanae (mullet) was another favourite, which to me tasted like the mackerel I have eaten in England.

Whai or sting-ray was taken with a wooden spear.

Wheke or octopus if small were taken by hand from among the rocks. Should the wheke twine its many legs round the arm of the catcher, he puts his other hand underneath the body.

Seaweed

Karengo (Laminaria sp.) was a seaweed which grew on flat clayey tidal rocks. It grew in plenty on the east coast of New Zealand.

Rimurehia or rehia was an edible seaweed, gathered in the sea close to the shore, or on the beach, and cooked in a hangi and eaten.

Rimiparo was another seaweed gathered and cooked and eaten in the same way. In the summer it was sometimes eaten cold.

Plant species

The pungapunga, the yellow pua, or pollen of the raupo (Typha angustifolia) was mixed into cakes with water and baked. The pungapunga was gathered in summer when the plant was in full flower, and was obtained by shaking the dense flowering spikes gently. Raupo grows in swamps by the edge of streams and rivers and lakes. It has a sweetish taste. The middle part of the white succulent roots of the raupo, called koreirei, was also favoured as a food. It was generally eaten raw during the summer season.

The roots of the pohue (Convolvulus sepium) were dug up out of the ground, cooked in a hangi and eaten. The root was long and tough, and got after much trouble. It was quite good to eat.

6.3 Contemporary species

Many of valued species gathered historically that were of high nutritional value are no longer available in quantities sufficient to enable them to be a primary food source. The species identified during the interviews include:

Kakahi	Morihana	Cockles	Pipi
Toheroa	Tuatua	Lamprey	Mutton birds
Pupu	Eel	Flounder	Paua
Mussels	Crayfish	Oysters	Seaweed
Koura	Watercress	Puha	Hapuka
Mullet	Kahawai	Kingfish	Gurnard
Snapper	Moki	Shark	Tarakihi
Trevally	Whitebait	Trout	Kina

As Table 3 confirmed most species are perceived to be "fewer" in abundance and many iconic species are now only consumed on special occasions. The decline of the freshwater resources is of particular concern to Te Arawa. In addition to the reduced numbers, the condition of the kai may be compromised as well. Most distressing and representing a significant cultural loss, is the possible loss of entire species e.g., koaro, and morihana from some streams and lakes.

While whanau made use of many species, the centrality of koura and whitebait as a critical food source in the Rotorua Lakes is well known and is reflected in the initiatives to restore populations of taonga species. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round.

Food security implies adequate access to affordable, high quality foods that are culturally acceptable. However, introduced aquatic species were not seen by Te Arawa as substitutes of equivalent cultural, spiritual or nutritional value. This is supported by the fact that trout is not eaten by 11% of respondents. However if trout is the abundant species and requires less catch effort than the declining indigenous species gathered historically, it is inevitable that some substitution occurs. It is clear from our research that whanau currently gather kai at quantities less than they did historically and at quantities less that they desire. This is discussed in the next section.

6.3.1 Estimates of the quantity of kai consumed

There is little data available to enable calculation of pre-European (historic) contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. From Makereti (1938) we know:

Two meals were taken each day, the first about 9 a.m., and the other about 4 p.m..…

For the calculation set out below in Table 5 we have assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats in the lakes, especially Rotorua. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

It started to change - in the 70s. Okawa Bay was established in 1971 and it became a subdivision and when you look there, it is all a mixture of all nationalities, whereas Mourea is the old hapu (Informant E).

In the late 1970s, early 1980s when the seaweed and the little maggots, eh, in the lakes start to stink. And that, you know, gradually got worse and as the seaweed went away the stink remained, (Informant M).

The Kai Consumption Survey asked respondents to identify quantities of various types of kai consumed. For taonga species, the following calculations for the quantities for the respective species are considerably less:

	Contemporary consumption of whitebait	**Equals 5.7g per person per day**
	Contemporary consumption of mussels	**Equals 16.9g per person per day**
	Contemporary consumption of kakahi	**Equals 0.3g per person per day**
	Contemporary consumption of koura	**Equals 2.5 per person per day**
	Contemporary consumption of trout	**Equals 10.9g per person per day**

With respect to contemporary consumption, from the Kai Consumption Survey, all respondents still consume kai awa, kai roto, or kai moana. For the comparative analysis in Table 5 we have extracted the quantities of fish consumed from the Kai Consumption Survey data as well as the frequency data.

Table 5: Estimates of the quantity of kai consumed.

Kai consumption historically	Kai consumption up in twentieth century 1970s, 1980s	Contemporary kai consumption
Assumptions The data for estimating the quantity per sitting is that relating to "fish streamed or grilled[9]". At least one meal of "kai gathered" per day per person. Because of the abundance compared to the present, at least 10% more per setting would be consumed compared to today's per sitting estimates. 219.44g per sitting per day. Plus 10%.	Assumptions The data for estimating the quantity per sitting is that relating to "fish steamed or grilled". At least 3 meals of "kai" per week per person. The quantity per sitting would be the same as today's per sitting estimates of 219.44g.	Assumptions The data for estimating the quantity per sitting is that relating to "fish steamed or grilled". The quantity per sitting would be the same as today's per sitting estimates of 219.44g. Special occasions are estimated to be 6 per year. Less than once a month is estimated at 9 per year (which accounts for 11.8% of respondents). 52.9% eat kai 1-3 times per month. 17.6% eat kai once a week per month. 5.9% eat kai twice per week. 5.9% eat kai 3-4 per week. 5.9% eat kai 5-6 per week.
Equals 241.38g per person per day	**Equals 94.05g per person per day**	**Equals 36.20g per person per day. This is similar to the average New Zealand consumption of 32.87g per person per day (Kim and Smith, 2006).**

For the taonga species, the following observations can be made

The quantities available fall far short of historic levels and the levels desired by whanau who wish to engage in mahinga kai practices. The species that possibly approach adequate abundance are mussels which respondents confirmed were available and often sourced from the supermarket or takeaway.

You don't go out and get any watercress anymore, your river has become Pak'n Save (Informant M).

[9] It is assumed that the "fish fillets" estimate would apply for butterfish, greenbone, kanakana, eels, founder, hapuka, mullet, kahawai, kingfish, gurnard, snapper, moki, shark, trevally and trout.

I mean, we have got to the stage we are feeling directed to go to supermarkets and buy from there, it is more convenient (Informant E).

We get our bulk food from the supermarket, whether that's vegetables, it's fish, seafood. Everything comes from the supermarkets. It is totally different today. We have no control over that. We aren't able to go out and get koura like how we did - it is a thing of the past (Informant E).

- For almost every species, the majority of respondents believed that the abundance of populations was declining.
- The majority of kai species are now only consumed on special occasions.
- The quantities of kai consumed have steadily decreased:
    - from approximately 241g historically;
    - to about 94g in the mid twentieth century;
    - to approximately 36g today.

These observations are supported by the statements of whanau -

Last time I had a feed of koura…. was six years ago (Informant B).

I haven't had one [koura] this year. I haven't had one this year. You see, like now what has – you know, you have got the sediment, you have got all the paru in the lake. The other thing you also got is the bottles, eh? And so guys are using those for koura, eh. Used to, but now the hapu have stopped all that – told those guys, eh? You know, and the only place you can get real good eating koura is here and here (Informant M).

Yet for some whanau consuming kai remains a treat and one kaumatua described the behaviours of his mokopuna:

Man, you ought to see them with bloody kinas. They eat kinas…Kinas, mussels, anything like that; they'll get into them (Informant C).

6.3.2 Sites at which kai gathering and other activities are undertaken

Historically different parts of the region were renowned for supplying prized resources. Often sites from which specific resources were gathered would be given a name e.g., it is recorded that in Lake Okataina each of the best mussel beds had its own name.

In the paragraphs that follow we summarise the features of some the lakes, plus the Kaituna River and Maketu that appear in historic references. Makereti (1938) explains:

> *Fishing grounds belonged to the hapu which owned the land going down to a lake or along a river, and were marked by posts as described in the account of sea fishing. In Lake Rotorua about half-way between Owhata on the mainland and Mokoia Island was such a post, called Hinewhata. My ancestors Wahiao and his father Umukaria who lived at Owhata used this post for tying their fishing nets on when they were getting inanga, and they also tied on bunches of fern for catching koura, or crayfish.*
>
> *In the old days inanga was taken by the hapu of Tuhourangi from Otamakari on the north of Tarawera Lake, Owhaia and Te Puna north of Tarawera, Te Manuka at the same place, Waitangi to the north-west, Parahamutu, Rahuiroa, Terapatiki, Matakana, all near by, from Kariri and Punaromia, from Waitoharuru (Wairoa Falls), and Karikaria close by, from Hawaiki on the south-west of Tarawera Lake, from Taneroa, from Whangaruru on the peninsula, from Te Ariki, from Tutaiinanga on Paeroa block, from Motutawa, and from all round Rotokakahi Lake at Okareka, on the west side of Otaku. All these were ancient fishing grounds.*
>
> *My people in the Lakes district, at Rotorua, Rotoiti, Okataiua, Tarawera, Rotokakahi, and other lakes, took the koura in many ways.*

In recent decades concern has been expressed at the deteriorating condition of the lakes, in particular Lake Rotorua where weed growths, scum, algae blooms, sedimentation and mud build up on the lake-bed, and poor water clarity have been experiences. During the 1970s it was recognised that water quality was deteriorating in Lake Rotorua because of increased nutrient loads - notably from treated sewage, streams draining pasture, and aerial top-dressing (Hamilton, 2003).

During the 1980s lake water quality targets for Lake Rotorua were adopted by the regional council, the decision was made to stop directly discharging treated sewage to

the lake, and nutrient load targets were set for sewage-derived nutrients. These initiatives saw improvements in lake water clarity, nutrient and chlorophyll concentrations from the early 1990s, but since then lake water quality has again deteriorated. Most of the decline is attributed to increasing nitrate in streams that drain agricultural land and the amount of nitrates that are locked up in the lake bed sediments.

This impacts a range of uses, including kai gathering. The outflow of Lake Rotorua is through the Ohau Channel which leads into Lake Rotoiti which in turn flows out and down the Kaituna River that flows about 50 km to enter the sea near Maketu. Degradation in one waterbody inevitably degrades others connected to it. Dr Edward White[10] explained that Lake Rotoiti shows significant “deterioration for a lake as large as Rotoiti. I see no prospect of either arresting this deterioration or of restoring the lake, without reducing the quantity of nutrients entering Lake Rotorua".

Ohau Channel

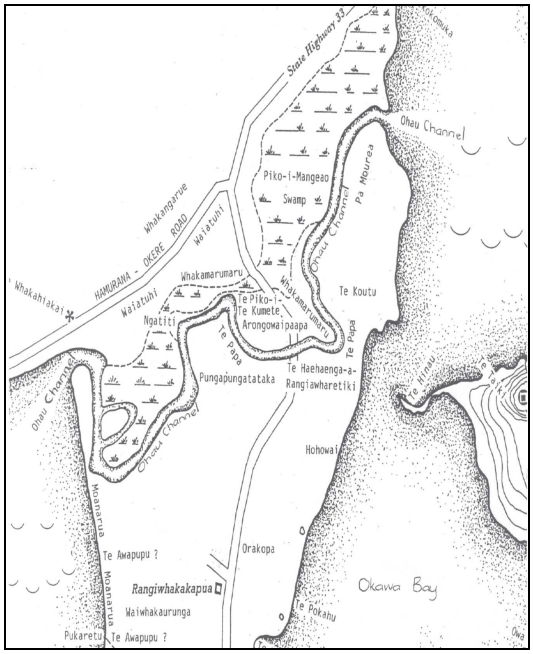
Whitebait were a commercial resource, being sold and traded. Mair reported that from around 1860 to 1919 he had seen Ngati Pikiao netting koaro in the Ohau channel Figure 48), sun-drying them, storing them for winter use, and bartering them profitably with West Coast tribes.

A resource kete from Environment Bay of Plenty (EBOP, 2010a, b) provides statements from a kaumatua who recalls her early childhood days living beside the Ohau Channel.

[10] Dr White was leader of the Freshwater Section of the Dept. of Scientific and Industrial Research who gave evidence to the Waitangi Tribunal on the health of Lake Rotoiti.

A crystal, clear, swift flowing river fringed with raupo, manuka scrub, grassy banks and paddocks, overhanging willows and dotted here and there with the odd domestic wharf, boatshed and kainga. It was a haven for wildlife, a rich food basket, a natural environment of wetlands and a place of historical and spiritual significance. It was a 'paradise' especially in the warmer months. Children would spend all their time swimming against the strong current, diving off banks, catching cockabullies in the shallows, hunting for frogs and tadpoles in the swamps, paddling the old Māori river canoes up and down and hunting for the best jackstones on the beds of shingle. Even then there were signs of human activity and land use upstream and downstream that would soon impact on this idyllic waterway. From the mouth at Lake Rotorua to the outlet at Lake Rotoiti, the river twisted and turned carrying a strong current of crystal clear waters, which provided a host of water activities including trout-fishing, boating and swimming in contrast to the traditional methods of fishing for inanga and koura and the gathering of kakahi.

Figure 50: The area around the Ohau Channel.



Swamps teemed with frogs and tadpoles while kotare above waited patiently to swoop down on unsuspecting prey. Noisy pukeko made untidy nests in the dense raupo, and fantails flitted among the manuka while the shy matuku stood still and erect perfectly camouflaged against a background of rushes and sedges. Pied stilts picked their way along the muddy flats while water rats hid among the debris and undergrowth.

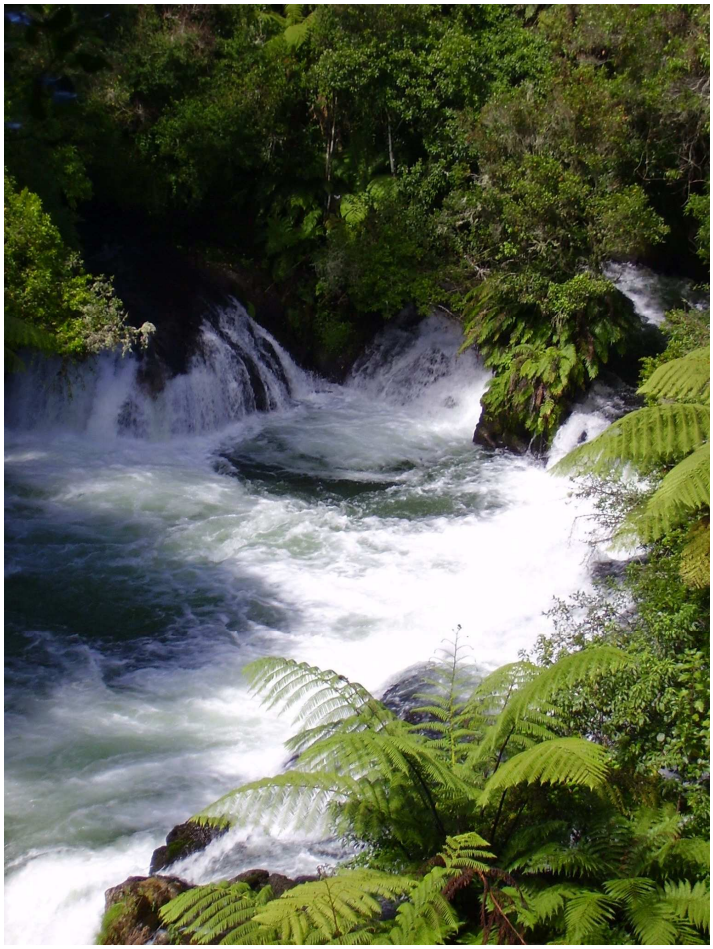
The old red, painted, wooden bridge that spanned the main road from Rotorua to Tauranga was a popular 'hangout' for the local swimming and diving champions. Many households drew water from the channel for domestic use and the washing of clothes in the river was a normal activity. Food scraps and other rubbish were often thrown unwittingly into the river.

Night hunting for koura or 'hi koura' was popular with the kids, who used long manuka sticks baited with threaded worms to entice the koura out of their holes in the banks. As soon as a koura attached itself to the bait the stick would be slowly drawn up to the surface and grabbed with bare hands or netted.

It's getting worse. 70s, 80s – it's getting worse. It got to the stage where my mother and father said "I don't want you going swimming because it's polluted" (Informant E).

Kaituna

The Kaituna River is famous for the pools in its upper reaches, the Okere falls not far from Lake Rotoiti and for the rapids and waterfalls. It discharges to the Maketu Estuary on the coast of the Bay of Plenty. Historically the river was valued for aquatic recreation, for gathering duck, and plants of many kinds (many of special value and importance, some species being rare) that grew along its banks. These were used for medicinal purposes, weaving, dyeing.



The place called Te Wai-i-rangi, (a lovely clear pool from which the river flows on into a green tunnel of vegetation), was, the place where those returning from battle would go to bathe and remove the tapu. Burial caves line the river in the steep gorge reaches.

Maketu

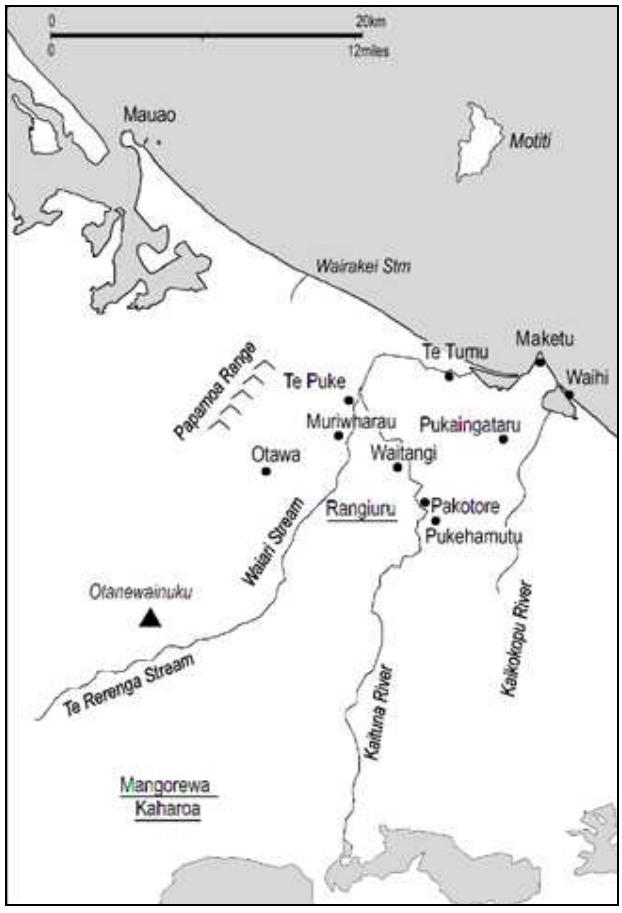
> *The tribes or hapu who owned land down to the sea would own the fishing rights for some distance out to sea. A stake would be put in at each end to mark the boundary line on each side, and these might be a few miles, or many miles apart. The stakes prevented any outsider from fishing in the waters. Only the members of the hapu, or of the several sub-hapu, who owned the land would have any right here. The Maori had names for each fishing rock, ground, or bank which belonged to a hapu, and called them all by name. Some of them were eight or ten miles out in the deep water. The Maori knew all the signs of a good fishing ground.*
>
> *Their fishing grounds were sometimes five, eight, or more miles away.*

Maketu remains important as a place where tupuna walked.[11] It was identified as the site of Tokaparore/Takaparore, the rock (or possibly anchor stone) to which the Te Arawa waka was tied when it first arrived. The Maketu Estuary has always been significant for Te Arawa. The stern anchor of the waka is said to have been placed at Te Awahou, roughly where the Kaituna River flows out to sea today following the diversion cut that was made in 1957. The bow anchor was set down at about the place where the Kaituna River used to flow out to sea at Maketu. The importance of Maketu to Te Arawa therefore can be traced back to their arrival in New Zealand.

The Kaituna River and the estuary at Maketu, were rich in kai awa and kaimoana respectively, providing fish, shellfish, eels, fresh-water crayfish (koura) and many other kinds of food.

Dr Ballara's evidence (Ballara, 2004) to the Waitangi Tribunal noted the range of natural resources in the Maketu area and its strategic importance as a point where communications routes converged. Figure 52 shows the area in the vicinity of Maketu.

Figure 51: The Maketu area.



[11] Don Stafford and Raewyn Bennett evidence to Waitangi Tribunal.

After the Kaituna River diversion cut was made the main flow of the river no longer ran through the estuary, and the resultant deterioration is of concern to Te Arawa. In the context of the present research this is significant given there is a perception that shellfish there may not be fit for human consumption because of contamination issues arising from the lack of flushing.

The health of aquatic resources has impacted kai gathering. Although the alienation of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and believed that the most damaging changes have occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change. Yet, as the interviews and Kai Consumption Survey show, many Te Arawa continue to gather and consume kai awa, kai roto and kai moana. But as the following tables show patterns of usage have changed.

Table 6: Numbers of lakes from which different species gathered[12].

Species	Historical	Today
Trout	12	9
Mussels	6	2
Morihana	-	-
Koura	10	8
Watercress	5	6
Puha	-	-
Inanga	3	7
Lamprey	2	1
Eel	5	6

While Table 6 suggests that the distribution of all species has changed, this information needs to be considered alongside Table 7 which provides greater clarification as to how the different lakes have been impacted by changes in gathering patterns. The increased fishing pressure on Lake Rotoiti is evident as the number gathering at Rotoiti have increased across all species. The other obvious changes are the decreased levels of gathering across all species in Rerewhakaaitu and from the streams in the area.

[12] These numbers are based on the results of the Kai Consumption Survey and refer specifically to the sites of gathering, not from species distribution surveys that tell us the sites where these species are known to be.

Table 7: Trends in the number of respondents gathering different species at each of the lakes.

Lake	Watercress	Trout	Kakahi	Inanga	Koura	Eel
Rotoiti	↑	↑	↑	↑	-	↑
Tarawera	-	↑	↓	↑	↓	↑
Rotorua	↑	↓	↓	↑	↓	↑
Rotokakahi	-	↓	-	-	↓	↑
Okataina	↑	↑	-	-	↓	-
Rotomahana	-	↓	-	-	↓	-
Rotoma	↑	↓	-	↑	↓	-
Rerewhakaaitu	↓	↓	↓	-	↓	-
Okareka	-	-	-	-	-	-
Rotoehu	-	-	-	-	-	↓
Ohau Channel	↑	↑	↑	↑	↓	-
Streams	↓	↓	↓	↓	↓	↓
Coast	-	↓	↓	↓	-	↑
Tikitapu	-	↓	-	-	-	-

Table 8 that follows focuses on 3 of the lakes – Rotorua, Rotoiti and Tarawera and shows the magnitude of the changes. Although those gathering inanga from the lakes shows an increase we are unsure whether they mean whitebait or the adult stage.

Table 8: Changes (shown as a %) in the number of respondents gathering different species at each of the lakes.

	Rotorua	Rotoiti	Tarawera
Trout	↓ 18.7	↑ 5.40	↑ 8.10
Mussels	↓ 33.3	↑ 33.3	↓16.70
Morihana	-	-	-
Koura	↓ 10.4	same	↓ 10.40
Watercress	↑ 42.0	↑ 20.3	-
Puha	↓ 9.80	↑ 8.30	↓ 7.70
Inanga	↑ 14.3	↑ 23.8	↑ 14.3
Lamprey	-	-	-
Eel	↑ 18.20	↑ 16.2	↑

In the tables that follow, we present information for each of the lakes and provide a relative ranking (present and past (in brackets) of the importance of gathering activities for each species across all lakes.

Figure 52: An aerial photograph showing the location of the respective lakes.

An aerial view of Lake Rotorua

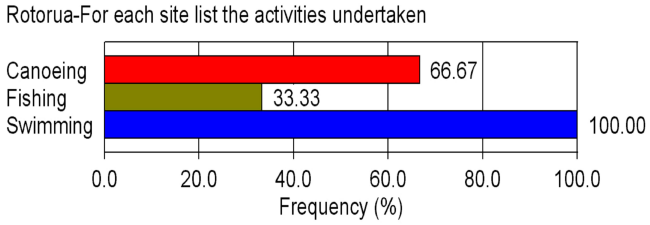
Table 9: Summary of Lake Rotorua.

Trends in gathering activity		**Present day rankings**	
Trout	↓ 18.7	Trout	3rd (2nd)
Kakahi	↓ 33.3	Kakahi	- (2nd)
Koura	↓ 10.4	Koura	2nd (2nd)
Watercress	↑ 42.0	Watercress	2nd (2nd)
Puha	↓ 9.80	Puha	2nd (1st)
Inanga	↑ 14.3	Inanga	3rd (-)
Eel	↑ 18.20	Eel	4th (-)

I wouldn't touch watercress in the Lake Rotorua, …, I just think it is too suspect …I don't know that there is a lot of watercress around - like I think there is where the natural springs are, I think there is watercress there, but as you are coming around Lake Rotorua, I shouldn't imagine that there would be that many spots left to actually pick watercress from anymore (Informant J).

They used to catch inanga around the edge of the lake….But now you don't see that, I mean not only that, the water is so murky you can't see them, but yes, we used to catch a lot of inanga, I tell you (Informant B).

Other activities: 33% of those who go to the lake fish. In contrast everyone who goes to the lake swims.



Rotorua now, we haven't swum there for ages (Informant A).

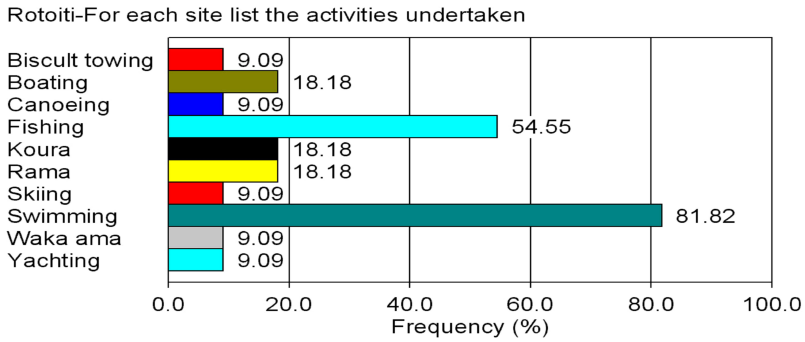
I wouldn't swim in it. I had EBOP down there just over the winter. They actually took photos of the amount of junk that came out of that lake onto our back lawn. So I wouldn't – I get a lot of tourists coming down to our village and they ask can they go for a swim. I just say, "No, don't bother" (Informant D).

Photos of Lake Rotoiti

Table 10: Summary of Lake Rotoiti.

Trends in gathering activity		Present day rankings	
Trout	↑ 5.40	Trout	1st (1st)
Kakahi	↑ 33.3	Kakahi	1st (1st)
Koura	same	Koura	1st (1st)
Watercress	↑ 20.3	Watercress	1st (1st)
Puha	↑ 8.30	Puha	1st (2nd)
Inanga	↑ 23.8	Inanga	1st (2nd)
Lamprey	-	Lamprey	-
Eel	↑ 16.2	Eel	2nd (3rd)

Other activities: Clearly a range of activities are undertaken, including a range of recreational activities. Fishing and gathering koura, including rama koura, feature strongly**.**



Setting a 'tau' in the lake was the most popular method of gathering this delicacy [koura]. *During the summer months bundles of raurauhe were cut, tied together and left to dry. These were then tied to a long main line and dropped into the lake bottom at about six metre intervals. Marker poles stood in the lake to identify the place of each family's tau. After a few weeks the ferns would be carefully drawn up out of the lake and shaken onto a korapa. In no time a large quantity would be caught and taken home for the 'weekend lunch or dinner'.* (Makereti, 1938)

Rotoiti, we have been known to swim … even in recent years, we come back and my kids jump out of the car, dive into it. We know full well that the lake is not well and it is so hot they just duck into the lake there and have a jump around and duck back in (Informant A).

Then you had puha …. We used to just go around the hills, all over the place collecting puha. And then there was watercress, all the creeks running into Lake Rotoiti were full of watercress. (Informant E)

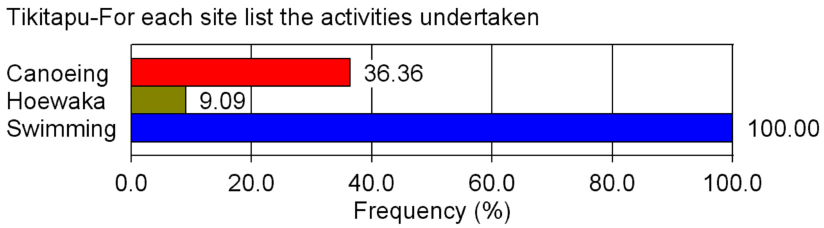
Photos of Lake Tikitapu

Lakes Tikitapu (foreground), Tarawera (left background), and Rotomahana(centre background) are all visible in this eastward-looking view.

Table 11: Summary of Lake Tikitapu.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	-	Kakahi	-
Morihana	-	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities: Everyone who goes to the lake swims. Canoeing is another popular activity.



Tikitapu, the Little Blue Lake …is the most picturesque lake in the district and owes much of its attractiveness to the magnificent forest which clothes the hills on its northern and western sides.
Raupo (Typha sp.) occurs in small quantity at the north end of the lake; it is so extremely rare in the district, that the whare are usually constructed of sedges and grasses.
We were mostly at Lake Tarewera and Lake Tikitapu…In summer time we'd probably be out at Tikitapu probably once, at least once a week (Informant F).

Photos of Maketu

Table 12: Summary for Maketu.

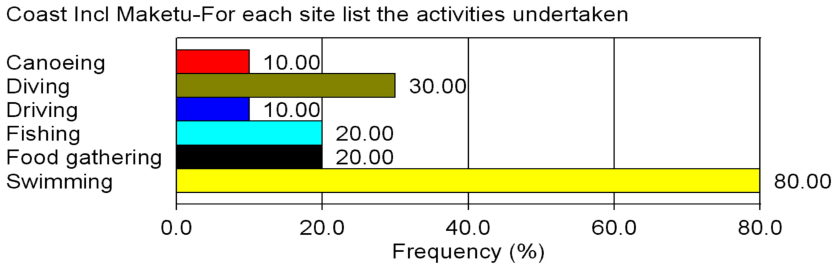
The kina and paua, crayfish and we go fishing and the main species are kahawai, snapper and gurnard fish…. Usually every long weekend we'd head to the coast for that. But since the fuel increases and so and so it's not as often… (Informant F).

Because when the whole river was coming through here, I remember I've been coming here since the 50s, as a kid, and all the fishing boats used to come in here …But all the fish used to come in here…..There stingrays, there were sharks, there were – everything was coming through here, kahawai and everyone just fishing here at the outlet. And now they're all fishing up at the cut .. Well, there's only pipi at the moment because all our tuangi have gone and pupus that we used to have in abundance have all disappeared (Informant K).

Trends in gathering		Present day rankings	
Trout	↓	Trout	6th
Kakahi	↓	Kakahi	- (4th)
Morihana	↓	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	↓	Puha	- (3rd)
Inanga	↓	Inanga	2nd (1st)
Lamprey	↓	Lamprey	1st (1st)
Eel	↑	Eel	3rd

It was in abundance, it was growing so fast that even our people couldn't keep up with it (Informant K).

Other activities Maketu is a popular swimming site.



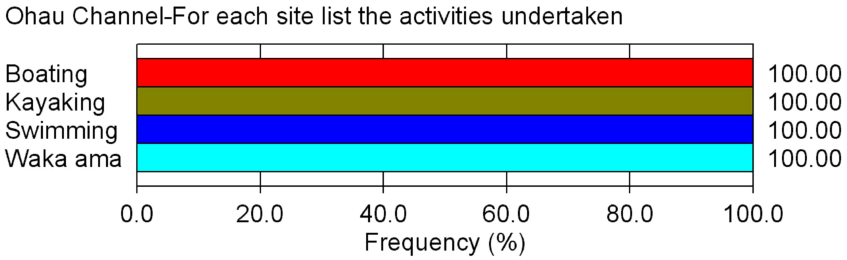
… the return of the estuary is vitally important and it's only because of the food bowl … It'll be entirely different. The outflow would be different and therefore it would – it'll only create a channel in certain areas. A channel will be created, so it wouldn't be the pristine that you'd want once upon a time. So that's the – which is very sad that it cannot be brought back the way that we wanted to ….But there's not enough volume of water actually coming through the system, actually it's only a trickle, and very disappointing really – very disappointing that way (Informant K).

Another area we used to frequent was the Maketu… especially in the summer you would want to go over there and collect pipi and mussels, and also we got family at Motiti Island, so it would give us any reason to go to the beach because it was a good - Newdicks was quite a popular place back then… I hardly see cockles now…Maybe even like try to increase the flow a little bit so that it is – well, you know, I do not know whether to narrow it or add some rock or that sort of - - -(Informant H).

Trout fishing in the Ohau Channel

The Ohau Channel today

Table 13: Summary for Ohau Channel.

<table>
<tr><td rowspan="10">My mother used to go out and she would get into her garden and she'd get all these worms, and she would bundle these worms up using a needle and thread. She would thread through the worm and create a bundle, and that is what we would use for our bait to catch the koura in the Channel - at the end of a willow stick. Oh, we used to love it because we would just quietly watch the koura grab the worm and then we would put the stick up and then catch it with a fish and chip container (Informant E).</td><td colspan="2">Trends in gathering activity</td><td colspan="2">Present day rankings</td></tr>
<tr><td>Trout</td><td>↑</td><td>Trout</td><td>-</td></tr>
<tr><td>Kakahi</td><td>↑</td><td>Kakahi</td><td>2nd</td></tr>
<tr><td>Morihana</td><td>-</td><td>Morihana</td><td>-</td></tr>
<tr><td>Koura</td><td>↓</td><td>Koura</td><td>8th (8th)</td></tr>
<tr><td>Watercress</td><td>↑</td><td>Watercress</td><td>6th</td></tr>
<tr><td>Puha</td><td>↑</td><td>Puha</td><td>6th</td></tr>
<tr><td>Inanga</td><td>↑</td><td>Inanga</td><td>8th</td></tr>
<tr><td>Lamprey</td><td>-</td><td>Lamprey</td><td>-</td></tr>
<tr><td>Eel</td><td>↓</td><td>Eel</td><td>-</td></tr>
<tr><td colspan="5">Other activities - The channel is still used for a range of recreational activities.
 
</td></tr>
<tr><td colspan="5">The Ohau Channel. I always felt that was my birth place, and my bedroom was right against the Channel and it was paradise. We saw a lot of things that other people just talk about, but we experienced everything on the Channel, and that was our food basket as well as Lake Rotoiti and Lake Rotorua ….We have lost that current - it was a very swift current flowing through the Ohau Channel and the children - we used to challenge that flow of water when we were swimming because half the year we would be in the Ohau Channel swimming. We spent a lot of time swimming, back and forwards from Lake Rotorua, down to Lake Rotoiti. We were the best swimmers … I put it back to we were born on the Ohau Channel - we were natural swimmers (Informant E).

Ducks and birds - when I was living on the Ohau Channel we had the Mataku, beautiful. We had the Shag and they would sit in the trees just watching down on the Ohau. When everything started happening, like the inanga would run, well, you would just see them darting down onto the water.. And the crying, it was something I missed when I went away from home - the call of the birds and the cry - it is something totally different. You could hear the water flowing past your home. My bedroom was right against the Ohau Channel, and that was a sincere sound, it is a sound you don't often hear (Informant E).</td></tr>
<tr><td colspan="5">Other kai consumption survey results: All those who gather at the Ohau Channel have changed how they gather kai because of contamination of sites they used to gather from.</td></tr>
</table>

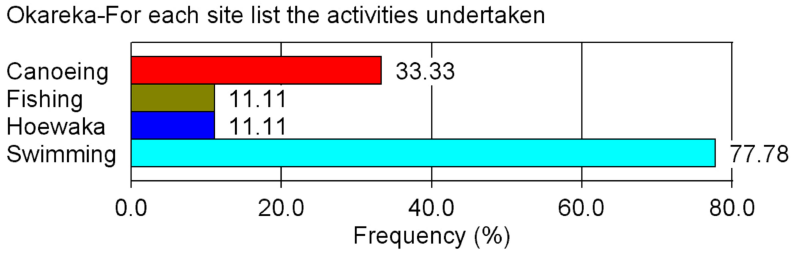
Photos of Lake Okareka

Table 14: Summary of Lake Okareka.

There is no gathering at the lake as it is wai tapu.

Trends in gathering activity		Present day rankings	
Trout	-	Trout	-
Kakahi	-	Kakahi	--
Morihana	-	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - As with the other lakes Okareka is popular for swimming.



The biggest ones [koura] *I have struck here in the Rotorua Lakes, when I used to dive the lakes, was Lake Okareka … Water skiing "Blue Lake….. Okareka, Rotoiti and Tarawera" (Informant D).*

And also the Green Lake, even though you are not supposed to fish in the Green Lake because of our links to that area, you can get access to those areas (Informant H)..

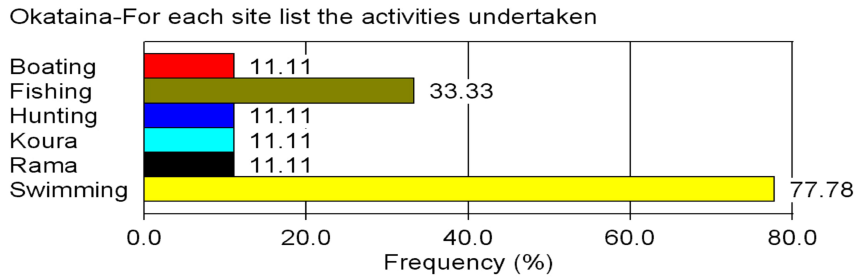
There are those beautiful picturesque moments that - like, I love going down to Lake Okataina and Lake Okareka, in summer they are the places that are a little bit hard to reach, I think, are probably a little bit more worth the effort to get there (Informant J).

Photos of Lake Okataina

Table 15: Summary of Lake Okataina.

Trends in gathering activity		Present day rankings	
Trout	↑	Trout	5th (6th)
Kakahi	↑	Kakahi	--
Koura	↓	Koura	7th (7th)
Watercress	-	Watercress	5th
Puha	-	Puha	5th
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - are very similar to the results for Rotoiti.



So, yes, so generally there are a lot of us and, like, when we went out here to Okataina there was a whole heap of us, so it is just something that we do as a family. Yes, so I suppose that is the beauty of your water is it always connects you in one way or another, and so, yes, that is why we tend to do things in droves, and also it is always more fun when there are heaps of you when you are going out swimming. You know, my children aren't fighting with each other and I have got all these other people to help (Informant J).

Other kai consumption survey results: All those who gather at the lake have not changed how they gather kai because of contamination of sites they used to gather from. All those who gather believe the kai gathered is not dangerous because of pollutants.

Photos of Lake Rotokakahi

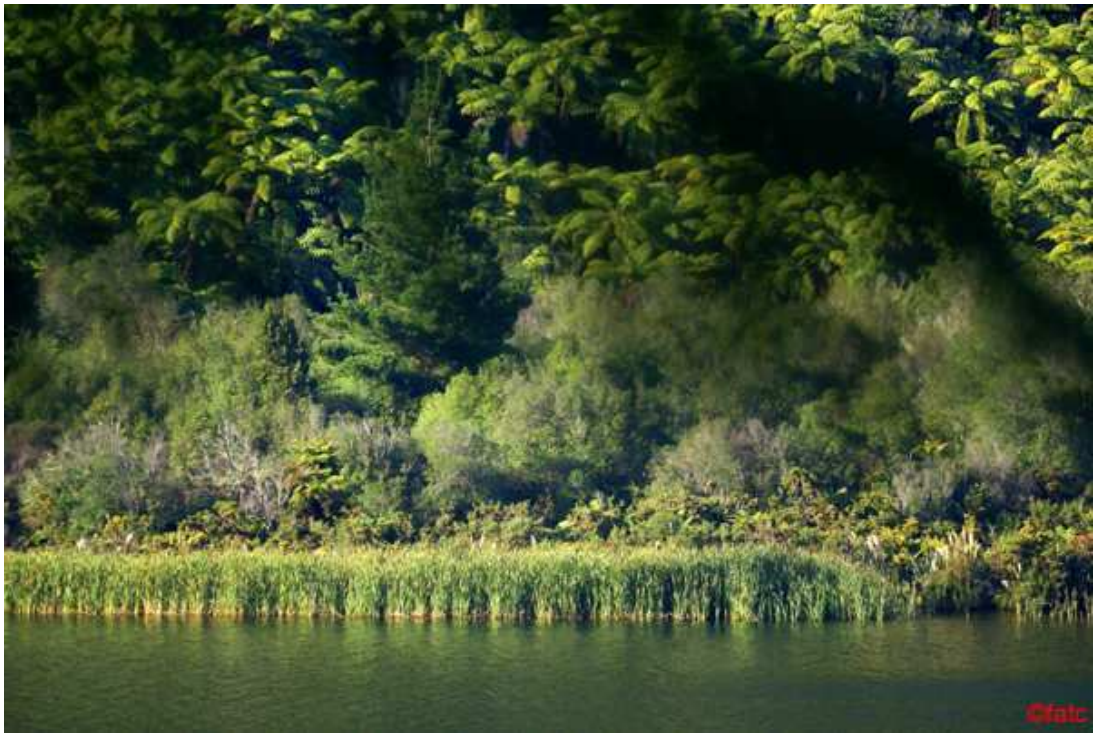
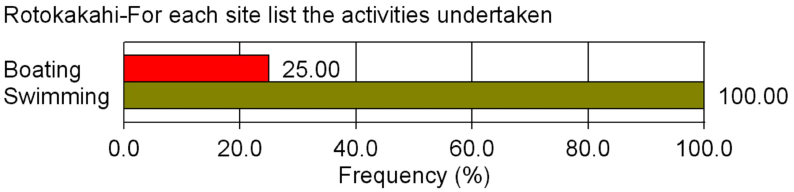


Table 16: Summary of Lake Rotokakahi.

Trends in gathering activity		Present day rankings	
Trout	↑	Trout	4th (4th)
Kakahi	-	Kakahi	-
Morihana	-	Morihana	- (2nd)
Koura	↓	Koura	5th (5th)
Watercress	-	Watercress	
Puha	-	Puha	
Inanga	-	Inanga	
Lamprey	-	Lamprey	
Eel	↑	Eel	6th

Other activities - All those that go to the lake swim there while a quarter of them go there for boating.



Other kai consumption survey results:

All those who gather at the lake have not changed how they gather kai because of contamination of sites they used to gather from.

Photos of Lake Rotomahana

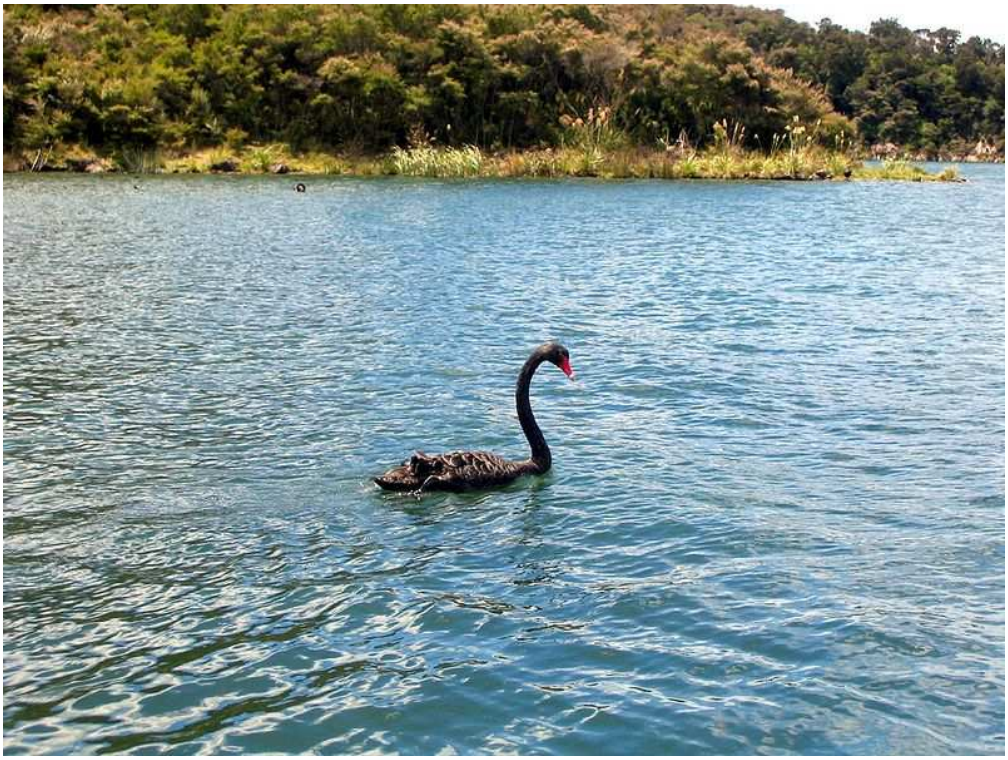
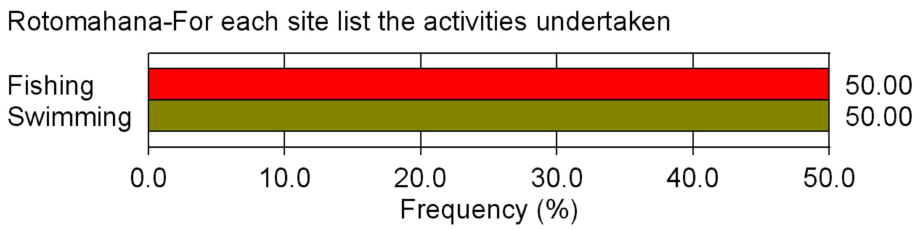


Table 17: Summary of Lake Rotomahana.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	- (5th)
Kakahi	-	Kakahi	-
Morihana		Morihana	-
Koura	↓	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	- (3rd)
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - Swimming and fishing are the two activities at Rotomahana.



Rotomahana is a funny lake, it is coloured all the time. Some places it is green. But I think Rotomahana you may have to be careful of (Informant A).

Rotomahana, they swim there (Informant A).

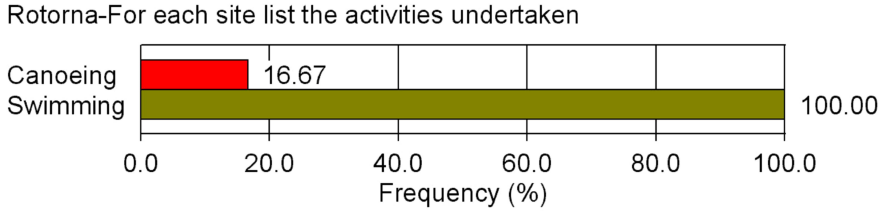
Rotomahana is of small size, its greatest diameter being less than a mile. From the numerous swamps which surround it the absence of wood, the dirty green colour of the water and the stunted aquatic vegetation which certainly exists under unfavourable circumstances the first view of this remarkable lake is strangely disappointing (Kirk 1872).

Photos of Lake Rotoma

Table 18: Summary of Lake Rotoma.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	-	Kakahi	-
Morihana		Morihana	- (2nd)
Koura	↓	Koura	4t (4th)
Watercress	↑	Watercress	3rd (4th)
Puha	↑	Puha	3rd (3rd)
Inanga	↑	Inanga	4th
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - All those who go to Rotoma go swimming.



I suppose the ones where there has been minimal development has always been - the lakes are still in a very similar quality, like Lake Rotoma, when I go out there I have swam and I have jumped off the rock or the cliff out there. It is still really similar to how I remember it as a child. The water quality, you know, it is beautiful, but as you are getting into more densely populated areas you really notice the poor quality of the lakes and the effect that that population has had on them (Informant J).

Because that is where all the morihana used to be in that lake, mind you they were in all the lakes but the Rotoma was known for that (Informant F).

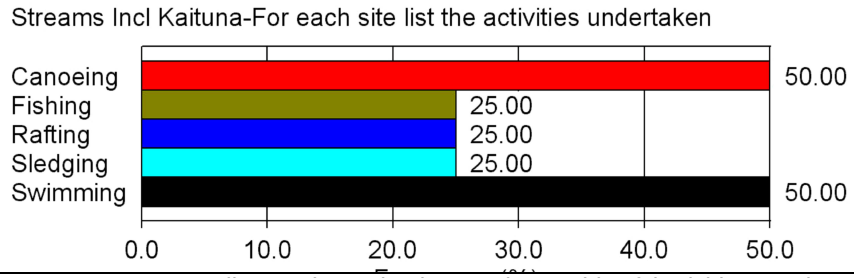
It was certainly Lake Rotorua and going down the Utuhina Stream…. and every now and then we would go out to - more often than not - Lake Rotoma to swim at the point and my grandfather was a keen fisherman, so there was a fishing club out at Lake Rotomahana that I used to go to as a child as well… (Informant J).

Fishing for whitebait on the Kaituna River (1931)

Table 19: Summary for streams.

Species gathered today	**Trends in gathering activity**		**Present day rankings**	
	Trout	↓	Trout	7th (7th)
	Kakahi	↓	Kakahi	-
	Morihana	-	Morihana	-
	Koura	↓	Koura	6th (6th)
	Watercress	↓	Watercress	4th (3rd)
	Puha	↓	Puha	4th
	Inanga	↓	Inanga	7th (3rd)
	Lamprey	↓	Lamprey	- (2nd)
	Eel	↓	Eel	5th (2nd)

Other activities



That Purenga stream… was yellow …down the bottom has a bit of bad history where council was allowing the raw sewerage to go out into the lake; years of it built up (Informant A).

Hamurana is crystal clear and it is full of phosphorous and, of course, the lake programme has to do something about that, (Informant A).

Utuhina - *even the flow of the river is quite different, so it would be good to have testing from the river because, I think, as you are coming further downstream and into the Lake, just the whole vegetation, … when I put my feet into the ground of the river on the Utuhina River, it is revolting. It is not like a clay, it is not even a mud. I can't even describe it. But it has that type of feeling to it (Informant J).*

I wouldn't let my children swim in there. The quality of the water is disgusting and it is unsafe. …. I can remember swimming in the Utuhina Stream as a child and it was lovely and clean and fresh, now to hop in it you can feel all the clay and all the silt that sits on the bottom and it is not very nice (Informant J).,
I think to go out in the areas I used to as a child where we used to gather - and I am talking about Rotorua predominantly - to gather koura, I don't believe there is any. So having gone down just to probably, I don't know, about five years ago, having gone down to take the children through the experience, there weren't actually any koura in places that we used to go to as children. So the rama koura did … I think even if we had have come across koura, I wouldn't have let the children eat them anyway (Informant J).

The Utuhina River between the Utuhina Bridge … when I was growing up it was a pristine river at that time….The river flow was excellent, clarity was excellent. We could even drink out of it …I learnt how to swim in the river, and I did all right, too, as a swimmer. Did no formal training. Because it had a good current, it had a good flow and you could actually just swim at a constant pace and stay in the same area. And we had a swing across the trees, because the trees used to – oh, we had willow trees but they sort of intertwined and you could – we had a swing.. but it was mainly our playground there ….And there was like little hotspots in the river, too. Like there was a lot of thermal underneath and it was in that whole area, so you had to sort of know where to put your foot and all the rest of it, and you were warned of areas where you shouldn't go and swim. But it was great (Informant H).

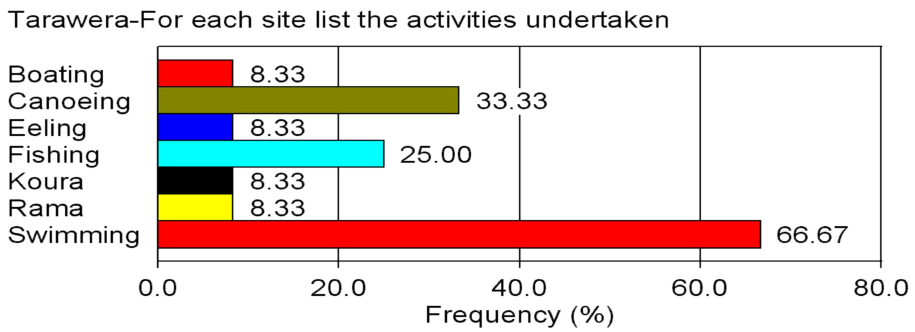
That silt build-up .. It would stick to your feet and then it was sort of like, "Oh, I want to go to the Aquatic now". Probably to Hamurana and Hamurana Springs there. That is still a nice river to swim in. Even now we still take our kids out there, because it is a nice spring and we went to the origin of that spring, as well, you know, just to show the kids, you know? (Informant H).

Photos of Lake Tarawera

Table 20: Summary for Lake Tarawera.

Trends in gathering activity		Present day rankings	
Trout	↑ 8.10	Trout	7th (3rd)
Kakahi	↓ 16.70	Kakahi	- (3rd)
Morihana	-	Morihana	- (2nd)
Koura	↓ 10.40	Koura	6th (3rd)
Watercress	-	Watercress	4th
Puha	-	Puha	4th (3rd)
Inanga	↑ 14.3	Inanga	7th
Lamprey	-	Lamprey	-
Eel	↑	Eel	1st (3rd)

Other activities - Eeling is specifically identified as an activity. Swimming and recreational activities are popular.



Tarawera, although the lake appears to be clear it still has its problems. We still have algae bloom over there …Tarawera, yes, but I would be very cautious in the summer time when the weather is hot and the algae starts to come up to the surface. We have that problem in Tarawera, although we are not treated as high a risk of other lakes, but I think the council is on to it (Informant A).

We would go to Tarawera where generally most of the swimming .. So, you know, I don't allow my children to wet their hair in the water in Lake Rotorua, I don't know, it is just certainly not the same sort of quality that I remember as a child and I wouldn't - Lake Tarawera is not so bad, but the inlet where we used to go to as a child to collect koura, there is a whole oil - I suppose because there's the big boats that sort of launch there, I think that it has had an impact. So where we used to previously go to get koura at that inlet, from last having had a look, and my husband went down and he had the goggles and the snorkels and had a really good look around, we couldn't find any, and that is just in the inlet area, but we haven't gone any further to have a look at that to see the impact on it. But, just in the areas we used to go immediately to because it was easy access, we haven't been able to find any of that - particularly koura - in those areas (Informant J).

Table 21: Summary of Lake Rotoehu.

Trends in gathering		Present day rankings	
Trout	-	Trout	-
Kakahi	-	Kakahi	-
Morihana	-	Morihana	- (2nd)
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	↓	Eel	- (4th)

Other kai consumption survey results
All those who gather from the lake have changed how they gather kai because of contamination of sites they used to gather from.

Table 22: Summary of Lake Rerewhakaaitu.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	↓	Kakahi	- (5th)
Morihana	-	Morihana	-
Koura	↓	Koura	-
Watercress	↓	Watercress	- (5th)
Puha	↓	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

When recounting their early lives interviewees described how interaction with the lakes occurred on a daily basis. Most days, interaction involved gathering kai for personal consumption or sharing. This was a commonplace group/whānau activity that permeated households and the community.

Table 23: Present day ratings of lakes on the basis of number of respondents gathering species from the lakes (1 = highest number of gatherers, 8 = lowest number of gatherers).

	Ratings							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Trout	Rotoiti	Tarawera	Rotorua	Rotokakahi	Okataina	Coast	Streams	Maketu
Kakahi	Rotoiti	Ohau	-	-	-	-	-	-
Morihana	-	-	-	-	-	-	-	-
Koura	Rotoiti	Rotorua	Tarawera	Rotoma	Rotokakahi	Streams	Okataina	Ohau
Watercress	Rotoiti	Rotorua	Rotoma	Streams	Okataina	Ohau	-	-
Puha	Rotoiti	Rotorua	Rotoma	Streams	Okataina	Ohau	-	-
Inanga	Rotoiti	Coast	Rotorua	Rotoma	Tarawera	Tarawera	Streams	Ohau
Lamprey	Coast	-	-	-	-	-	-	-
Eel	Tarawera	Rotoiti	Coast	Rotorua	Streams	Rotokakahi	-	-

Across all species we can obtain an average rating for the present day usage of the lakes. The results confirm the significance of Lakes Rotoiti, Rotorua and Tarawera. The average ratings for present day gathering are:

Rotoiti 1.14

Rotorua 2.67

Tarawera 3.40

Rotoma 3.50

Coast 4.00

Rotokakahi 5.00

Streams 5.50

Okataina 5.50

Ohau Channel 6.00

Rotomahana, Rerewhakaaitu, Rotoehu –
not gathered

We are also able to prepare rankings based on historic use. These are shown in Table 24.

Table 24: Historic ratings of lakes on the basis of numbers gathering species**.**

	Ratings							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Trout	Rotoiti	Rotorua	Tarawera	Rotokakahi	Rotomahana	Okataina	Streams	
Kakahi	Rotoiti	Rotorua	Tarawera	Coast	Rerewhakaaitu	Ohau	-	-
Morihana	Rotoiti	Rotorua	-	-	-	-	-	-
Koura	Rotoiti	Rotorua	Tarawera	Rotoma	Rotokakahi	Streams	Okataina	Ohau
Watercress	Rotoiti	Rotorua	Streams	Rotoma	Rerewhakaaitu	-	-	-
Puha	Rotorua	Rotoiti	Rotoma	-	-	-	-	-
Inanga	Coast	Rotoiti	Streams					
Lamprey	Coast	Streams	-	-	-	-	-	-
Eel	Tarawera	Streams	Rotoiti	Rotoehu	-	-	-	-

The average rankings for past gathering are as follows:

Rotoiti 1.57

Rotorua 1.83

Rotoehu 2.00

Tarawera 2.50

Coast 2.67

Rotomahana 3.00

Rotoma 3.25

Rotokakahi 3.67

Streams 4.50

Rerewhakaaitu 5.00

Okataina 6.50

Ohau Channel 7.00

The present day ranking confirms the importance of the coast and the higher ranking accorded Rotoma. In contrast, Rotoehu, Rotomahana, Rotokakahi, Rerewhakaaitu and the streams appear to have slipped in the numbers of gatherers using them.

6.3.3 Mahinga kai and taonga species

The main species harvested by Maori in the lakes prior to European settlement included:

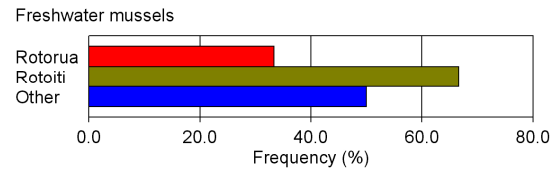
- The juvenile (inanga) and adult (kokopu) stages of the koaro.
- Adult common bully (toitoi).
- Eels (in Lake Tarawera).
- Koura and kakahi.

Fishing grounds for inanga, kokopu and toitoi were clearly marked, and actively managed (Phillips et al., 2007a). Informants also confirmed the importance of the respective kai species.

> *But it was sustainable, you know, it filled us up and fed us, and of course Inanga. Which was one of the staple diets during those days too, because they used to dry them as well eat them fresh. So, no, it was - I think everybody in Rotorua used to live on crayfish, especially the Maori families - crayfish and kakahi, way back in those days. But Lake Rotorua was clear when I was going out - clear as crystal and you could see - when we used to go and get morihana, you could see the schools and they were huge schools of morihana swimming all around the lake, all around the lakefront and they used to breed in the raupo (Informant B).*

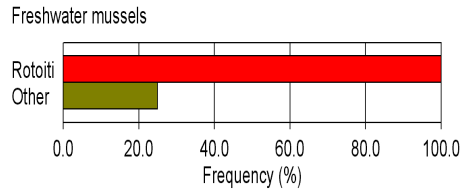
A management framework for customary fisheries in the Rotorua lakes has been developed through a joint project between NIWA and the Te Arawa Lakes Trust (Phillips et al., 2007a; see also http://www.niwa.co.nz/our-science/freshwater/our-services/freshwater-species-and-habitat-management/te_arawa_lakes). The outputs from that programme include tools, monitoring methods, and guidelines for managing culturally significant mahinga kai and taonga species. Data collected from our study will be useful in augmenting existing knowledge and is detailed below.

Table 25: Kakahi.

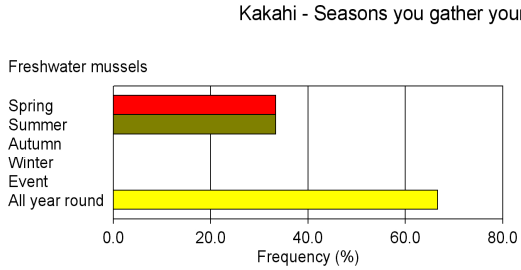


* Note: Multiple answer percentage-count totals not meaningful.

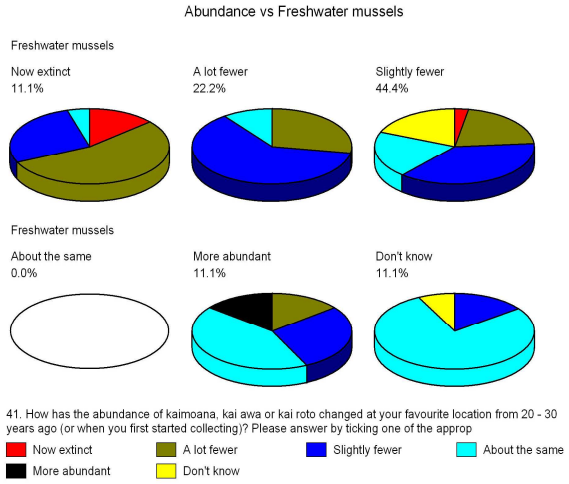
Also recorded in Rerewhakaaitu, Rotoehu, Rotokakahi, Rotoma, Tarawera (Phillips et al., 2007b)

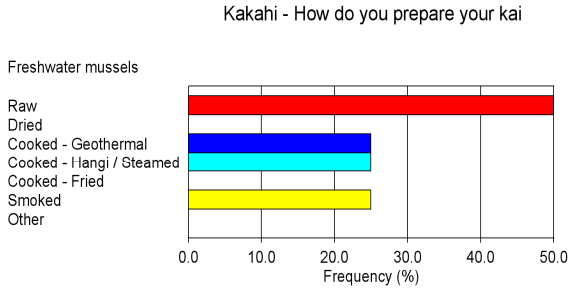


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

Kakahi are still gathered and consumed today, mostly from Lake Rotoiti. They are eaten raw or cooked in various ways. 77% of the participants believe kakahi have reduced in abundance.

Kakahi …is the most important on story, song and proverb. For instance there is an old saying tane moe whare, kurua te takataka; tane rou kakahi, aitia te ure (Man drowsing in the house smack his head, man skilled in dredging kakahi, marry him) – Hiroa, 1921

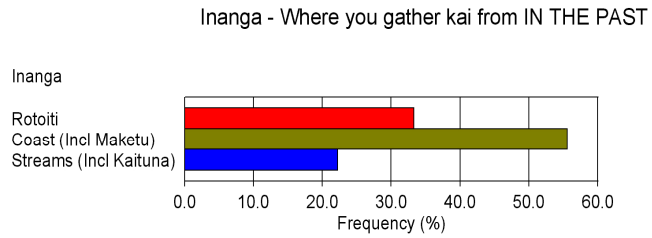
The kakahi is very tasteless and insipid (Hiroa, 1921).

It was cooked and fed to infants – it could be sucked like milk (Hiroa, 1921)

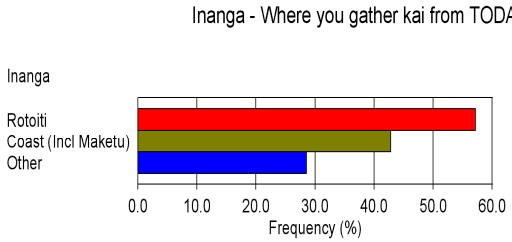
The only concern that my mum had, of course, when I brought kakahi back. She was really conscious of kakahi having a poisonous element, depending where you got it from.… kakahi was the main culprit perhaps in being certain that you did not get it from a place that is polluted from a swamp or anything else. So getting it from the river was good. The same thing happens here. The clearer the water and the lakes, the safer you are from getting kakahi (Informant A).

We used to live on kakahi. My mother used to cook a lot of kakahi, with bacon and something else - it would give them a bit of taste, it was just like eating cold water (Informant B).

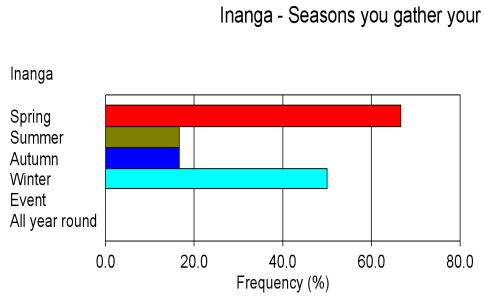
Table 26: Inanga.



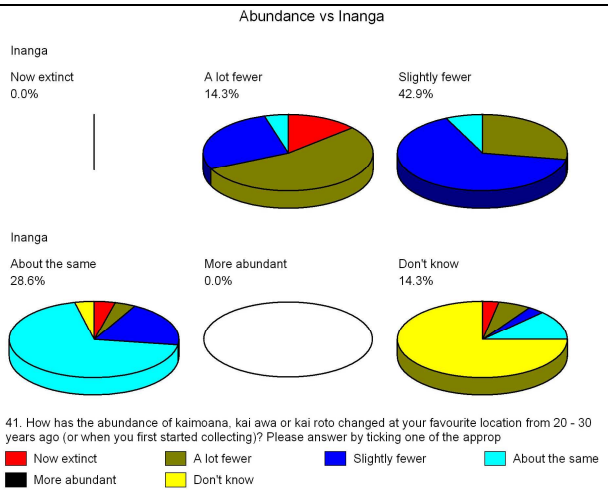
* Note: Multiple answer percentage-count totals not meaningful.

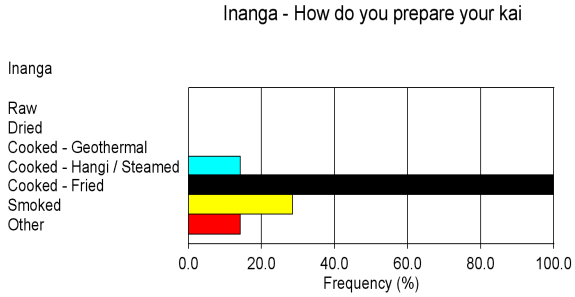


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

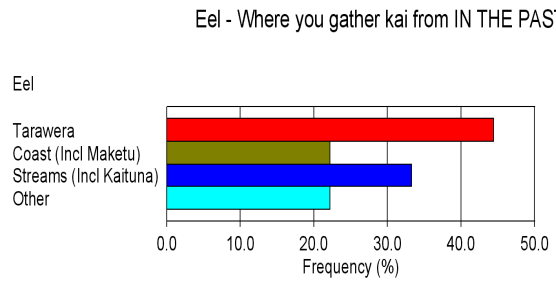
- 57% believe that inanga are fewer in number
- There are limited waterbodies from which inanga are gathered.
- It is always cooked.

Well, ever since I was a child my family went out using the old methods of catching inanga, koura, collecting kakahi, morihana, all the natural species from out of the lakes. And we just lived on that for breakfast, lunch and tea … And we never, ever came home without anything …If you want a feed of whitebait today you can sit around all day, which I have done, and it will take about a whole day just to catch a cupful (Informant E).

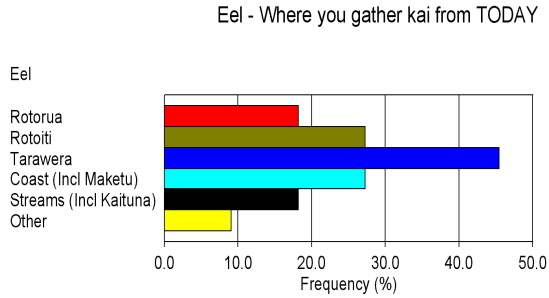
I mean, us as children, it was an enjoyment as well, but at that stage when you are very young you don't sort of realise you are providing for your family - food, so that was bringing in food, and my mother was very strict. She would come down and she would check us, and if any of the inanga would – well, they used to froth in the tub and sometimes they used to jump out. My mother would pick every one up. She would tell us - you are not to let one go into the grass. We had to make sure that nothing was being wasted (Informant E).

They used to get a lot of whitebait ... it is slim pickings these days. I, myself, never sort of experienced the sort of abundance that my parents sort of (Informant H).

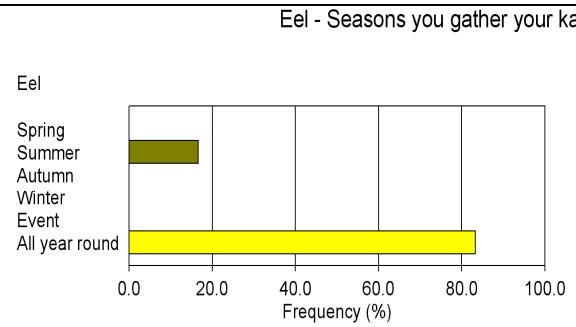
Table 27: Eel.



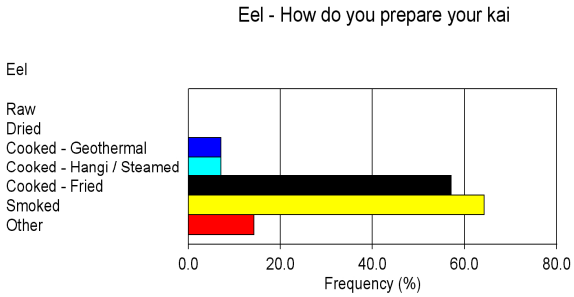
* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.

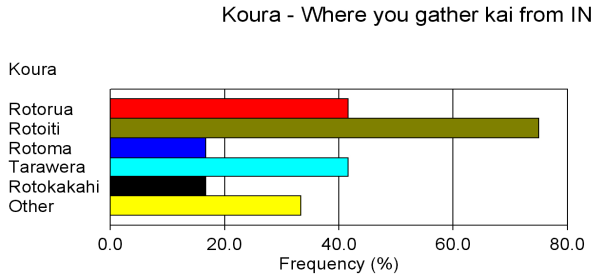
Eel is still gathered, predominantly from lake Tarawera, all year round. It is mostly fried or smoked. Eels are thought o have been stocked in the Te Arawa Lakes (Martin et al, 2007).

Each family that I knew … had a holding box for where we stocked our eels and so that we will have eels right throughout the winter. While the eels were in that box they fed themselves from the insects and whatever that came in through the box feeding, they never made fat but they were clear of anything in their insides, in their stomachs. So as far as eels were concerned, we had a lot of eels and we lived on the river (Informant A).

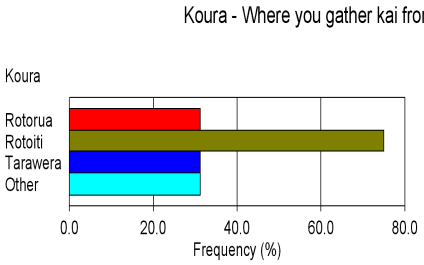
The only difference I know, … is the eels from Murupara …. Murupara are very thin skinned eels. Tarawera are very thin skinned but big and fat. But I guess you can tell the difference in kai from different places, you can identify them (Informant A).

Yes, eels. We used to get a lot of eels in Rotorua … and I used to go down the Kaituna River …I would go down the Kaituna with my uncles, and they taught me - showed me the holes and everything down there. Of course the weir that they built down at Okere Falls changed all that as well - it changed the places where the eels used to rest, because now it's a raging torrent nearly all the way down. Before it was a torrent with backwash in it and then that is where all the eels used to lie… Used to catch eels at Tarawera as well - in the lake as well as in the stream coming down from the tea rooms, the same way - would feel for them there. They were big eels….Yes, the eels are very, very big, yes, they are a good size. There is about 28 pound, the average size….Yes, well Tarawera - yes, they average 28. And so does Rerewhakaaitu - they are huge, because nobody fishes for them. And the same down the Kaituna River, you know, the eels I used to catch there with my hands were all in their 20 pounds - you know 20 pounders - big eels. Three eels and you had a load to bring home…I have caught eels in Rotoiti (Informant B).

Table 28: Koura.

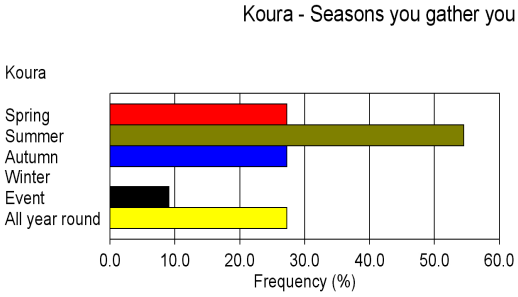


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.

They have also been recorded in lakes Okareka, Okataina, Rerewhakaaitu, Rotoehu, Rotoma, Tikitapu (Parkyn and Kusabs, 2007)



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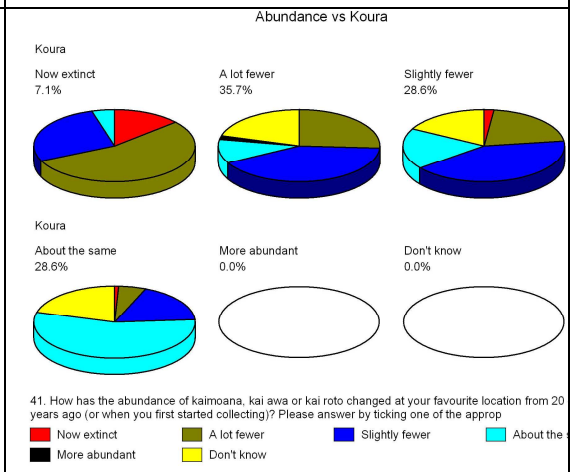
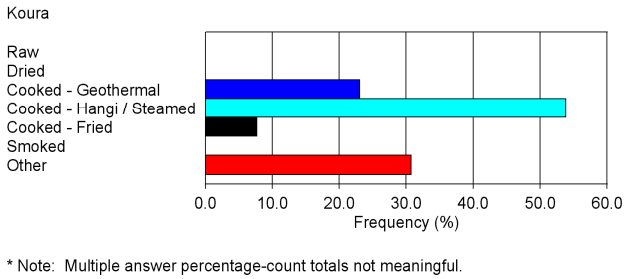




* Note: Multiple answer percentage-count totals not meaningful.

Maori Land Records show 152 individual ancestral fishing grounds in Lake Rotorua, 40 in Rotoiti, 19 in Lake Rotoehu, and 11 in Lake Rotoma (Stafford, 1994, 1996)

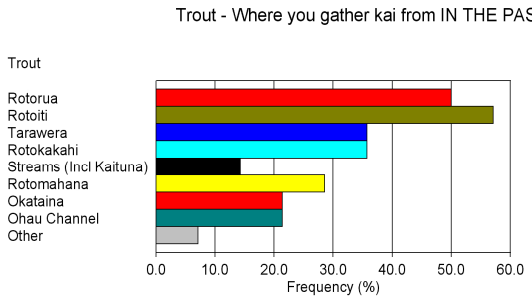
Mair (1923) knew of 700 fishing grounds in Lake Rotorua.

Koura are predominantly harvested from Lake Rotoiti, mostly in summer. 69% of participants believe there are fewer koura than there used to be.

Everybody ate bloody kouras. They wouldn't eat the ones from the sea though. Less there than in there were in the old days; there's less … We used to go out at night - rama koura and we used to catch them. You can't even see anything now because of the dirtiness of the water….Or either they're out in the deep and they can't come in because the weed is stopping them from coming in, maybe? …Nobody's been diving for them for years and years because nobody wants to swim in that dirty lake (Informant C).

Last time I had koura was at a tangi and that was this year, and the discussion that went on at the tangi table, at the hakere table, was great because we hardly ever see koura on the table, whereas previously it was quite common practice to have koura on there, now - I think it is the first tangi that I have been to in over 10 years where there was actually koura on the table at Ohinemutu ….Because, I suppose they're a delicacy in their own right, nothing was ever added to it to provide flavour because the flavour was already there in the koura (Informant J).

Table 29: Trout.



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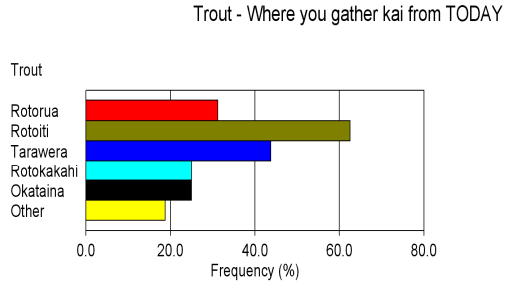
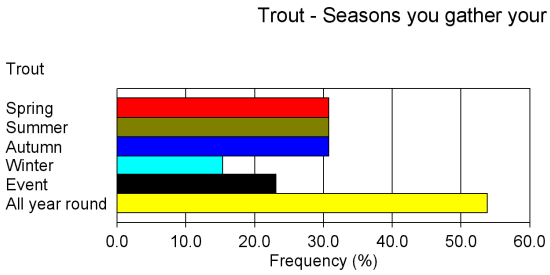
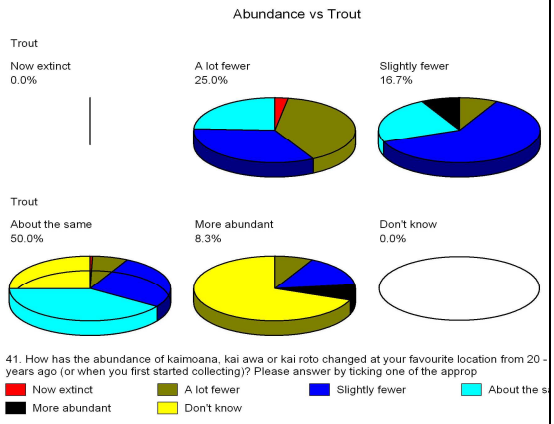
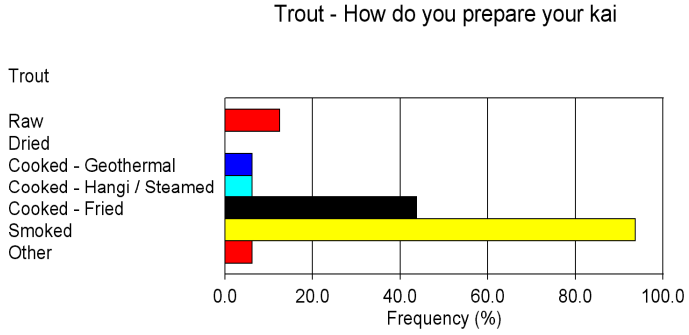


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

Trout are widely fished, although the number of lakes were they are gathered from has reduced. They are collected all year round and mostly smoked. Most participants believe trout numbers are similar or have even increased in comparison to historic records.

We would go down and my grandfather was a keen fisherman, so we were always out and my grandfather was fishing every weekend, and he always came home with good trout and they were always lovely and fleshy and yes. So, and that was every weekend, my grandfather would come home with at least three or four trout and he wouldn't even be out on there that long when he would be fishing during the fishing season (Informant J).

6.3.4 Perceived changes in the abundance of species that are gathered

A number of questions on the Kai Consumption Survey sought to determine the reasons for the dietary changes. The quantitative data summarised in Table 3 suggest the declining abundance of aquatic species is likely to be one of the main causes of diet change. However interviewees also reported degradation of aquatic environments, societal change (more specifically working longer hours) and the introduction of licensing of fisheries as barriers to their engagement in mahinga kai activities. With respect to the quantities gathered Pakeha settlers described the abundance of kai as 'shoals of inanga". Also during the 1860s, Captain Gilbert Mair described Maori trapping of adult koaro in the Hamurana Stream (Rotorua) at night.

> *Two hours after the net was lowered 'several hundredweight of the fat little fish were emptied into the canoe….This process was repeated during the night till quite a ton weight had been obtained . . . Of course the introduction of trout was the death knell of the koaro'*[13]

> *An example of this productivity was at the opening of Tamatekapua at Ohinemutu in 1873 where a reputed 500 rohe (a rohe was roughly the equivalent of a modern sack) of dried koura and inanga were consumed (Hiroa, 1921)*

Other descriptions are found in historical text -

> *The people who lived inland had an enormous supply ….. until the Europeans introduced the trout and other fish. Now our fresh-water fish have almost entirely disappeared.*

> *Koura (crayfish) were found in great quantities in the lakes and rivers...…*

> *The whitebait went up the river like a company of soldiers in great numbers, keeping a column two or three feet wide.*

McDowall provided further descriptions of the losses that were experienced in the 1940s:

> *My grandfather, who farmed the banks of the Ohau from the early 1900s, took substantial [whitebait] catches – 20kg or more – from this river. When he took us whitebaiting in the 1940s, catches of 5 kg could be expected during good*

[13] McDowall (1984), p 91

> *runs. By then the Ohau River ran through fully developed pastoral country. He had in the early 1900s cleared his property of dense tawa forest. The streams had probably once supported banded kokopu and giant kokopu and masses of inanga when there was still forest. By the time I was there we only saw a few inanga and the odd banded kokopu in the tiny patch of remaining bush*[14].

A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining. In the 1930s, a number of factors were blamed for the decline in whitebait catches including: excessive take by whitebaiters; predation by sea birds, herrings, eels, trout; draining of swamps, backwaters, and creeks; or damage to estuarine spawning grounds by stock. By the 1990s a number of native fish species had disappeared from waterways or were in decline. A combination of factors was attributed to these losses including: afforestation, sedimentation and flooding, wetland drainage, river modifications, sewage, water abstraction (irrigation), and pollution arising from adjacent land uses.

6.3.5 Seasonality of kai gathering

Differences in seasonality also existed from place to place, for example, in Taupo inanga fishing began in September, while in Rotorua it was from December onwards.

> *The koura came in October and lasted from November to March. They ceased being fat in April. Inanga and kokopu were in season from December to February and perhaps to March; toitoi from May to September. Kakahi were obtained throughout the year but were best in winter (Hiroa, 1921).*

Although some whanau adhere to seasonal regimes, the technology (in particular the gear) available to fishers today means that resources can be gathered all year round. While all year availability provides a secure food supply for whanau, it will affect the abundance of species. The following Table has been compiled with the data from the Kai Consumption Survey and identifies the seasons when species are gathered today.

[14] McDowall (1984), p 79

Table 30: Seasonal kai gathering patterns today.

SPECIES	SUMMER	AUTUMN	WINTER	SPRING	MOST
Kakahi					66.7%all year
Morihana					66.7% winter
Cockles					45.5% all year
Pipi					53.8% summer
Toheroa					100% summer
Tuatua					50% all year
Lamprey					50% all year
Mutton birds					75% autumn
Pupu					66.7% summer
Eel					83.3% eel
Flounder					66.7% flounder
Paua					62.5% summer
Mussels					50% summer
Crayfish					55.6% summer
Oysters					57.1% summer
Seaweed					100% summer
Koura					54.5% summer
Watercress					50% spring
Puha					45.5% spring
Hapuka					100% all year
Mullet					75% all year
Kahawai					66.7 all year
Kingfish					57.1% summer
Gurnard					83.3% all year
Snapper					55.4% all year
Moki					75% all year
Shark					66.7% summer
Tarakihi					50% all year
Trevally					50% all year
Whitebait					66.7% spring
Trout					58% all year
Kina					63.6% summer

Key:

	All the seasons when gathering occurs		When the greatest concentration of gathering occurs

Although this research focuses on aquatic ecosystems, gathering birds was also regulated

> *But it was totally controlled - you never went out until somebody went up to check to see if they had enough to shoot, and they'd come back and say – "right, the season is open, you can go up", and then you were allowed about probably a month and a half, maybe two months, because that was the feeding period for the miro (Informant B).*

Informants also spoke of the seasonality of gathering -

> *We would go from August catching inanga and that would go for two-three months. I mean, the seasons have changed today, warmer climate change. But when the inanga ran it was just a mass of black running along the banks of the Ohau Channel, and we were just collecting tubs full, it was just continuous (Informant E).*

> *Then koura sort of came over the summer period - December, January, February and we caught rama koura - that was catching it along the shoreline, just with a fish and chip basket and using candles inside a huge fruit tin. So we were saving energy, you know, that was our light. And we always chose a full moon. Our parents knew - they sort of had this Maori calendar as to when was the best time to go out and they would tell us to go out and they would prepare everything for us and make sure we were safe, and they would tell us when to come home and when to go out (Informant E).*

> *During the summertime, we like to go out probably once a fortnight (Informant D).*

> *It was on a regular basis……we did the gathering of the koura at night…we would do rama koura and we would have a spotlight… and I would say in a summer we would probably have koura about, I suppose, four times in that summer period, and we would be looking at - say there would be enough to feed a family, so there was five of us and there was normally enough for two meals, so we are probably looking at, on average, I would say between - I would say probably about 60 koura at any one time (Informant J).*

It is important to realise the even today seasonality is a management technique that respects the life stages of kai species.

Yes, it was the summer months and it wasn't only simply because the water was warm, it was also a matter that you allowed the stocks to replenish themselves so that there was a period that they could - where I suppose the stocks could refill again, otherwise they would be greatly depleted (Informant J).

6.3.6 Processing of preferred species

The processing of kai species needs to be understood if all possible pathways of contaminants are to be identified.

Historically[15]

Koura *(crayfish) would be … dropped into the boiling water for a few seconds, then taken straight out and eaten, or the crayfish might be put into the steam hole for two or three minutes. Koura cooked in this way were beautiful.*

Fish *was generally steamed in a hangi, either in a tukohu or in a vessel, and meat or birds were also cooked in these steam holes.*

All the fish were steamed in a hangi, though some were dried and put away in a whata for future use.

Koeaea (whitebait), *like koura, needed very little cooking, and might be put for a minute or two in the boiling water, or steamed. In the old days the koeaea was only eaten fresh. It was caught in July, August, and early September.*

Inanga (Retropinna), *a small fish, was a favourite food of the Maori, and was eaten either fresh or dried. It was the relish eaten with the fern root.*

Shellfish *were eaten raw, or cooked for a very short time on hot coals. They might be placed in a heap, and a fire built round them. Or they might be dried and threaded on takiaho, a string of prepared fibre.*

Kuku *either cooked or eaten raw.*

[15] These descriptions were taken from Makereti (1938). We note that none of the interviewees used the term "koeaea".

The pipi *was eaten raw, dried, or cooked either on hot coals, or by steaming for a very short time.*

The eel *was generally cooked in a hangi… either cut into pieces, or cooked whole, encased in the leaves of the puwha (Sonchus oleraceus, var.), or sometimes bound spirally in the leaves of the harakeke (Phormium sp), and then placed on the hot stones of a hangi. Tuna cooked in this way was lovely, the outside skin getting quite pakawera, i.e., well browned and crackly. Tuna was considered a great delicacy.…Many are dried and put away for future use, or for taking to relatives for some special gathering. The people prepare teahi rara tuna, the fire for drying eels. The eels are laid on a frame made of green rods over the fire. If small, they are put on just as they are, but if large, they are opened out and kept open with small pieces of wood before they are laid on the fire (ka pawhara tia).*

The flesh of the dried ***shark*** *was considered a great delicacy. It had a very strong smell.*

From the Kai Consumption Survey we know that whanau today use a number of different methods to process the kai they gather.

Table 31: Number of respondents (as a %) that use different methods to process the kai they gather.

SPECIES	SMOKED	COOKED –	RAW	COOKED	COOKED	DRIED	OTHER
Kakahi	25	-	50	25	25	-	-
Morihana	33.3	33.3	-	33.3	66.7	-	-
Cockles	-	-	23.1	23.1	61.5	-	30.8
Pipi	-	7.7	23.1	15.4	46.2	-	38.5
Toheroa	-	-	33.3	66.7	66.7	-	-
Tuatua	-	-	33.3	33.3	66.7	-	-
Lamprey	-	-	-	-	-	-	-
Mutton birds	14.3	28.6	-	14.3	-	-	71.4
Pupu	-	-	-	-	75	-	25
Eel	64.3	57.1	-	7.1	7.1	-	14.3
Flounder	20	100	-	-	-	-	13.3
Paua	6.7	53.3	46.7	-	20	-	26.7
Mussels	17.6	47.1	76.5	5.9	11.8	-	29.4
Crayfish	6.7	33.3	26.7	20	46.7	-	20
Oysters	6.7	6.7	93.3	-	6.7	-	6.7
Seaweed	-		40	-	20	20	20
Koura	-	7.7	-	23.1	53.8	-	-
Watercress	-	7.7	15.4	30.8	53.8	-	38.5
Puha	-	15.4	-	23.1	38.5	-	38.5
Hapuka	45.5	81.8	-	-	-	-	18.2
Mullet	85.7	42.9	-	-	-	-	-
Kahawai	85.7	50	14.3	-	7.1	-	14.3
Kingfish	60	80	10	-	10	-	-
Gurnard	55.6	77.8	11.1	-	22.2	-	11.1
Snapper	81.3	75	31.3	-	12.5	-	12.5
Moki	57.1	71.4	-	-	-	-	28.6
Shark	28.6	71.4	-	-	-	14.3	14.3
Tarakihi	50	71.4	35.7	-	21.4	-	21.4
Trevally	37.5	62.5	12.5	-	25	-	37.5
Whitebait	28.6	100	-	-	14.3	-	14.3
Trout	93.8	43.8	12.5	6.3	6.3	6.3	-
kina	6.3	6.3	93.8	-	-	-	6.3

Observations

- Koura - the majority are steamed although a small percentage are now fried.

- Fish – a significant number of species are now smoked e.g., trout (93%), snapper (81.3%), mullet and kahawai (each 85.7%) and eel (64.3%). Frying fish seems to be the next most common means of processing although being steamed in a hangi, or boiled is still a common practice.

- Koeaea (whitebait) – is mainly fried although 28.6 % claim they smoke it.

- Shell-fish such as kina are still eaten raw (93.8%) Kuku were eaten raw by 76.5% of respondents while oysters are eaten raw by 93%. Many are still steamed but in contrast to the past practice, none of the respondents said they dried kaimoana. Only seaweed, shark and trout were dried by a minority of the respondents.

- The pipi are eaten raw, or cooked by steaming (geothermally or in a hangi). Respondents did not say they dried pipi.

- In contrast to the traditional way of processing eel (in a hangi) the majority of respondents smoke it or fry it. No one reported that they dried it.

  The pigeon – these were probably preserved in their own fat, because we don't get the same fat pigeon today as we did then. I remember shooting pigeon, it was just a ball of fat and inside would be a whole heap of fat inside the stomach itself…No, it was interesting growing up with the old people and how they regarded food - any food that you gathered.

6.3.7 Kai gathering – its contribution to wellbeing

The concept of mahinga kai extends beyond the nutritional value of species and its physical health benefits to encompass a range of cultural values. It describes species available locally and encompasses the cultural values attributed by whanau and hapu to these species as each is gathered, processed and distributed according to tikanga and kawa. Some of these values are discussed, albeit briefly, in the paragraphs below.

Whakapapa - Whakapapa is an important conceptualisation for Maori. Whakapapa connections to the lakes are evident in at least two ways:

1) collective ownership of lands and/or customary rights to fishing grounds and natural resources; and

2) the names of tūpuna/whanaunga or important iwi/hapū or events that have been given to geographical locations, landmarks, other such things.

The old time Maori …soon ascertained the parts of the lake where the various foods were most plentiful and most easily procured. These spots became the fishing grounds carefully marked and jealousy guarded by the various subtribes and families. They were given names and the most famous alluded to in song and story (Hiroa, 1921)

Whakapapa is also central to kai gathering, which like many other cultural activities, is built around collective action (Ireson 1992, 1996). This is highlighted in Rotorua Lakes where rights of manawhenua determine access to reserves and fishing grounds.

Our iwi and our hapu locally were very respectful people. We honoured everybody's rights when it came to hapu collecting from certain areas (Informant E).

We stayed within our boundaries. We were respectful and even the way we fished there was a lot of respect… No, that is gone. People are fishing over other boundaries. They have got this thing about the more they can catch, it is a money making proposition. The traditional values are going out the window, and it is sad to see (Informant E).

The current generations aspire to continue ahi kā, to perpetuate Te Arawa culture and identity which has always included the right to utilise specific resources (e.g., koura, kakahi) and practice certain activities primarily associated with the kai gathering. A few whānau in Lake Rotoiti epitomise this, by retaining the traditional way of gathering koura (tau koura).

Whanaungatanga - Whanaungatanga is an important process for the reinforcement of whakapapa links and the development of a close relationship with the lakes and the taonga they sustain. Whanaungatanga refers to the reciprocal support relationship between members of the same whānau, hapū and iwi. Through the co-existence and interaction amongst different generations and wider family networks, each of which has experienced different periods and aspects of Te Arawa history, interviewees have a broad knowledge of the social, cultural, environmental, and economic history of the Rotorua Lakes area, and of their own family's connection to the lakes. This knowledge has been generated through a range of social interactions with kaumatua and/or other whanaunga and friends from different generations. Tangihanga, hui and wānanga provide important occasions for comparing experiences, generating

information and affirming whakapapa and whanau ties. Such interactions continue to facilitate the transfer of mātauranga Māori, cultural values and traditions.

Wairuatanga - Te Arawa use different ways to feel spiritually connected with their takiwa.

> *Previously Utuhina or on the shores of Lake Rotorua would be where I would get cleansing and spiritual cleanliness, I can't do that now (Informant J).*

Gathering kai with whanau at a traditional fishing place, that they know was named by their tupuna and utilised by successive generations of their whanau, is one way.

Being able to contribute the kai that their takiwa is renowned for, to ceremonies and to manaaki manuhiri can also bring that connection:

> *I suppose where your wairua is uplifted and where you find strength because you are able to cleanse yourself there, that can't happen anymore. And those are the things that I think that I miss and that I am sad that my children don't have that opportunity to do those things. I mean, as a child, you know, you can spend all day running and just the feel of the water on you, you know, just because it is so cold, and just the freshness and how alive it makes you feel when you emerge yourself from the water (Informant J).*

Manaakitanga - Historically a surplus of food was gathered as surpluses enabled whanau to access other resources through bartering, trading and gifting, thus setting up reciprocal obligations (Makereti, 1938). During the year whanau visited neighbouring hapu, taking surplus food to share. Being able to gather abundant foods and thus able to engage in a range of economic practices ensured whanau had access to a variety of foods. Because of trade, however, people weren't restricted to kai immediately available to them from their local area but had access to a wide range of foods. Degradation of the lakes, however, meant that Te Arawa were denied access to a significant percentage of their traditional sites of kai gathering across Rotorua Lakes and streams.

> *At the large hui at Awahou in 1899 there were six hundred people from the Bay of Plenty and East Coast. The gathering lasted a week and koura was the chief food (Hiroa, 1921)*
>
> *A great present of koura was sent to Kawana Paipai in 1859 (Hiroa, 1921)*

As has already been mentioned –

At the opening of Tame te Kapua at Ohinemutu in 1873 it is said that at the feast were five hundred rohe of dried koura and inanga (Hiroa, 1921)

Durie (2004) contends that mauriora is dependent upon a secure cultural identity, and therefore diet changes can lead to loss of culture and identity. Having the ability to manaaki visitors by supplying kai sourced from one's takiwa means that the activities of fishing, and gathering other foods creates and maintains community ties and reinforces identity. Conversely the inability to manaaki guests and sustain whanaungatanga can lead to cultural loss. As informants explained -

At home we would share them out with all the families along the way and what was left over we dried. We dried for the winter (Informant B).

And that is what it is really about - the sharing, and that is what food gathering was about, or planting your gardens was the same. You didn't just plant for yourself, you planted for everybody.… they always shared everything… I've always had a garden… I always planted something (Informant B).

We dived for our people. We look after our people. Big tangis and all that. We look after our people (Informant C).

But sadly informants believed that the sharing culture is gone:

No, that has gone too. That is gone because in the old days there – because I was brought up by my mother and my grandfather. And every Sunday they used to come around – like the older ones – and drop off a piece of wild pork, some fish, some koura, eh. But that's gone. … now I take my kids; my son, my daughter and now my mokopuna down to the pa whenever there is a hui, whenever there is a tangi. But the rest of the kids – when we moved …they lost that connection (Informant M).

It was always enough to feed the family and then some left over to be able to give to people that came….Yes, so when taking from the lake it was always really important that we didn't just keep it for ourselves, that we shared it, particularly like koura, it was always made sure that my grandmother got some and both my sets of grandparents and aunties and, yes, there was always plentiful, enough for our family and some of our extended family (Informant J).

Matauranga Maori -

> *Yeah, but I think it is the younger generations that are – they are getting worse and worse because their parents aren't giving good – showing the good way. You know, they are obviously, "Oh, well, you know". Because to me, Papatuanuku and, you know, Tangaroa, you know, we are kaitiaki of them and if we don't look after them we can't collect from them or they can't look after us (Informant H).*

As has been previously stated, the activities of gathering and preparing kai serves the functions of passing on traditional knowledge from one generation to the next. Matauranga Maori is developed and transmitted through practices of food management, harvesting and preparation.

> *I suppose I learnt from - and my brother and sister did - we learnt from our father and our uncles, and it was really things that they had learnt. So it is really generational information that comes down, and it was always - the key was sustaining. You know, making it sustainable so that next year you could come back and there was still some more there (Informant J).*

> *As a child, I have never seen a morihana, I didn't even know that they existed until as I have got older and we have spoken about the morihana, but they used to say …they would just pick them straight up and eat them raw, (Informant J).*

A great deal of knowledge is needed in order to obtain kai - knowledge of techniques and also knowledge of ecosystems. If populations of aquatic species do not return, knowledge of the techniques of gathering these foods along with the associated ecological and cultural knowledge and the techniques of gathering will likely also begin to disappear. Historical text and evidentiary statements provide insights to the knowledge held by earlier generations:

> *There were expert men who understood all the movements of a school of fish. These men generally took up a position on the top of a hill near the sea, and looked out for any signs of a school of fish, and then passed on the sign to a party of men who were fishing in a canoe. The seas which surrounded New Zealand were teeming with fish. ..*

> *In Cook's First Voyage, page 57, Cook writes: "The seine, the large net which has already been noticed, is produced by their united labour, and is probably the joint property of the whole town. Their fishing hooks are of shell or bone,*

and they have baskets of wicker work to hold the fish." On page 48, he writes: "Early in the morning, the Indians (meaning Maori) brought in their canoes a prodigious quantity of mackerel, of which one sort were exactly the same with those caught in England. These canoes were succeeded by other canoes equally loaded with the same sort of fish, and the cargoes purchased were so great that everyone of the ship's company who could get salt cured as many as would serve him for a month's provision. These people frequently resort to the bay in parties to gather shellfish, of which it affords an incredible plenty. Indeed, wherever we went, whether on the hills or through the vales, in the woods or on the plains, we saw many wagon loads of shells in heaps, some of which appeared fresh, others very old."

Crozet in his Voyage, pp. 40–41, writes also of the abundance of many kinds of fish caught by the Maori, and of the art of the Maori in all that concerns fishing, and goes on to say: "Their fishing lines, as well as their nets of every description, are knotted with the same adroitness as those of the cleverest fishermen of our seaports. They manufacture seines five hundred feet long, and for want of corks to hold up the nets, they make use of a very light white wood, and for lead to weigh it down, they make use of very heavy round pebbles enclosed in a network sheath which runs along the bottom of the seine, etc."

Te aho hi ika, the lines used for fishing, were made from the finely dressed muka (fibre) of the flax. They were very strong, and often carried hooks to catch very large fish, such as the manga (barracuda), or the hapuku (groper).

In my district manuka grew near Lakes Rotoiti and Rotorua, and this became quite famous for making hooks. People came from the coast on purpose to get these manuka sticks, which the prevailing winds had blown almost into the shape of fish hooks.

As food species disappear from the dining table, the particular knowledge of how to prepare foods is also lost.

I used to also go and get mutton birds on Whale Island…I used to go every year and get mutton birds. I started when I was nine - I used to go over there with the old people. Then when I was 11 I was allowed to go on my own (Informant B).

We were working at six, doing allsorts of things, not just milking the bloody cows, but digging the garden and helping grandma do this and do that, and so

we had a working life, everyday was a working day. And by the time you are 11 you could do anything…Totally independent, you could look after the family, you could cook, do the housework, everything. And that is how it had to be, which I reckon was wonderful, that they taught us all these things. By the time I was 15 I was ready to marry - you know, that is what they said, I could marry at 15, because I could go to work and look after our family and look after children. So that is one of the sad things about today, young people haven't had the opportunity to do all those things (Informant B).

I found that catching fish was the easiest part. I used the long line most of the time. And it's hard to get these young kids, aye, because they were – I used to get them out on that boat; they never played up at me. They knew the rules; they play up, well, we stay another couple of weeks out there and they hated it. A lot of them used to get seasick. They didn't like – don't play up with him or he'll stay another week. And we'll have to eat fish for breakfast, fish for dinner, fish for tea. I've got a change today, boys - more fish! (Informant C).

Because of the continuity and frequency of kai gathering, people were readily able to monitor fluctuations in stock and environmental conditions. They were then able to build up tacit and local knowledge of the environment.

Tikanga Maori - Kai gathering was and is governed by tikanga. Generally, whānau members spanning two, or sometimes three generations, together collected different kai moana species from traditional mahinga kai areas.

Makereti (1938) tells us that historically -

- *When a fishing expedition was arranged, several canoes, each manned by several men, were placed under strict tapu.*

- *If a man was married, he kept away from his wife until all fishing operations were over.*

- *The first inanga caught in the season were always offered to the gods, and the rest of that first catch was used at a ceremonial feast, karakia being repeated by the Tohunga.*

- *Both men and canoes were under tapu, and each canoe would carry a mauri, … in a hidden part to maintain the tapu, and add mana to move the gods when an appeal was made asking protection for the ropu (company) from the many*

dangers at sea, and from the many beings who lived in the deep waters of Moana-nui-a Kiwa, the great ocean of Kiwa.

- *The first fish caught on an expedition was offered to Tangaroa as a thanksgiving, and it was done with the ceremony of karakia.*

- *The fish was then placed in the sea again, and this karakia was repeated asking that abundance of fish might be sent to fill their nets or bite on their hooks.*

- *The men who went on fishing expeditions had no food before they went, and none until after their return, when the tapu was taken off by a Tohunga.*

- *Even when fish was caught, and pulled up into the waka (canoe), it must not touch the top of the gunwale. If it did, it was considered to be an evil omen, aitua.*

- *When fish was placed in the canoe, it was laid in the way of the canoe, and not across it. If the fish were placed across and a man stepped over them, it was thought that some aitua (bad luck) would happen to him.*

- *No Maori went out fishing alone. Fishing … was done by a ropu or company of men.*

- *When men went fishing, and one of them had a new line, none of the others would throw out his line till after the new line had been wetted. When placing his bait on the hook or hooks, he would tuwha, spit on it, and after gathering up his line, he would pass it under his left kuwha (thigh). After this he would turn his face to the bow of his canoe, and throw his line over the left side of it, and as the line went out and got wet, he held it in his left hand, and picking up some sea water in the cup of his right hand, sprinkled this on the line. The first fish he caught would not be eaten, but kept to be given as an offering to the gods. This offering would be cooked on a fire which was specially kindled on his return to land, and the fish, which was divided into two parts, was offered to the spirits of his male ancestors, and to the spirits of his female ancestors.*

From the interviews we extracted skills, knowledge and tikanga that continue to be upheld today:

- location of fishing grounds;

- rights to fishing grounds;
- knowledge, location and impact of thermal resources including natural sources of contamination;
- how to read and understand the waters, and the dangerous places around the area;
- knowledge of the location of different habitats of species, knowledge of life stages of species, such as when to collect or leave to replenish and grow;
- how to get a 'feed' if needed;
- how to remove the skeleton from koura;
- how to make and mend equipment;
- diving – traditionally and with equipment;
- gathering in traditional way e.g., tau koura;
- seasonal information;
- boat handling and maintenance;
- karakia before gathering;
- ika mātua (the return of the first fish to Tangaroa);
- take enough for a 'feed', any excess is to be given away to those who can't get it;
- rāhui in event of accident or death.

Tikanga remains relevant today:

> *I mean, you just didn't go out - if we went out eeling we'd all stand in a group and my grandfather would do a karakia and ask Tangaroa to let us have some luck, and we always got heaps of luck - we had eels everywhere (Informant B).*

But there is also an obligation to teach the next generation:

> *Yes, no, but you've got to teach the ones that do it to share, that is the big issue. Today, if you don't go out and somebody goes - oh, stuff him - part of the whanau, you know, he doesn't go out. But you have got to learn to say – well, he's got to realise that they are not all the same. But the point of going out to get all this kai is to be able to share it with somebody else - there is no sense otherwise, there is no sense in going to get all this stuff because the joy is seeing the joy on other people's faces when you say "here", and that is when it's worth it. Otherwise you can hoard you bloody freezers up and whatever and it doesn't mean a damn thing (Informant B).*

Te Reo - That kai is instrumental to a culture is reflected in the Te Reo that pertain to fishing grounds, their names and the names of the landmarks by which they are located and the different species. Te Reo contains knowledge and is an expression of culture and identity. Yet Te Reo has been declining for many reasons, one of which may be attributed, in part, to changing lifestyles. When a valued species disappears from a local ecosystem, or the activities associated with a species decrease, the associated Te Reo drops out of usage. When 61% of the respondents confirmed that they would stop gathering if advised that species and sites were contaminated, the indirect cultural impacts that would ensue should this happen would represent a significant loss.

Cultural survival - This section of the report has attempted to describe how kai gathering is the glue that binds whanau, hapu and community together, providing a sense of identity that also serves as the vehicle for the transmission of values and knowledge. The degradation of the lakes and consequent impacts on mahinga kai was a significant issue in the Te Arawa claim as evidenced by statements in the Tribunal Report. Archived documents provide in-depth testimony concerning the cultural and spiritual significance of aquatic kai species and of the water bodies across Rotorua Lakes themselves while informants identified the need for education.

> *You have got to teach them, eh? You have got to get them interested (Informant A).*

> *But one of the things is – it is education of our people. Our people need to be educated now about their resources or tools so that our fishermen can test their own catch …They should be made to do that. I mean I don't mind being stopped on the lake and having my fish tested so it is safe for me and my family (Informant A).*

All I would like is for my children to have the opportunity to enjoy the lakes in the same manner that I did, and it is as simple as that. That my children and my grandchildren enjoy the same benefits that I did as a child, that they can grab the tyre from down the road and roll it into the lake and all 10 of them jump on it and I know that - you know, previously you would be worrying about their swimming ability, but now you worry about them putting their head under that water. So to take that away and to watch, you know, the neighbourhood kids, all 10 of them, be able to access that water again, that is what I would like to see (Informant J).

It was our playground, it fed us, it taught us a lot of things about, you know, like especially now, these days, our children don't realise – you know, because you have got to get in touch with nature now and these are like – it was an educational basket. You know, you could investigate and even the species along, you know, like the ducks and the – you know, there was like – the ducks that we used to like were those ones with the bright yellow eyes (Informant H).

Hauora Maori - The presence of kaumatua represents "intellectual capital". They are holders of a wealth of critical information about the past and can draw on this knowledge to provide accurate assessments of environmental condition, including changes over time, at a localised level. The results from the Kai Consumption Survey confirm that differences in behaviours, perceptions and knowledge are found with the different generations. Loss of relationships with the natural world could lead to grief. Many feel whakama when unable to fulfil the social roles expected of their age groups. At stake with the loss of kai gathering is not only cultural survival, but potentially the physical and mental wellbeing of whanau members.

So we walk along the shore to get down to Utahina, to walk along the shore is mainly - it is just covered up in lake weed, so it is really hard to see if they actually still exist on those shorelines.

So my children don't spend the time in the water that I would like them to because the water is what connects you to - you know, it is what makes us well. It is one of the things that makes us well and provides us strength, and so then where do my children go to? (Informant J).

6.4 Perception of the health of the lakes' environs

Questions sought information from interviewees about their perceptions of:

- What environmental impacts that act as barriers to gathering?

- What environmental activities have impacted the condition of sites from which kai is sourced?

- What activities have led them to change their gathering behaviours?

With increasing European settlement around the lakes in the late 1800s, forests were milled, agriculture was established and urban settlements were developed. Numerous conflicts developed between the new settlers and Te Arawa, whose capacity to provide kairoto from the lakes and koha for hospitality was diminished with deteriorating water quality and introductions of exotic species. Today, through degradation Te Arawa have been progressively alienated from the lakes, their taonga and their role as kaitiaki although a number of restorative initiatives are being implemented. In the following paragraphs we identify some of the activities impacting the health of the lakes:

Changing land uses- Native vegetation around the edges of Lakes Rotorua and Rotoiti was milled for timber and cleared for farming, and later septic tanks were installed. These developments resulted in an increased nutrient load flowing from the catchments into the lakes. Excess nitrogen and phosphorous led to the growth of blue-green algae in the lakes. In the paragraphs that follow we summarise many of the impacts of concern to Te Arawa.

Sewage - Pumping sewage effluent into the Kaituna River is offensive on medical, social, spiritual and cultural grounds.

> *I suppose out of all the lakes, I think Rotorua was the most damaged from the sewerage, because when I was growing up - you wouldn't believe, they had the sewerage - the town dump down by the lake (Informant B).*

> *If we believe the lake is polluted then it is, and that the food in it is polluted. But we've been eating it for years so we're probably all immune to it now. But if anybody else from our side probably came in from overseas, they probably get crook (Informant B).*

> *I suppose there always is health risks, when pollutants go into the lake, but the trouble with health risks is that they're not instantaneous, you know, it takes years for it to appear (Informant B).*

They pump the town sewerage up into the forest in towards the Tukurangi Pa and as far back as probably about up to here (Informant H).

It's not right down here with the quality of the kai, then it must be from Te Puke, in which I won't be afraid to say that Te Puke is – they're mongrels, their 'shit' - all right and that's honest (Informant K).

Forest Clearance - Many native fish live within the forests in steep, cold streams with rapids and pools, that still retain a heavy cover of native forest. These habitats support banded kokopu (in pools), short-jawed kokopu (needs plentiful instream cover to hide in), red-finned bully (in wider streams), longfin eel (needs deep pools, large bank overhangs, log piles), koaro (in clear streams), banded kokopu, and giant kokopu. Koaro which are now rare disappear from streams when the forest canopy is removed. In unmodified streams koaro may still be found. Forested streams are probably the habitat required for spawning lamprey.

The trees are gone, some of them are gone, some cut down. Plus we went to a barbecue down the lake, summer this year, and what surprised me was the bareness. Not only bare of, you know it, around the shoreline, but bare of people to when I was – eh? Because it was always covered in kids. And all the kids were actually by us at the barbecue, throwing stones into the lake, even though it was a nice warm day (Informant M).

Deterioration in Water Quality Many native freshwater fish thrive in cold, clear, actively running water as they need a constant, organically clean, thermally and chemically stable water supply (Hine and Boustead, 1974).

Informants described the changes in water quality across the region:

But I remember being able to go down to the rock and when I jumped in the water, the water was cold and it was just what you did on a summer day. Now if I went to jump into that water it would be luke warm, and so what is going on that as a child it used to be able to quench me and be able to sustain me that now actually it's like "I'm not even jumping in there", something is going on with it(Informant J).

I think if I wouldn't drink it, then why would I throw my children in to swim in it, and yet there was a time where I would have been quite happy to have drunk out of the Utuhina River (Informant J).

You can get any shellfish you like out of this one. But …they're slowly disappearing (Informant C).

And I looked down and it looked down and it looked like somebody had done some big, huge, washing, eh, there was all this froth, eh, you know? And I go, "Look at that". All along the shore it was just thick froth. And I said, "Well, nobody got a washing machine this big, so it must be something else". Which I felt sad for because there is a lot of history in those lakes; a lot of people swam, a lot of people died in that lake, a lot of wars on that lake, eh.… It is a lake of memories, good ones; memories of flowers, memories of people. And at the moment now, all they are is memories because you have got a whole lot of rubbish that is stuck in it, (Informant M).

We get 44 gallon drums, we get pallets, we get everything coming down the Utuhina Stream, but in our bay, which is right next to the Saint Faith's Church, I get all the tennis balls.…… He gets all the golf balls, which we can't work out because tennis balls are lighter than golf balls and yet they come further around to the yacht club – that is right next to the yacht club, yeah. And I think one day there we got over a thousand golf balls out of there. And so that is coming down the golf course up here, down the Utuhina (Informant D).

Without your water quality, food will never be sustainable from the lakes, waterways (Informant E).

Especially in summer time when the algae bloom gets at its worst, you know, and you see - because we frequent Lake Tarawera, when you see that yucky horrible greeny colour and Lake Rotomahana that totally, totally looks disgusting now …The colour and all those floating things and heaps of feathers and all that weed and the smell (Informant F).

Even Noho Kakahi get a lot of ugly looking floating algae looking things in there. Yeah, the colours have all changed. In Tarawera you could look over the jetty and look down and you could see the lake weed at the bottom and now you can't see anything full stop (Informant G).

I took my grandchildren for a swim down the lake, and I hadn't been to the lake for a while, and we were swimming around there for ages and I got some kouras and I knew they was hot so I let them go…. we were walking home and I go (sniff, sniff) something was stink, eh, and I smelt it and it was me, from

the lake. So I got home and from then I wouldn't go back in the lake (Informant M).

Yes, the smell from the lake [Rotorua] is so putrid. So, I mean, certainly as I got older as a teenager, I don't think it was just a teenage thing, I just think the quality in the lake just seemed to deteriorate at quite a rapid period, or maybe I became more - because as a child there was no problem in putting your head under the water, but now, and then if you go around (Informant J).

Bio-security – specific to Maketu, one species of concern was identified –

Starfish, but that's fallen off some of these big boaties. Those big boats, when they empty their ballasts and that's where those come from. You know, when they come over and then they collect the logs and they pump all their ballasts out (Informant C).

Irrigation - Extraction of flows to enable irrigation can cause rapid alterations in stream flows resulting in exposure of bank vegetation, and loss of fish habitats.

Disappearance of kaiora - Insects represent a source of food for freshwater fish. Native fish are deprived of this resource by forest clearance, agricultural pesticides, and competition from introduced fish. As early as 1920, the entomologist Tillyard reported to the Government that trout had caused serious declines in aquatic insects in the Rotorua–Taupo streams and lakes (Tillyard, 1920). Informants commented on other changes:

And I remember even getting some paua - oh, about maybe eight years ago I suppose – and you know, they were okay but then you take them out of the shell and you can actually see the discolouration in the shells and it is like it is from the quality of food that is keted and (Informant H).

I missed all that - beautiful, it was just natural. And the croaking of the frogs - we didn't even need a clock to wake us up in the morning. Five in the morning the frogs would croak and they would start in harmony and sing all these beautiful tunes - high and low, and that got us up - the frogs. See, you don't even hear a frog today, you don't see a frog, it must be affecting the environment (Informant E).

I mean the birdlife was one of the most beautiful things to watch and you could always tell with the seagulls when the inanga was running - the birds would tell you. Now you don't see that as often. We've lost that as well. The

birds will go to another area where it's peaceful and quiet, plus if you have the habitat taken away like your swamp lands taken, they will go elsewhere, and that's what's happened to the Ohau Channel because of the dredging and now it's like parkland (Informant E).

But the pauas, they are all stunted; they're all got to a certain size and that's it. They never grew any bigger. Everybody else, they say - oh, we got some big pauas. You can't get big pauas here. They only get to it once, I think, and that's it (Informant C).

Impact on wahi tohu

Maori used tohu within their natural environment as indicators of predictability. By using indicators that have evolved over time through trial and error, through a history of continual use, Te Arawa monitored the condition of the environment, shaped their behaviours accordingly, and if necessary protected it by applying a rahui – using tohu to understand predictability represents a traditional management technique akin to the contemporary practice of adaptive management. Sadly changes to many lakes mean that historical patterns and processes are changing to the extent that rainfall (and other climate patterns) and lakes are being described as unpredictable, meaning the application of tohu may be limited.

Dredging - As swamps have been drained, natural streams have been straightened and dredged, destroying the food resources, refuges, and spawning gravels of native fish. However some informants believed dredging was not necessary at Maketu:

Well, I thought – I told them that. I said, "well, you know, the only way you're going to get to this - is you're going to have to dredge this" He said, "you won't be able to do it." (Informant C).

Swamp Drainage - Before the clearance and drainage of the vast kahikatea forestlands, extensive tracts of swamp, with pools enclosed by flax and raupo, were a feature of the region. These habitats sustained inanga in vast numbers, shortfin eels, and giant kokopu. Maintaining swamps is vital to the productivity of whitebait fisheries. Areas of lowland fisheries have been lost to land clearance, drainage, and trampling by stock. Drainage was identified as a particular concern at Maketu.

Pine Forestry Practices - Pine forests replace native forests and create a new environment around streams that is not a substitute for native forest cover. Forestry practices of burning, bulldozing, road building, and hauling modify streams.

Rapids, riffles, flats, shallow gravels, deep pools, and overhanging banks that provide the habitats in which native fish forage, hide, and breed are modified or lost. Forestry practices can disturb stream banks and stream beds, and load stream flows with sediment. Forestry practices can alter the chemical composition of streams as slashed vegetation rots, as phosphorus, nitrogen, and potash enter streams after burning, as forests are sprayed with chemicals and fertilisers, as mills discharge effluents, and as toxins leach out of sawdust and waste woods.

> *We used to have native trees and native trees don't throw out pollen (Informant E).*

> *Rotorua, Rotoiti, they are all small lakes, they just can't handle it. I say it is caused through pollen, everything else has changed the quality of our water (Informant E).*

> *But it's not only the kai from the lakes that depleted a lot, it was also from the forestry…the trees getting cut down and the poison coming in (Informant G).*

Modifying Estuaries - Many species of native fish pass through estuaries that provide a crucial transitional habitat which reduces the shock to migrating fish of changing from fresh water to salt water (Dinamani and Hickman, 1980). Maketu has been impacted by landuses and the diversion of the Lower Kaituna River.

> *Put it back through the estuary. But you can't – they say, oh, it will open it up and it will just flush it – you'll never flush it because they've left it too long. She's silted up that high now; she'd be, well, you could walk across here; walk across the thing. Before you had to go down a bank; now you can walk straight off the bank and straight into the sea (Informant C).*

Impacts of river management

> *The environmental impacts that have now impacted on Maketu whereby in the early years everything was pristine, beginning from Rotorua/Ohau and then down here, and we have seen the changes over the 50 odd or more years. But what we valued most was, I guess what was coming from Rotorua, the freshwater and the marrying into the saltwater which created within the estuary here. And from that – from a human being sort of observation and within ourselves and our firm belief that the wairua of the water and both mean together it created a uniqueness in terms of Newton's, whatever you call it, the "mixing" and, of course, with the end result, resulted in the food bowl of Te Arawa (Informant K).*

It was the installing of the weir around about '89, we've lost the whitebait (Informant E).

In addition to the adverse effects of the Kaituna Cut, the wall at Rotoiti was identified as a concern:

But I'm not very happy with the wall that they put in. I think it's going to cause problems. Why I say that is that just from my own way of thinking is that when you put a wall up and the wall becomes a barrier between Lake Rotorua and Lake Rotoiti…when the river was flowing down through the lake it dragged Rotoiti with it … The current going down drags the Lake Rotoiti water with it and creates a movement up the top end of the lake, admit it takes a while but it does…But when you put a barrier in, Rotoiti becomes a swamp…And you are not going to have that water dragging the Rotoiti water with it because it's going down against the wall (Informant B).

Game Fish Introductions - Trout and other foreign fish species were introduced into the Te Arawa Lakes from the 1870s onwards by acclimatisation societies, local bodies and government departments.

In lakes and rivers trout compete with native fish for floating insects, aquatic larvae (especially dragonfly nymphs, fly, caddis, mayfly, and stonefly larvae), and native aquatic snails and molluscs, especially in winter when food sources are meagre. Small longfinned eels living amongst the river gravels feed on aquatic larvae (caddis and mayfly), snails, and midges; their food is so similar to those of trout that competition is likely (McDowall, 1989).

But not all introductions were negative:

Morihana was probably one of the most valued fish in Lake Rotorua or in any of the lakes, that was a real delicacy, morihana, but of course that was introduced.

Land intensification

Like other regions around New Zealand land intensification is a concern especially if land use is dairying:

And now the cows – because the cows don't come down but there must be seepage, you know, back into the river. Well, I think if you knocked the blimmen river back to the way it used to run, then you'll get them - they'll

come back. What they did, they blocked off the main river and then they opened up this new one. Well, since they opened that up, then you get very small ones (Informant C).

Informants described the obligations they believe rest with the landowner -

So my whakaaro is, where everybody has got a farm around here, wherever there is an outlet, that should be all tested. And if, say, people have got a farm there, as I was saying, they own that piece, but the land not the water. We do. The people of Rotorua. So what we must be protecting is all this. So if they have got a farm there say, "Okay, you guys, you get plenty of money out of that, so use some of that money to make sure your sediment doesn't reach the lake" (Informant M).

Government and council actions acting as barriers – including the impacts of fisheries regulation - Government regulation required Te Arawa to pay for licences to take trout and certain other introduced species from the lakes. This restricted the ability of Te Arawa to fish in a customary manner (such as with nets), restricted their food supplies and imposed a financial burden.

Informants described how they felt when regulation was introduced –

Once they started bringing in fishing licences. We were saying "well, what about us and our indigenous fish?" We could just take - you know, when we thought we owned the lakes and it was leased out to the Crown, to us it was our traditional fishing rights and it just felt our fishing right was being taken from us (Informant E).

Our old people said – "no way are we going to take compensation, because the day we take compensation we will lose our customary rights, we will lose our customary fishing grounds, we will lose it all", and they are true (Informant E).

As part of the Te Arawa Lakes Settlement Act 2006, however, the Crown has made regulations to empower the Trustees of the Te Arawa Lakes Trust to manage the customary and recreational food gathering of included species in the Te Arawa Lakes (refer to http://www.tearawa.iwi.nz/fisheries-regulations; see also http://www.niwa.co.nz/our-science/freshwater/our-services/freshwater-species-and-habitat-management/te_arawa_lakes).

Other resource laws - The statutes displaced Maori interests in the indigenous fauna and consequently Te Arawa lost their economic and social interests in the flora and fauna. Iwi and hapu lost rangatiratanga over the fauna of their whenua. Statutes protected the conditions for introduced fauna to thrive. As a result predatory game fish displaced native fish from lakes and waterways (Rowe and Kusabs, 2007). Spawning grounds of inanga and kokopu were and continue to be damaged by stock and logging. Maori lost their self-sustaining harvests.

Loss of riparian vegetation -

Historical text describe the natural vegetation around the lake. However informants raised the loss of vegetation as an issue.

Raupo, they've all disappeared around the lakes - it used to all around the lake. Poupou, which they used to use for making their whariki and all that. But it has all disappeared, you know, because when they disappear other things disappear. The homes for koura, they used to live in the poupou, under the roots. Well, they all disappeared so they've had to move somewhere else, and the raupo - they used to live in amongst the raupo and all that (Informant B).

I'd like to see all that stuff growing back again, especially the poupou and the raupo, I'd like to see it all back around the lake, and the lake a bit more cleaner than what it is. There is not really much we can do at the moment because all the silt at the bottom now, it is all built-up and I think it's going to stay murky for quite a long time. But I think once - give it another 20 years, as long as we clean the streams up, it will wash it all out (Informant B).

We used to walk through all the weeds and the raupo…. We used to go with our pitchforks and catch the morihana, eh? And it was like walking through a garden. So the key is, whoever is looking at this and they are trying to figure out how a person got a motor mower into the water …All the dust, the sediment comes up and blocks the view of the koura. But, when I was a kid you didn't have that. Years ago we would have cut a car tyre up, hammer it to a piece of wood, light it, and that is how we used to catch koura. And you could just walk like that and you would still see them (Informant M).

I don't know how they did it, but I am trying to figure out people can get a lawnmower into the water, eh? Because everything around has disappeared. Whereas we used to have to climb though it, eh? You know, you had the little

vines … you used those to swing out over the lake? Well, those are all gone. And, to me, the motor mower goes that far.. (Informant M).

Raupo was the cleanser of the waters (Informant E).

The chemicals were actually killing our raupo and our natural cleansers. When you look at a raupo you will see it has got a sponge like that goes into the water and it sort of sucks in all those nutrients (Informant E).

And this is what I've been telling the Environment Bay of Plenty and RDC. It was just all raupo until they started building homes. And what do the new owners want - a jetty instead. So they pull out all the raupo and up goes the jetties. See, you change your environment (Informant E).

It's one of the things that just sorts of just sneaks up on you though, the vegetation around the lake, just sort of a wee bit disappearing and then a wee bit disappearing (Informant G).

New settlements/subdivision - The lakes were removed from the ownership and management of Te Arawa.

It's absolutely beautiful. And this is why people are spending heaps of money coming to live in the bay, but they bring all their jetskis, they bring all their motorboats and it's just crazy over Christmas. They go round and round in circles - just about hitting each other. The noise is quite threatening too, because you can't hear your phone…(Informant E).

I suppose what you do notice is that as our population increases and as we are not so appreciative of our whenua, the repercussions are that our lakes pay for our non-appreciation. So as Rotorua has got bigger, Lake Rotorua has got - the quality of the water in Lake Rotorua has paid the price for development here, you know, and as our farms have got bigger and as our technology has got bigger and better, the prices have been paid with the whenua, particularly our water (Informant J).

Now the hundreds and hundreds of boats that are getting launched at our lakes. Fuel leaking into the water. Because we're on the jetty and you can just see all the fuel and the oil sitting on top, yeah, still dive through it. Curse them and dive in (Informant F).

All of the changes described above are relevant to this research as changes, directly and indirectly impact cultural practices, principles and tikanga associated with food gathering:

- Young people are growing up not learning the basic knowledge associated with kai species, fishing, boating and gathering.

- Whanau are "losing the taste" of kai.

From 30 down there wouldn't be a huge interest in it because it is not something that they have grown up with, but certainly from my age up, like, you know, if my grandmother was to - if you were to put a plate of koura in front of her, I think she would almost eat the shell from it. You know, that is the sort of level of delicacy it is for her, whereas if I were to put it in front of my son, he actually wouldn't be that impressed with it (Informant J).

- Kai generally was known to be good for health. There is a feeling that the younger generation don't know this, or if they do, they don't practice it.

- Fish and seafood is purchased more now, but often as fish and chips.

- Water quality is a concern for parents and therefore they are reluctant to let kids explore/play in aquatic environments unattended.

- Parents feel their children have missed something not growing up in an active hapū gathering environment.

- The context within which fundamental cultural practices such as whanaungatanga are learned have been impacted -

Generally I go with wider whanau, so we tend to do everything with my mother and father, my brothers and sisters, and even my grandmother. So generally there are four generations of us that are travelling out on these things, so, yes. Like, as an example, we go out to Lake Okataina, … which is where my great grandmother lies is over here, so she was buried over here, so it is sort of like when we are going out to these other areas it is generally like on a historical journey to learn about things about who we are.

Finally, the result of these environmental perceptions is uncertainty as to whether or not kai is contaminated from urban environment.

See, that is another thing we need to be watching to – is the taking of watercress from polluted streams and swamps and things like that. And we have got to be careful of taking watercress (Informant A).

No, no. I think the condition is still the same, except for the pipis. I just didn't like the pipis, whether it is the – I gave these to an old kuia and she said to me, "Oh, I put them in hot water and didn't get enough for a sandwich, they were see-through". But then I cleaned it out (Informant D).

Washed them out in a bucket and it was black, the water, so. But I know they are looking at diverting the cut, or putting it back through the cut. I do not know what they are going to do with the waterways over there. Yes. No, that is about all I really know about that area (Informant D).

It has got a muddy taste - it has to do with the taste, plus the look. I looked at the inanga and it used to be pure black and white when we were children - distinctive, because we used to make fish flies and then we found - there seemed to be a greeny looking yellowy stomach colouring of the inanga. It started to change colour and it didn't look right. I think it has a lot to do with the change - bland change of inangas to - often we see the pollen has got a lot to do, you see it come through here at the Ohau Channel today (Informant E).

I wouldn't take the risk of getting watercress from other areas because too many people are using sprays in the drains, the creeks running into the lakes (Informant E).

Whereas previously you would have quite healthy, and I don't know what healthy means, but they would - like the shell of the koura would be relatively strong and as the time went on the koura - like even when you eat you could, it was similar to a prawn in that when you broke it the flesh was still quite compact and still quite firm after you had cooked it, but recently if you - as you went on, the koura would actually become a lot more soft, like the flesh that you would be eating wouldn't be as firm and as sweet as it had been previously (Informant J).

Despite the level of environmental change and the potential for contamination, it needs to be acknowledged that lifestyles today leave little time for fishing activities.

6.5 Health and wellbeing of whanau members – the mixed methods and contradictions

Te Arawa continues to be dependent upon kai gathering both physically and culturally. Mahinga kai was the primary food source and the basis of an economy based on trade, barter and exchange. The transition from wild sourced kai to a western style of diet comprising commodity/convenience foods consequently impacted Te Arawa socially, culturally, economically and spiritually.

As part of the fisheries redress of the Te Arawa Settlement Act 2006 Te Arawa have their own fisheries regulations to manage their customary food gathering – Te Arawa Lakes (Fisheries) Regulations 2006. A Komiti Whakahaere has been established to coordinate the development of species management plans for each of 5 key mahinga kai species, namely koura, kakahi, koaro, smelt and tuna.

Toxic contamination and the resultant health impact on humans has received considerable research attention over the past three decades (Edelstein, 1988; Freudenburg, 1984; Perrow, 1984). This research seeks to explore the health risks of the changing kai gathering behaviours sourced by whanau and hapu in order to determine the ongoing risk of exposure to contaminants.

Changes to the relationship with the lakes have resulted in a range of health and wellbeing implications. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between the lakes and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

Physical health - Physical health is directly linked to the quantity and quality of food consumed, as well as the cultural, social and economic conditions within which individuals live. In the context of this research programme, physical health consequences arise from four factors:

1. changes in the nutritional value of foods consumed today compared to their traditional diet;

2. being denied access to gather also affects health by limiting the physical exercise associated with the act of gathering;

3. the risk of contamination of kai that is consumed;

4. the risk of contamination from the sites that kai is gathered from.

The loss of access and use of traditional resources is now recognised as being a contributor to a change to a western style of diet and the consequent rise in diet-related illnesses which from an economic perspective could cost society. However the converse is also of concern as for those whanau who still gather kai, there is a risk of exposure to contaminants from eating wild sourced kai.

An important health benefit of kai gathering results from the act of gathering itself – an activity that requires physical activity. The importance of exercise to general physical health is widely recognised.

> *The old man; threw us in the lake and taught us how to swim and we were about seven or eight. We used to come down here but then we were diving when we were about 10, 11. We were going out with the old man and diving, and we dived from then right through but only to feed the, like I say, again (Informant C).*

> *Well, I was lucky, I had the chance to be brought up on the shores of the lake. And during the summer I would go down there at 10 o'clock in the morning, after breakfast, jump off the boat when the whistles come, go back after lunch. That would be hard case. We were all sitting out in the boat, and the whistles all along the lake go. You know, like my cousin Fred, my cousin Johnny Mata, their father and then my mum, my koroua and them would whistle out. And then we would jump off, swim back and go for lunch and then meet you after 1 o'clock, come back down to the lake. And we were still there at night, light our fires and go home sometimes at 10, 11 o'clock at night, after we would get the run of koura (Informant M).*

> *It was our playground. Yeah. There was places – we had the clay rocks… We used to walk those every day, in the water (Informant M).*

> *Every time we went out. It never ran out, eh? We would go down and we would all meet down at the lakefront and play around and what- have-you, and then go out and then just dive, (Informant M).*

The comments confirm that Te Arawa, like other Maori, were physically active in the course of gathering kai. Although the amount of exercise that whanau get now as a result of gathering has declined, those surveyed reported engaging in some activity,

although the frequency of such activity has declined as gathering behaviours have changed.

However, it cannot be assumed that all gathering will be beneficial as the physical act of gathering resources could expose whanau to health risks as the sites where gathering occurs, specifically the waters and sediments, could be contaminated. The levels of contaminants in kai gathered and the environments in which they are found in the Rotorua lakes area, will be reported separately. In addition, models describing possible risk to tangata whenua will be developed as part of the risk assessment and communication component of this project.

> *It is common for those children today to have sore eyes or running eyes, diving into the water that has become contaminated by goodness knows what from up top (Informant A).*
>
> *I shot a lot of ducks. …We shoot the Green Lake and nobody shoots the Green Lake ….I need a mate now. I need a mate with a small boat so we just can put it into the Green Lake and set our maemae (Informant A).*
>
> *See, a lot of our rivers and waters were commonly used for washing clothes and they had their lines along the riverbanks. If you notice, you see their clothes hanging up, and of course if you go down to Kawerau, people are worried about the effects from the mill. Well they are still having that – ongoing problem with the bottom end of the Tarawera River (Informant A).*
>
> *And the safest place to swim is actually down at Tarua Road in the Aquatic (Informant M).*

Wellbeing - The benefits derived from being in natural settings are also gaining increased recognition (Kaplan and Kaplan 1977, 1982). In addition to the data on diseases within the family (using data obtained from the Kai Consumption Survey), the interviewees described the broader social, economic and cultural impacts resulting from the changing patterns of kai gathering and consumption on their wellbeing – as individuals, as whanau and as a collective. The comments of informants describe the contribution of gathering and eating kai on wellbeing.

Continuity of the relationship between tangata whenua and the lakes of the Rotorua region through many generations has been essential in the creation and maintenance of a powerful sense of place and whānau - reinforcing ancestral connections, identity, pride and ownership of the area. This relationship has also been the source of healthy kai that has sustained the whanau of Te Arawa. It also brings responsibility and

obligation for honouring and maintaining the kaitiakitanga, mātauranga, tikanga, and manaakitanga associated with aquatic environments. The lakes were and continue to be, the dominant 'environmental' context for work, leisure, culture, life and death. Indeed, many features of the lake environment provide a daily reminder to past events and people, reinforcing this strong sense of place-centered identity and kaitiakitanga. The lakes of the Rotorua region are both physical and emotional tūrangawaewae.

Having experienced a slow cultural transformation for generations, some hapu members feel/know their collective wairua has been damaged, which brings its own type of frustration and mamae. However, despite the many changes there are those who feel culturally and spiritually sound and have an optimistic view on hapu and cultural health. For them, asserting rangatiratanga is necessary if hapu and cultural health are to improve over the next generations. For many indigenous tribes, the primary goal is simply survival – politically, culturally and physically. While physical survival will always be dependent on the lands, freshwaters and seas within a tribal territory continuing to sustain life, cultural survival is predicated on the assumption that the tribe will continue to have the will and the capacity to preserve practices that sustain, strengthen and revitalize the iwi sense of identity.

> *We have got to treat all these other lakes the same as they are treating Rotorua and Rotoiti (Informant A).*

7. The next steps in the research process

7.1 Next steps

Using the site specific data and the species data that resulted from the Kai Consumption Survey, the next stage of the research has identified the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori. A summary of the sites and species from Te Arawa that were used to develop a sampling programme for investigation of contaminant levels is presented in Appendix 2. The analyses that have been undertaken will then enable the researchers to establish potential pathways of contaminant bioaccumulation via the food web, as well as potential risks based on present kai consumption patterns. This information will then be available to whanau from Te Arawa. It is at this stage that consideration needs to be given to how the data (and implementation) is to be disseminated.

7.2 Disseminating advice about contamination issues

> *Communicating the risks of environmental contaminants in the food chain to northern Aboriginal peoples poses significant challenges for communities at risk and environment and health professionals alike..… communication practice on this issue include increased fear and confusion in northern communities, changes in the dietary behaviour and traditional lifestyles of their residents, and associated impacts on their society, economy, and health. … The importance of this information is increasing as research begins to detect subtle health effects from exposure to these substances among newborns in some northern regions. Thus planning and evaluation are needed for risk communication, and possibly changes to the scale at which communication work is done in northern communities. Furgal et al., (2005).*

Furgal et al (2005) contends that some of the challenges associated with communicating contamination risks are unique to the specific issue and the context of communities. Te Arawa find themselves in a Catch 22 - as a result of trying to balance two potentially conflicting perspectives:

1. the health and wellbeing benefits that results from the continuing practice of gathering kai or conversely the impacts that arise when changing from a traditional lifestyle and diet; and

2. the adverse impacts on health and wellbeing arising from contamination of aquatic ecosystems and potentially the kai species themselves.

The cultural comprehension of what is "risky" behaviour is complex. Maori, like those in other indigenous communities, have limited experience with food safety issues of relevance to contaminants potentially found in foods they gather.

Understanding how indigenous communities perceive contaminants has significant impacts on the reception and effect of messages delivered. Usher et al., (1995) contend that communities may distrust the information they receive about contaminants in foods and their distrust could affect their reception of further explanations or clarifications. Furgal et al., (2003a) found that concerns over contaminants was not a determinant of food choice in one Labrador community, yet Kuhnlein et al., (2003) reported that 42% of women interviewed in five western Arctic communities indicated "concern over contaminants" as a reason why they did not serve more foods to their families. The objective of this research is to effectively convey to Maori the potential risk of gathering kai. Overseas research indicates a number of aspects need to be addressed.

The advice to be delivered - A minimal amount of work has been undertaken to identify the types of messages that elicit certain or desired responses. Usher et al., (1995) indicates that good messages are direct, simple, not condescending, put in a personal context, accurate, translated into local languages, delivered early and often, and build upon local understandings and knowledge of the issue.

> *What needs to happen is, as part of the discussion, is finding the alternative…. we are not simply saying that the message is "here is the problem, deal with it" actually "here's the problem but we have an alternative for you so that you can still continue to do the things that you and your family have always done" (Informant J).*

Materials to be presented - Numerous forms of materials have been used to communicate messages on contaminants and country food in North America including posters, fact sheets, reports, pamphlets, personal letters, radio public service announcements, radio call-in shows, regional video programs, door-to-door or face-to face communication, community meetings, school curriculum materials, and national live television broadcasts (Furgal et al., 2003b). From the Kai Consumption Survey we know that a range of media is likely to be needed.

Delivering the advice - To be effective a message has to be distributed through pathways that ensure it will reach and engage the target audience - in this instance, hapu members who gather kai. Furgal (1999) and Grondin and Carron (1999) in their work with northern hemisphere communities identified the need to consider both formal and informal pathways of delivery and information circulation. Data from the

Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by:

Formal networks: Health Protection Officers and Environmental Protection Officers.

Maori Health Workers.

Informal networks Whanau members.

While Maori have been active in developing relationships with resource management agencies, formalised relationships with the parties that can undertake the research necessary to understand contamination issues and deliver the messages may need to be developed.

> *Apart from the paper and the signs being out there, email is always a good communication tool, a text (Informant F).*

> *I suppose an exercise would good for our people, you know, to know what are the - which are the best weeds for the lake and which are the real pests so that we, yeah - a lot of our people don't know this. In some cases don't know the difference between the native weed and the pest weed (Informant F).Maori learn best by kanohi ki te kanohi, face to face discussion, and also being involved in the discussion. So not just simply saying "this is it, here it is", but saying "okay, this is it, here it is, what do you think the solutions are for you and your family". You know, so - and the other key is finding presenters that actually present in a medium that they take it on board, and that is the key (Informant J).*

Specificity - Vaughan (1995) and Slovic (2000) contend that personal experience, gender, age, socioeconomic status, and profession influence perceptions of risk. Understanding how Te Arawa see the issue is critical to ensure that the communication is best oriented towards their understandings and perspectives.

McGrath (2003) argues for a relationship based approach to exchanging knowledge on issues such as contaminants within and between communities. This will require scientists and communicators to understand the informal paths of information flow in communities so they can develop mechanisms that support and utilise these pathways to communicate information about contaminants.

> *One might argue that little true "communication" on the issues of contaminants, food, and health has taken place between scientists, health professionals, and Aboriginal residents in many northern communities; rather, a great deal of scientific information has simply been disseminated (Leiss, 1997).*

Understanding and developing ways to better communicate information on contaminants and their impacts on health is critical. Reports of contamination can undermine confidence of whanau in their environment and gathering of resources as a source of individual and collective well-being.

7.3 Implications for future management

The results of the Kai Consumption Survey show that the gathering and consumption of kai awa, kai roto and kai moana is highly complex. This is in terms of both the differences in availability of kai awa, kai roto and kai moana between hapu, the diversity of aquatic habitats, and the diversity within and between whanau. There is some indication that consumption levels are also related to the quality of kai awa, kai roto and kai moana that is available and the quality of aquatic ecosystems that they come into contact with when gathering. These results enable us to make a number of observations with respect to future management.

Sites from which kai is gathered - Where and when people gather kai is a function of the location of their work, the proximity of waterbodies, and other activities of a whanau. This is supported by Garaway (2005) who argues in relation to fishing that it is almost always combined with other activities. The Kai Consumption Survey confirmed that whanau are likely to go fishing in a nearby lake or stream thus reducing the time spent travelling between areas of work, home and collecting. For Te Arawa this means gathering from the lakes. Fortunately many in the community, aside from Te Arawa, are putting their hand up to protect the many waterbodies that support kai gathering.

Perceived changes in the abundance of species - If Maori are interacting with aquatic ecosystems on a regular basis they are ideally placed to observe changes – to sites and to species. Guidance is needed to ensure that their observations are part of a structured and robustly designed perception study so that they do not have their observations dismissed as being "anecdotal". However, the challenge will be that few agencies support perception based assessments – let alone prove that a species is at risk and in need of management intervention. The implementation of the Te Arawa Lakes Regulations (2006) includes development of species management plans by Te Arawa iwi members, through a Komiti Whakahaere. As part of these plans a

monitoring programme is likely to be initiated and will allow direct involvement of iwi members in reporting on changes in species abundance and distribution.

Kai gathering behaviours - There is a complex mosaic of uses and users of aquatic resources within a takiwa that collectively shape the livelihoods of whanau and hapu. Kai gathering cannot be classified as one activity. Instead, they are part of a complex combination of activities for a range of members in a household. As the survey shows whanau hunt, and tend fruit and vegetable gardens. The effort afforded to gather kai is not a homogenous activity – it is a flexible activity that is undertaken by different people, at different times, targeting different species from different waterbodies using a range of equipment. Collectively this confirms a complex relationship between humans and their environment. It is important that information continues to be collected to increase our understanding of these range of behaviours, including their aspirations.

Health and wellbeing of whanau members - Some informants explained that kaumatua represent valuable human and cultural capital: knowledgeable about kai gathering. While they may be disempowered by modern technologies they are well connected in the hapu and many continue to utilise their knowledge of mahinga kai.

7.4 Conclusion

This report has confirmed that the lakes and coast are integral to the cultural identity of the whanau of Te Arawa. It has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of both kai awa, kai roto and kai moana in the behaviours of whanau and hapu resident in the Rotorua Lakes Area.

The results from the Kaimoana Consumption Survey clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal that kai awa, kai roto and kai moana are vitally important to whanau and hapu in the Rotorua Lakes Area. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

Although the tendency with some contamination studies is to focus on the negative aspects whanau, despite witnessing degradation to valued taonga, articulated a positive vision for the future and we conclude this report with their words.

It would be wonderful to see the lakes come back to its pristine, clean quality (Informant E).

Nice clean, pristine – what I would like to see happen is my grandchildren or even their grandchildren dive in the lake and they can still see the same sparkle I did. And not put your foot on the bottom and then its dustier on the bottom of the lake than it is out of the lake. You know what I mean? (Informant M).

I think I'd like to see them cleaned up so that my kids don't have to go down every summer and read to see if there is a warning before they go swimming and that, you know. Be like when I was younger, used to just go down, you can swim, and an increase in the koura in our new clean lakes because I know they are getting scarcer and scarcer for those who do still go out and try catch them. I mean, I used to have fun using the scoop to catch them but I think the last time I went out it was a waste of time, didn't even get a pot full (Informant G).

But the amount of restorative work required cannot be overestimated –

That is what my wish is, to help the lakes. Because it is our food basket - treat it like that, and if you do, the quality – it's water, and water is sustainable - without water you can't do anything. You cannot even exist. My father said "take the sewage out of the lakes" and he fought through the Treaty of Waitangi to get the Rotorua District Council to take the sewage out. He proved the point, but when he died he said - it took him a lifetime. And it was so difficult because bureaucracy. He said – "You know, I've got mum to thank me. Mum was the one - she would help me. I would sit up late at night writing to the Crown. Nobody would listen to me". …So, that is my wish, that people will think twice about the environment and put more money into saving our lakes (Informant E).

The need for collaboration is recognised as an important strategy for realising the vision –

I see a positive future if all parties can work together and make sure that they are rowing the same boat and going on the same journey, and I mean, yes, if we get back to some of the fundamentals and, you know, and it can be something as little as starting to recycle properly so that those things aren't going into our lakes, simple stuff that if people within their homes start taking ownership for what is going on in their home and the things that they do as a

person and the impact on the environment, then if everybody started doing that, the benefits for Rotorua, we would see them in as short of a time as it has taken to pollute the lake (Informant J).

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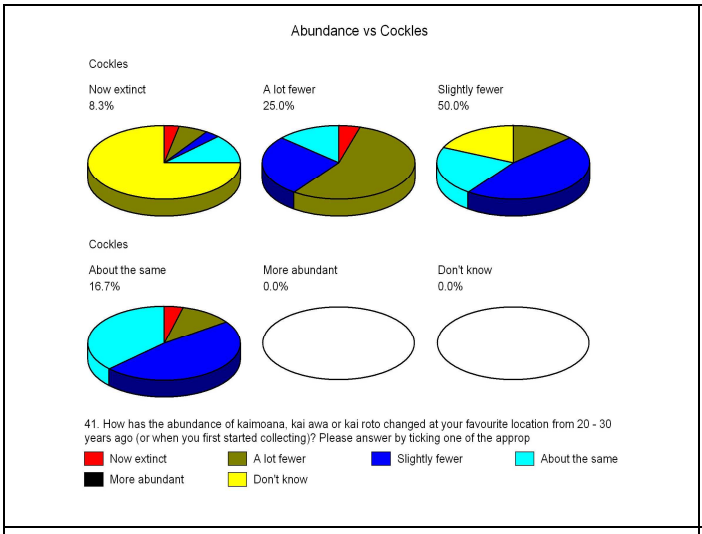
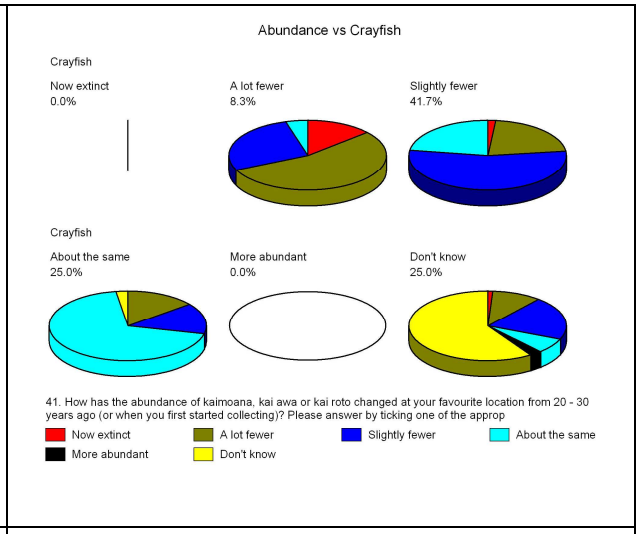
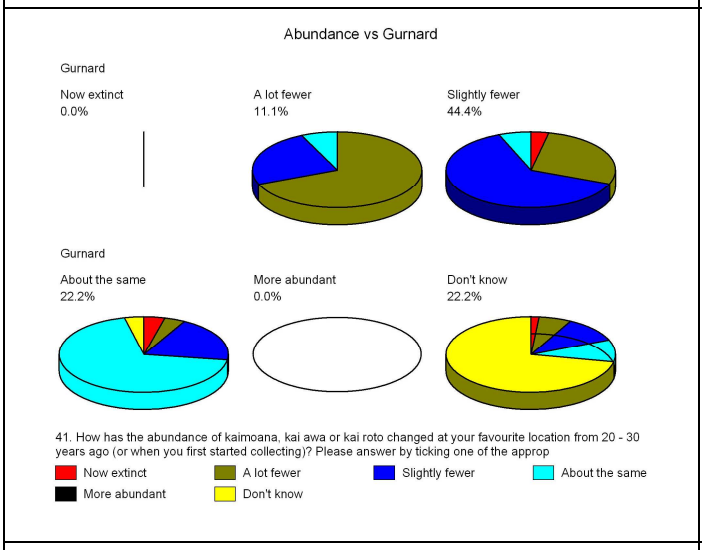
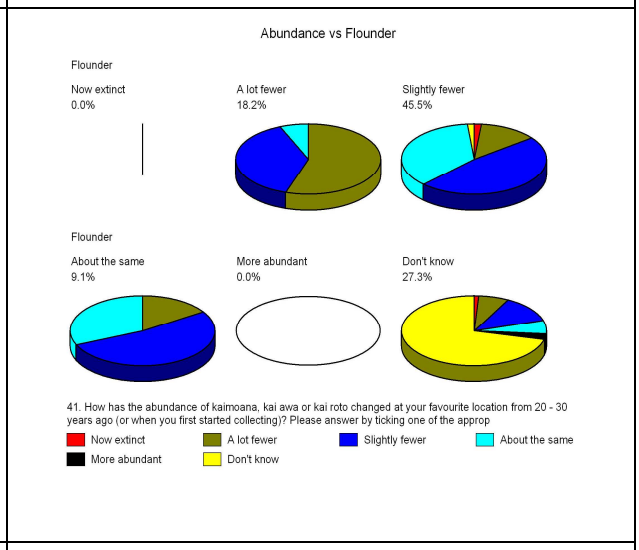
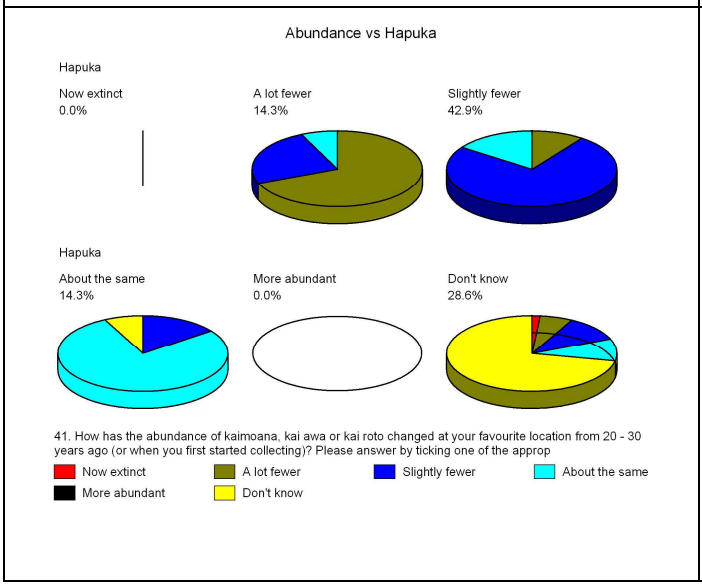
Appendix 1: Perception of changes in abundance of species

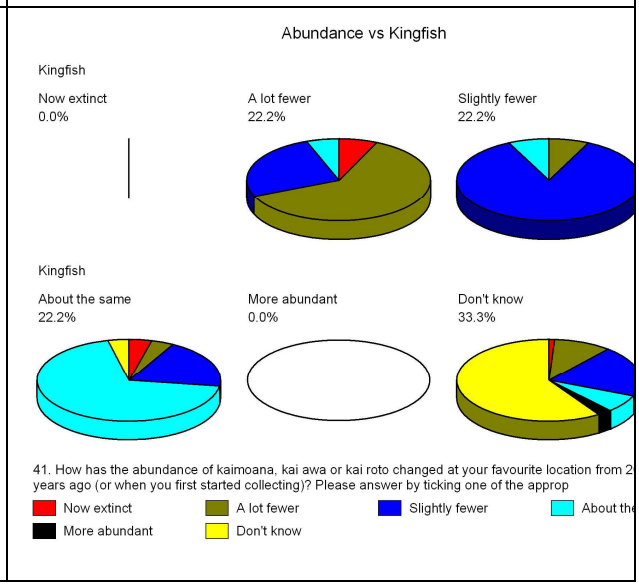


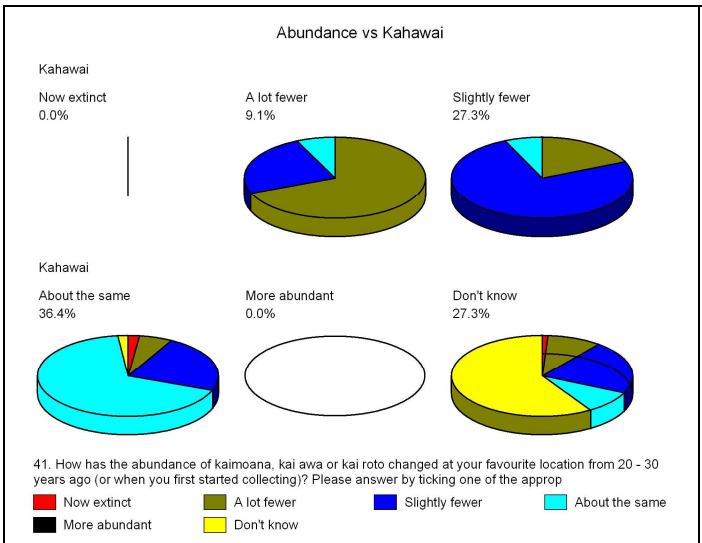


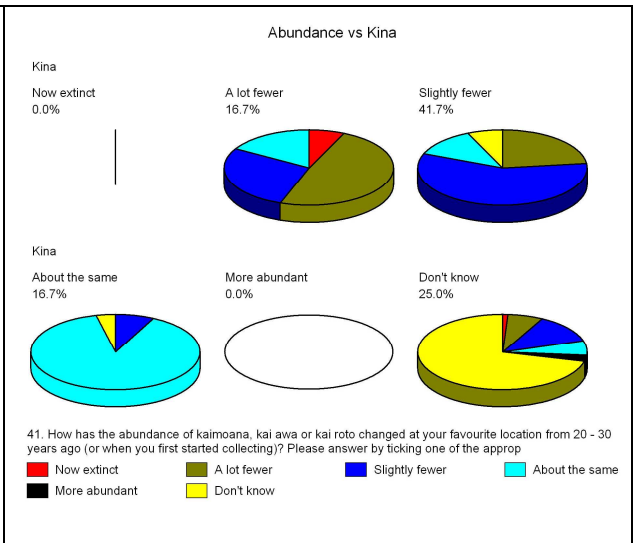


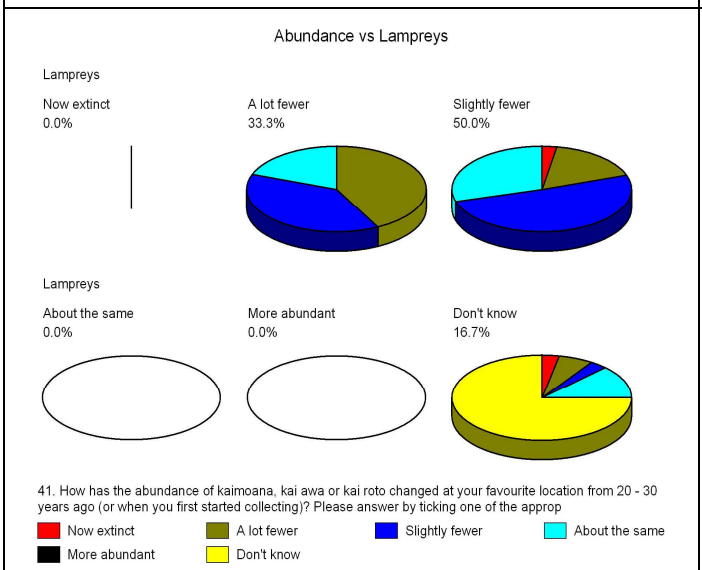


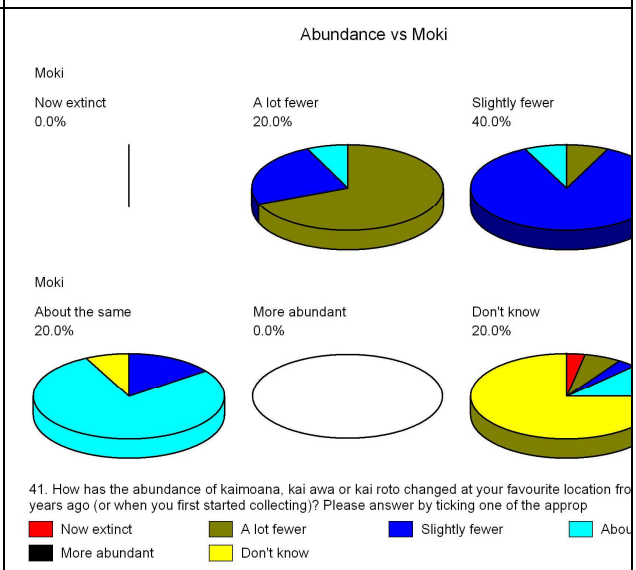


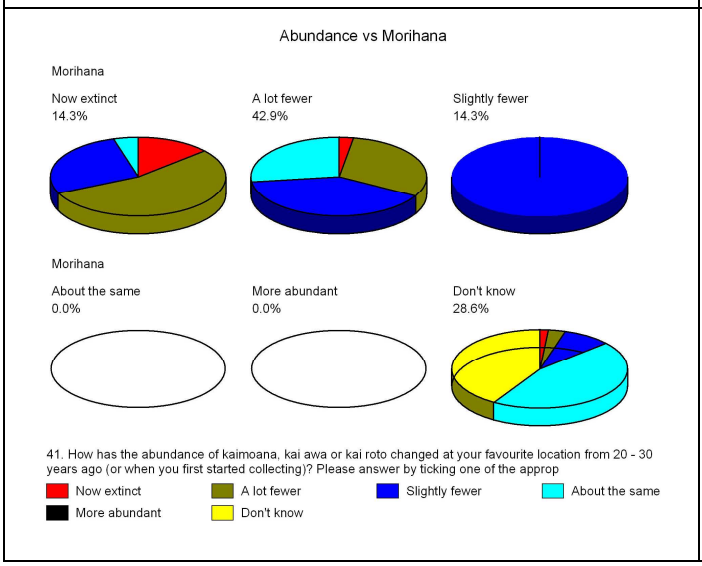


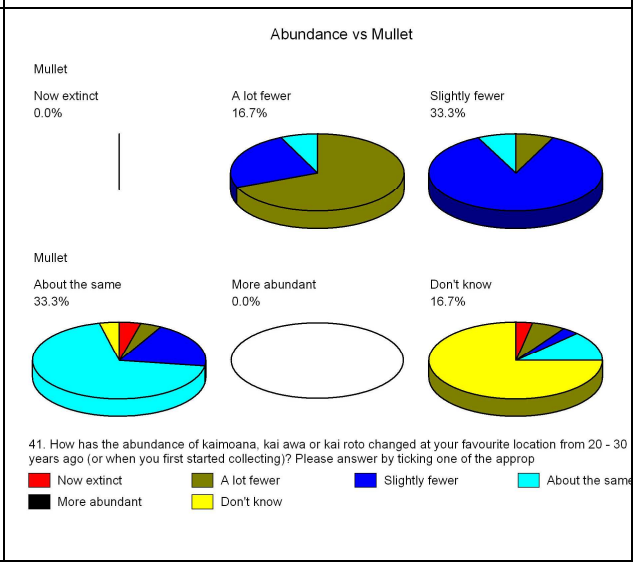

Abundance vs Kahawai
Kahawai
Now extinct
0.0%
A lot fewer
9.1%
Slightly fewer
27.3%
Kahawai
About the same
36.4%
More abundant
0.0%
Don't know
27.3%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

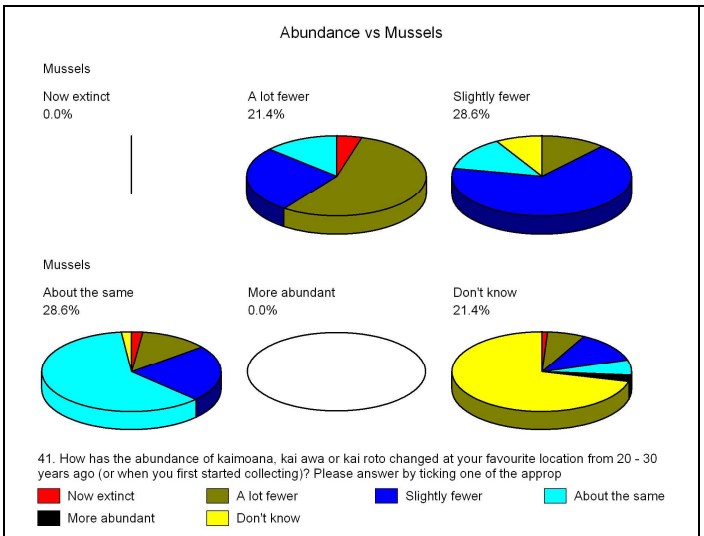

Abundance vs Kina
Kina
Now extinct
0.0%
A lot fewer
16.7%
Slightly fewer
41.7%
Kina
About the same
16.7%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

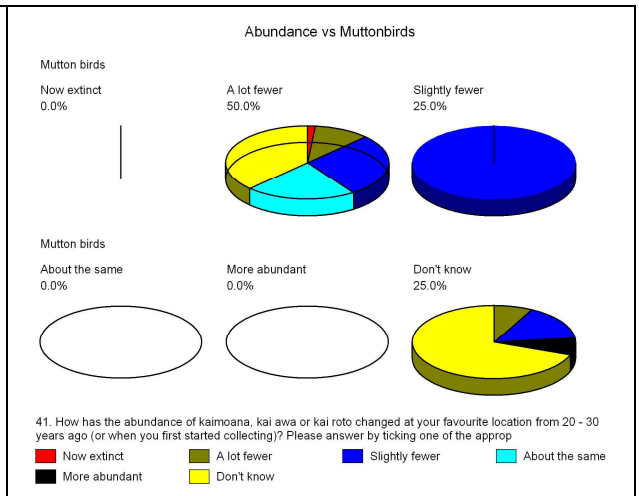

Abundance vs Lampreys
Lampreys
Now extinct
0.0%
A lot fewer
33.3%
Slightly fewer
50.0%
Lampreys
About the same
0.0%
More abundant
0.0%
Don't know
16.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

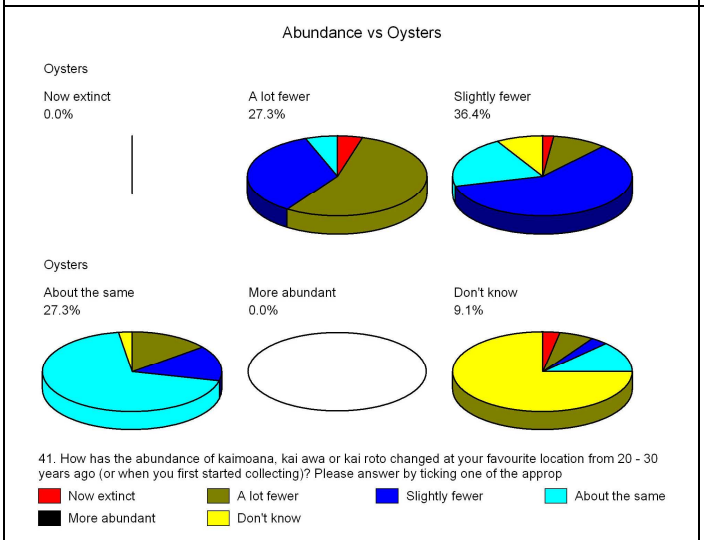

Abundance vs Moki
Moki
Now extinct
0.0%
A lot fewer
20.0%
Slightly fewer
40.0%
Moki
About the same
20.0%
More abundant
0.0%
Don't know
20.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location fro
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

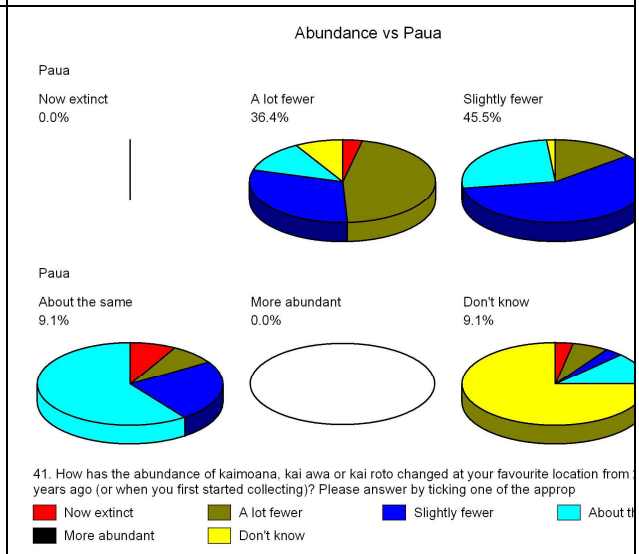

Abundance vs Morihana
Morihana
Now extinct
14.3%
A lot fewer
42.9%
Slightly fewer
14.3%
Morihana
About the same
0.0%
More abundant
0.0%
Don't know
28.6%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

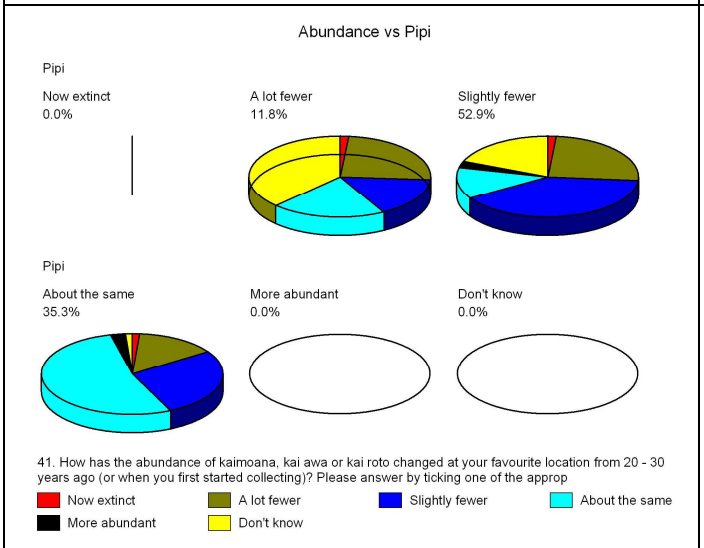

Abundance vs Mullet
Mullet
Now extinct
0.0%
A lot fewer
16.7%
Slightly fewer
33.3%
Mullet
About the same
33.3%
More abundant
0.0%
Don't know
16.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

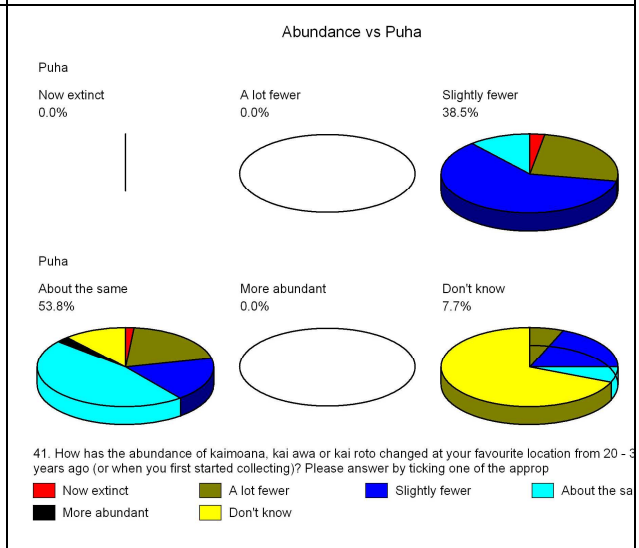

Abundance vs Mussels
Mussels
Now extinct
0.0%
A lot fewer
21.4%
Slightly fewer
28.6%
Mussels
About the same
28.6%
More abundant
0.0%
Don't know
21.4%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Muttonbirds
Mutton birds
Now extinct
0.0%
A lot fewer
50.0%
Slightly fewer
25.0%
Mutton birds
About the same
0.0%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

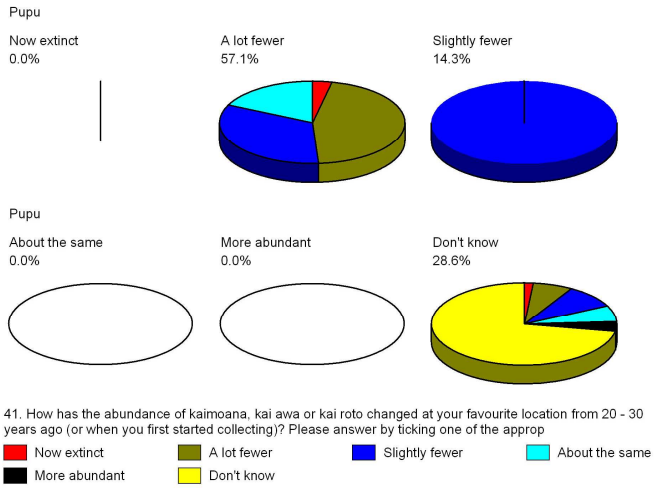

Abundance vs Oysters
Oysters
Now extinct
0.0%
A lot fewer
27.3%
Slightly fewer
36.4%
Oysters
About the same
27.3%
More abundant
0.0%
Don't know
9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Paua
Paua
Now extinct
0.0%
A lot fewer
36.4%
Slightly fewer
45.5%
Paua
About the same
9.1%
More abundant
0.0%
Don't know
9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know


Abundance vs Pipi
Pipi
Now extinct
0.0%
A lot fewer
11.8%
Slightly fewer
52.9%
Pipi
About the same
35.3%
More abundant
0.0%
Don't know
0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Puha
Puha
Now extinct
0.0%
A lot fewer
0.0%
Slightly fewer
38.5%
Puha
About the same
53.8%
More abundant
0.0%
Don't know
7.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 -
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

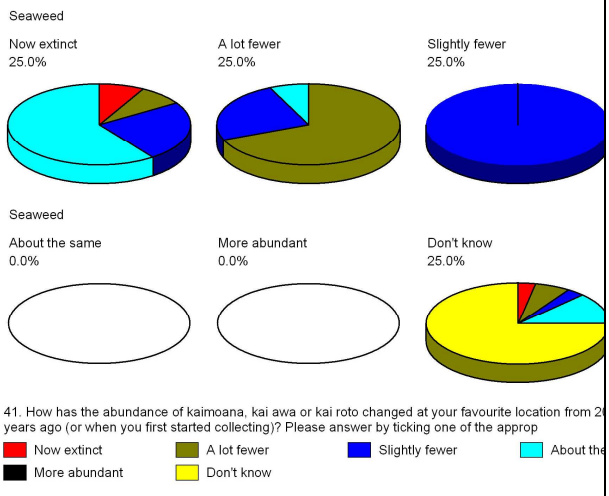
Abundance vs Pupu



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

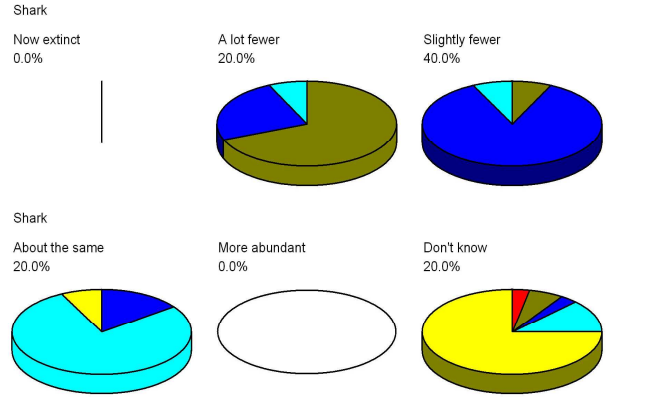
Abundance vs Seaweed



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 2
years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the
More abundant | Don't know

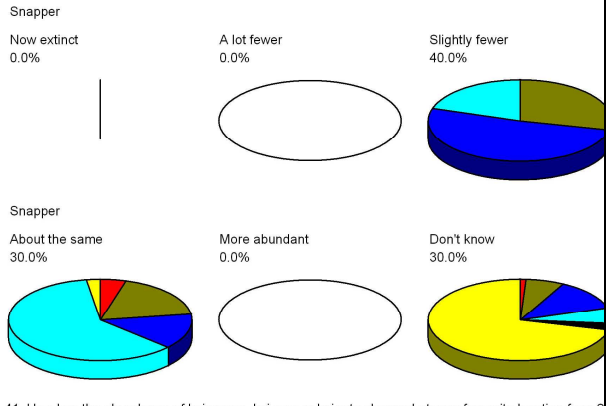
Abundance vs Shark



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

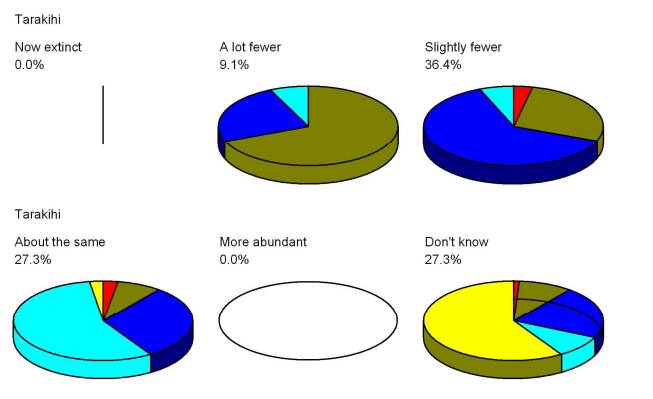
Abundance vs Snapper



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 2
years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About th
More abundant | Don't know

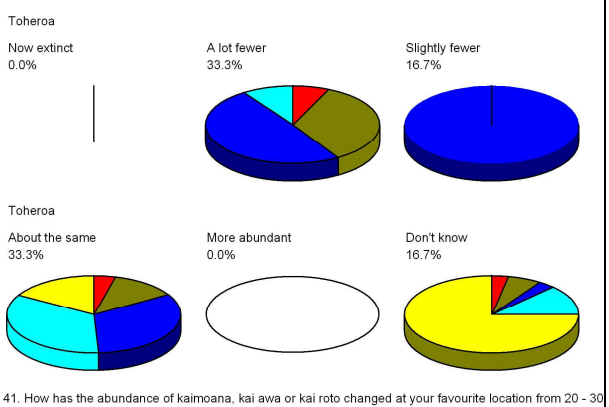
Abundance vs Tarakihi



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

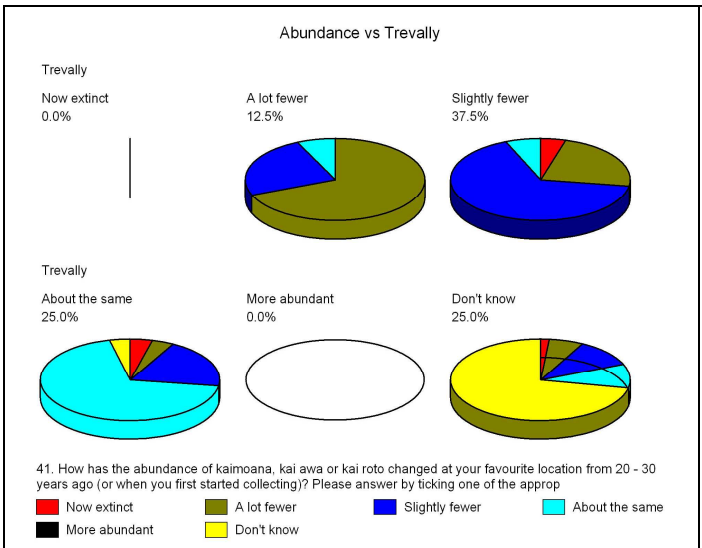
Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

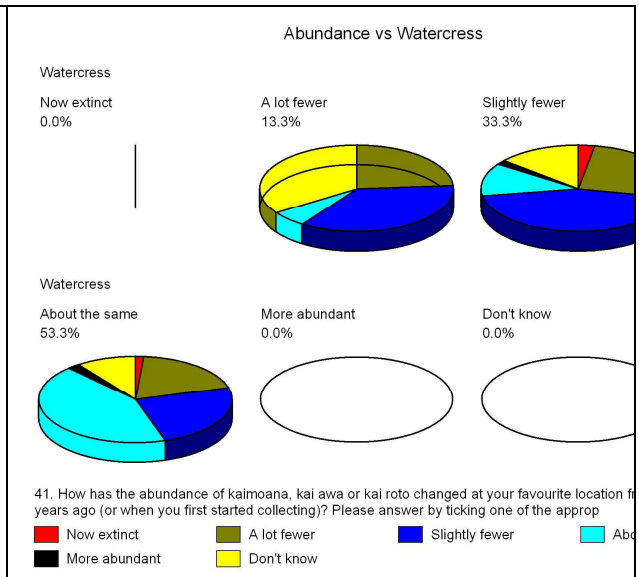
Abundance vs Toheroa

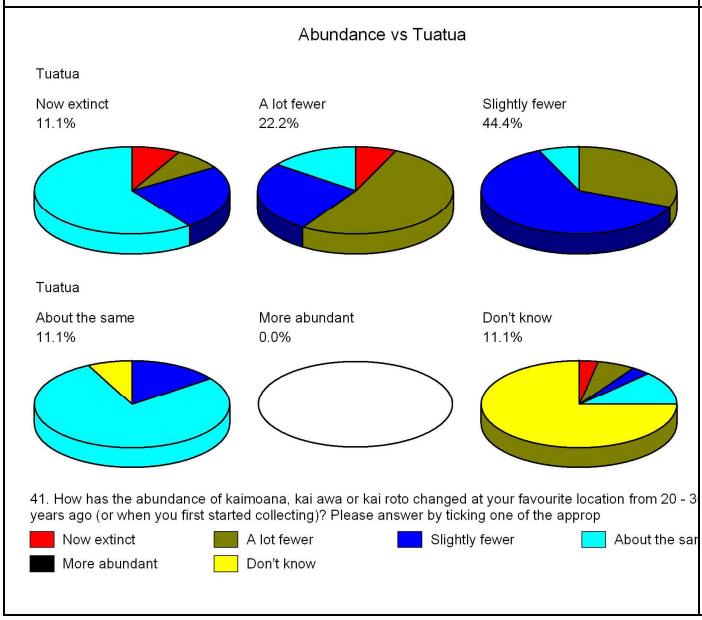


41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the sam
More abundant | Don't know


Abundance vs Trevally
Trevally
Now extinct
0.0%
A lot fewer
12.5%
Slightly fewer
37.5%
Trevally
About the same
25.0%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Watercress
Watercress
Now extinct
0.0%
A lot fewer
13.3%
Slightly fewer
33.3%
Watercress
About the same
53.3%
More abundant
0.0%
Don't know
0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location fr
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know


Abundance vs Tuatua
Tuatua
Now extinct
11.1%
A lot fewer
22.2%
Slightly fewer
44.4%
Tuatua
About the same
11.1%
More abundant
0.0%
Don't know
11.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 3
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

Appendix 2: Sites and species identified by iwi participants (number of respondents)

Kai	Rotorua	Rotoiti	Rotoma	Tarawera	Rotokakahi	Coast (incl Maketu)	Streams (incl Kaituna)	Ohau Channel	TOTAL
Trout	2	3		3	2	1	1	1	**13**
Koura	2	4	1	2				1	**10**
Pipi						7			**7**
Kakahi	1	3						1	**5**
Cockles						5			**5**
Tuatua						5			**5**
Inanga (Whitebait)		3				1	1		**5**
Eel		2				2	1		**5**
Kahawai						5			**5**
Kina						5			**5**
Paua						5			**5**
Mussels						5			**5**
Crayfish						5			**5**
Morihana (goldfish)		1	1	1	1				**4**
Watercress	1	3							**4**
Puha	2	2							**4**
Snapper						4			**4**
Flounder						4			**4**
Tarakihi						4			**4**
Pupu (mudsnail)						2	1		**3**
Kingfish						3			**3**
Moki						3			**3**
Shark						3			**3**
Oysters						3			**3**
Hapuka						2			**2**
Gurnard						2			**2**
Trevally						2			**2**
Seaweed						2			**2**
Lampreys						1			**1**
Mullet						1			**1**

Note: No gathering recorded from lakes Rotomahana, Rerewhakaaitu, Okareka, Okataina, Tikitapu or Rotoehu.

NIWA
Taihoro Nukurangi

A survey of wild kai consumption in the Te Arawa rohe

NIWA Client Report: HAM2010-096
August 2010

NIWA Project: HRC08201

A survey of wild kai consumption in the Te Arawa rohe

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Te Arawa Lakes Trust

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Contents

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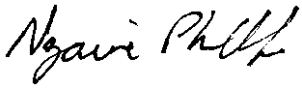

Dr Ngaire Phillips

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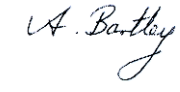


Executive Summary

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. Human health may be threatened either by the consumption of food (especially fish and shellfish) contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001). This research, funded by the New Zealand Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming. As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined, and pathways of potential contaminant uptake by tangata whenua investigated by analyzing relevant food-chain components.

Three Maori communities were involved in this research: Te Arawa: centred around the Te Arawa / Rotorua Lakes and Maketu coastal area; Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and Te Runanga o Arowhenua: centred on South Canterbury. The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts on the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

This report documents the results of the above research programme, specifically investigating the level of kai consumed by Te Arawa, whose whanau have resided in the Rotorua area for centuries. The lakes of the region were and remain taonga (treasures) for Te Arawa and are the foundation of their identity, cultural integrity, wairua, tikanga and kawa. For centuries the lakes have also been the mainstay of their economy as they and their margins were an important source of freshwater fish, waterfowl, and plants[1].

[1] For a detailed account of the traditional history of Te Arawa, see D M Stafford (1967) *A History of the Te Arawa People*, Auckland, Reed Books

On 18 December 2004, the Crown and Te Arawa signed a Deed of Settlement for Te Arawa Historical Claims and Remaining Annuity Issues over 14 lakes; Lakes Rotoehu, Rotomä, Rotoiti/Te Roto-Whaiti-i-kite-ai-a-Ihenga-i-Ariki- ai- a Kahumatamomoe, Rotorua / Rotorua-nui-a Kahumatamomoe , Ökataina / Te Moana i kataina a Te Rangitakaroro, Ökareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngähewa, Tutaeinanga, Ngäpouri/Opouri and Ökaro/Ngakaro.

With respect to the research design drawing on the earlier work of Bebbington (1999), importance of kai to whanau was examined using standard interview techniques according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

All of those interviewed for this research expressed a strong relationship with the lakes and the wider terrestrial and marine surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship. Two thirds of the participants spent their childhood in the middle of the North Island while 15.8% specifically identified Rotorua as the place where they spent their childhood.

A large variety of wild kai continues to be regularly collected, gifted, purchased and/or consumed. While whanau made use of many species, the centrality of koura and whitebait as a critical food source in the Rotorua Lakes is well known and is reflected in the initiatives to restore populations of taonga species. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in Rotorua Lakes region. Consistent with a kai gathering lifestyle:

- 42% grew their own vegetables;

- of the 42%, 21% of those who grew vegetables also grew fruit.

Having determined that all of respondents do consume different types of kai:

- 38% of respondents said they now only eat kai on special occasions; while

- 25.5% eat kai less than once a month; and

- 10% only eat kai 1-3 times per month.

In other words 73% eat kai 1-3 times per month or less. Of concern when reviewing the complete list of species and the frequency with which each was consumed, some respondents identified six species as being extinct (i.e., no longer present in the areas they gather kai from) – kakahi, cockles, koura, morihana, seaweed and tuatua.

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were then used as the basis for a sampling programme which examined contaminants in sediment and kai. Kai was gathered from 11 of the 14 waterbodies listed. The most highly used area was the coast as 52.4% said they gathered from Maketu followed by lakes Rotoiti (17.5%) and Tarawera (12%). There was no gathering by participants from lakes Rerewhakaaitu, Okareka, and Tikitapu.

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered. With respect to abundance, 56% felt that "fewer" stocks were available today, specifically, 22% of respondents believed that across all species gathered there were now a "lot fewer" available while another 33% believed that abundance was "slightly fewer".

There are little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation we assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats in the lakes, especially Rotorua. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, we can conclude that all respondents still consume kai awa, kai roto, or kai moana. In comparison to historic levels, the following conclusions can be drawn:

- The quantities available are substantially lower than historic levels and the levels desired by whanau who wish to engage in mahinga kai practices. The species that possibly approach

adequate abundance are mussels, which respondents confirmed were available and often sourced from the supermarket or takeaway.

> *You don't go out and get any watercress anymore, your river has become Pak'n Save (Informant M).*
>
> *I mean, we have got to the stage we are feeling directed to go to supermarkets and buy from there, it is more convenient (Informant E).*
>
> *We get our bulk food from the supermarket, whether that's vegetables, it's fish, seafood. Everything comes from the supermarkets. It is totally different today. We have no control over that. We aren't able to go out and get koura like how we did - it is a thing of the past (Informant E).*

- For almost every species, the majority of respondents believed that the abundance of populations was declining.

- The majority of kai species are now only consumed on special occasions.

- The quantities of kai consumed have steadily decreased:

    - from approximately 241g historically;

    - to about 94.1g in the mid twentieth century;

    - to approximately 36.2g today (which is similar to the average New Zealand consumption rate).

Part of the reduction in quantities consumed can be attributed to environmental degradation. A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining. In the 1930s, a number of factors were blamed for the decline in whitebait catches including: excessive take by whitebaiters; predation by sea birds, herrings, eels, trout; draining of swamps, backwaters, and creeks; or damage to estuarine spawning grounds by stock. By the 1990s a number of native fish species had disappeared from waterways or were in decline. A combination of factors was attributed to these losses including: afforestation, sedimentation and flooding, wetland drainage, river modifications, sewage, water abstraction (irrigation), and pollution arising from adjacent land uses. All of these changes directly and indirectly impact cultural practices, principles and tikanga associated with food gathering:

- Young people are growing up not learning the basic knowledge associated with kai species, fishing, boating and gathering.

- Whanau are "losing the taste" of kai.

From 30 down there wouldn't be a huge interest in it because it is not something that they have grown up with, but certainly from my age up, like, you know, if my grandmother was to - if you were to put a plate of koura in front of her, I think she would almost eat the shell from it. You know, that is the sort of level of delicacy it is for her, whereas if I were to put it in front of my son, he actually wouldn't be that impressed with it (Informant J).

- Kai generally was known to be good for health. There is a feeling that the younger generation don't know this, or if they do, they don't practice it.

- Fish and seafood is purchased more now, but often as fish and chips.

- Water quality is a concern for parents and therefore they are reluctant to let kids explore/play in aquatic environments unattended.

- Parents feel their children have missed something not growing up in an active hapū gathering environment.

- The context within which fundamental cultural practices such as whanaungatanga are learned has been impacted.

Finally, the result of these environmental perceptions is uncertainty as to whether or not kai is contaminated from within the urban environment.

Despite the level of environmental change and the potential for contamination, it also needs to be acknowledged that lifestyles today leave little time for fishing activities.

Changes to the health of the lakes and consequently the relationship of Te Arawa with the lakes have resulted in a range of health and wellbeing implications for Te Arawa whanui. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between the lakes and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

- 63.1% of respondents indicated they knew where to get advice about contamination issues.
- Only 26.4% (and two specific age groups – those in their 40s and 70s) did not know where to go to obtain information.

This study has confirmed that the lakes are integral to the cultural identity of the whanau of Te Arawa. It has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of kai awa, kai roto and kai moana in the behaviours of whanau and hapu resident in the Rotorua Lakes Area. The results clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal, that kai awa, kai roto and kai moana are vitally important to whanau and hapu in Rotorua Lakes. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

1. Introduction

1.1 Background

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. In the aquatic environment, contaminants transported by the air and in the water are highly likely to be deposited in sediments, where in turn, fish and shellfish are exposed. Contaminants are generally stored in the lipids of biota and can be biomagnified up the food-chain. Human health may be threatened either by the direct consumption of fish and shellfish contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001).

Concerns about the potential accumulation of contaminants in fish and other wildlife, which commonly form a component of indigenous peoples' diets, and their consequent potential effects on human health, has led to a worldwide proliferation of studies examining the effect of environmental contaminants on fish, wildlife and communities. For example, leading international indigenous contaminant research programmes, e.g., the Northern Contaminants Programme (NCP) and the Effects on Aboriginals from the Great Lakes Environment (EAGLE) Project were established in response to concerns regarding the exposure of humans to elevated levels of contaminants in the traditional subsistence diets of indigenous peoples. Research to date has shown that certain indigenous communities have elevated contaminant levels due to exposure through their traditional diet (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999; Van Oostdam et al., 2003). In addition, fish and wildlife are used as indicators of the health of the ecosystems.

The impact of environmental contamination on the resident "wild kai", and in turn, on Māori iwi/hapū consuming them, has not been investigated to date. A recent review of wild food in New Zealand identified gaps in knowledge of contaminants in non-commercial wild-caught foods, especially in terms of consumption levels (and hence exposure) (Turner et al., 2005). A resulting draft position paper identified a need for information and education on contaminants in kai (NZFSA 2005). In response, the National Institute for Water and Atmospheric Research (NIWA), in conjunction with Tipa & Associates and iwi research partners, Ngāti Hokopu ki Hokowhitu, Te Arawa Lakes Trust and Te Runanga o Arowhenua initiated a programme of research to investigate the contaminant levels and risk to Maori health associated with 'wild kai' – food gathered from the sea (kai moana), rivers (kai awa), and lakes (kai roto). This

research, funded by the Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

1.2 Research Rationale

Traditionally, Maori had their own knowledge systems of how the environment contributed to health and well-being. Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming.

As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined.

While it could be argued that contamination of wild kai has the potential to directly impact the physical health of Maori, the impacts of contamination and/or loss of an important cultural activity on wellbeing are also explored during the course of the project. Maori associate their well-being as individuals and as members of whanau, hapu and iwi, with maintaining the health of the natural environment (Durie 1994, 1998, Panelli and Tipa 2007, 2008). Maori strongly believe that the whenua and tangata are inextricably intertwined, and when one of these becomes unbalanced, the other equally suffers (Harmsworth and Warmenhoven 2002; Sims and Thompson-Fawcett 2002). Therefore, the sustainability of the natural environment and the long-term well-being of Maori are seen by some Maori as one and the same thing (Panelli and Tipa 2007). This is consistent with conceptualisation of wellbeing proposed by other indigenous communities (Adelson 2000, Greiner et al., 2005, McLennan 2003, McLennan and Khavarpour 2004, McGregor et al., 2003). Customary and recreationally gathered "wild kai" resources are therefore of significant cultural, recreational and economic importance in both traditional and contemporary Maori society (Waitangi Tribunal 1983, 1984, 1987, 1988, 1989, 1991, 1992, 1995, 1998)[2].

The majority of the international research in the area of contaminants in the traditional diets of indigenous peoples has primarily focused on the levels and health effects of exposure to heavy metals and organochlorine contaminants through the consumption of marine fish and mammals in peoples from the northern hemisphere, i.e., the Inuit

[2] The evidence submitted to the Tribunal by Iwi, and the summary reports from the Tribunal itself provide a graphic depiction of the significance of gathering kai for whanau, hapu and iwi.

people of northern Alaska, Canada and Greenland (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999). Research to date has shown that certain Inuit communities have elevated contaminant levels (e.g., mercury, lead and chlordane) due to exposure through their traditional diet (Van Oostdam et al., 2003).

It is unlikely that contemporary Maori communities have been exposed through their diet of "wild kai" to the levels of organochlorine contaminants as high as those observed in indigenous populations residing in the northern hemisphere (due to occurrence of large mammals in the customary diet of Inuit). However, the impact of environmental contamination on the resident "wild kai" and, in turn, on Māori iwi and hapu consuming them, has not been investigated to date. In addition, while existing consumptive advice is available for some species of relevance to Māori, this advice is based on average national consumptive patterns and doesn't account for potentially higher consumption rates of specific traditionally harvested foods by Māori, with its concomitant elevated exposure risk. Māori utilise kai from rivers, lakes and the oceans (as well as the land).

This research aims to identify and communicate the risks posed by the presence of environmental contaminants in the kai moana, kai roto and kai awa to the Maori communities that gather these resources. Major outcomes of the research will be development of a generically applicable risk assessment framework, and Maori-targeted risk communication strategies. It is envisaged that the research will be of interest to the wider Maori community, non-Maori, public health providers, as well as indigenous peoples worldwide for whom fish and shellfish constitute a major part of their diets.

1.3 Research aim

The overall aim of our research project is:

> *To determine to what extent locally available kai moana, kai roto, kai awa, and the associated aquatic environments pose a health risk to tangata whenua.*

Successful frameworks for undertaking research in a manner that is culturally acceptable, and which ensures the protection of intellectual property rights, were developed between NIWA and Ngāti Hokopu and Te Arawa during the HRC and FRST funded programmes 'The Revitalisation and Enhancement of Matauranga

Hauora of Aquatic Environments (C01X0226)' and 'Sustainability and Management Framework for Te Arawa Lakes' Customary Fisheries (CO1X0305)'.

Memoranda of Understanding between NIWA and Ngāti Hokopu ki Hokowhitu, Te Arawa and Te Runanga o Arowhenua have been established to formally record the expectations of conduct between NIWA and the respective parties with respect to the present research.

Three Maori communities were involved in the overall research:

- Te Arawa: centred around the Rotorua Lakes.
- Ngāti Hokopu ki Hokowhitu: centred around Whakatane.
- Te Runanga o Arowhenua: centred on South Canterbury.

These communities were selected on the basis of previous contact (and research projects underway) with key researchers. Permission was obtained and confirmed by a sub-contractual agreement.

The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

There are four main stages to the research project:

1. Objective 1: The first stage involves interviewing key informants and undertaking a survey to identify what kai moana species are harvested and eaten by iwi/hapu members from Ngāti Hokopu, Te Arawa and Te Runanga o Arowhenua, and the aquatic environments they are currently sourced from.

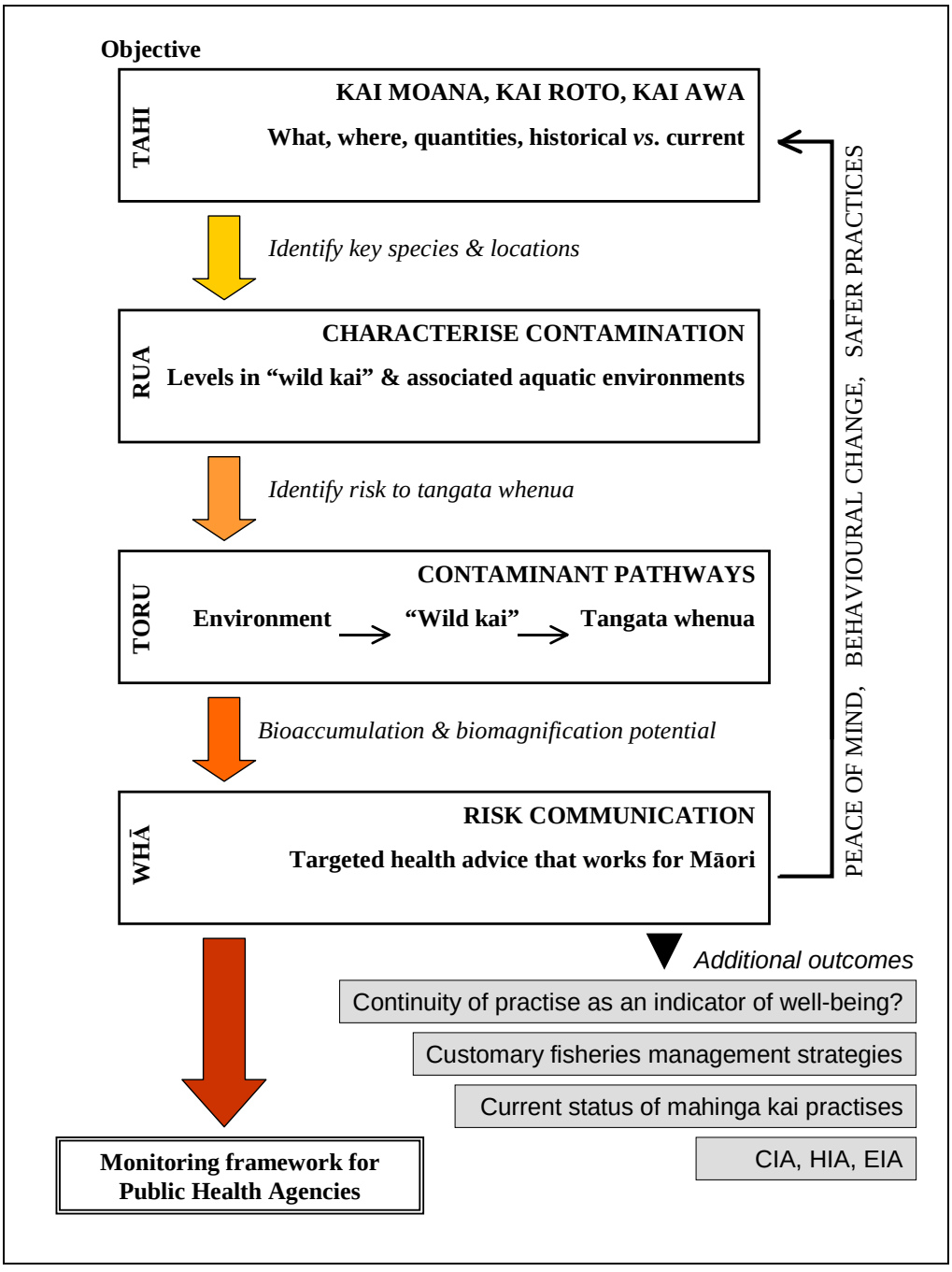
2. Objective 2: The second stage identifies the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori.

3. Objective 3: This stage establishes potential pathways of contaminant bioaccumulation via the food web utilising methyl mercury as an example of a bioaccumulative contaminant.

4. Objective 4: This stage identifies the potential health risks associated with the collection and consumption of contaminated “wild kai”, and develops risk consumption advice specifically targeted at Maori, that will take into consideration both the benefits and risks associated with eating kai moana, kai roto and kai awa.

Figure 1 provides a graphic representation of the identified research priorities, the objectives, and possible outputs.

Figure 1: Research priorities, the objectives, and possible outputs.



The first objective of the research (to provide a description of the kai moana, kai roto and kai awa collection, processing and consumption patterns of iwi/hapu members) is clearly a precursor to Objectives 2–4. This first stage identifies:

- What types of kai have been collected and/or eaten in the last 2–3 generations (e.g., species, life-stage, abundance)?
- Where were/are they harvested from and when (e.g., location, ecosystem, season, time of day, life-stage)?
- How is kai moana stored and processed for consumption?

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by whanau in and around the Rotorua Lakes and the potential effects of environmental contamination on their physical, spiritual and cultural well being.

To elicit the data needed we included methods that have been used previously with hapu around New Zealand. This consisted of focus groups and hui, followed by interviews. For this objective it was important to assemble a group of willing participants with knowledge and experience of kai gathering in the takiwa (area) and rohe.

1.4 Report Structure

This report has been divided into a number of sections:

Section 1: Sets out the background and the aims of this study.

Section 2: Describes the methodology that was used.

Section 3: Provides some information on Te Arawa and their rohe in the Central North Island, in particular around the Rotorua Lakes.

Section 4: Outlines international developments within which the research is situated, specifically:

4.1 indigenous communities and participatory approaches to management and research;

4.2 contemporary wellbeing research, and implications for this study;

4.3 international observations of the impact of changing diets;

4.4 effects of contaminants on health;

4.5 Maori conceptualisations of health and wellbeing.

Section 5: Introduces the empirical analysis by outlining the quantitative research results; specifically with respect to contemporary patterns of gathering. This chapter is informed by the Kaimoana Consumption Survey.

Section 6: Based on the results, develops a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It provides a brief comparative analysis by discussing the contemporary patterns alongside historic traditional patterns. It pulls together the qualitative and quantitative research results and identifies main themes that are then discussed in the context of international literature.

Section 7: Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

2. Methodology and Data Analysis

There is growing recognition of the significance of aquatic habitats and the resources found within them that sustain indigenous communities. Yet this recognition has not been accompanied by investigations to increase understanding of the specific contribution of aquatic habitats and resources to the health and wellbeing of communities depending on these resources.

Drawing on the earlier work of Bebbington (1999), importance to whanau was examined according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

This section of the report outlines the methodology employed, but starts with a description of the Maori community studied.

2.1 Study area

This report details the results of one case study: Te Arawa. Participants living in and around the Rotorua Lakes were recruited from Te Arawa whanui. Availability to take part in the research was the only exclusion criterion, although the preference was for key informants to be active kai gatherers. The study was undertaken under Ethics Approval MEC/07/07/088 and all participants gave written informed consent.

2.2 Methodology

The research team utilised two research methodologies to contrast the instrumental and hermeneutic role of aquatic resources as a source of kai awa, kai roto and kai moana. The first was a quantitative survey of wild kai consumption using a questionnaire, while the second incorporated participatory research techniques via a focus group and a series of qualitative interviews.

The survey followed once the interviews were complete. This was to ensure that the sites and species about which data was sought in the questionnaire were identified by the hapu, and not predetermined by researchers.

2.3 Quantitative survey - Kaimoana consumption survey

The Kaimoana Consumption Survey questionnaire was adapted from a range of other studies (including diet surveys, fish consumption surveys, traditional use surveys, surveys of the health of indigenous communities and perception/preference surveys). The survey questionnaire was approved as part of the Ethics Committee approval process, with minor modifications to reflect differences between the 2 iwi groups. The species and sites listed in the questionnaire were specific to the Rotorua Lakes area and are based on those identified during the interviews. The Te Arawa Lakes Trust reviewed and amended the survey to reflect the kai that is in their rohe.

2.3.1 Kaimoana consumption: quantifying importance of sites and species

We examined consumption using a food frequency questionnaire with frequency categories ranging from less than once per month to one or more times per day. Consumption is one of the principal means by which the importance of kai awa, kai roto and kai moana and the intimate and dependent relationship with aquatic environments from which they are sourced can be determined.

2.3.2 Existing estimates

Kaimoana consumption records in New Zealand are sparse. Estimates were derived using data from the questionnaire by calculating the amount consumed and the frequency of consumption.

2.3.3 Seasonal variation

Some species of kai awa, kai roto and kai moana are seasonal resources while others are open access. Seasonality is explained in historical literature recognising that tikanga and kawa was attuned and responsive to the life-cycle of the different species. Therefore, questions in the survey identified where possible seasonal patterns of contemporary gathering.

2.3.4 The impact of kai awa, kai roto and kai moana on whanau and hapu livelihoods

Arguably there is a need for a broader understanding of the importance of aquatic resources as a source of kai beyond the simplistic statements of mahinga kai that often

accompanies ecologically based descriptions of aquatic ecosystems. The questionnaire sought to address this need by analysing the complex relationship that whanau have with waterbodies found in their takiwa.

2.3.5 Other data

Other data gathered included:

1. demographic information, such as data on the prevalence of certain medical conditions, lifestyle factors including risk-related behaviours, and family history;

2. self-reported health status using generic, health-related quality of life questions;

3. kai gathering locations; and

4. perceptions held by whanau members about the importance of aquatic ecosystems and species, and their assessment of the health of these resources.

2.4 Qualitative methods

The qualitative methods used here address the first of the research objectives as stated in Section 1.3 above. Methods involved an introductory hui, a focus group session, follow-up interviews, informal discussions with many people and reviewing secondary data sources (documents).

2.4.1 Literature review

An examination of relevant literature was undertaken for four reasons

1. to provide a more comprehensive understanding of historical resource use and patterns of activity in the study community;

2. to gain an appreciation of the changes to the aquatic habitats over time, as perceived by Te Arawa participants;

3. to identify the changes over successive generations that have impacted on kai gathering behaviours; and

4. to address issues of concern with respect to waterbodies.

Qualitative data were collected from published and unpublished documents, from libraries, the Waitangi Tribunal (evidence to the Tribunal and reports from the Tribunal), statutory and iwi plans, and statutory planning documents. Internet searches also yielded further material.

2.4.2 Participatory methods

Before commencing working with Te Arawa whanui, an introductory presentation was given at a hui of Te Arawa at Te Papaiouru Marae and the participatory nature of the research was outlined. At the start of all interactions (focus group and interviews) the roles and obligations of participants and researchers were discussed.

Focus group - A focus group was convened in mid 2008 which was attended by approximately thirty participants. The participants were engaged in a guided discussion lasting 1–1.5 hours. The focus group followed the framework of questions presented in Box 1. This session focused on gaining a broad understanding of the spatial extent and description of aquatic resources from which kai awa, kai roto and kai moana were sourced, and the overall importance of each waterbody and species to whanau and hapu. Maps were used to record information about species, locations and other relevant information but given the numbers in attendance, map work was limited.

In depth semi-structured interviews - In the months following the focus group meetings, 13 follow-up interviews were conducted. The purpose of these interviews was to collect additional and more detailed data related to the location and types of kai collected and consumed, and factors that may have influenced gathering.

The questions used for the focus group were also used to guide the interviews that probed more deeply into the personal experiences, thoughts and feelings of the individuals. The intention was to identify and explore the diversity and complexity of relationships and gain a comprehensive understanding of the changes to aquatic environments and the emergent issues seen as potentially impacting health and wellbeing as perceived by different individuals. Interviews were carried out with 13 individual resident in and around the Rotorua Lakes. Each interviewee was identified by the Te Arawa Lakes Trust.

BOX 1: QUESTIONS AT THE FOCUS GROUP and INTERVIEWS

Species of kai

- What (species of kai) did you gather when you were young?
- What places can you remember visiting to gather kai when you were growing up?
- Did you collect year round or seasonally?
- Can you recall any places that you were told not to go to for kai?
- Were there any times / occasions that you were unable to gather kai?
- How long did it take to gather the kai that you needed?
- What (species of) kai do you gather today? What places do you use today?
- Do you gather kai year round or is it seasonal?
- What events / conditions etc. stop you from gathering kai?
- How often would you or someone in your whanau go out to gather kai?
- How long does it take to gather kai compared to when you were younger?
- What species / sites have you lost over the years? When and why did you stop using them?

Behaviours with kai

- Is kai shared? With whom? Has this changed over your lifetime?
- How was kai prepared? Has this changed?
- What methods are used to collect kai? Has this changed?

Condition of kai

- What quantities were taken when you were younger? What quantities are taken today?
- What was the condition of the kai when you are younger? How does this compare with what is taken today?

Observed and known changes

- What changes to the experience of gathering kai have you observed? How has this affected you and your whanau? How have you adapted to these changes?
- What changes to the habitats have you observed and how have these affected you?
- What sort of things would you like to see happen in the aquatic environment you associate with and why?
- Are you happy with your current level of access to kai that you value? What are the main barriers you face today?

Wider benefits of gathering kai

- What do you like about being able to go and gather kai?
- When you gather kai are you with other whanau or hapu members?
- What rules or beliefs do you follow with respect to gathering kai?
- Do you feel any special attachment to the places from which you gather your kai?

Health risks

- Do you know of any health risks associated with gathering kai?
- If you were told not to gather kai from an area because of the health risks would you still gather from there?
- What type of information would you need to help you decide whether to gather kai from an unsafe site?

There were four principal outputs: a map documenting the types, locations, and quantities of kai moana collected and consumed by those present; the transcripts from the interviews; a revised questionnaire for future use; and this report.

2.5 Qualitative data analysis

In summary, informants were interviewed and interacted with in different fora, and their written documents (both historic and contemporary) and submissions provided further context for interpreting their values, practices, activities and concerns. Accessing multiple sources of data was one of the methodological tools employed to ensure the validity of data collected.

Lincoln and Guba (1985, 224-225) contend that the role of data analysis is "to 'make sense' of the data in ways that will, firstly, facilitate the continuing unfolding of the research, and secondly, lead to a maximal understanding of the phenomenon being studied in its context. There were two aspects to the data analysis:

1. firstly to identify sites and resources to be sampled for analysis of contaminant levels; and

2. secondly, the analysis involved identifying, sorting and grouping data from very detailed individual transcripts to identify key themes. The methods of data collection resulted in a considerable quantity of raw data being gathered, and data from a variety of sources had to be systematically analysed.

Data were coded and categorised to enable similar themes to be distilled. Some of the themes had been established *a priori* based on key issues that had emerged while reading related literature and undertaking preliminary discussions when scoping the research topic and negotiating entry to the three communities. Principal categories that were identified represent the headings under which the research findings are presented in sections 5 and 6.

2.6 Quantitative data analysis

The questionnaire was constructed on Survey Pro 5 (Apian Software Inc) and all data were entered into this programme. The results that are reported in section 5 and discussed in section 6 have been produced using the Survey Pro reporting functions. Microsoft Excel was used to construct two of the graphs.

2.7 Summary of methods applied

The methods applied to enable us to understand kai gathering behaviours over different time periods are set out in Table 1.

Table 1: Methods used during the course of the research.

Pre-European	19th Century post	20th Century up to	Present day
Manuscripts		Interviews	Interviews
Cultural maps	Cultural maps		Review of literature
Historical texts	Historical texts	Evidence to the	Kai Consumption
	Evidence to the Waitangi	Photographs	Maps
Evidence to the	Paintings		Photographs

3. Study Group: Te Arawa

> *If you look at Rotorua – the name of Rotorua – if you follow that trail that is actually the history of the Te Arawa waka, eh. You see, when they came up and got to Rotoiti… and that is where Ihenga saw the lake and then called it the long narrow lake…. Then he came across here and he saw this big huge lake, Te Rotorua, the second lake, and he named it after his Uncle Kahu Mata Moemoe, who was Tamata Kapua's son, who was the kaihautu on the waka Te Arawa when it came across. So what you have there – and if you listen …Then you go down here and you go to the cockabullies of Okere, then you go to the Te Heke Heke of the Kaituna, to the rapids of the Kaituna…. at Maketu …where the waka of Te Arawa landed, eh. .. It's a journey of history… So you are taking the journey from here, all the way around there. And there is a lot. That is only one of many.. ... And they are memories that are buried now by sediment (Informant M).*

Te Arawa arrived at Maketu around 1350 (Stafford, 1967). Te Arawa is a confederation of iwi which are descended from the crew of the Arawa canoe. From Maketu the voyagers and their succeeding generations moved inland occupying the central part of the North Island. This means Te Arawa have resided in the Rotorua area for centuries and the lakes of the region were and remain taonga (treasures) for Te Arawa. They are the foundation of their identity, cultural integrity, wairua, tikanga and kawa. The numerous lakes of the Rotorua district as shown in Figure 2 are found in hill country approximately 80 kilometres south of Tauranga, and 50 kilometres west of Whakatane[3]. The lakes of the Rotorua district remain the centre of Te Arawa settlement. For centuries the lakes have also been the mainstay of their economy as the lakes and their margins were an important source of freshwater fish, waterfowl, and plants[4].

The Te Arawa Maori Trust Board was established in 1924, pursuant to Section 27 of the Native Land Amendment Act and the Native Land Claims Adjustment Act 1922, and operated under the Maori Trust Board's Act 1955. Fifteen hapu were represented on the Board as well as one seat allocated for Tumataunenga which acknowledged the returned serviceman of Te Arawa who served in the First or Second World Wars, totalling 19 representatives. Initial membership of the Board was based on ownership

[3] Historically attention has focused primarily upon the three largest lakes of the area; Rotorua, Rotoiti, and Tarawera. During the 1918 Native Land Court investigation of title to the Rotorua lakes, counsel for the applicants informed the court that he had only prepared the applications for Rotoiti and Rotorua, but that he would attend to the others in due time. However, the Court's inquiry was abandoned, and a settlement was negotiated that applied to Rotorua, Rotoiti, Tarawera, Rotoehu, Rotoma, Okataina, Okareka, Rerewhakaitu, Rotomahana, Tikitapu, Ngahewa, Tutaeinanga, Opouri, and Ngakaro. 'Minutes of the Rotorua Lakes Case: Application for Investigation of Title to the Bed of Rotorua Lake', 16 October 1918, p 137, cl 174, NA Wellington.

[4] For a detailed account of the traditional history of Te Arawa, see Stafford (1967).

of the 14 Te Arawa lakes, which surround the Rotorua district, and this remained the structure of the Board.

On 18 December 2004, the Crown and Te Arawa signed a Deed of Settlement for Te Arawa Historical Claims and Remaining Annuity Issues over 14 lakes; Lakes Rotoehu, Rotomä, Rotoiti/Te Roto- Whaiti-i-kite-ai-a-Ihenga-i-Ariki- ai- a Kahumatamomoe, Rotorua / Rotorua-nui-a Kahumatamomoe , Ökataina / Te Moana i kataina a Te Rangitakaroro, Ökareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngähewa, Tutaeinanga, Ngäpouri/Opouri and Ökaro/Ngakaro.

The settlement was made up of 4 components of a "redress package", one of which was the Cultural Redress recognizing Te Arawa traditional, historical, cultural and spiritual association with the lakes covered in the settlement, including the transfer of 13 lakebeds.

Te Arawa Lakes Trust (formerly Te Arawa Maori Trust Board) is the new governance entity to receive and manage the redress on behalf of Te Arawa, to ensure that the benefits of the settlement will be available to all registered members of Te Arawa, wherever they live.

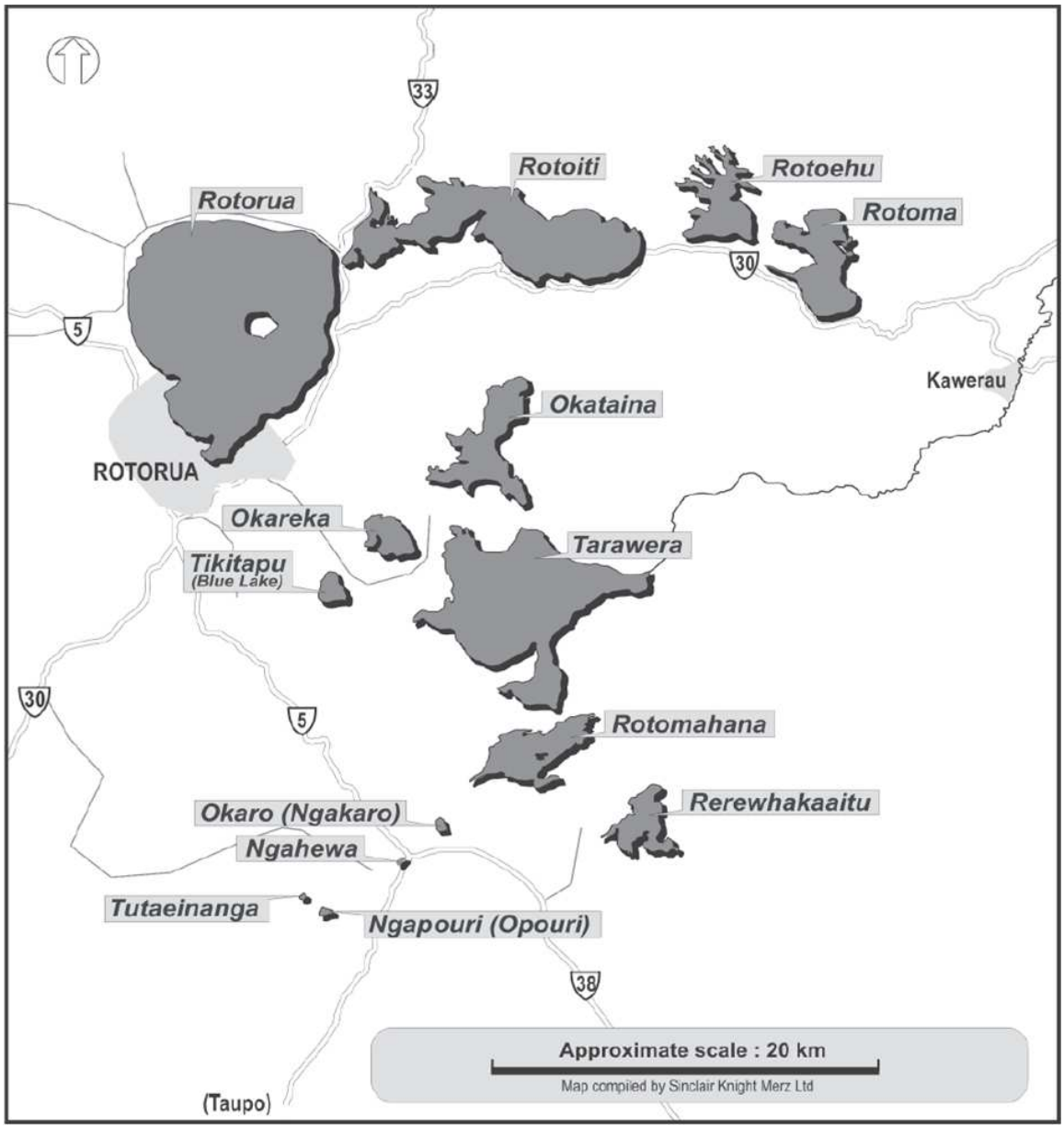


Figure 2: Map of the Te Arawa lakes.

Implementation of this project saw NIWA and its subcontractors working with representatives of Te Arawa Lakes Trust. The Trust had two champions - individuals who helped facilitate the focus groups and the interviews.

> *All these lakes are historical to this country. The history of these lakes is actually the history of this country (Informant M).*

4. International developments relevant to the research

Consistent with the need for the present research to be examined in a context of international literature and academic thought, this section seeks to position the research design and data analyses within contemporary writings from four related areas:

- indigenous communities and participatory approaches to management;
- contemporary wellbeing research, and implications for this study;
- international observations of the impact of changing diets and effects of contaminants on health; and
- Maori conceptualisations of health and wellbeing.

4.1 Indigenous communities and their participation in management

This research sought to utilise participatory research methods. Participation is seen as a means of affording affected parties the opportunity to articulate their interests, enhancing the quality of information available to decision makers; enhancing the potential for support of decisions by enabling early and meaningful involvement; and affecting one's destiny as the opportunity to participate in decisions is a key element of self-empowerment and self-actualisation (Fenge, 1994). In the context of this research project, in addition to collecting environmental contamination data, the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana are examined, and empirical data collected for use by whanau and hapu.

Participatory approaches to environmental management received emphasis initially in the Brundtland report (WCED 1987) and in Agenda 21, at the 1992 ‘Earth Summit’. Perhaps the greatest significance of these fora lay in the acknowledgement that sustainable development would require new approaches to environmental management, and that effective environmental management would need to be differentially negotiated within individual states, even within individual communities. In effect, this research will also result in a range of cultural values and perspectives of particular aquatic locations being documented and available to each Maori community to inform local processes of management should they so choose.

Pimbert and Pretty (1997) contend that new partnerships and connectedness between different interests is required in environmental management and argue that

participatory processes must be locally grounded which will likely require different solutions for different places. This research will facilitate new participatory processes between environmental managers, public health managers, science agencies and Maori. Despite the increase in participatory initiatives, Pimbert and Pretty (1997) also warn that the call for peoples' participation risks becoming a catch-cry and part of the conventional rhetoric without delivering meaningful outcomes for participants. This warning reinforced the desire of the researchers to deliver a meaningful and effective process for application by Maori and outputs such as those listed in Figure 1 for use by Maori and resource managers.

The drive for greater participation has been paralleled by a concerted drive by indigenous communities to reassert their customary and Treaty rights to access and use land and water resources and greater recognition of the knowledge held within communities including indigenous communities (Western et al, 1994, Pinkerton 1989, 1992, Notzke 1994, Berkes and Folke 1998). Although a range of terms are used, often interchangeably, Berkes (1999) defines indigenous knowledge as that knowledge held by indigenous peoples and traditional ecological knowledge as a subset of that – a practical knowledge of species and beliefs regarding human interaction with the ecosystem. Menzies and Butler (2008) list the attributes of traditional ecological knowledge as cumulative (from long term intergenerational interaction), dynamic (informed by a customary lifestyle but not unchanging), providing a historical understanding of change, local, holistic (viewing all elements as interconnected), embedded (in a unique matrix of local, cultural, historical and traditional elements), moral and spiritual. In order to understand the changes to the diets of successive generations of Maori, the research team was dependent on key informants being experienced and knowledgeable (with indigenous knowledge and/or traditional ecological knowledge) about kai gathering.

Sadly, Maori, like other indigenous communities have witnessed the destruction of valued environments and their alienation from the resource bases upon which their cultures and identities are constructed (Berkes 1991, 1994, 1999). Documenting the changes that have been experienced in the Rotorua Lakes region and the impacts on whanau and hapu, including a profound sense of loss, was therefore vital.

The growth of interest in the knowledge held by indigenous communities is related to the wider shift within resource management to an ecosystem based management approach (Menzies and Butler, 2003) and recognises that indigenous communities understand the way species interrelate and how ecosystems work as a whole. It recognises that indigenous communities have a well developed understanding of the local environment and their own impacts on local ecosystems. The data collected via the interviews and questionnaire confirmed the proposition of Berkes (1999, page 33)

that the "use of traditional knowledge may benefit development by providing more realistic evaluations of local need, environmental constraints and natural resource production systems".

Initiatives involving the incorporation and/or application of indigenous knowledge are emerging around the world as resource managers seek to engage with indigenous communities. New Zealand has also experienced the drive for greater participation, including greater recognition of the beliefs, values and practices of Maori. In 1991, the Resource Management Act 1991 became the governing legislation for resource use in New Zealand (Davis and Threfall 2006). Two sections are of particular relevance.

Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including "the relationship of Maori and their cultures and traditions with their ancestral lands, water, sites, *wahi tapu* and other *taonga*" (section 6(e)). Gathering from tribal lands and waters, species that are often accorded the status of "taonga", clearly falls within the gambit of section 6(e) and is thus a matter of national importance.

Pursuant to section 7(a) decision-makers are required to have particular regard to *kaitiakitanga*. The Act presently defines kaitiakitanga as:

> *The exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

The responsibilities of Tangata Kaitiaki are to protect the integrity of resources (including the kai species identified by informants). This requires Maori to focus on long term environmental results, which are likely to include healthy ecosystems with abundant populations of valued kai species that are able to sustain cultural uses well into the future. Despite these encouraging and potentially enabling provisions, often there is little guidance given to managers and regional bodies seeking to meet the obligations to indigenous communities (a challenge Maori confront in New Zealand). This research seeks to produce outputs that will guide both Maori and non-Maori resource managers.

4.2 Contemporary wellbeing research: implications for this study

For indigenous communities food is not just a resource for sustenance as many might understand it in western contexts (Slocum 2007). Rather, Panelli and Tipa (2007,

2008) argue, that food needs to be understood in a wider cultural context that interweaves complex indigenous cultural and environmental relations.

Panelli and Tipa (2007, 2008) contend that to identify these relationships primarily by a particular bio-physical character (e.g., forests, coasts and waterways) misses the range of spiritual, physical, social, material, cultural, economic and political relationships that might be involved in any one case. The complexity of these relationships must be appreciated before the significance of an 'individual' phenomenon or activity (such as food or food gathering) might even begin to be approached (let alone the cultural or health implications of such things). They further contend that to consider kai gathering without this contextual understanding would diminish its cultural value and the rich dimensions that underpin whanau and hapu experiences of identity and well-being. The results of the Kai Consumption Survey reported in subsequent sections of this report support the proposition that individual experiences of interviewees vary as lives are influenced by a complex combination of: cultural beliefs, values and uses; a history of colonization, loss of lands, alienation from their lands, waters and resources; and contemporary interactions with a dominant non-Maori world that is based primarily on capitalist, western values (Panelli and Tipa, 2008). The range of perceptions, preferences and the experiences of members of Te Arawa that emerged from the analysis of data collected for the present research are set out in sections 5 – 7 of this report.

Indigenous communities have traditionally been resource users and developers (O'Regan 1984, Notzke 1994). They used natural and physical resources for subsistence (physical survival) and sustenance (spiritual survival). Internationally there are calls to recognize and protect cultural knowledge and practices that are 'fundamental for food security and well being' (FAO 2007). Gombay (2005: 418) explains the significance of this stance, and when describing the Inuit argues that when they:

> *hunt, fish, or gather food the material and immaterial worlds blend together, with layer upon layer of meaning and understanding. The getting of country foods is about understanding the land in which one lives. It is about building an awareness and knowledge of one's place in the natural world ….*

The gathering, exchange and consumption of kai are also significant cultural activities for Maori. Complex associations with the environment and mahinga kai have developed over centuries and include social, economic, psychological, spiritual and physical dimensions that are an intrinsic part of health and well-being of whanau members. Diversity is wide (as evidenced by the individual variation from the survey results) but this is considered acceptable within whanau and hapu. The data collected

helps explain how sourcing kai from lands and waters reaffirms firstly, connectedness with the lands and waters to which one has whakapapa, and secondly ensures continuity of practices initiated and valued by tupuna. In the Maori context, kai gathering practices also enable social and environmental responsibilities to be fulfilled. To be denied the opportunity to manaaki visitors to one's home and marae would have consequential adverse effects on the health and well-being of Maori – a point that may be experienced beyond the individual and whanau level.

4.3 Maori conceptualisations of health and wellbeing

Durie (1994) introduced *Te Whare Tapa Whā* - a four sided house - or the four cornerstones of health; these being: *hinengaro* (mental well-being), *wairua* (spiritual well-being), *whanau* (family well-being) and *tinana* (physical well-being) which was subsequently adopted by the Ministry of Health (2006). Durie (2004) then proposed a second conceptualisation, *Te Pae Mahutonga*, which he contends represents the fundamental components of health promotion - *Mauriora*, *Waiora*, *Toiora* and *Te Oranga*. He explains that: *Mauriora* is dependent on a secure cultural identity; *Waiora* refers to healthy air, land and water environments which requires a balance between use and development and protection; *Toiora* focuses on personal behaviours and responsiblities; and *Te Oranga* recognises that health promotion (in particular increasing well-being) requires increased participation by Maori in societal affairs.

Another conceptualsation, by Pere (1997) emphasises reciprocity and interconnection between individual selves and wider social interests. In this sense, each experience of well-being would vary from place to place reflecting *whenua* (earth), *turangawaewae* (standplace), *whanaungatanga* (kinship), *whanau* (family), *wairua* (spirit), *hinengaro* (mind, heart), *whatumanawa* (feelings) and *tinana* (body). This conceptualisation by Pere helps explain connections between specific understandings of *whenua* and the social and cultural relations developed in particular places.

Panelli and Tipa (2008) explain how many Maori express a strong affinity for the earth and adhere to basic principles regarding their relationship with other aspects of creation and quote Crengle (2002) who explains all parts of the environment are related to one another and exist within a mutually inter-dependent whole. Deriving economic or social benefit from resource utilisation (recognised as contributors to wellbeing), must be carefully balanced.

Initiation of the current research programme and exploring the contribution of kai gathering to health and wellbeing is predicated on the belief that understandings of health and well-being can be enhanced by explicit conceptualisations that align spiritual, social and cultural elements in connection with bio- physical bases.

4.4 Effects of contaminants on health

While some agencies and researchers contend that people everywhere are exposed to chemical contaminants in the environment, international studies confirm that the majority of exposure to contaminants comes from food, with the consumption of contaminated fish identified as the largest single source of exposure in Canada (Health Canada 1997). Of concern, fish constitutes a significant dietary source of protein for many populations worldwide, especially indigenous communities.

Traditionally, the diet of many indigenous communities (including Maori) consisted of fish, game, waterfowl, and plants sourced from local lands, waters and coasts. Contemporary diets, in contrast, are likely to be a combination of traditional food items and more easily accessed commodity or convenience foods. Despite the change to convenience foods, traditional foods continue to underpin cultural identity for many indigenous communities. Delormier and Kuhnlein (1999) explain how changes experienced by Eastern James Bay Cree have affected diet, traditional food use, and nutrition. They contend that the reduced use of traditional food by younger generations, changes in fish consumption as a result of contamination, and increased incidence of obesity, diabetes, and cardiovascular disease within communities, represent particular socio-cultural concerns. Exploration of these issues and the longer term impacts has necessitated examination of the current diet and food consumption patterns of the Cree. The nature and extent of the risk that Maori confront in New Zealand is unknown but this research attempts to assess the risk.

If food is a major route of human exposure to many persistent toxic environmental contaminants the present research hypothesised that the consumption rates of aquatic species by Maori could represent a significant risk of exposure given their potential higher rates of consumption of these foods. The information gathered through the interviews and the questionnaire therefore had to enable the research team to establish whether there were any correlations between the contaminant levels measured in the participants' tissues (hair) (a separate component) and the fish or shellfish species they consumed in the past year. While such a relationship could not be considered as defining a direct cause:effect relationship, it would increase our understanding of the possible exposure risk to tangata whenua. We have also developed a model of potential contaminant accumulation pathways between participants and the kai they consume and calculation of relative risk, based on measured contaminant levels in kai species, their associated environments and consumers. Furthermore, the data had to enable the research team to assess the levels of contaminants in the respective fish and shellfish species consumed, by identifying important species and harvesting locations. These data were subsequently used to develop a sampling plan for kai species and associated environmental parameters. The results of these strands of research are to be presented elsewhere.

In risk management, the focus is on ensuring that mitigation strategies are culturally appropriate yet rarely are Maori perspectives or knowledge explicitly included in determining the hazards or health outcomes to be considered in the risk assessment. In the absence of explicit procedures to apply health risk assessment in Maori communities, the data derived from the questionnaires and interviews will contribute to the development of a health risk assessment model. Again using data gathered from this stage, we will develop Maori-focused guidelines with respect to the consumption of wild sourced kai and will also explore the appropriateness of existing information dissemination tools for effectively communicating risk.

5. Research results

In this section of the report we start by providing a description of the contemporary mahinga kai practices of whanau and hapu across the Rotorua Lakes region that has been extracted from secondary data sources, interviews with whanau members and the Kai Consumption Survey.

5.1 Background of participants

All respondents to the Kai Consumption Survey were Maori residing in the Rotorua Lakes region. All of those interviewed for this research expressed a strong relationship with the lakes and the wider terrestrial and aquatic surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship.

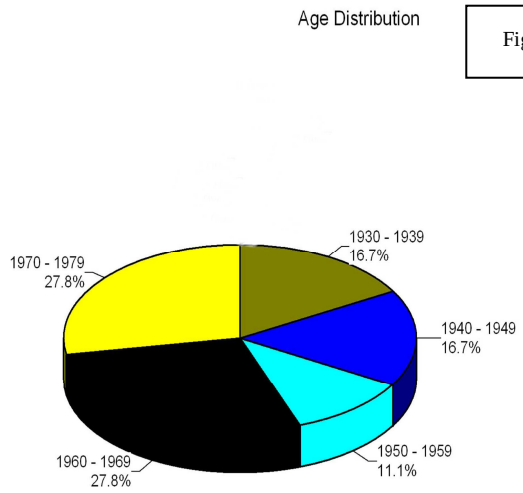


Figure 3

Only a limited number of participants have completed the survey to date (Figure 3):

- 5 are aged 20-29 years
- 5 are aged 40-49 years
- 2 are aged 50-59 years
- 3 was aged 70-79 years
- 3 was aged 80-89 years

Of the 18 participants 8 were female and 10 were male, and 1 did not answer the question.

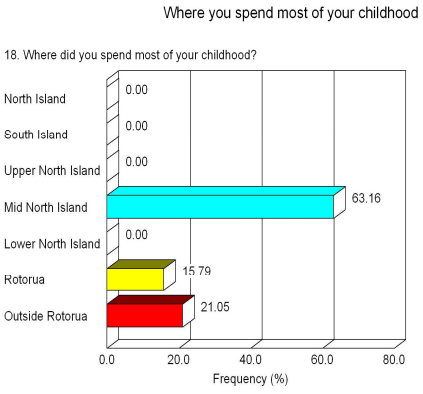


Figure 4

Two thirds of the participants spent their childhood in the middle of the North Island while 15.8% identified Rotorua as the place where they spent their childhood Figure 4).

The most explicit strands of the relationship with the lakes, are whakapapa, birthplace/wāhi whenua, childhood experiences, livelihood, recreation and kai gathering. Cultural values, principles, and tikanga such as kaitiakitanga, manaakitanga, mana and tino rangatiratanga help describe the importance of kai gathering for individuals and provide common bonds and experiences that provide a sense of common identity that connects them physically and spiritually to the lakes region.

5.2 Patterns of kai consumption

5.2.1 Introduction

A large variety of kai continues to be regularly collected, gifted, purchased and/or consumed. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in Rotorua Lakes region. The range of species that are consumed are listed in Table 2.

Table 2: A list of foods that are still consumed today by Te Arawa living in the Rotorua Lakes region.

Toheroa	Morihana	Gurnard	Lampreys	Crayfish	Whitebait
Tuatua	Pipi	Snapper	Mutton birds	Oysters	Trout
Watercress	Cockles	Moki	Eel	Pupu	Kina
Puha		Shark	Flounder	Seaweed	Paua
		Tarakihi	Hapuka	Freshwater crayfish	Mussels
			Mullet	Trevally	Butterfish
			Kahawai		Freshwater mussels
			Kingfish		

We would also have rotten corn, and that was after harvesting, and we used to put the rotten corn into bags .. so that the rats would not get into the bag and make a hole, otherwise we'd lose all our rotten corn. And the rotten corn would be hanging off a huge willow tree which was sort of flowing over the Ohau Channel, and we would be getting rotten corn at a different time of the year (Informant E).

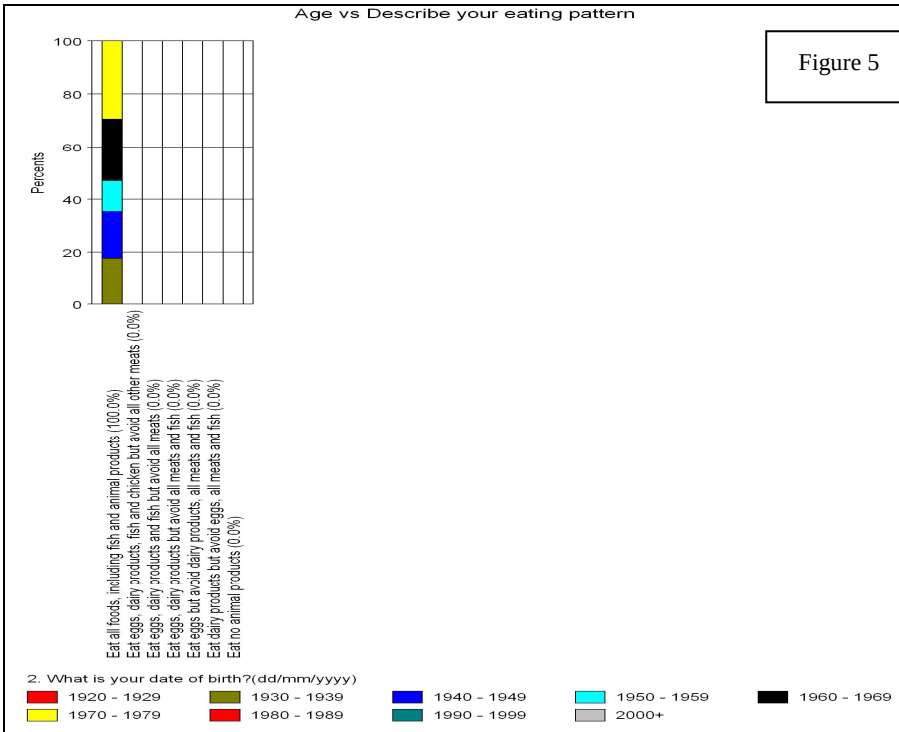


Figure 5

All participants eat all foods, including fish, meat and all dairy products (Figure 5).

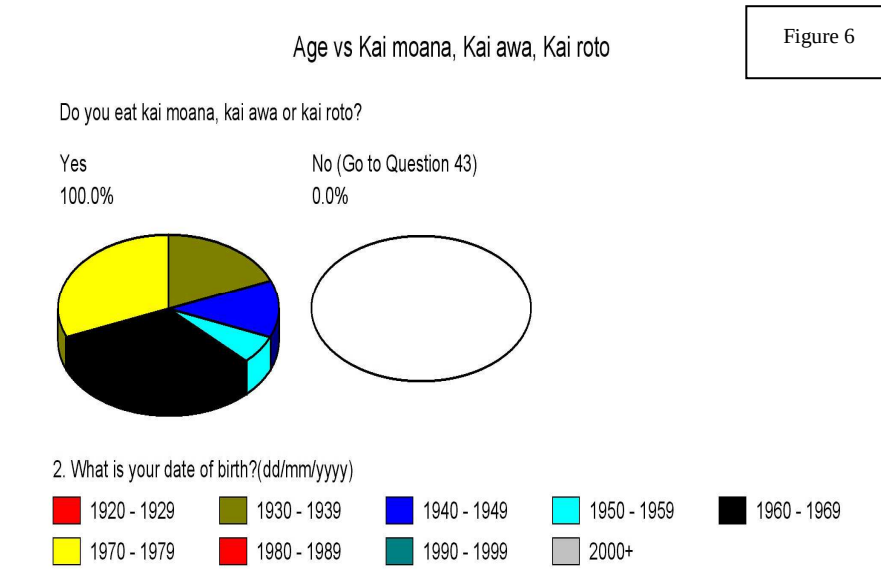


Figure 6

All participants eat kai moana, kai awa or kai roto (Figure 6).

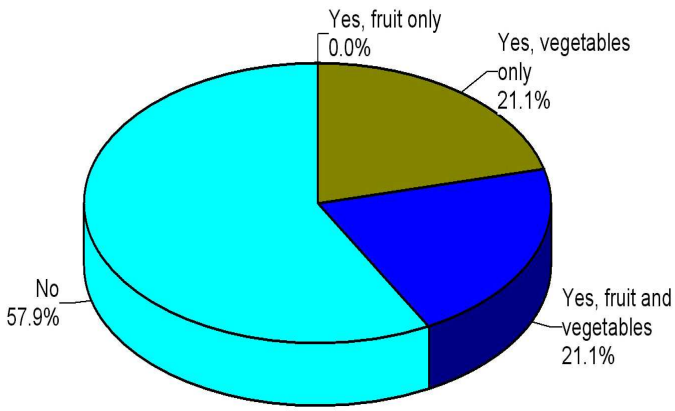


Figure 7

Consistent with a kai gathering lifestyle:

- 42% grew their own vegetables.
- Of the 42%, 21% of those who grew vegetables also grew fruit (Figures 7).

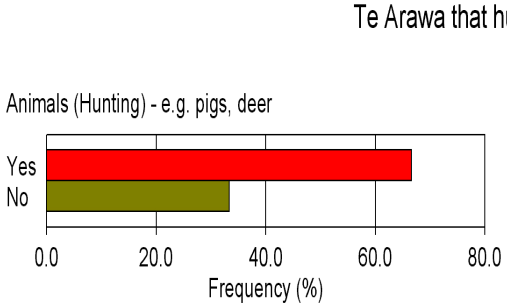


Figure 8

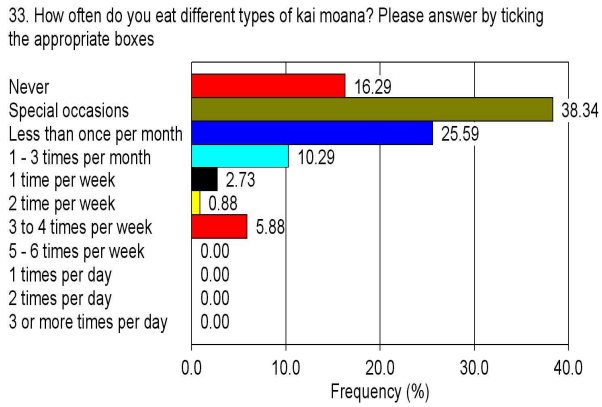
Approximately 66% of respondents hunted.

Yeah, we hunted a lot. Yeah, we hunted a lot but it was mostly at Tarawera, all those sort of things we hunted there. But the lakes were pretty good - those lakes were always pretty clean. The Rotokakahi was always clean – it's still clean but it's starting to – the weed is starting to blanket it now…especially Tarawera where we used to go hunting. You could go in there – we used to go in there and get some watercress for our tea, you know, to cook up with our tucker, you know. Not any more. I don't know why. But I think DOC, I think, poisoned a lot of them. The streams – we used to get a lot of it and it was beautiful watercress from Tarawera (Informant C).

I mean, even our parents - we owned gardens, we grew our own vegetables, our own fruit. We had sections - three acre sections, two acre sections, one acre sections - huge sections. We would have our chooks, we would have everything. Our parents - I know my father was disgusted when he first saw baked beans and spaghetti and everyone was eating that, and he's saying "what's the matter with people, don't they know how to use a spade anymore?" You know, and that is what they were so used to - using their hands to create work and then producing food (Informant E).

How often do you eat different types of kai moana

Figure 9



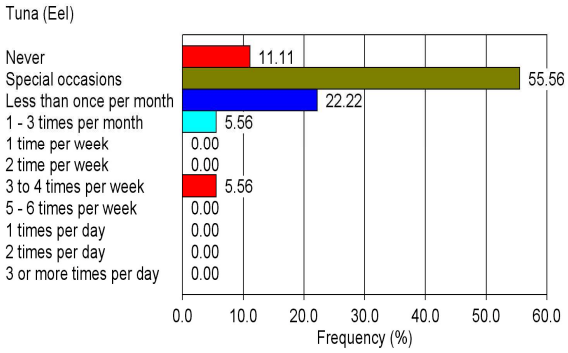
Having determined that all of respondents do consume different types of kai:

- 38% of respondents said they now only eat kai on special occasions; while
- 25.5% eat kai less than once a month; and
- 10% only eat kai 1-3 times per month (Figure 9).

In other words 73% eat kai 1-3 times per month or less.

Amount of Eel consumed

Figure 10

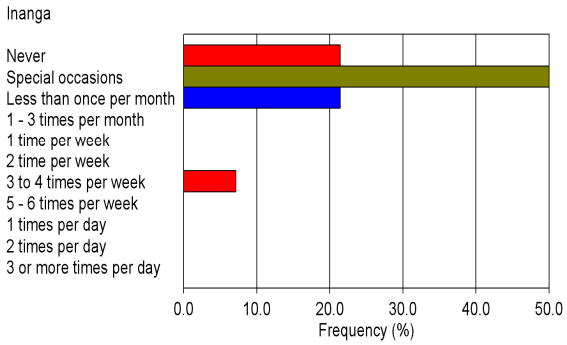


Figures 10 - 15 illustrate how often the various species are consumed:

- Only 5% of those eating eel have this food 1-3 times per month in contrast to 56% who eat eel on special occasions.
- It was of concern therefore that 57% of the respondents believed that there were now "fewer" eels present.

Amount of whitebait consumed

Figure 11



For whitebait, 50% of the respondents indicated they consumed these species at special occasions while another 20% have it less than once per month and another 20% **never** consume whitebait.

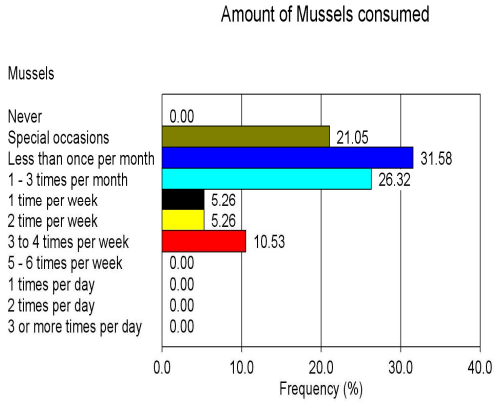


Figure 12

Marine mussels are consumed weekly – specifically once or twice per week by 10.5% and 3-4 times per week by another 10.5%.

Respondents observed that mussels can now be easily accessed from supermarkets.

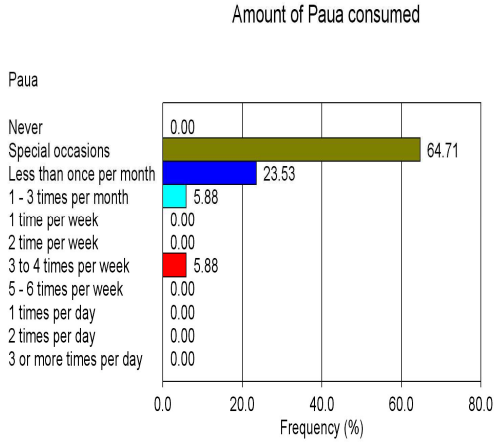


Figure 13

64.7% of respondents only eat paua on special occasions and other 23% less than once per month.

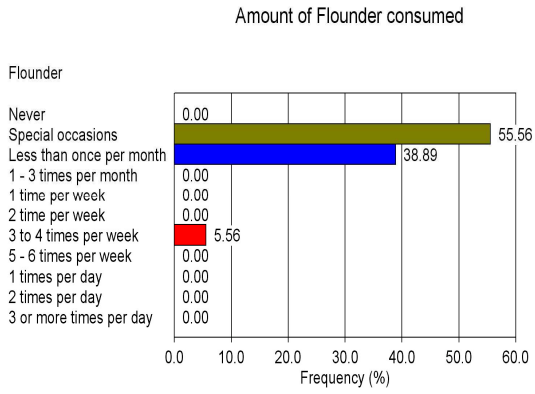


Figure 14

As with the other species flounder (55.5%) was consumed mainly on special occasions.

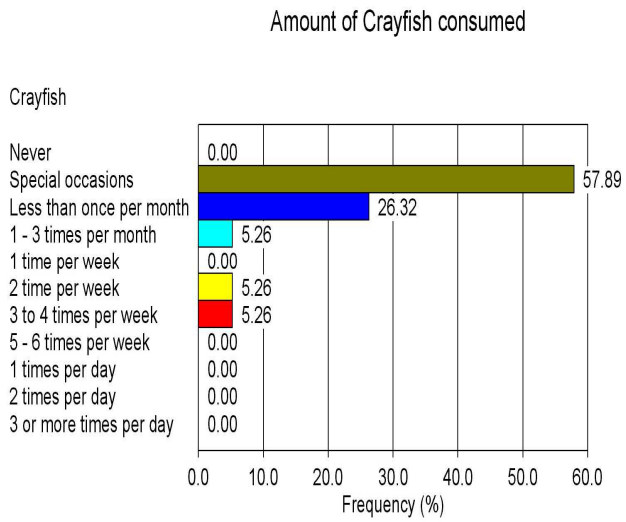


Figure 15

Similarly crayfish was mainly consumed on special occasions by 57.9%.

As whanau explained -

> *We took kai from the river in the way of eels and kakahi and trout. Of course, trout being an introduced species, we made full use of their being available (Informant A).*

Of concern when reviewing the complete list of species and the frequency with what each was consumed, some respondents identified six species as being extinct (i.e., no longer present in the areas they gather from) – kakahi, cockles, koura, morihana, seaweed and tuatua.

How respondents prepare their kai also has health implications. It was accepted that although many would prepare their own kai, others would purchase fish at take-aways, and supermarkets (as either fresh or tinned fish). Figures 16-20 illustrate the difference between age groups.

Figure 16

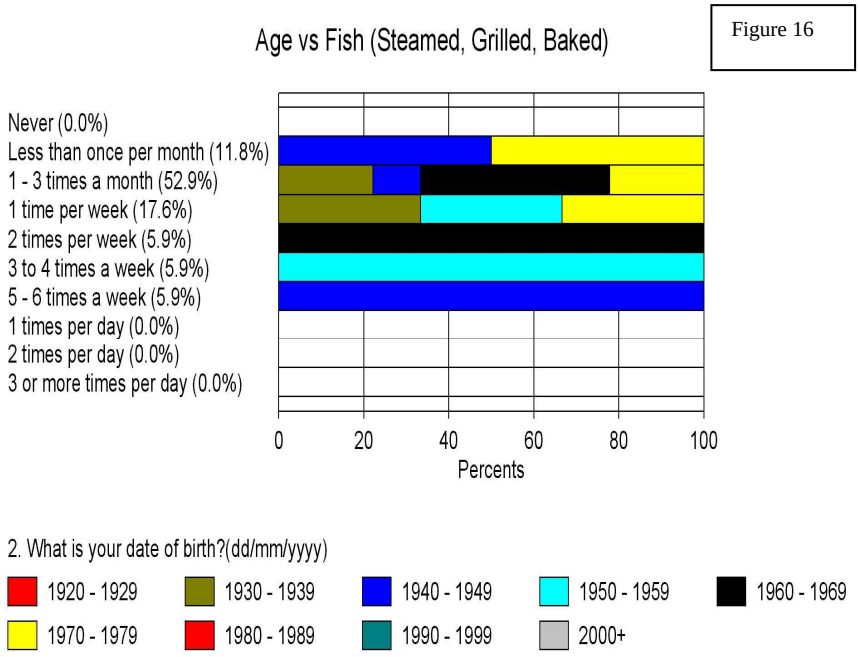
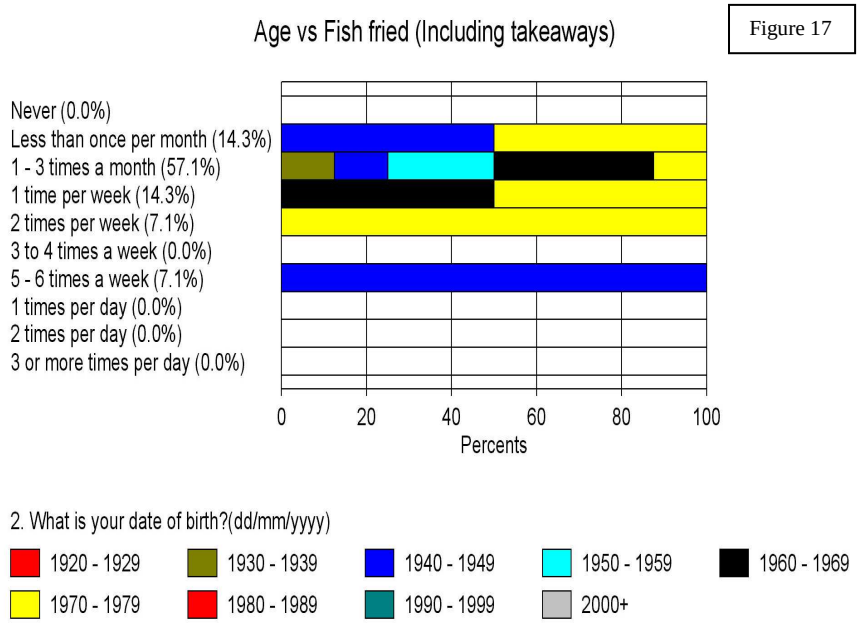


Figure 17



52.9% of respondents consumed steamed, grilled or baked fish 1-3 times per month while another 17.6% recorded consuming at least once per week. Another 17.7% eat fish more than once per week.

Those who eat fish 5-6 times per week were all in their 60s while those eating it 3-4 times per week were all in their 50s.

Today convenience foods can be purchased from a variety of sources and is available:

- as tinned fish;
- as fresh fish available in the deli of a supermarket; and
- as fish and chips at a takeaway store.

The graphs at left confirm that:

- Fried fish is consumed frequently and by 28% of respondents at least once per day.

- 57% eat fried fish at least 1-3 times per month.

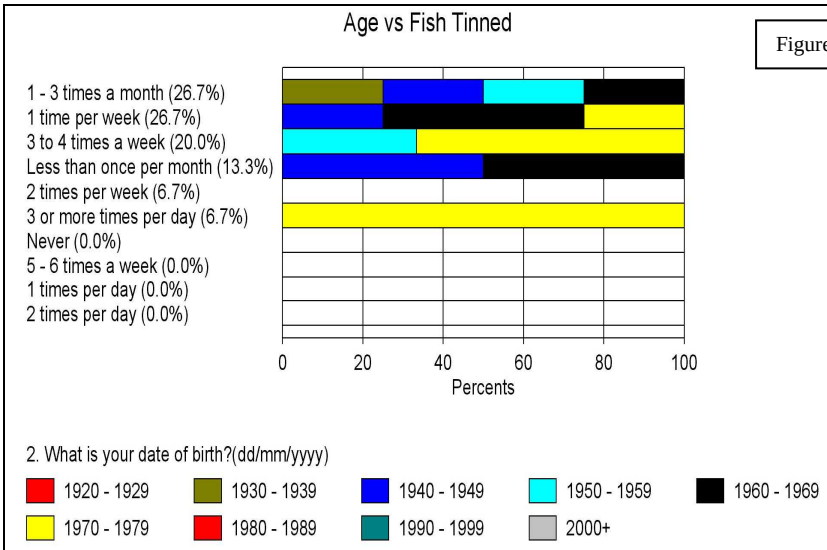


Figure 18

Interestingly Kaumatua consume fried fish and tinned fish 1-3 times per month. In contrast those aged in their 30s were all weekly consumers of tinned fish.

We wanted to determine how dependent whanau were on kai. A question therefore asked if kai moana was the main source of food for the whanau.

37% of informants agreed with this statement (21% agreeing strongly). Those who agreed were aged 40 years and older. In contrast those aged in their thirties were either neutral or disagreed.

In fact 36.8% spread across four age groups disagreed or strongly disagreed – in other words, despite the historic dependency of the lakes for sustenance, kai was not the main source of food for their family.

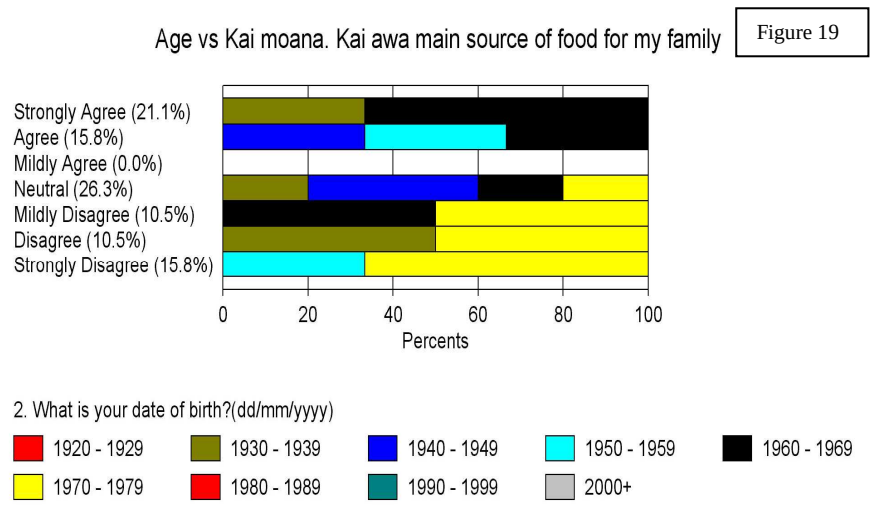


Figure 19

Questions sought to identify changes from a traditional kai dominated diet to a western style diet (Figure 20). It was of concern that 30.8% of respondents eat meat pies, pasties, quiche or savouries at least weekly, and all are aged in their 30s and 40s.

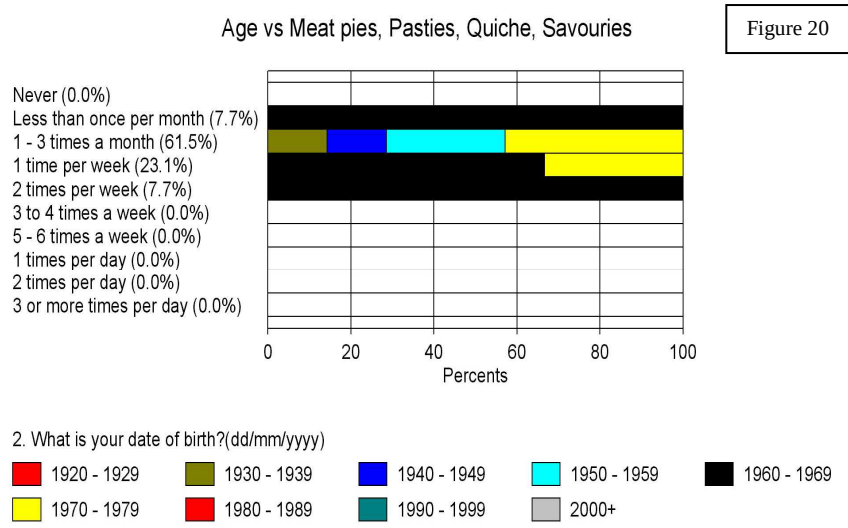


Figure 20

5.2.2 Estimates of the quantity of kai consumed

This research investigates the risk of contamination from eating wild sourced kai. A key consideration is the amount of kai that they are actually consuming, along with the levels of contaminant present. We calculated consumption rates by examining:

- the frequency or number of times they consume kai; and
- the quantity per sitting.

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week. From the data collected we also know that they consumed approximately 219g of fish per sitting[5].

5.2.3 Sites at which kai gathering and other activities are undertaken

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were used as the basis for a sampling programme which examined contaminants in sediment and kai species. Figures 21 and 22 below confirm kai was gathered from 11 of the 14 waterbodies listed. The most highly used area was the coast as 65.05% said they gathered from Maketu followed by lakes Rotoiti (21.04%) and Tarawera (14.39%). There was no gathering by participants from lakes Rerewhakaaitu, Okareka, and Tikitapu.

[5] This is discussed more fully in section 6.3.1

Figure 21

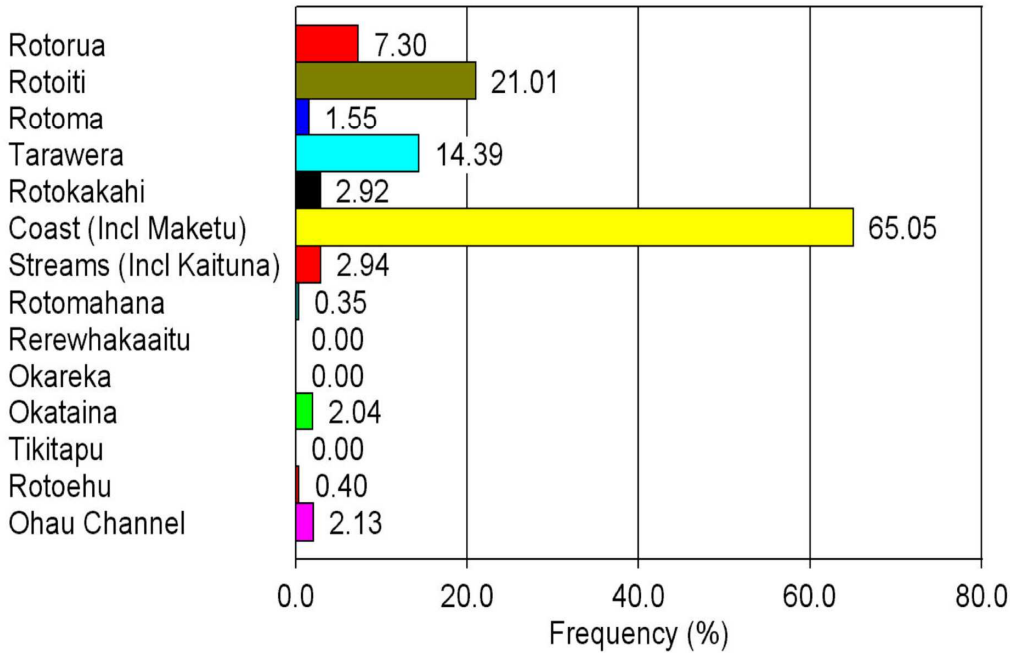
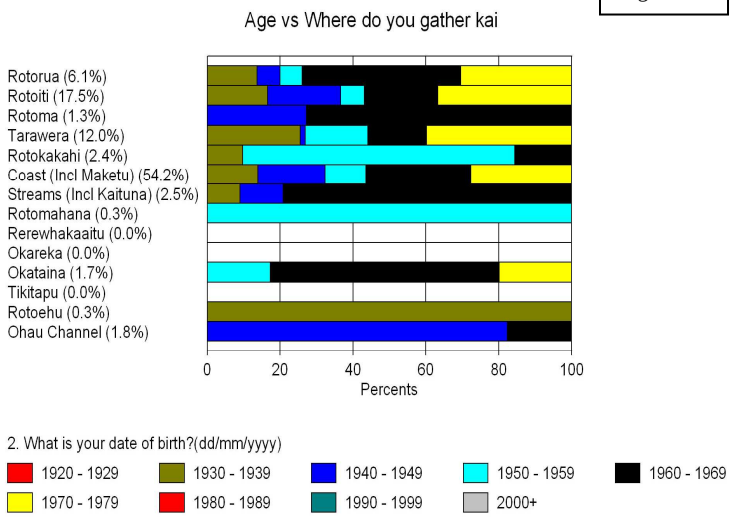


Figure 22



Of the sites listed in the Figures at left (Figure 22):

With respect to ages:

- those that gathered from Rotoehu were in their 70s.
- those that gathered from Rotomahana were in their 50s.
- all age groups were represented amongst the gatherers in Lakes Rotorua, Rotoiti, Tarawera, and the coast.

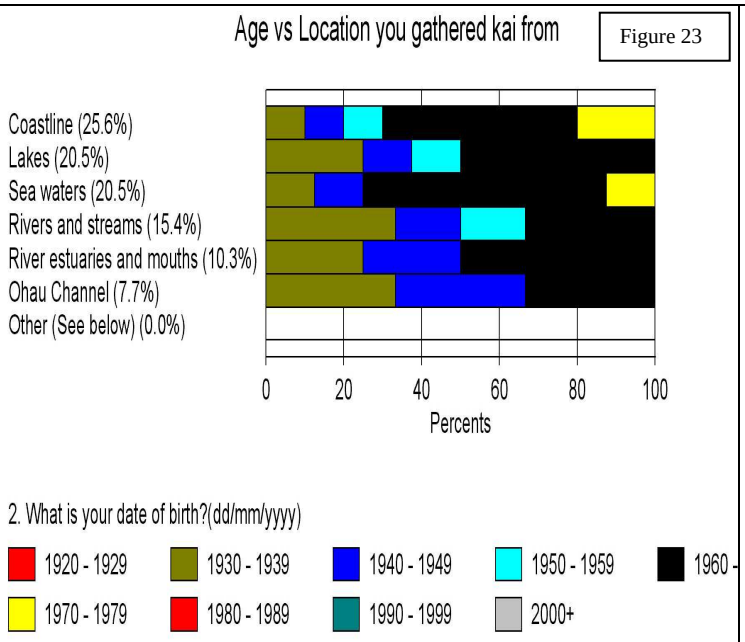


Figure 23 suggests that those in their 30s prefer kaimoana or marine species as gathering occurs at the coast or at sea. This result could also be a reflection of their mobility and possibly access to boats.

In contrast kaumatua gather from all habitat types.

In Figure 24 we show where each of the species are gathered. Most freshwater species are gathered from a range of sites (other than kakahi). Many more coastal species are gathered than freshwater species, although some species (inanga, eels) are gathered in both areas. Figure 25 shows the proportion of individuals that gather each species. Trout, koura, pipi, mussels, kahawai, cockles, snapper and kina are gathered by at least 70% of participants.

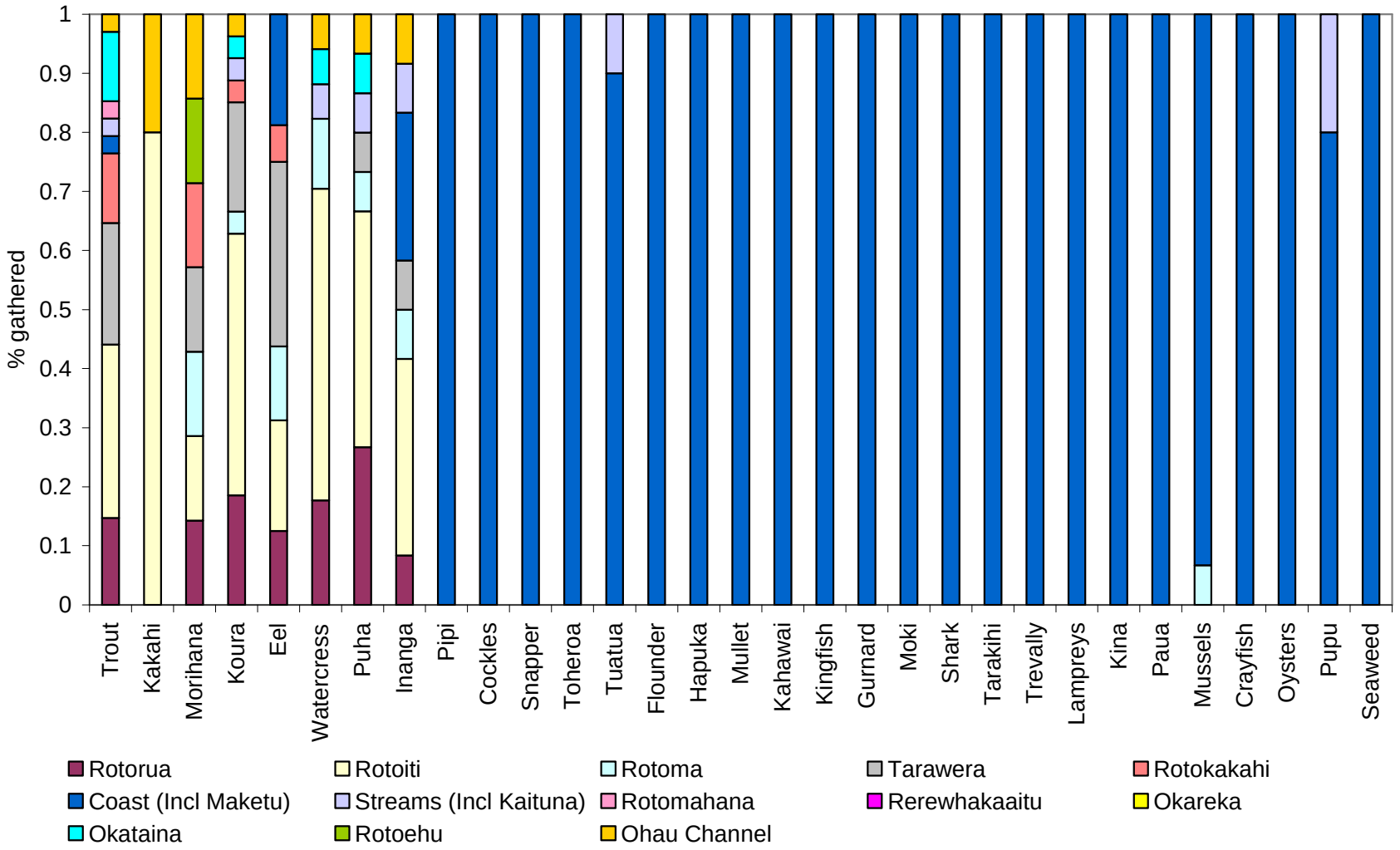


Figure 24: Relative proportions of sites from which the different species of kai were gathered.

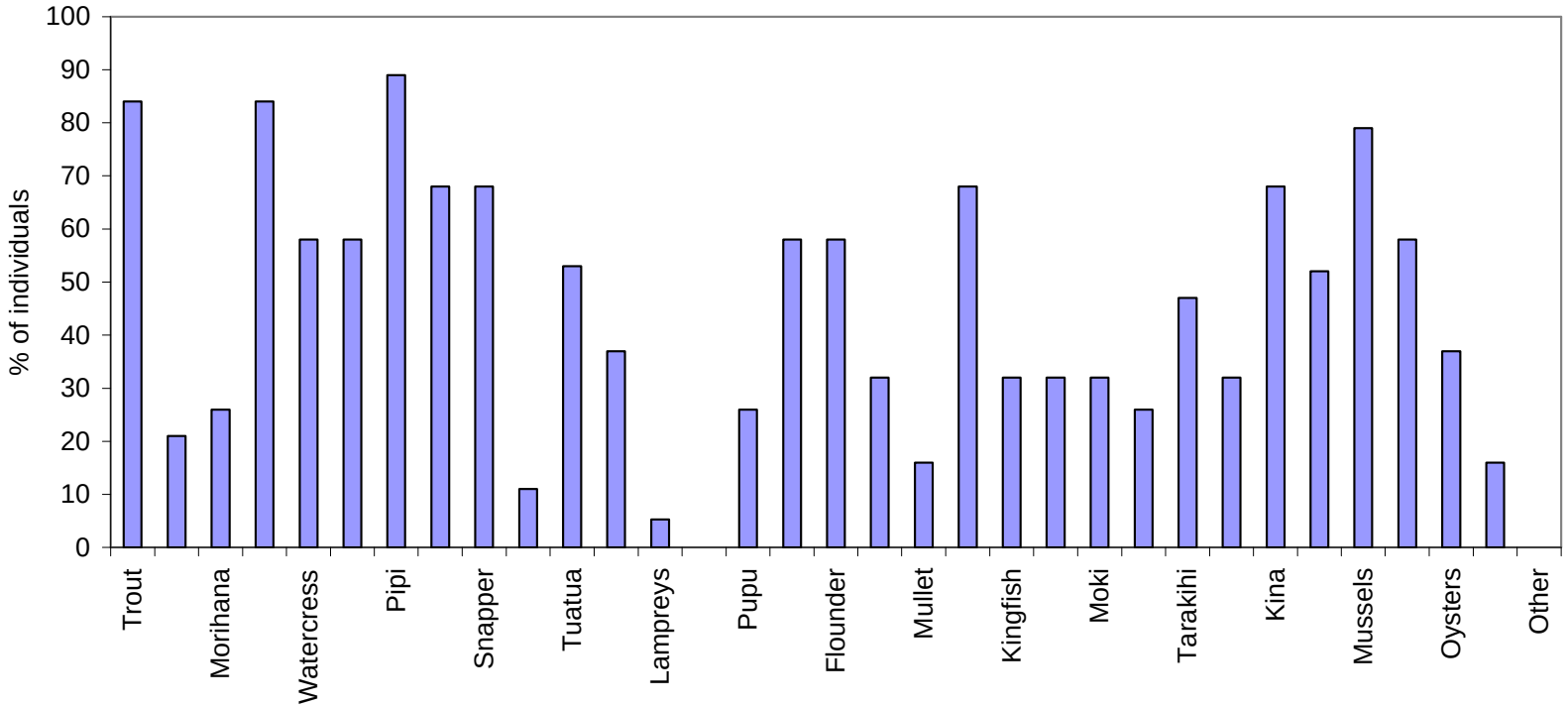


Figure 25: Percentage of individuals who gather each species.

5.2.4 Other sources of kai

This project is about the risk of exposure to contaminants as a result of kai gathering. If there are concerns about the safety of kai consumed, and people are consuming kai that has been gifted, it is important for them to know where the kai comes from.

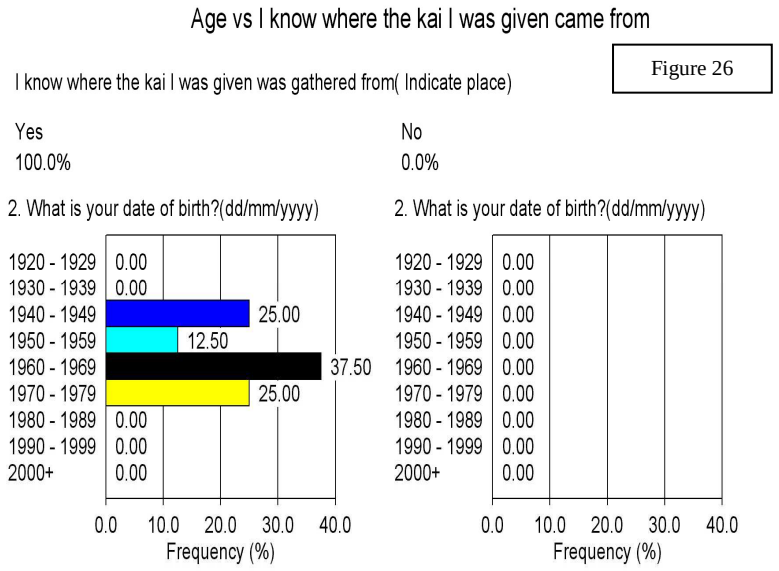


Figure 26

All respondents indicated that they did know the source of the kai they were gifted (Figure 26).

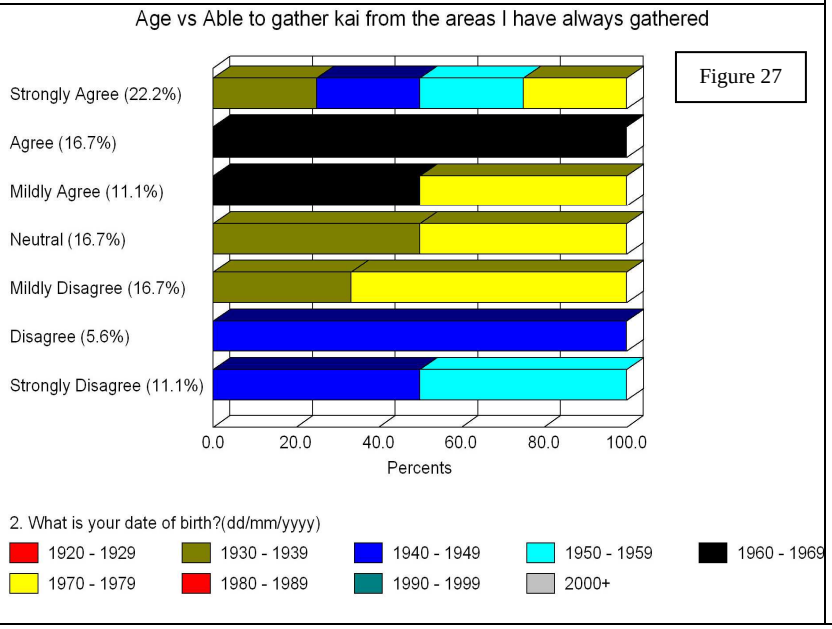


Figure 27

Assuming the sites whanau gather from would change if the condition of the site was degraded; respondents were asked if they were able to gather from the sites that they have always gathered from (Figure 27).

- 50% agree that they can.
- 33% say that they cannot.

No trends can be detected when looking at the respective age groups, although those aged in their 40s all agreed with the statement.

Tangata whenua have witnessed and experienced a range of changes to the local waterbodies and their relationship with them in the last few decades. One of the changes witnessed concerns the abundance of kai available. This is considered in the next section.

5.2.5 Perceived changes in the abundance of species that are gathered

If kai are to be promoted as a beneficial source of food, sufficient quantities of healthy stocks need to be available in order to sustain gathering. The Consumption Survey asked whanau to provide an assessment of the stocks of various species gathered and whether or no abundance had changed. Table 3 presents a summary of these results.

Table 3: Changes in the abundance of species (as a percentage of respondents)[6].

Species	A lot fewer	Slightly fewer	About the same	More abundant
Kakahi	22.2	44.4	-	11
Morihana	42.9	14.3	-	-
Cockles	25.5	50	16.7	8.3
Pipi	11.8	52.9	35.3	-
Toheroa	23.3	16.7	33.3	-
Tuatua	22.2	44.4	11	-
Lamprey	33	50.5	-	-
Mutton birds	50	25	-	-
Pupu	57.1	14.3	-	-
Eel	28.6	28.6	21	-
Flounder	18.2	45.5	0.1	-
Paua	36.4	45.5	9.1	-
Mussels	21.4	28.6	28.6	-
Crayfish	8.3	41.7	25	-
Oysters	27.3	36.4	27.3	-
Seaweed	25	25	-	-
Koura	7.1	35.7	25	-
Watercress	13	33.3	28.6	-
Puha	0	38.5	53.3	-
Hapuka	14.3	42.9	14.3	-
Mullet	16.7	33.5	33.3	-
Kahawai	9.1	27.3	36.4	-
Kingfish	22.2	22.2	22.2	-
Gurnard	11	44	22	-
Snapper	0	40	3	-
Moki	20	40	20	-
Shark	20	40	20	-
Tarakihi	9.1	36.4	27.3	-
Trevally	12.5	37.5	25	-
Whitebait	14.3	42.9	28.6	-
Trout	25	16.7	50	8.3
Kina	16.7	41.7	16.7	-

[6] Perceptions with respect to individual species are summarised in Table 8 with graphs included as **Appendix 1**

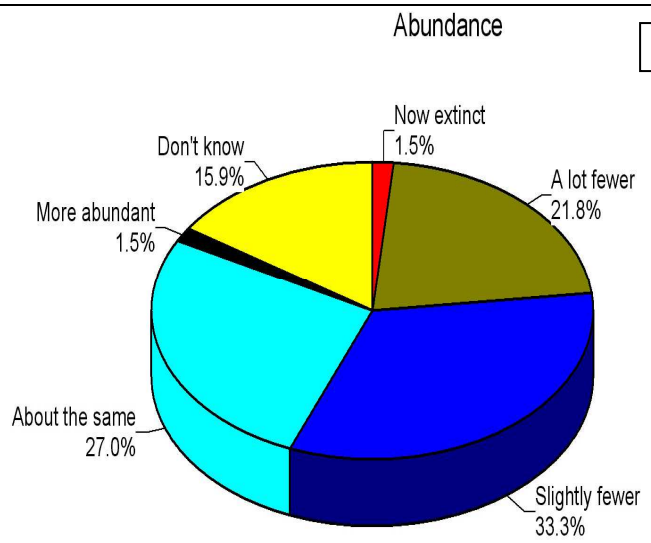


Figure 28

With respect to abundance, 56% felt that "fewer" stocks were available today, specifically, 22% of respondents believed that across all species gathered there were now a "lot fewer" available while another 33% believed that abundance was "slightly fewer"(Figure 28).

As stated earlier 1.5% believed that a number of species – including morihana and koaro were extinct (i.e., no longer present at those places previously gathered from).

5.2.6 Kai gathering behaviours

It cannot be assumed that all kai consumed is gathered by the respondents. Questions in the survey therefore asked about purchasing kai and sought to understand if it was shared within the whanau and wider community.

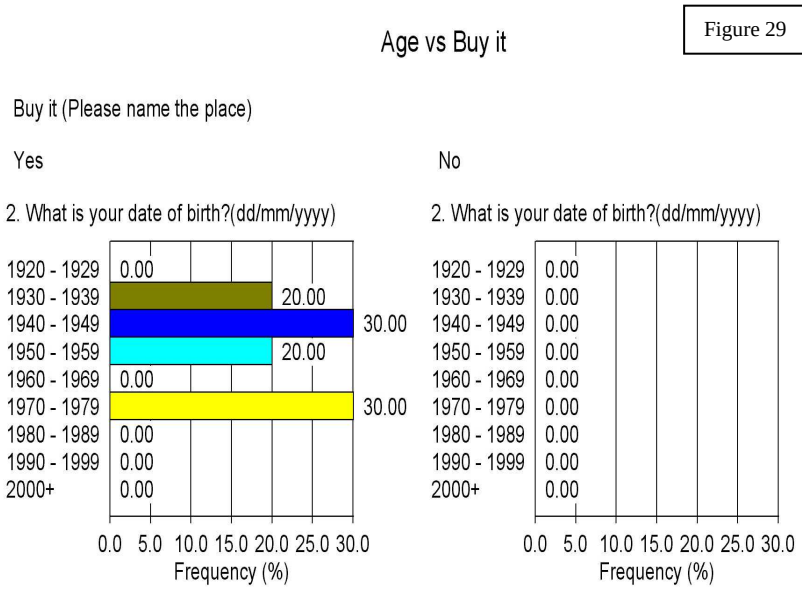


Figure 29

All respondents buy some of their kai (Figure 29).

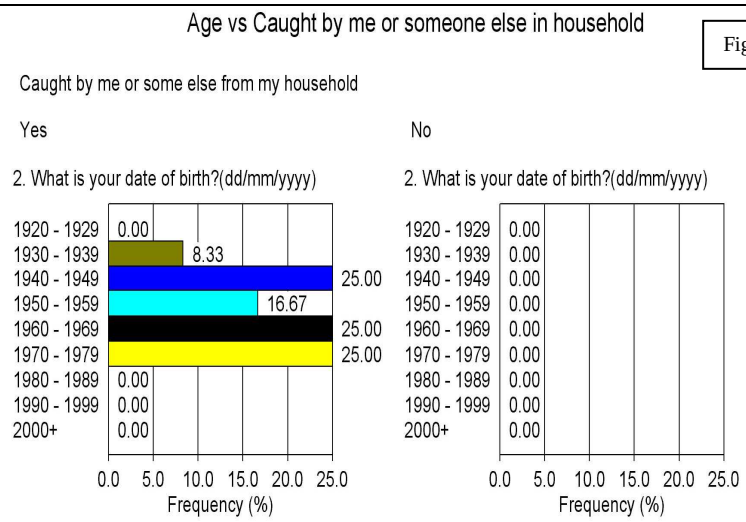


Figure 30

All respondents confirmed that they or someone in their household caught their own kai (Figure 30).

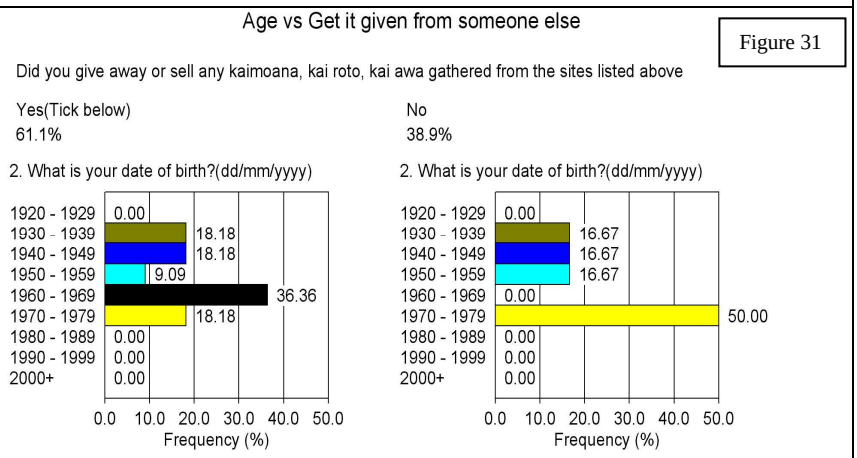


Figure 31

61% of participants said that they also were also given kai (Figure 31).

Aside from knowing how to gather kai, whanau need to know how to prepare the respective species.

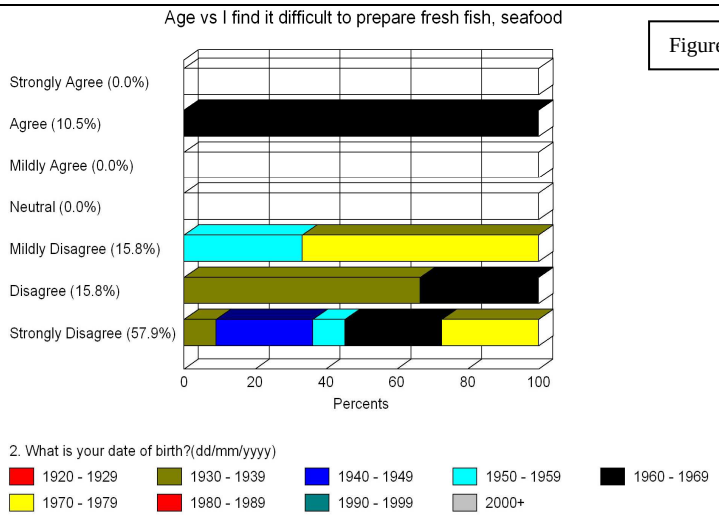


Figure 32

90% of respondents disagreed with the statement (58% strongly disagreeing) that it was difficult to prepare fresh fish and seafood. In other words 90% knew how to prepare their kai (Figure 32).

Of note however was the difference between generations, those that agreed with the statement – i.e., they find kai difficult to prepare - were all aged in their 40s.

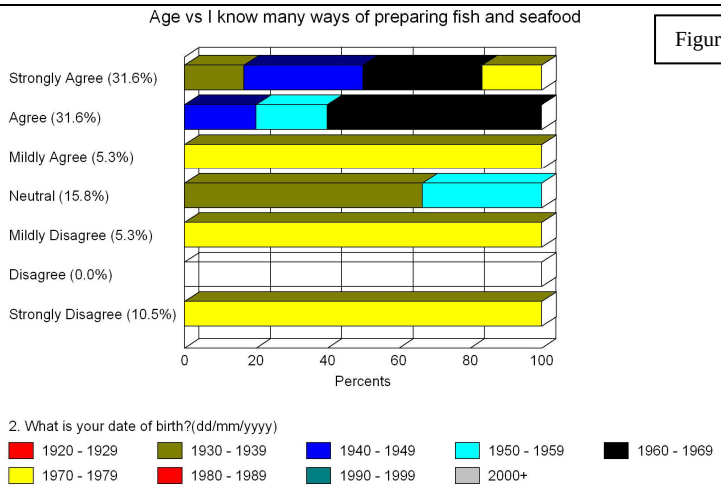


Figure 33

68.7% of respondents know many ways of preparing kai (Figure 33). In contrast, those aged in their 30s replied that they definitely did not know multiple ways of preparing kai.

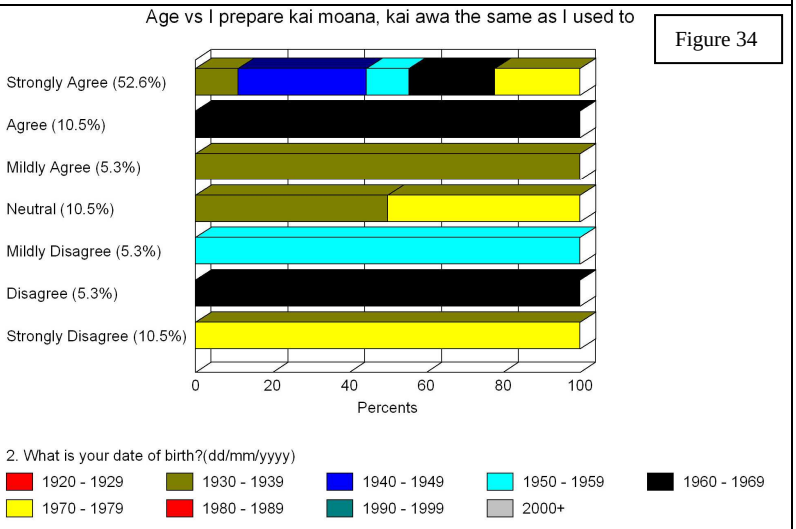


Figure 34

52.6% (across all age groups) strongly agree they prepare kai the same way that they have always done (Figure 34). In fact, 68% of respondents indicated they prepared their kai the same way as they have always done.

5.2.7 Perception of the environment

Yeah, about 60 years ago, beautiful, high and wide and I guess you got the incoming tide from the ocean and the outflow and that, you know. Well, look, it's just quite natural, eh, how you got the Kaituna coming down, you know, and pushing up and you got the foreshore, both doing justice to the estuary and that's how it used to be (Informant K).

The lake was our playground that is all we had. Along Kotu during the summer and we never went anywhere else. We walked it, we swam it, we sailed it, we played in it (Informant M).

Maori experience environments and central to their continued interaction and utilisation of environments will be their perception of the good health of such areas. A number of questions in the survey asked for them to give an assessment of the condition of the sites from which they gather kai.

Figure 35

Responses were mixed when asked about the condition of sites (Figure 35), with:

- 52.7% believing sites to be in good condition while
- another 31% did not provide an assessment.
- Only 16% appeared to believe that sites from which they gather are not in a good condition.

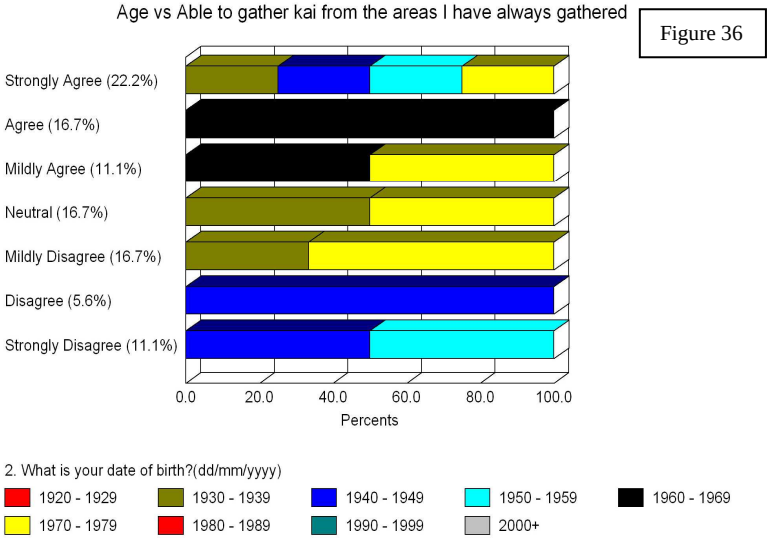


Figure 36

This is supported by the assessment by 50% of respondents who believe that kai could be gathered from the same sites that have always been accessed (Figure 36).

With respect to age differences those who believed they could no longer gather from the sites they have previously been able to were aged in their 50s and 60s.

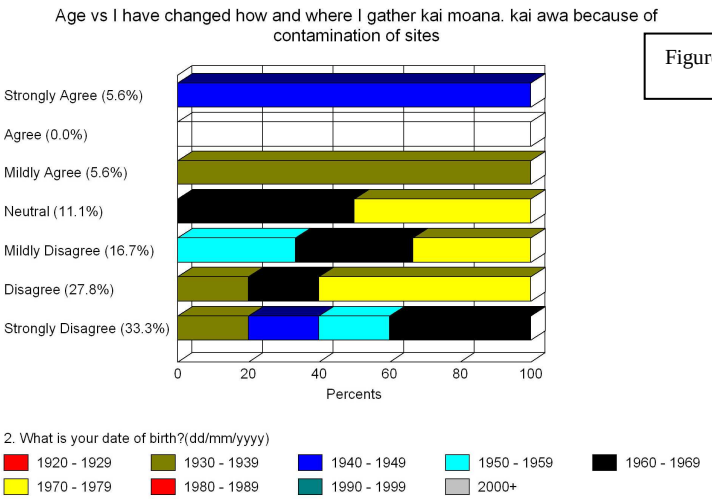


Figure 37

Responses were also mixed when asked about changing the sites they gather from as a result of perceived contamination at the sites (Figure 37):

- Only 11% agreed that they had changed their gathering behaviour.
- In contrast 77.8% across all age groups disagreed.

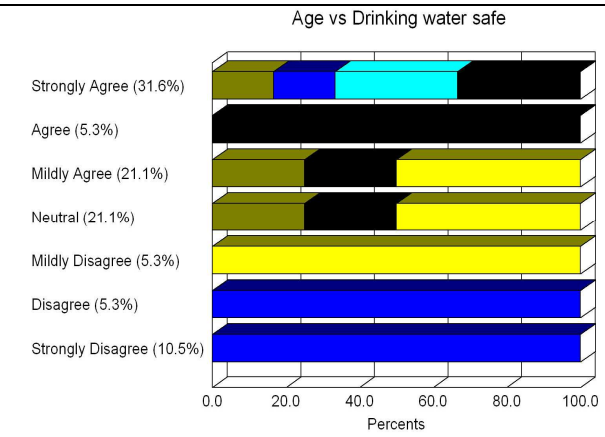


Figure 38

The majority of participants (58%) believed that their drinking water was safe (Figure 38). However, 21% did not comment.

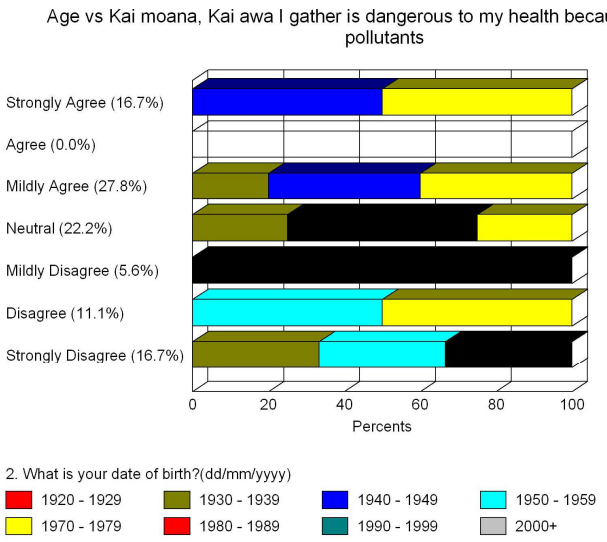


Figure 39

In relation to pollutants (Figure 39):

- 44.5% strongly disagreed with the statement that the kai gathered was dangerous to human health because of pollutants with (16.7 strongly disagreeing)
- However 22% did not provide an assessment.

With respect to age differences all respondents in their 60s agreed with the statement – that kai is dangerous because of pollutants.

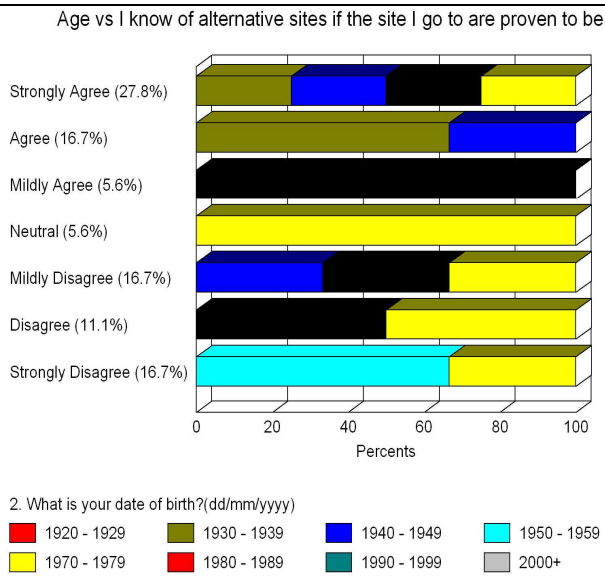


Figure 40

No clear trends emerged when asked if kai gathering was dangerous to the health of respondents because of pollutants or toxins.

However, if a site is contaminated then the expectation would be that alternative sites would be used.

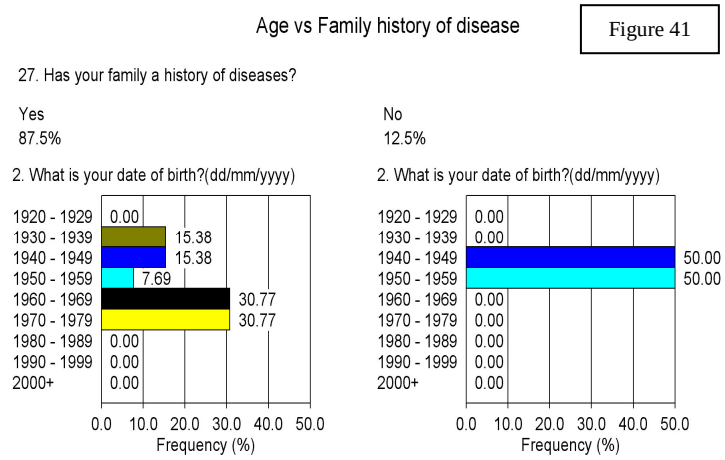
However only 50% knew of alternative sites that they could use (Figure 40). 27.8% strongly agreed with the statement that they would use alternative sites.

All respondents aged in their 70s knew of alternate sites.

5.2.8 Health of whanau members – Self Reported Rates of Diseases

Participants were asked to self report diseases prevalent in the family (Figures 41 and 42).

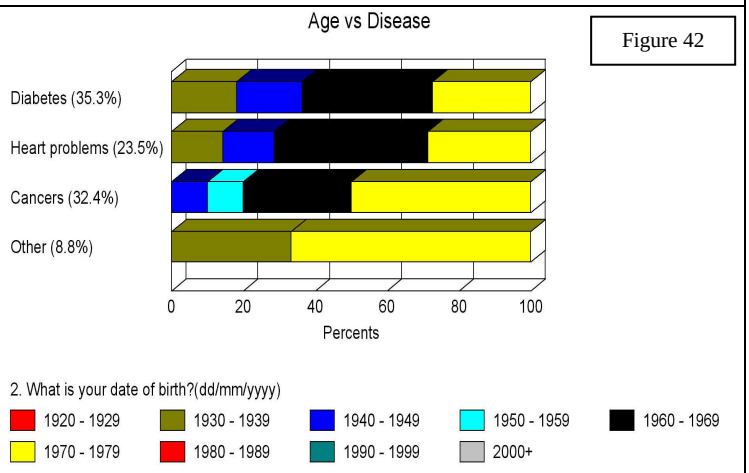
Figure 41



The lowest reported incidence of disease was among those in their 50s (at 7.69%) while those aged in their 60s and 70s each scored 15.38% which contrasts with a rate of 31% for those aged in their 30s and 40s.

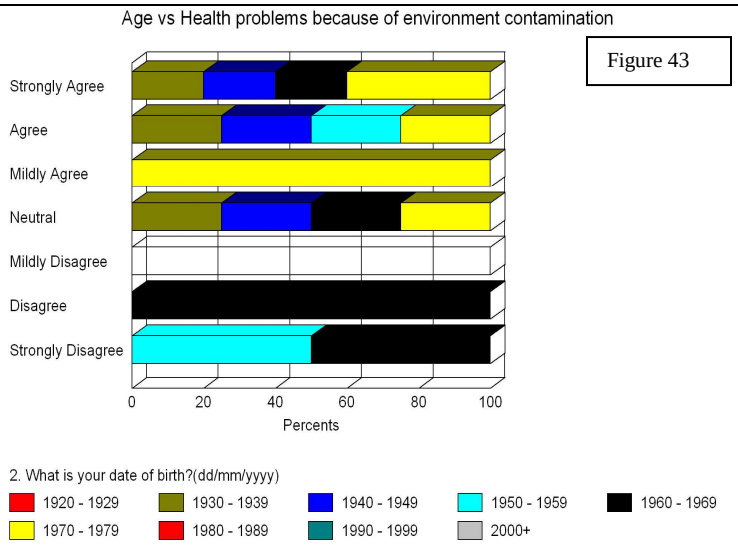
- 87.5% reported that there was a history of disease in their family.
- 35.3% of participants, across four age groups, reported a history of diabetes within their whanau.
- 32.4% of participants, across four age groups, reported a history of cancers within their family.
- 23.5% of respondents, reported heart problems (Figure 42).

Figure 42



Despite the prevalence of illness in their whanau (at above average rates) 84.2% of the individuals participating rated their health as good, very good or excellent (Figure 43). No one rated their health as poor.

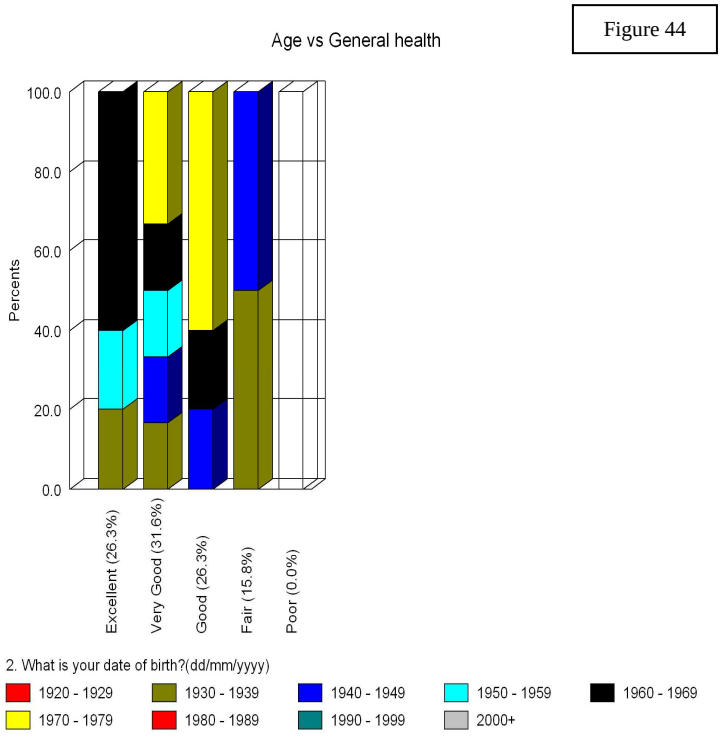
Figure 43



Two questions in the survey asked if respondents believed their health problems could be attributed to environmental contamination or more specifically water contamination (Figure 43).

With respect to environmental contamination, 61% of participants across most age groups agreed with the statement that health problems can be attributed to contamination.

Figure 44

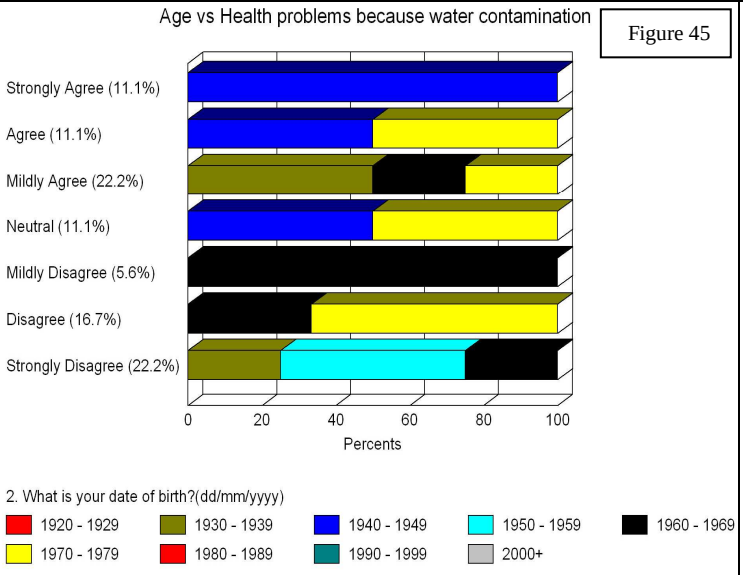


Other age group observations (Figure 44):

- The eldest participant considered their health as excellent.
- Those aged in the 70s and 60s were the only ones to rate their health as fair.
- The greatest variation was in the 70+ years age group with participants rating their health fair, very good or excellent.

As expected, the youngest participants (aged in their 30s and 40s) considered their health very good or good.

Figure 45



Interestingly 44.5% of participants disagreed with contaminated water being the source of their health problems while an equal number agreed.

The "casting vote" lies with the 11.1% who provided no comment (Figure 45).

5.2.9 Disseminating advice about contamination issues

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

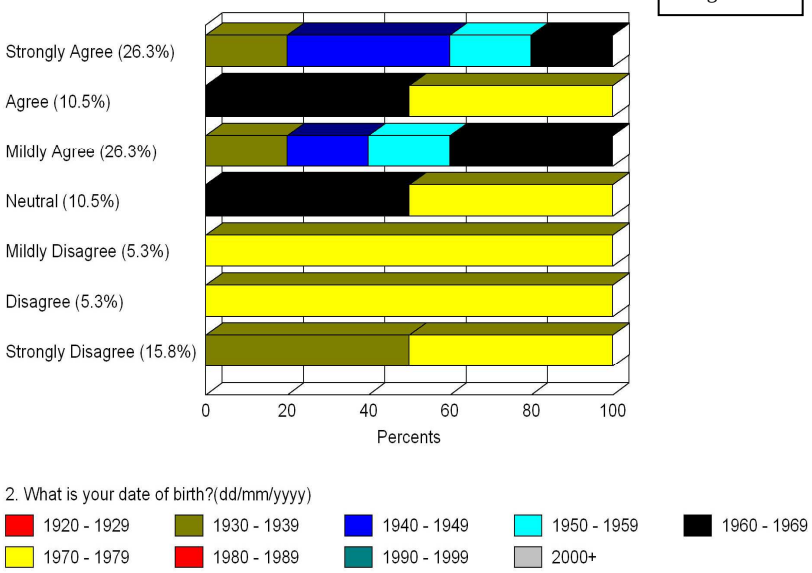


Figure 46

63.1% of respondents indicated they knew where to get advice about contamination issues (Figure 46).

Only 26.4% (and two specific age groups – those in their 40s and 70s) did not know where to go to obtain information.

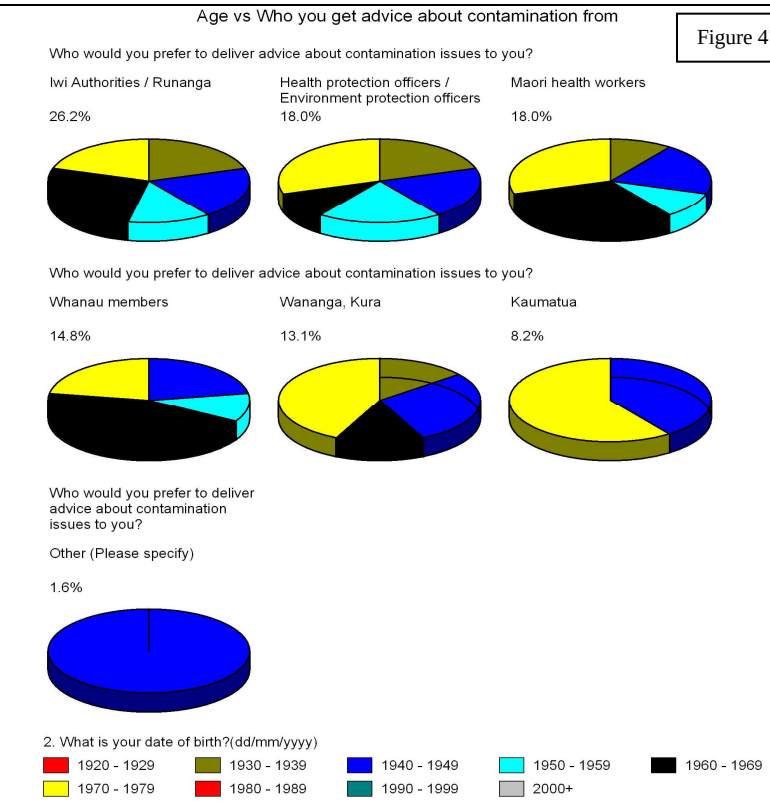


Figure 47

There is a slightly higher preference for iwi authorities/runanga to deliver the information (26.2%), although HPOs/EPOS, Maori health workers, whanau members and whananga were also considered important (Figure 47).

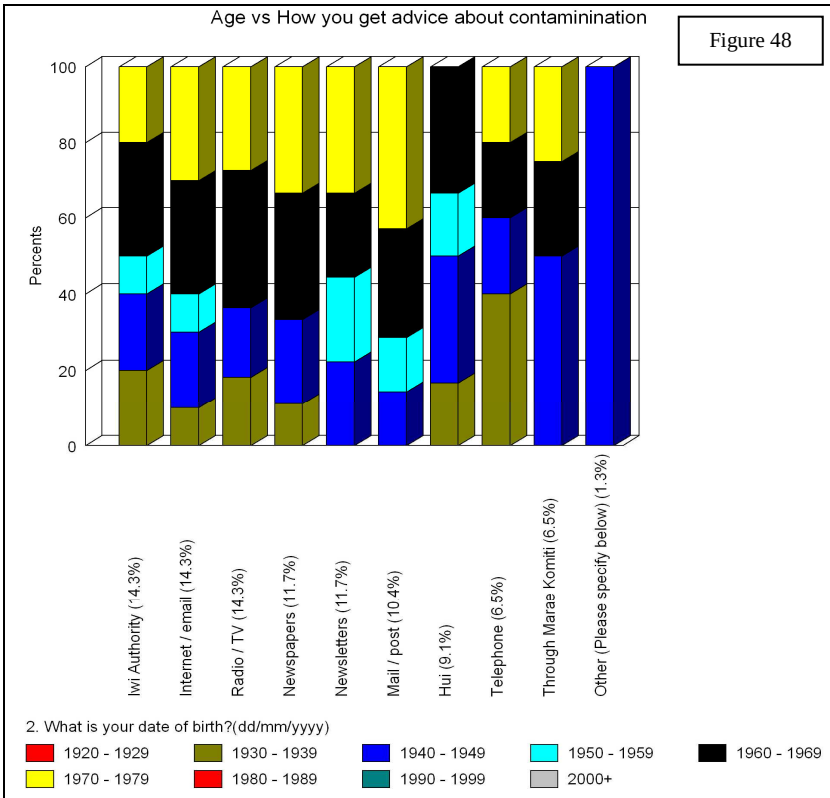


Figure 48

Similarly there was no clear preference with respect to the means of communicating contaminant information, which in fact suggests that a range of media should be used. About 9 different media were supported evenly (Figure 48).

However, when reviewing the means of communicating we need to be cognisant of the equipment needed by whanau.

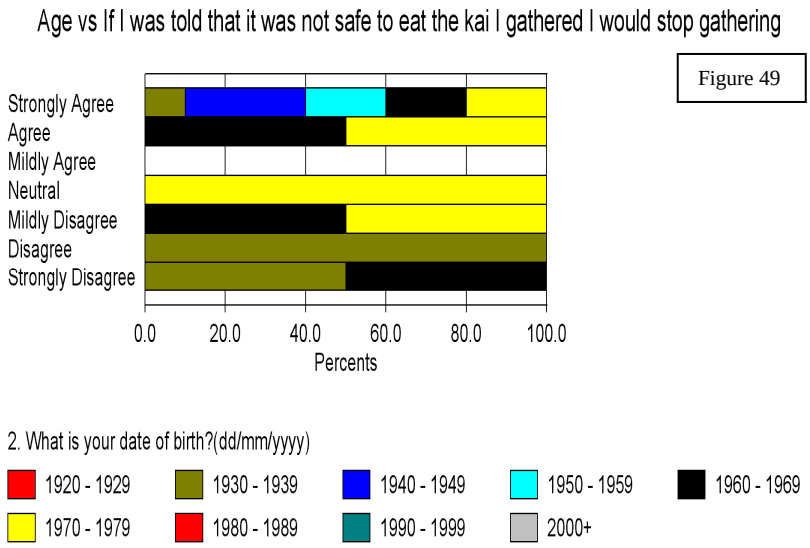


Figure 49

The final result (Figure 49) concerns the long-term outcome of this programme and the need to communicate health risk. Importantly, 63.6% of respondents (across all age groups) indicated they would stop gathering kai if advised that kai was not safe.

In the section that follows we discuss the implications for Te Arawa of the results presented in this chapter.

6. Discussion - understanding the socio-economic-cultural importance of kai to whanau and hapu

> *Indigenous relationships to the land are based in cultural practices. Harvesting of traditional foods is a central, material part of this relationship. A key problem for indigenous peoples occurs when, because of the practices of competing world views such as those often held by colonial states, practising these material connections becomes difficult. Problems ensue. These problems include issues related to health and well-being, and a disruption of well-established life-ways. (Fediuk and Thom, 2003, p 1)*

The discussion in this chapter compares traditional and contemporary consumption patterns of kai gathering, processing and consumption, the health of significant sites, and summarises environmental change over the last 160 years to identify drivers of the transitions from a traditional kai based diet to a western diet. Insights, firstly, concerning the impact of dietary changes and secondly, the ongoing risk of exposure to contaminants and the impacts of this risk on the health and wellbeing of whanau are discussed in the wider political / social / cultural context in order to give a more complete reporting of cultural-environment relations.

From the histories of Te Arawa and written manuscripts, descriptions of lifestyle heavily dependent of kai gathering emerges. The resources available from these lakes were crucial for sustaining the livelihoods of Te Arawa whanui prior to European settlement. Kai gathering was the basis of an economy and culture before contact with Europeans. In this chapter we distinguish kai gathering in three time periods:

- pre European settlement through until late nineteenth century using mostly information sourced from secondary sources;
- twentieth century up until the 1970s and 1980s – using information sourced from interviews with members of Te Arawa whanui; and
- the present - using information obtained from:
    - the interviews with members of Te Arawa whanui;
    - the kai consumption survey; and
    - monitoring reports of EBoP, research reports and statutory plans.

6.1 Structure of this chapter

Te Arawa have continually asserted their right to have their mahinga kai and cultural practices protected. However, many whanau in Rotorua Lakes have witnessed the degradation of valued habitats and experienced significant barriers to gathering kai. They continue to express their concerns in a variety of forums. This chapter follows the format of Chapter 5 and discusses:

- patterns of kai consumption;
- estimates of the quantity of kai consumed;
- sites from which kai is gathered;
- perceived changes in the abundance of species;
- kai gathering behaviours;
- perception of the environment;
- health and wellbeing of whanau members; and
- disseminating advice about contamination issues.

6.2 Traditional patterns of gathering

> *At 1840, Lakes Rotoehu, Rotomā, Rotoiti, Rotorua, Ōkataina, Ōkareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngāhewa, Tutaeinanga, Ngāpouri, and Ōkaro were rich in resources. These included extensive indigenous fauna and flora that provided food, shelter, and economic resources for Te Arawa as well as the means to provide for manuhiri (visitors) and others in the district. The lakes were also primary transport routes for the area. To Te Arawa, the lakes were taonga, and their relationship to the lakes and environs was and continues to be the foundation of their identity, cultural integrity, wairua, tikanga and kawa.*

The evidence of Captain Gilbert Mair, before the Native Land Court during its 1918 inquiry, explained the significance of aquatic resources, (as apart from birds and rats), that the Rotorua district was seen to be unsuitable for cropping. This resulted in fishing assuming greater importance to Te Arawa. Mair listed the various species of

fish caught in the Rotorua lakes including: kakahi (a kind of freshwater mussel), kokopu, koaro (fish similar to small trout), koura (freshwater crayfish), and inanga (whitebait)[7].

Rights to water fowl were held by particular hapu, and were sustainably managed. Kawa (shags) and seagulls, which nested on the lakes' margins, were also managed as were plants such patches of raupo growing along the lake shore[8]. Overall, the list of food items, materials, and other resources relied on by Central North Island Māori including Te Arawa to sustain themselves is substantial. Listed below are some that have been referred to in written text and statements –

Fish and crustacea including:

> eels of different kinds, koura (freshwater crayfish), inanga or whitebait, kōaro, kokopu, kakahi (freshwater mussel), karehe (freshwater pipi), toitoi (common bully), ngorungoru, pahore, mataitai (foodstuff from the sea, generally).

Birds including:

> ducks, kaka, kiwi, kakapo, kukupa and kereru (pigeons), tui, taiko (petrels), mutton birds, matuku (bitterns), kahu, weak.

Other fauna including:

> kerewai (a green beetle, found in manuka scrub), kiore (rats), and [as a later introduction] pigs.

Plant products including:

> flax, kakaho, raupo, paopao (another type of reed), kiekie, toetoe, aruhe (fern root), putere (raupo root), mānuka [used for medicine and also for constructing koneke and shelters], tahara, mingimingi, kaponga bark [for medicine], tutu and koromiko [for medicine], makaikai/maikaika tubers (a kind of potato), kohekohe, pukeatea, rewarewa, mangeao, puriri, wharangi, kotukutuku, makomako, kaponga-mamuka, tawhero, mawa, kawakawa, piripiri [these last 13 all having medicinal uses], ti kouka shoots, berries (tawa, hinau, titoki, makomako, kotukutuku, rohutu, poporo, karaka, miro, tutu), young fern fronds (moku, paretao and pikopiko), rarauhe (bracken),

[7] Evidence of Gilbert Mair, ibid, pp 191–196
[8] Evidence of Wiremu Maihi Ereatara, ibid, p 306

tāwhara fruit and flowers [both used for food], huahua, tupakihi, tawhara, puha, watercress, and [cultivated] kumara, hue (gourds), and taro.

Timber including:

totara, puriri, tanekaha, pohutukawa, white pine.

Other materials such as:

paru [for dyeing fibre], kokowai (red ochre), sulphur [used for medicinal purposes].

Other natural resources:

water, geothermal resource [both with multiple uses including spiritual].

Another comprehensive description of the species sourced from the Rotorua Lakes area is provided by Makereti in “Old Time Maori” (originally published in 1938).

Table 4: Species traditionally gathered from across the Rotorua Lakes region sourced from the writings of Makereti (1938).

SPECIES				
Koeaea (whitebait)	Kokopu (*Galaxias*)	Upokororo (grayling)	Eel	Koura (crayfish)
Inanga/smelt (*Retropinna retropinna*)	Tamure (schnapper)	Trevally	Kahawai	Kumukumu (gurnard)
Kingfish	Mangopare	Pepeke	Kapeta	Parore
Mangotara	Koheriri (horse mackeral)	Kutorotoro (sandfish)	Tutahuna	Tarakihi
Mango (shark)	Hapuka (groper)	Kanae (mullet)	Warehou (sea bream)	Moki
Manga (barracuda)	Tuangi (cockles)	Kuku (mussels)	Karengo (*Laminaria*)	Rimurehia / rehia – edible seaweed
Paua (*Haliotis*)	Kina (*Echinus*)	Tio (oysters)	Pipi	Kotukutuku (*Fuchsia excorticata*)
Aruhe (bracken fern)	Poporo berries (*Solanum aviculare*)	Hakeke (*Polyporus*) – an edible fungus	Kakahi (freshwater mussel, *Echyridella menziesi*i)	Toitoi (*Gobiomorphus gobioides*)
Kumara	Tutu – the berries of the puho (*Coraria ruscifolia*)	Harore (*Agaricus adiposus*)	Kiore – rat (*mus esculens*)	Pig
Para twahti, para reka or para (*Marratia fraxinea*)	Berries of the karaka tree (*Corynocarpus laevigata*)	Pungapunga – pollen of raupo (*Typha sp.*) koreirei – roots of the raupo	Many different bird species	Potato
Tawa berries (*Beilschmiedia tawa*)	Ti kouka or whanaka (*Cordyline australis*)	Puwha (*Sonchus oleraceus*)	Tawhara – part of the kiekie (*Freycinetia banksii*)	Fruit of the Hinau tree (*Elaeocarpus dentatus*)
Taro	Fruit of tumingi (*Cyathodes acerosa*)	Roots of pohue (*Convolvulus sepium*)	Te korito – heart of Nikau palm (*Areca sapida*)	Fruit of the Makomako (*Aristotelia racemosa*)
Young fronds of the fern Moku (*Asplenium bulbiferum*)				

Makereti (1938) also describes how the respective species were gathered.

Shellfish

Shellfish was an important food, and many species were found in the sand of the beach when the tide was out. The varieties are too numerous to mention. All shellfish were collected by women and not by men.

Kuku, mussels, were taken from the rocks by hand and collected in baskets.

Paua (Haliotis)… is taken from the rocks by hand, and the inside is taken out and beaten to soften it before it is cooked on hot coals or in a hangi.

Kina (Echinus)... is generally eaten raw. It is usually collected at the same time as the paua.

Tio, oysters of two kinds, were found on the coast. One kind is rather small and has a rough and crinkled shell, and is found on rocks. The other is much larger, and has a comparatively smooth shell, and lives in mud. The Maori did not care a great deal for oysters, as he did for other shell-fish.

Pipi grows all over New Zealand, generally in sand banks or in sandy mud, and was a favourite food.

Freshwater fish

Koura …..They used the paepae, a dredge net, and also whakaweku, bunches of fronds of raurahe (bracken) sunk to the bottom of the lake, or tau, bunches of fern tied to a post.….Our people also ruku koura, that is, dived for crayfish, going to the bottom of the lake and bringing them up between both hands.

Inanga (Retropinna retropinna) was taken in great quantities in most of our lakes with the kupenga, or seine net. They were also taken in an oval hoop net with a long wooden handle which went right across the net, and also in a small conical scoop net. The fishers who used these small nets waded near the shore. But the big net was generally used in the old days in Lake Taupo and Lake Rotorua, Lake Rotokakahi, and other lakes...

Toitoi (Gobiomorphus gobioides) is a small fish caught in the lakes, and like inanga was taken in nets…. Toitoi was also called titarakura and other names.

Pahore was another small fish found in the lakes like the toitoi.

Koeaea or whitebait was much thought of, and it is one of the nicest of all small fish….

Kokopu (Galaxias) was an important food among the people who lived inland..… The kokopu was generally taken on dark nights in summer and autumn….. Its flavour was not unlike whiting, and there were about six varieties.

The upokororo or grayling, of which there were the tirango, kutikuti, and rehe, were caught in traps when they were going up rivers after a flood while the water was still dirty. The upokororo was also taken in nets and by other means.

The Maori sometimes caught the patiki or flounder with a spear. The spear was made with a point at the end which was barbed. It was not unlike the spear used for catching birds.

Kakahi, the fresh-water mussel.

Eels were taken in a hinaki, eel trap, set at a pa tuna (eel weir), and with a bob, spear, or even with the hand..…

Marine species

The mango (shark) was taken, not only to eat, but for the teeth. The teeth of the mako shark, or some of its species, were used as ornaments and as cutting implements.

There were also hapuku (groper), tamure (schnapper), kanae (mullet), warehou (sea bream), moki, kahawai, kumukumu (gurnard), and other fish.

Sea crayfish were also taken by diving. Men and women were clever at the work of ruku koura, that is diving for crayfish among the rocks of the sea.

Kahawai (Arripis salar) was caught by trawling.

Hapuku (groper), another favourite fish, was also caught by trawling.

Kanae (mullet) was another favourite, which to me tasted like the mackerel I have eaten in England.

Whai or sting-ray was taken with a wooden spear.

Wheke or octopus if small were taken by hand from among the rocks. Should the wheke twine its many legs round the arm of the catcher, he puts his other hand underneath the body.

Seaweed

Karengo (Laminaria sp.) was a seaweed which grew on flat clayey tidal rocks. It grew in plenty on the east coast of New Zealand.

Rimurehia or rehia was an edible seaweed, gathered in the sea close to the shore, or on the beach, and cooked in a hangi and eaten.

Rimiparo was another seaweed gathered and cooked and eaten in the same way. In the summer it was sometimes eaten cold.

Plant species

The pungapunga, the yellow pua, or pollen of the raupo (Typha angustifolia) was mixed into cakes with water and baked. The pungapunga was gathered in summer when the plant was in full flower, and was obtained by shaking the dense flowering spikes gently. Raupo grows in swamps by the edge of streams and rivers and lakes. It has a sweetish taste. The middle part of the white succulent roots of the raupo, called koreirei, was also favoured as a food. It was generally eaten raw during the summer season.

The roots of the pohue (Convolvulus sepium) were dug up out of the ground, cooked in a hangi and eaten. The root was long and tough, and got after much trouble. It was quite good to eat.

6.3 Contemporary species

Many of valued species gathered historically that were of high nutritional value are no longer available in quantities sufficient to enable them to be a primary food source. The species identified during the interviews include:

Kakahi	Morihana	Cockles	Pipi
Toheroa	Tuatua	Lamprey	Mutton birds
Pupu	Eel	Flounder	Paua
Mussels	Crayfish	Oysters	Seaweed
Koura	Watercress	Puha	Hapuka
Mullet	Kahawai	Kingfish	Gurnard
Snapper	Moki	Shark	Tarakihi
Trevally	Whitebait	Trout	Kina

As Table 3 confirmed most species are perceived to be "fewer" in abundance and many iconic species are now only consumed on special occasions. The decline of the freshwater resources is of particular concern to Te Arawa. In addition to the reduced numbers, the condition of the kai may be compromised as well. Most distressing and representing a significant cultural loss, is the possible loss of entire species e.g., koaro, and morihana from some streams and lakes.

While whanau made use of many species, the centrality of koura and whitebait as a critical food source in the Rotorua Lakes is well known and is reflected in the initiatives to restore populations of taonga species. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round.

Food security implies adequate access to affordable, high quality foods that are culturally acceptable. However, introduced aquatic species were not seen by Te Arawa as substitutes of equivalent cultural, spiritual or nutritional value. This is supported by the fact that trout is not eaten by 11% of respondents. However if trout is the abundant species and requires less catch effort than the declining indigenous species gathered historically, it is inevitable that some substitution occurs. It is clear from our research that whanau currently gather kai at quantities less than they did historically and at quantities less that they desire. This is discussed in the next section.

6.3.1 Estimates of the quantity of kai consumed

There is little data available to enable calculation of pre-European (historic) contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. From Makereti (1938) we know:

Two meals were taken each day, the first about 9 a.m., and the other about 4 p.m..…

For the calculation set out below in Table 5 we have assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats in the lakes, especially Rotorua. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

It started to change - in the 70s. Okawa Bay was established in 1971 and it became a subdivision and when you look there, it is all a mixture of all nationalities, whereas Mourea is the old hapu (Informant E).

In the late 1970s, early 1980s when the seaweed and the little maggots, eh, in the lakes start to stink. And that, you know, gradually got worse and as the seaweed went away the stink remained, (Informant M).

The Kai Consumption Survey asked respondents to identify quantities of various types of kai consumed. For taonga species, the following calculations for the quantities for the respective species are considerably less:

	Contemporary consumption of whitebait	**Equals 5.7g per person per day**
	Contemporary consumption of mussels	**Equals 16.9g per person per day**
	Contemporary consumption of kakahi	**Equals 0.3g per person per day**
	Contemporary consumption of koura	**Equals 2.5 per person per day**
	Contemporary consumption of trout	**Equals 10.9g per person per day**

With respect to contemporary consumption, from the Kai Consumption Survey, all respondents still consume kai awa, kai roto, or kai moana. For the comparative analysis in Table 5 we have extracted the quantities of fish consumed from the Kai Consumption Survey data as well as the frequency data.

Table 5: Estimates of the quantity of kai consumed.

Kai consumption historically	Kai consumption up in twentieth century 1970s, 1980s	Contemporary kai consumption
Assumptions The data for estimating the quantity per sitting is that relating to "fish streamed or grilled[9]". At least one meal of "kai gathered" per day per person. Because of the abundance compared to the present, at least 10% more per setting would be consumed compared to today's per sitting estimates. 219.44g per sitting per day. Plus 10%.	Assumptions The data for estimating the quantity per sitting is that relating to "fish steamed or grilled". At least 3 meals of "kai" per week per person. The quantity per sitting would be the same as today's per sitting estimates of 219.44g.	Assumptions The data for estimating the quantity per sitting is that relating to "fish steamed or grilled". The quantity per sitting would be the same as today's per sitting estimates of 219.44g. Special occasions are estimated to be 6 per year. Less than once a month is estimated at 9 per year (which accounts for 11.8% of respondents). 52.9% eat kai 1-3 times per month. 17.6% eat kai once a week per month. 5.9% eat kai twice per week. 5.9% eat kai 3-4 per week. 5.9% eat kai 5-6 per week.
Equals 241.38g per person per day	**Equals 94.05g per person per day**	**Equals 36.20g per person per day. This is similar to the average New Zealand consumption of 32.87g per person per day (Kim and Smith, 2006).**

For the taonga species, the following observations can be made

The quantities available fall far short of historic levels and the levels desired by whanau who wish to engage in mahinga kai practices. The species that possibly approach adequate abundance are mussels which respondents confirmed were available and often sourced from the supermarket or takeaway.

You don't go out and get any watercress anymore, your river has become Pak'n Save (Informant M).

[9] It is assumed that the "fish fillets" estimate would apply for butterfish, greenbone, kanakana, eels, founder, hapuka, mullet, kahawai, kingfish, gurnard, snapper, moki, shark, trevally and trout.

I mean, we have got to the stage we are feeling directed to go to supermarkets and buy from there, it is more convenient (Informant E).

We get our bulk food from the supermarket, whether that's vegetables, it's fish, seafood. Everything comes from the supermarkets. It is totally different today. We have no control over that. We aren't able to go out and get koura like how we did - it is a thing of the past (Informant E).

- For almost every species, the majority of respondents believed that the abundance of populations was declining.
- The majority of kai species are now only consumed on special occasions.
- The quantities of kai consumed have steadily decreased:
    - from approximately 241g historically;
    - to about 94g in the mid twentieth century;
    - to approximately 36g today.

These observations are supported by the statements of whanau -

Last time I had a feed of koura…. was six years ago (Informant B).

I haven't had one [koura] this year. I haven't had one this year. You see, like now what has – you know, you have got the sediment, you have got all the paru in the lake. The other thing you also got is the bottles, eh? And so guys are using those for koura, eh. Used to, but now the hapu have stopped all that – told those guys, eh? You know, and the only place you can get real good eating koura is here and here (Informant M).

Yet for some whanau consuming kai remains a treat and one kaumatua described the behaviours of his mokopuna:

Man, you ought to see them with bloody kinas. They eat kinas…Kinas, mussels, anything like that; they'll get into them (Informant C).

6.3.2 Sites at which kai gathering and other activities are undertaken

Historically different parts of the region were renowned for supplying prized resources. Often sites from which specific resources were gathered would be given a name e.g., it is recorded that in Lake Okataina each of the best mussel beds had its own name.

In the paragraphs that follow we summarise the features of some the lakes, plus the Kaituna River and Maketu that appear in historic references. Makereti (1938) explains:

> *Fishing grounds belonged to the hapu which owned the land going down to a lake or along a river, and were marked by posts as described in the account of sea fishing. In Lake Rotorua about half-way between Owhata on the mainland and Mokoia Island was such a post, called Hinewhata. My ancestors Wahiao and his father Umukaria who lived at Owhata used this post for tying their fishing nets on when they were getting inanga, and they also tied on bunches of fern for catching koura, or crayfish.*
>
> *In the old days inanga was taken by the hapu of Tuhourangi from Otamakari on the north of Tarawera Lake, Owhaia and Te Puna north of Tarawera, Te Manuka at the same place, Waitangi to the north-west, Parahamutu, Rahuiroa, Terapatiki, Matakana, all near by, from Kariri and Punaromia, from Waitoharuru (Wairoa Falls), and Karikaria close by, from Hawaiki on the south-west of Tarawera Lake, from Taneroa, from Whangaruru on the peninsula, from Te Ariki, from Tutaiinanga on Paeroa block, from Motutawa, and from all round Rotokakahi Lake at Okareka, on the west side of Otaku. All these were ancient fishing grounds.*
>
> *My people in the Lakes district, at Rotorua, Rotoiti, Okataiua, Tarawera, Rotokakahi, and other lakes, took the koura in many ways.*

In recent decades concern has been expressed at the deteriorating condition of the lakes, in particular Lake Rotorua where weed growths, scum, algae blooms, sedimentation and mud build up on the lake-bed, and poor water clarity have been experiences. During the 1970s it was recognised that water quality was deteriorating in Lake Rotorua because of increased nutrient loads - notably from treated sewage, streams draining pasture, and aerial top-dressing (Hamilton, 2003).

During the 1980s lake water quality targets for Lake Rotorua were adopted by the regional council, the decision was made to stop directly discharging treated sewage to

the lake, and nutrient load targets were set for sewage-derived nutrients. These initiatives saw improvements in lake water clarity, nutrient and chlorophyll concentrations from the early 1990s, but since then lake water quality has again deteriorated. Most of the decline is attributed to increasing nitrate in streams that drain agricultural land and the amount of nitrates that are locked up in the lake bed sediments.

This impacts a range of uses, including kai gathering. The outflow of Lake Rotorua is through the Ohau Channel which leads into Lake Rotoiti which in turn flows out and down the Kaituna River that flows about 50 km to enter the sea near Maketu. Degradation in one waterbody inevitably degrades others connected to it. Dr Edward White[10] explained that Lake Rotoiti shows significant “deterioration for a lake as large as Rotoiti. I see no prospect of either arresting this deterioration or of restoring the lake, without reducing the quantity of nutrients entering Lake Rotorua".

Ohau Channel

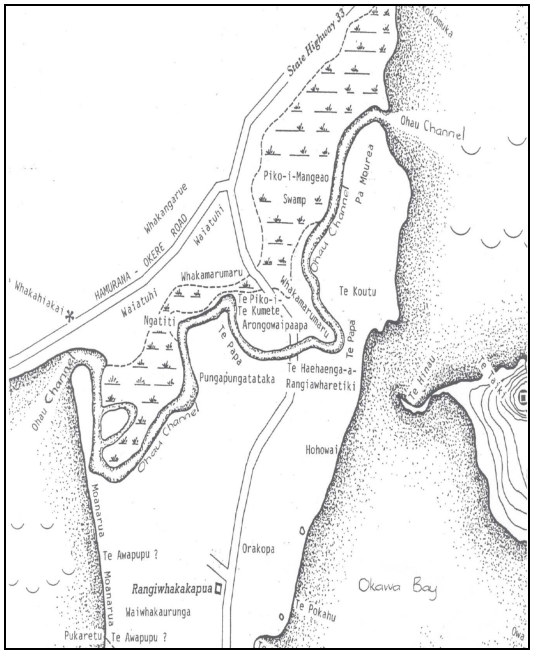
Whitebait were a commercial resource, being sold and traded. Mair reported that from around 1860 to 1919 he had seen Ngati Pikiao netting koaro in the Ohau channel Figure 48), sun-drying them, storing them for winter use, and bartering them profitably with West Coast tribes.

A resource kete from Environment Bay of Plenty (EBOP, 2010a, b) provides statements from a kaumatua who recalls her early childhood days living beside the Ohau Channel.

[10] Dr White was leader of the Freshwater Section of the Dept. of Scientific and Industrial Research who gave evidence to the Waitangi Tribunal on the health of Lake Rotoiti.

A crystal, clear, swift flowing river fringed with raupo, manuka scrub, grassy banks and paddocks, overhanging willows and dotted here and there with the odd domestic wharf, boatshed and kainga. It was a haven for wildlife, a rich food basket, a natural environment of wetlands and a place of historical and spiritual significance. It was a 'paradise' especially in the warmer months. Children would spend all their time swimming against the strong current, diving off banks, catching cockabullies in the shallows, hunting for frogs and tadpoles in the swamps, paddling the old Māori river canoes up and down and hunting for the best jackstones on the beds of shingle. Even then there were signs of human activity and land use upstream and downstream that would soon impact on this idyllic waterway. From the mouth at Lake Rotorua to the outlet at Lake Rotoiti, the river twisted and turned carrying a strong current of crystal clear waters, which provided a host of water activities including trout-fishing, boating and swimming in contrast to the traditional methods of fishing for inanga and koura and the gathering of kakahi.

Figure 50: The area around the Ohau Channel.



Swamps teemed with frogs and tadpoles while kotare above waited patiently to swoop down on unsuspecting prey. Noisy pukeko made untidy nests in the dense raupo, and fantails flitted among the manuka while the shy matuku stood still and erect perfectly camouflaged against a background of rushes and sedges. Pied stilts picked their way along the muddy flats while water rats hid among the debris and undergrowth.

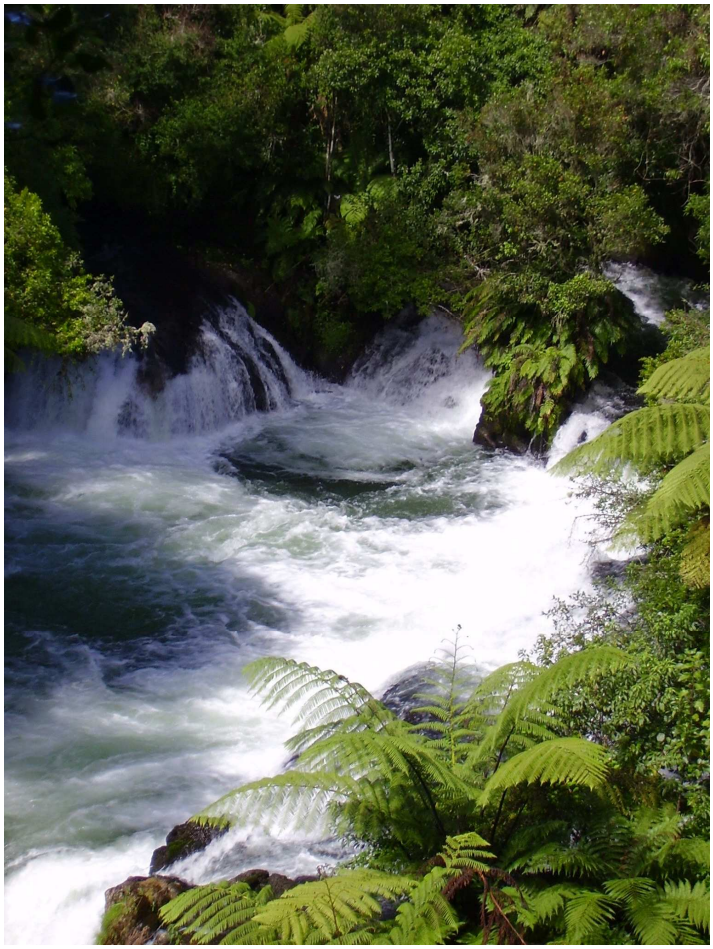
The old red, painted, wooden bridge that spanned the main road from Rotorua to Tauranga was a popular 'hangout' for the local swimming and diving champions. Many households drew water from the channel for domestic use and the washing of clothes in the river was a normal activity. Food scraps and other rubbish were often thrown unwittingly into the river.

Night hunting for koura or 'hi koura' was popular with the kids, who used long manuka sticks baited with threaded worms to entice the koura out of their holes in the banks. As soon as a koura attached itself to the bait the stick would be slowly drawn up to the surface and grabbed with bare hands or netted.

It's getting worse. 70s, 80s – it's getting worse. It got to the stage where my mother and father said "I don't want you going swimming because it's polluted" (Informant E).

Kaituna

The Kaituna River is famous for the pools in its upper reaches, the Okere falls not far from Lake Rotoiti and for the rapids and waterfalls. It discharges to the Maketu Estuary on the coast of the Bay of Plenty. Historically the river was valued for aquatic recreation, for gathering duck, and plants of many kinds (many of special value and importance, some species being rare) that grew along its banks. These were used for medicinal purposes, weaving, dyeing.



The place called Te Wai-i-rangi, (a lovely clear pool from which the river flows on into a green tunnel of vegetation), was, the place where those returning from battle would go to bathe and remove the tapu. Burial caves line the river in the steep gorge reaches.

Maketu

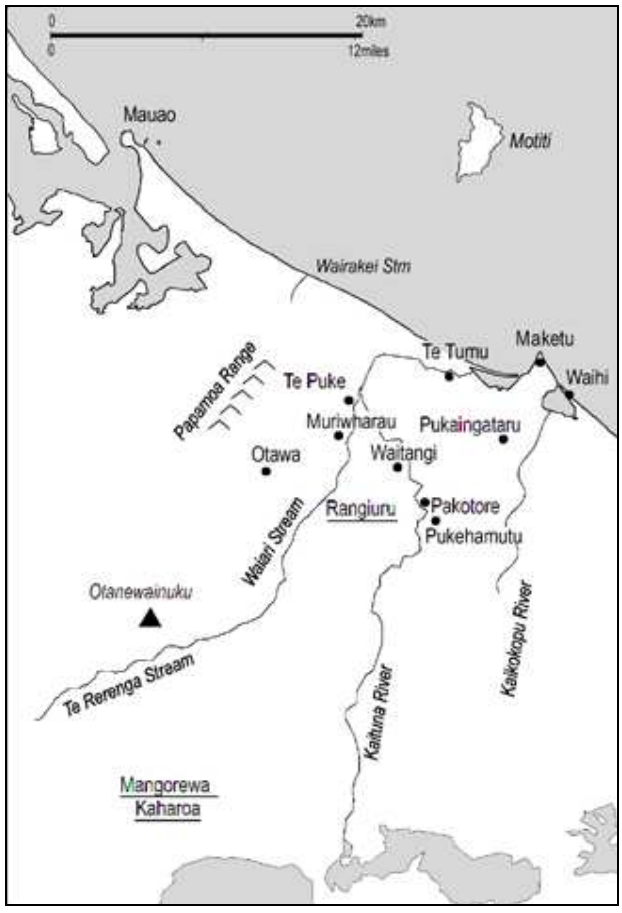
> *The tribes or hapu who owned land down to the sea would own the fishing rights for some distance out to sea. A stake would be put in at each end to mark the boundary line on each side, and these might be a few miles, or many miles apart. The stakes prevented any outsider from fishing in the waters. Only the members of the hapu, or of the several sub-hapu, who owned the land would have any right here. The Maori had names for each fishing rock, ground, or bank which belonged to a hapu, and called them all by name. Some of them were eight or ten miles out in the deep water. The Maori knew all the signs of a good fishing ground.*
>
> *Their fishing grounds were sometimes five, eight, or more miles away.*

Maketu remains important as a place where tupuna walked.[11] It was identified as the site of Tokaparore/Takaparore, the rock (or possibly anchor stone) to which the Te Arawa waka was tied when it first arrived. The Maketu Estuary has always been significant for Te Arawa. The stern anchor of the waka is said to have been placed at Te Awahou, roughly where the Kaituna River flows out to sea today following the diversion cut that was made in 1957. The bow anchor was set down at about the place where the Kaituna River used to flow out to sea at Maketu. The importance of Maketu to Te Arawa therefore can be traced back to their arrival in New Zealand.

The Kaituna River and the estuary at Maketu, were rich in kai awa and kaimoana respectively, providing fish, shellfish, eels, fresh-water crayfish (koura) and many other kinds of food.

Dr Ballara's evidence (Ballara, 2004) to the Waitangi Tribunal noted the range of natural resources in the Maketu area and its strategic importance as a point where communications routes converged. Figure 52 shows the area in the vicinity of Maketu.

Figure 51: The Maketu area.



[11] Don Stafford and Raewyn Bennett evidence to Waitangi Tribunal.

After the Kaituna River diversion cut was made the main flow of the river no longer ran through the estuary, and the resultant deterioration is of concern to Te Arawa. In the context of the present research this is significant given there is a perception that shellfish there may not be fit for human consumption because of contamination issues arising from the lack of flushing.

The health of aquatic resources has impacted kai gathering. Although the alienation of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and believed that the most damaging changes have occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change. Yet, as the interviews and Kai Consumption Survey show, many Te Arawa continue to gather and consume kai awa, kai roto and kai moana. But as the following tables show patterns of usage have changed.

Table 6: Numbers of lakes from which different species gathered[12].

Species	Historical	Today
Trout	12	9
Mussels	6	2
Morihana	-	-
Koura	10	8
Watercress	5	6
Puha	-	-
Inanga	3	7
Lamprey	2	1
Eel	5	6

While Table 6 suggests that the distribution of all species has changed, this information needs to be considered alongside Table 7 which provides greater clarification as to how the different lakes have been impacted by changes in gathering patterns. The increased fishing pressure on Lake Rotoiti is evident as the number gathering at Rotoiti have increased across all species. The other obvious changes are the decreased levels of gathering across all species in Rerewhakaaitu and from the streams in the area.

[12] These numbers are based on the results of the Kai Consumption Survey and refer specifically to the sites of gathering, not from species distribution surveys that tell us the sites where these species are known to be.

Table 7: Trends in the number of respondents gathering different species at each of the lakes.

Lake	Watercress	Trout	Kakahi	Inanga	Koura	Eel
Rotoiti	↑	↑	↑	↑	-	↑
Tarawera	-	↑	↓	↑	↓	↑
Rotorua	↑	↓	↓	↑	↓	↑
Rotokakahi	-	↓	-	-	↓	↑
Okataina	↑	↑	-	-	↓	-
Rotomahana	-	↓	-	-	↓	-
Rotoma	↑	↓	-	↑	↓	-
Rerewhakaaitu	↓	↓	↓	-	↓	-
Okareka	-	-	-	-	-	-
Rotoehu	-	-	-	-	-	↓
Ohau Channel	↑	↑	↑	↑	↓	-
Streams	↓	↓	↓	↓	↓	↓
Coast	-	↓	↓	↓	-	↑
Tikitapu	-	↓	-	-	-	-

Table 8 that follows focuses on 3 of the lakes – Rotorua, Rotoiti and Tarawera and shows the magnitude of the changes. Although those gathering inanga from the lakes shows an increase we are unsure whether they mean whitebait or the adult stage.

Table 8: Changes (shown as a %) in the number of respondents gathering different species at each of the lakes.

	Rotorua	Rotoiti	Tarawera
Trout	↓ 18.7	↑ 5.40	↑ 8.10
Mussels	↓ 33.3	↑ 33.3	↓16.70
Morihana	-	-	-
Koura	↓ 10.4	same	↓ 10.40
Watercress	↑ 42.0	↑ 20.3	-
Puha	↓ 9.80	↑ 8.30	↓ 7.70
Inanga	↑ 14.3	↑ 23.8	↑ 14.3
Lamprey	-	-	-
Eel	↑ 18.20	↑ 16.2	↑

In the tables that follow, we present information for each of the lakes and provide a relative ranking (present and past (in brackets) of the importance of gathering activities for each species across all lakes.

Figure 52: An aerial photograph showing the location of the respective lakes.

An aerial view of Lake Rotorua

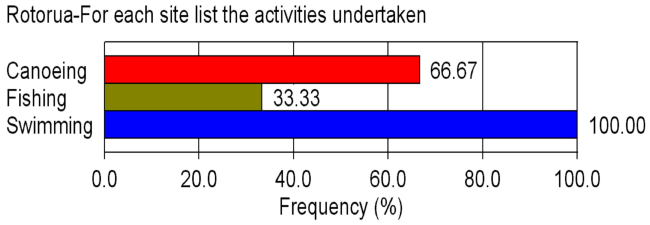
Table 9: Summary of Lake Rotorua.

Trends in gathering activity		**Present day rankings**	
Trout	↓ 18.7	Trout	3rd (2nd)
Kakahi	↓ 33.3	Kakahi	- (2nd)
Koura	↓ 10.4	Koura	2nd (2nd)
Watercress	↑ 42.0	Watercress	2nd (2nd)
Puha	↓ 9.80	Puha	2nd (1st)
Inanga	↑ 14.3	Inanga	3rd (-)
Eel	↑ 18.20	Eel	4th (-)

I wouldn't touch watercress in the Lake Rotorua, …, I just think it is too suspect …I don't know that there is a lot of watercress around - like I think there is where the natural springs are, I think there is watercress there, but as you are coming around Lake Rotorua, I shouldn't imagine that there would be that many spots left to actually pick watercress from anymore (Informant J).

They used to catch inanga around the edge of the lake….But now you don't see that, I mean not only that, the water is so murky you can't see them, but yes, we used to catch a lot of inanga, I tell you (Informant B).

Other activities: 33% of those who go to the lake fish. In contrast everyone who goes to the lake swims.



Rotorua now, we haven't swum there for ages (Informant A).

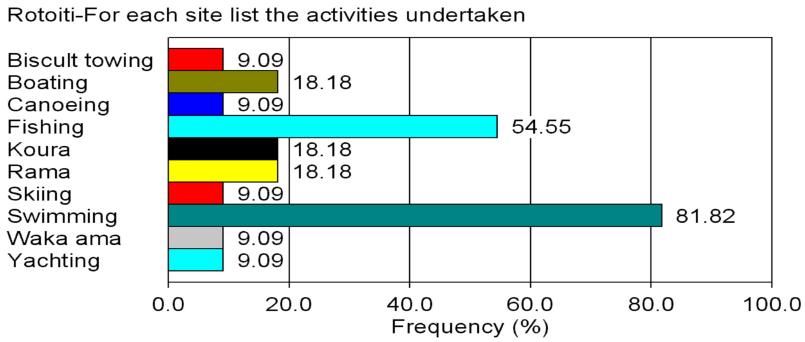
I wouldn't swim in it. I had EBOP down there just over the winter. They actually took photos of the amount of junk that came out of that lake onto our back lawn. So I wouldn't – I get a lot of tourists coming down to our village and they ask can they go for a swim. I just say, "No, don't bother" (Informant D).

Photos of Lake Rotoiti

Table 10: Summary of Lake Rotoiti.

Trends in gathering activity		Present day rankings	
Trout	↑ 5.40	Trout	1st (1st)
Kakahi	↑ 33.3	Kakahi	1st (1st)
Koura	same	Koura	1st (1st)
Watercress	↑ 20.3	Watercress	1st (1st)
Puha	↑ 8.30	Puha	1st (2nd)
Inanga	↑ 23.8	Inanga	1st (2nd)
Lamprey	-	Lamprey	-
Eel	↑ 16.2	Eel	2nd (3rd)

Other activities: Clearly a range of activities are undertaken, including a range of recreational activities. Fishing and gathering koura, including rama koura, feature strongly**.**



Setting a 'tau' in the lake was the most popular method of gathering this delicacy [koura]. *During the summer months bundles of raurauhe were cut, tied together and left to dry. These were then tied to a long main line and dropped into the lake bottom at about six metre intervals. Marker poles stood in the lake to identify the place of each family's tau. After a few weeks the ferns would be carefully drawn up out of the lake and shaken onto a korapa. In no time a large quantity would be caught and taken home for the 'weekend lunch or dinner'.* (Makereti, 1938)

Rotoiti, we have been known to swim … even in recent years, we come back and my kids jump out of the car, dive into it. We know full well that the lake is not well and it is so hot they just duck into the lake there and have a jump around and duck back in (Informant A).

Then you had puha …. We used to just go around the hills, all over the place collecting puha. And then there was watercress, all the creeks running into Lake Rotoiti were full of watercress. (Informant E)

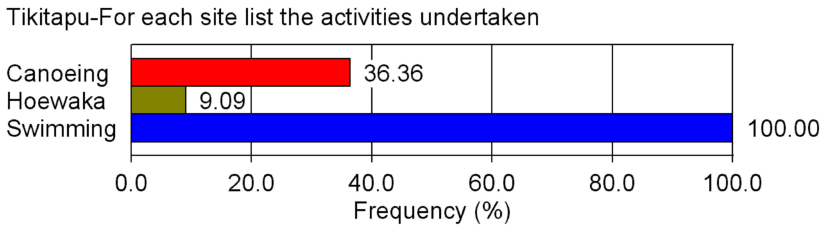
Photos of Lake Tikitapu

Lakes Tikitapu (foreground), Tarawera (left background), and Rotomahana(centre background) are all visible in this eastward-looking view.

Table 11: Summary of Lake Tikitapu.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	-	Kakahi	-
Morihana	-	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities: Everyone who goes to the lake swims. Canoeing is another popular activity.



Tikitapu, the Little Blue Lake …is the most picturesque lake in the district and owes much of its attractiveness to the magnificent forest which clothes the hills on its northern and western sides.
Raupo (Typha sp.) occurs in small quantity at the north end of the lake; it is so extremely rare in the district, that the whare are usually constructed of sedges and grasses.
We were mostly at Lake Tarewera and Lake Tikitapu…In summer time we'd probably be out at Tikitapu probably once, at least once a week (Informant F).

Photos of Maketu

Table 12: Summary for Maketu.

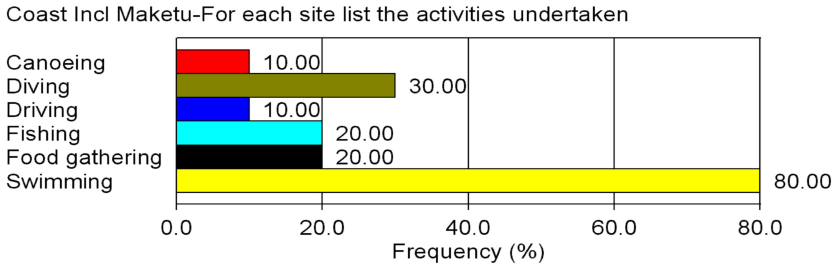
The kina and paua, crayfish and we go fishing and the main species are kahawai, snapper and gurnard fish…. Usually every long weekend we'd head to the coast for that. But since the fuel increases and so and so it's not as often… (Informant F).

Because when the whole river was coming through here, I remember I've been coming here since the 50s, as a kid, and all the fishing boats used to come in here …But all the fish used to come in here…..There stingrays, there were sharks, there were – everything was coming through here, kahawai and everyone just fishing here at the outlet. And now they're all fishing up at the cut .. Well, there's only pipi at the moment because all our tuangi have gone and pupus that we used to have in abundance have all disappeared (Informant K).

Trends in gathering		Present day rankings	
Trout	↓	Trout	6th
Kakahi	↓	Kakahi	- (4th)
Morihana	↓	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	↓	Puha	- (3rd)
Inanga	↓	Inanga	2nd (1st)
Lamprey	↓	Lamprey	1st (1st)
Eel	↑	Eel	3rd

It was in abundance, it was growing so fast that even our people couldn't keep up with it (Informant K).

Other activities Maketu is a popular swimming site.



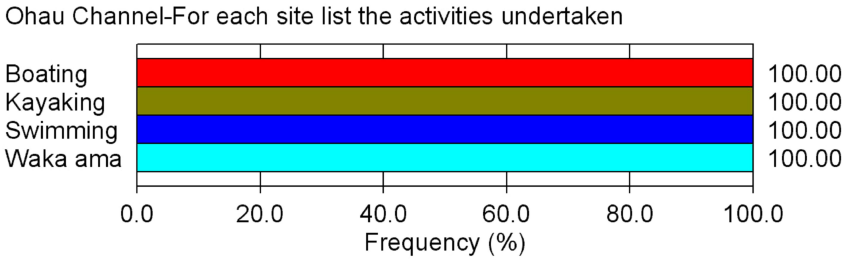
… the return of the estuary is vitally important and it's only because of the food bowl … It'll be entirely different. The outflow would be different and therefore it would – it'll only create a channel in certain areas. A channel will be created, so it wouldn't be the pristine that you'd want once upon a time. So that's the – which is very sad that it cannot be brought back the way that we wanted to ….But there's not enough volume of water actually coming through the system, actually it's only a trickle, and very disappointing really – very disappointing that way (Informant K).

Another area we used to frequent was the Maketu… especially in the summer you would want to go over there and collect pipi and mussels, and also we got family at Motiti Island, so it would give us any reason to go to the beach because it was a good - Newdicks was quite a popular place back then… I hardly see cockles now…Maybe even like try to increase the flow a little bit so that it is – well, you know, I do not know whether to narrow it or add some rock or that sort of - - -(Informant H).

Trout fishing in the Ohau Channel

The Ohau Channel today

Table 13: Summary for Ohau Channel.

<table>
<tr><td rowspan="10">My mother used to go out and she would get into her garden and she'd get all these worms, and she would bundle these worms up using a needle and thread. She would thread through the worm and create a bundle, and that is what we would use for our bait to catch the koura in the Channel - at the end of a willow stick. Oh, we used to love it because we would just quietly watch the koura grab the worm and then we would put the stick up and then catch it with a fish and chip container (Informant E).</td><td colspan="2">Trends in gathering activity</td><td colspan="2">Present day rankings</td></tr>
<tr><td>Trout</td><td>↑</td><td>Trout</td><td>-</td></tr>
<tr><td>Kakahi</td><td>↑</td><td>Kakahi</td><td>2nd</td></tr>
<tr><td>Morihana</td><td>-</td><td>Morihana</td><td>-</td></tr>
<tr><td>Koura</td><td>↓</td><td>Koura</td><td>8th (8th)</td></tr>
<tr><td>Watercress</td><td>↑</td><td>Watercress</td><td>6th</td></tr>
<tr><td>Puha</td><td>↑</td><td>Puha</td><td>6th</td></tr>
<tr><td>Inanga</td><td>↑</td><td>Inanga</td><td>8th</td></tr>
<tr><td>Lamprey</td><td>-</td><td>Lamprey</td><td>-</td></tr>
<tr><td>Eel</td><td>↓</td><td>Eel</td><td>-</td></tr>
<tr><td colspan="5">Other activities - The channel is still used for a range of recreational activities.
 
</td></tr>
<tr><td colspan="5">The Ohau Channel. I always felt that was my birth place, and my bedroom was right against the Channel and it was paradise. We saw a lot of things that other people just talk about, but we experienced everything on the Channel, and that was our food basket as well as Lake Rotoiti and Lake Rotorua ….We have lost that current - it was a very swift current flowing through the Ohau Channel and the children - we used to challenge that flow of water when we were swimming because half the year we would be in the Ohau Channel swimming. We spent a lot of time swimming, back and forwards from Lake Rotorua, down to Lake Rotoiti. We were the best swimmers … I put it back to we were born on the Ohau Channel - we were natural swimmers (Informant E).

Ducks and birds - when I was living on the Ohau Channel we had the Mataku, beautiful. We had the Shag and they would sit in the trees just watching down on the Ohau. When everything started happening, like the inanga would run, well, you would just see them darting down onto the water.. And the crying, it was something I missed when I went away from home - the call of the birds and the cry - it is something totally different. You could hear the water flowing past your home. My bedroom was right against the Ohau Channel, and that was a sincere sound, it is a sound you don't often hear (Informant E).</td></tr>
<tr><td colspan="5">Other kai consumption survey results: All those who gather at the Ohau Channel have changed how they gather kai because of contamination of sites they used to gather from.</td></tr>
</table>

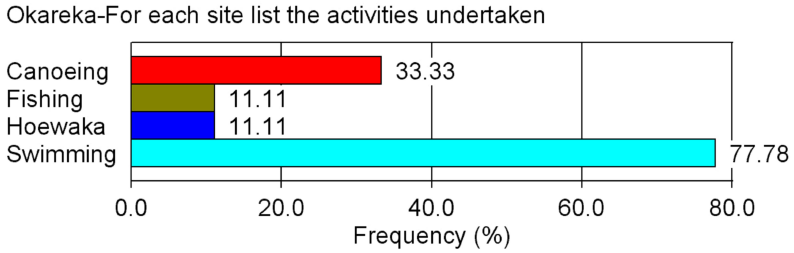
Photos of Lake Okareka

Table 14: Summary of Lake Okareka.

There is no gathering at the lake as it is wai tapu.

Trends in gathering activity		Present day rankings	
Trout	-	Trout	-
Kakahi	-	Kakahi	--
Morihana	-	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - As with the other lakes Okareka is popular for swimming.



The biggest ones [koura] *I have struck here in the Rotorua Lakes, when I used to dive the lakes, was Lake Okareka … Water skiing "Blue Lake….. Okareka, Rotoiti and Tarawera" (Informant D).*

And also the Green Lake, even though you are not supposed to fish in the Green Lake because of our links to that area, you can get access to those areas (Informant H)..

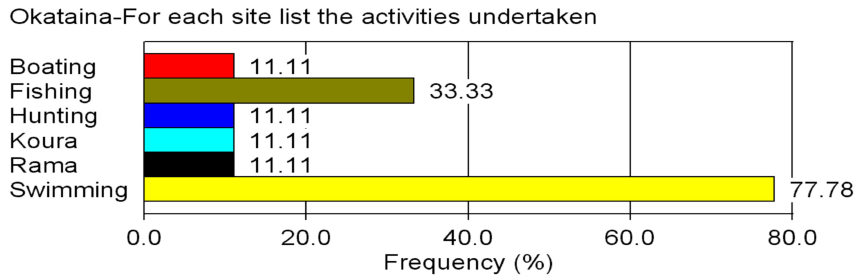
There are those beautiful picturesque moments that - like, I love going down to Lake Okataina and Lake Okareka, in summer they are the places that are a little bit hard to reach, I think, are probably a little bit more worth the effort to get there (Informant J).

Photos of Lake Okataina

Table 15: Summary of Lake Okataina.

Trends in gathering activity		Present day rankings	
Trout	↑	Trout	5th (6th)
Kakahi	↑	Kakahi	--
Koura	↓	Koura	7th (7th)
Watercress	-	Watercress	5th
Puha	-	Puha	5th
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - are very similar to the results for Rotoiti.



So, yes, so generally there are a lot of us and, like, when we went out here to Okataina there was a whole heap of us, so it is just something that we do as a family. Yes, so I suppose that is the beauty of your water is it always connects you in one way or another, and so, yes, that is why we tend to do things in droves, and also it is always more fun when there are heaps of you when you are going out swimming. You know, my children aren't fighting with each other and I have got all these other people to help (Informant J).

Other kai consumption survey results: All those who gather at the lake have not changed how they gather kai because of contamination of sites they used to gather from. All those who gather believe the kai gathered is not dangerous because of pollutants.

Photos of Lake Rotokakahi

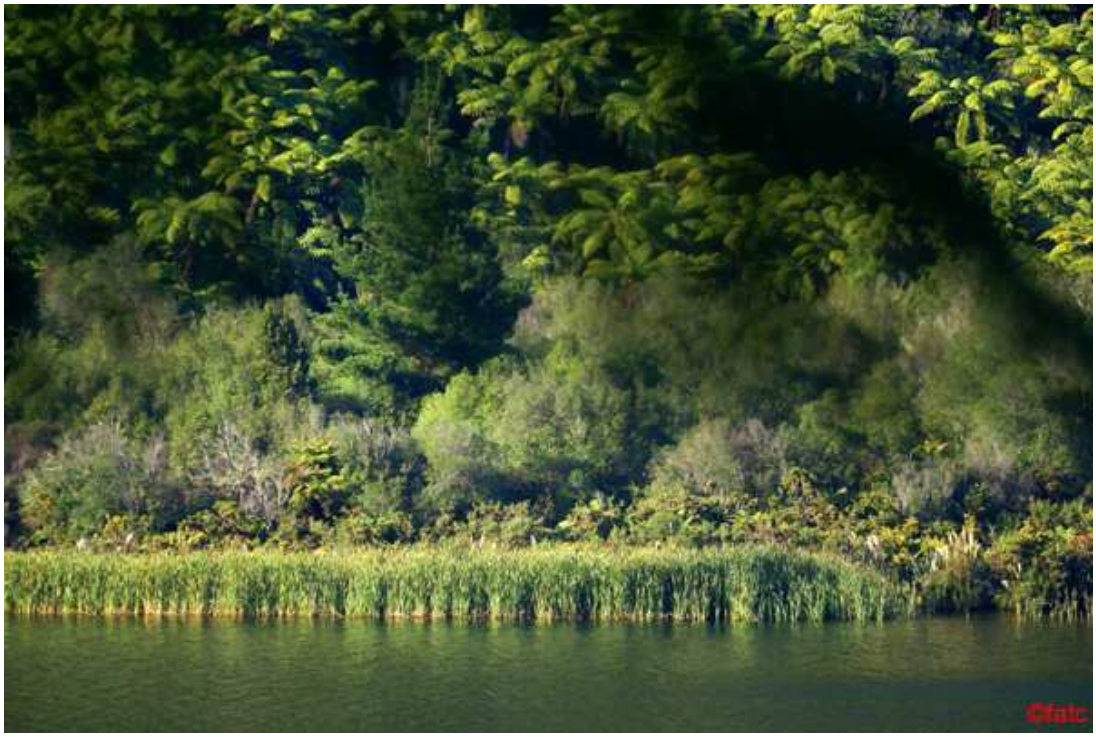
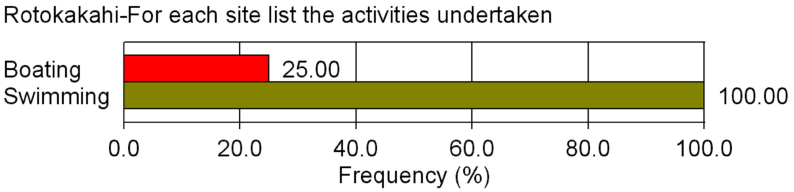


Table 16: Summary of Lake Rotokakahi.

Trends in gathering activity		Present day rankings	
Trout	↑	Trout	4th (4th)
Kakahi	-	Kakahi	-
Morihana	-	Morihana	- (2nd)
Koura	↓	Koura	5th (5th)
Watercress	-	Watercress	
Puha	-	Puha	
Inanga	-	Inanga	
Lamprey	-	Lamprey	
Eel	↑	Eel	6th

Other activities - All those that go to the lake swim there while a quarter of them go there for boating.



Other kai consumption survey results:

All those who gather at the lake have not changed how they gather kai because of contamination of sites they used to gather from.

Photos of Lake Rotomahana

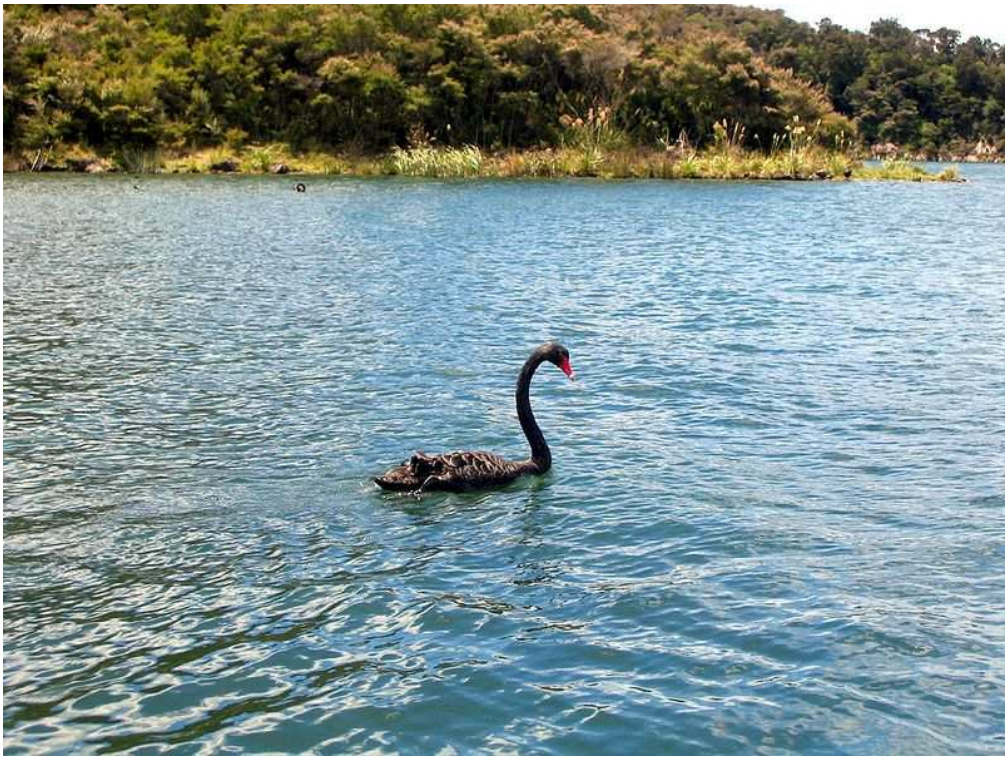
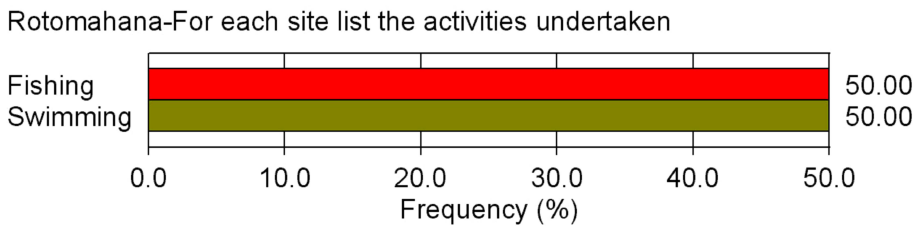


Table 17: Summary of Lake Rotomahana.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	- (5th)
Kakahi	-	Kakahi	-
Morihana		Morihana	-
Koura	↓	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	- (3rd)
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - Swimming and fishing are the two activities at Rotomahana.



Rotomahana is a funny lake, it is coloured all the time. Some places it is green. But I think Rotomahana you may have to be careful of (Informant A).

Rotomahana, they swim there (Informant A).

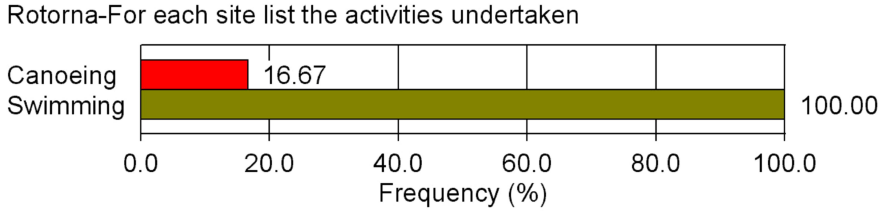
Rotomahana is of small size, its greatest diameter being less than a mile. From the numerous swamps which surround it the absence of wood, the dirty green colour of the water and the stunted aquatic vegetation which certainly exists under unfavourable circumstances the first view of this remarkable lake is strangely disappointing (Kirk 1872).

Photos of Lake Rotoma

Table 18: Summary of Lake Rotoma.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	-	Kakahi	-
Morihana		Morihana	- (2nd)
Koura	↓	Koura	4t (4th)
Watercress	↑	Watercress	3rd (4th)
Puha	↑	Puha	3rd (3rd)
Inanga	↑	Inanga	4th
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - All those who go to Rotoma go swimming.



I suppose the ones where there has been minimal development has always been - the lakes are still in a very similar quality, like Lake Rotoma, when I go out there I have swam and I have jumped off the rock or the cliff out there. It is still really similar to how I remember it as a child. The water quality, you know, it is beautiful, but as you are getting into more densely populated areas you really notice the poor quality of the lakes and the effect that that population has had on them (Informant J).

Because that is where all the morihana used to be in that lake, mind you they were in all the lakes but the Rotoma was known for that (Informant F).

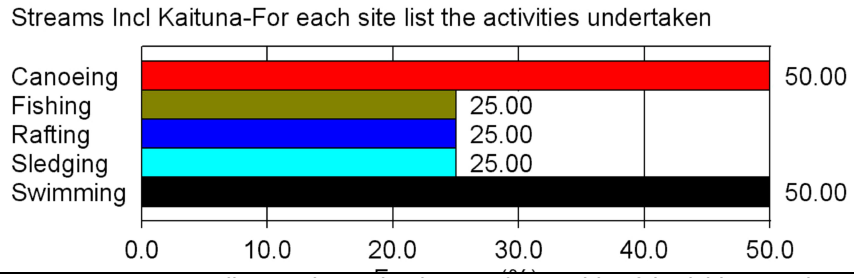
It was certainly Lake Rotorua and going down the Utuhina Stream…. and every now and then we would go out to - more often than not - Lake Rotoma to swim at the point and my grandfather was a keen fisherman, so there was a fishing club out at Lake Rotomahana that I used to go to as a child as well… (Informant J).

Fishing for whitebait on the Kaituna River (1931)

Table 19: Summary for streams.

Species gathered today	**Trends in gathering activity**		**Present day rankings**	
	Trout	↓	Trout	7th (7th)
	Kakahi	↓	Kakahi	-
	Morihana	-	Morihana	-
	Koura	↓	Koura	6th (6th)
	Watercress	↓	Watercress	4th (3rd)
	Puha	↓	Puha	4th
	Inanga	↓	Inanga	7th (3rd)
	Lamprey	↓	Lamprey	- (2nd)
	Eel	↓	Eel	5th (2nd)

Other activities



That Purenga stream… was yellow …down the bottom has a bit of bad history where council was allowing the raw sewerage to go out into the lake; years of it built up (Informant A).

Hamurana is crystal clear and it is full of phosphorous and, of course, the lake programme has to do something about that, (Informant A).

Utuhina - *even the flow of the river is quite different, so it would be good to have testing from the river because, I think, as you are coming further downstream and into the Lake, just the whole vegetation, … when I put my feet into the ground of the river on the Utuhina River, it is revolting. It is not like a clay, it is not even a mud. I can't even describe it. But it has that type of feeling to it (Informant J).*

I wouldn't let my children swim in there. The quality of the water is disgusting and it is unsafe. …. I can remember swimming in the Utuhina Stream as a child and it was lovely and clean and fresh, now to hop in it you can feel all the clay and all the silt that sits on the bottom and it is not very nice (Informant J).,
I think to go out in the areas I used to as a child where we used to gather - and I am talking about Rotorua predominantly - to gather koura, I don't believe there is any. So having gone down just to probably, I don't know, about five years ago, having gone down to take the children through the experience, there weren't actually any koura in places that we used to go to as children. So the rama koura did … I think even if we had have come across koura, I wouldn't have let the children eat them anyway (Informant J).

The Utuhina River between the Utuhina Bridge … when I was growing up it was a pristine river at that time….The river flow was excellent, clarity was excellent. We could even drink out of it …I learnt how to swim in the river, and I did all right, too, as a swimmer. Did no formal training. Because it had a good current, it had a good flow and you could actually just swim at a constant pace and stay in the same area. And we had a swing across the trees, because the trees used to – oh, we had willow trees but they sort of intertwined and you could – we had a swing.. but it was mainly our playground there ….And there was like little hotspots in the river, too. Like there was a lot of thermal underneath and it was in that whole area, so you had to sort of know where to put your foot and all the rest of it, and you were warned of areas where you shouldn't go and swim. But it was great (Informant H).

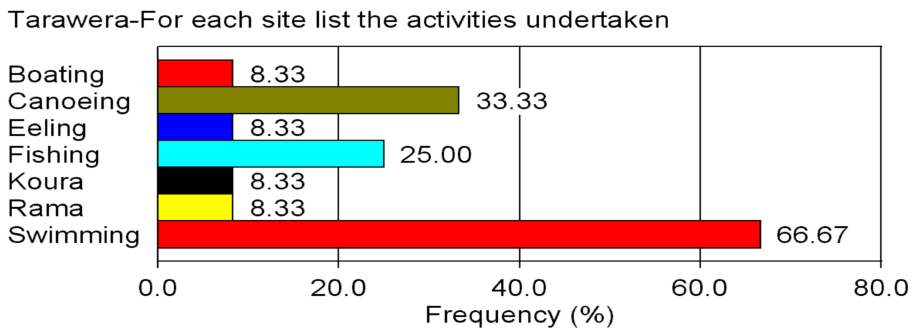
That silt build-up .. It would stick to your feet and then it was sort of like, "Oh, I want to go to the Aquatic now". Probably to Hamurana and Hamurana Springs there. That is still a nice river to swim in. Even now we still take our kids out there, because it is a nice spring and we went to the origin of that spring, as well, you know, just to show the kids, you know? (Informant H).

Photos of Lake Tarawera

Table 20: Summary for Lake Tarawera.

Trends in gathering activity		Present day rankings	
Trout	↑ 8.10	Trout	7th (3rd)
Kakahi	↓ 16.70	Kakahi	- (3rd)
Morihana	-	Morihana	- (2nd)
Koura	↓ 10.40	Koura	6th (3rd)
Watercress	-	Watercress	4th
Puha	-	Puha	4th (3rd)
Inanga	↑ 14.3	Inanga	7th
Lamprey	-	Lamprey	-
Eel	↑	Eel	1st (3rd)

Other activities - Eeling is specifically identified as an activity. Swimming and recreational activities are popular.



Tarawera, although the lake appears to be clear it still has its problems. We still have algae bloom over there …Tarawera, yes, but I would be very cautious in the summer time when the weather is hot and the algae starts to come up to the surface. We have that problem in Tarawera, although we are not treated as high a risk of other lakes, but I think the council is on to it (Informant A).

We would go to Tarawera where generally most of the swimming .. So, you know, I don't allow my children to wet their hair in the water in Lake Rotorua, I don't know, it is just certainly not the same sort of quality that I remember as a child and I wouldn't - Lake Tarawera is not so bad, but the inlet where we used to go to as a child to collect koura, there is a whole oil - I suppose because there's the big boats that sort of launch there, I think that it has had an impact. So where we used to previously go to get koura at that inlet, from last having had a look, and my husband went down and he had the goggles and the snorkels and had a really good look around, we couldn't find any, and that is just in the inlet area, but we haven't gone any further to have a look at that to see the impact on it. But, just in the areas we used to go immediately to because it was easy access, we haven't been able to find any of that - particularly koura - in those areas (Informant J).

Table 21: Summary of Lake Rotoehu.

Trends in gathering		Present day rankings	
Trout	-	Trout	-
Kakahi	-	Kakahi	-
Morihana	-	Morihana	- (2nd)
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	↓	Eel	- (4th)

Other kai consumption survey results
All those who gather from the lake have changed how they gather kai because of contamination of sites they used to gather from.

Table 22: Summary of Lake Rerewhakaaitu.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	↓	Kakahi	- (5th)
Morihana	-	Morihana	-
Koura	↓	Koura	-
Watercress	↓	Watercress	- (5th)
Puha	↓	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

When recounting their early lives interviewees described how interaction with the lakes occurred on a daily basis. Most days, interaction involved gathering kai for personal consumption or sharing. This was a commonplace group/whānau activity that permeated households and the community.

Table 23: Present day ratings of lakes on the basis of number of respondents gathering species from the lakes (1 = highest number of gatherers, 8 = lowest number of gatherers).

	Ratings							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Trout	Rotoiti	Tarawera	Rotorua	Rotokakahi	Okataina	Coast	Streams	Maketu
Kakahi	Rotoiti	Ohau	-	-	-	-	-	-
Morihana	-	-	-	-	-	-	-	-
Koura	Rotoiti	Rotorua	Tarawera	Rotoma	Rotokakahi	Streams	Okataina	Ohau
Watercress	Rotoiti	Rotorua	Rotoma	Streams	Okataina	Ohau	-	-
Puha	Rotoiti	Rotorua	Rotoma	Streams	Okataina	Ohau	-	-
Inanga	Rotoiti	Coast	Rotorua	Rotoma	Tarawera	Tarawera	Streams	Ohau
Lamprey	Coast	-	-	-	-	-	-	-
Eel	Tarawera	Rotoiti	Coast	Rotorua	Streams	Rotokakahi	-	-

Across all species we can obtain an average rating for the present day usage of the lakes. The results confirm the significance of Lakes Rotoiti, Rotorua and Tarawera. The average ratings for present day gathering are:

Rotoiti 1.14

Rotorua 2.67

Tarawera 3.40

Rotoma 3.50

Coast 4.00

Rotokakahi 5.00

Streams 5.50

Okataina 5.50

Ohau Channel 6.00

Rotomahana, Rerewhakaaitu, Rotoehu –
not gathered

We are also able to prepare rankings based on historic use. These are shown in Table 24.

Table 24: Historic ratings of lakes on the basis of numbers gathering species**.**

	Ratings							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Trout	Rotoiti	Rotorua	Tarawera	Rotokakahi	Rotomahana	Okataina	Streams	
Kakahi	Rotoiti	Rotorua	Tarawera	Coast	Rerewhakaaitu	Ohau	-	-
Morihana	Rotoiti	Rotorua	-	-	-	-	-	-
Koura	Rotoiti	Rotorua	Tarawera	Rotoma	Rotokakahi	Streams	Okataina	Ohau
Watercress	Rotoiti	Rotorua	Streams	Rotoma	Rerewhakaaitu	-	-	-
Puha	Rotorua	Rotoiti	Rotoma	-	-	-	-	-
Inanga	Coast	Rotoiti	Streams					
Lamprey	Coast	Streams	-	-	-	-	-	-
Eel	Tarawera	Streams	Rotoiti	Rotoehu	-	-	-	-

The average rankings for past gathering are as follows:

Rotoiti 1.57

Rotorua 1.83

Rotoehu 2.00

Tarawera 2.50

Coast 2.67

Rotomahana 3.00

Rotoma 3.25

Rotokakahi 3.67

Streams 4.50

Rerewhakaaitu 5.00

Okataina 6.50

Ohau Channel 7.00

The present day ranking confirms the importance of the coast and the higher ranking accorded Rotoma. In contrast, Rotoehu, Rotomahana, Rotokakahi, Rerewhakaaitu and the streams appear to have slipped in the numbers of gatherers using them.

6.3.3 Mahinga kai and taonga species

The main species harvested by Maori in the lakes prior to European settlement included:

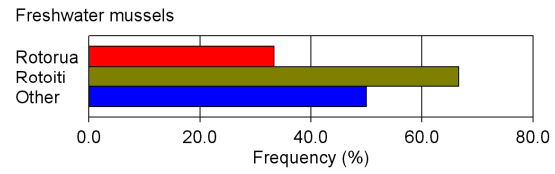
- The juvenile (inanga) and adult (kokopu) stages of the koaro.
- Adult common bully (toitoi).
- Eels (in Lake Tarawera).
- Koura and kakahi.

Fishing grounds for inanga, kokopu and toitoi were clearly marked, and actively managed (Phillips et al., 2007a). Informants also confirmed the importance of the respective kai species.

> *But it was sustainable, you know, it filled us up and fed us, and of course Inanga. Which was one of the staple diets during those days too, because they used to dry them as well eat them fresh. So, no, it was - I think everybody in Rotorua used to live on crayfish, especially the Maori families - crayfish and kakahi, way back in those days. But Lake Rotorua was clear when I was going out - clear as crystal and you could see - when we used to go and get morihana, you could see the schools and they were huge schools of morihana swimming all around the lake, all around the lakefront and they used to breed in the raupo (Informant B).*

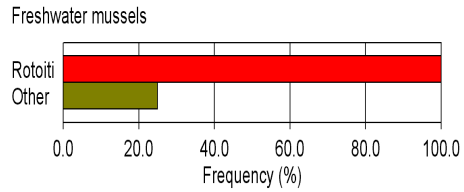
A management framework for customary fisheries in the Rotorua lakes has been developed through a joint project between NIWA and the Te Arawa Lakes Trust (Phillips et al., 2007a; see also http://www.niwa.co.nz/our-science/freshwater/our-services/freshwater-species-and-habitat-management/te_arawa_lakes). The outputs from that programme include tools, monitoring methods, and guidelines for managing culturally significant mahinga kai and taonga species. Data collected from our study will be useful in augmenting existing knowledge and is detailed below.

Table 25: Kakahi.

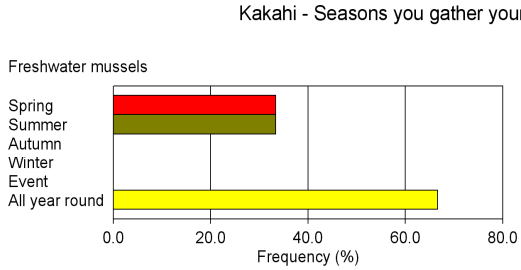


* Note: Multiple answer percentage-count totals not meaningful.

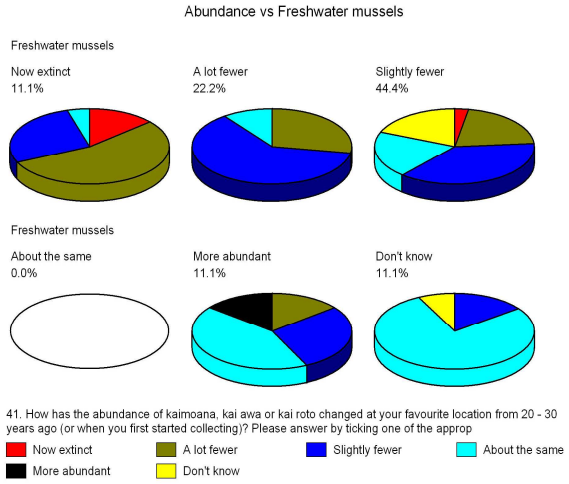
Also recorded in Rerewhakaaitu, Rotoehu, Rotokakahi, Rotoma, Tarawera (Phillips et al., 2007b)

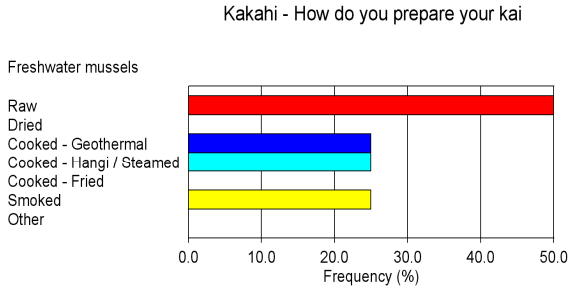


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

Kakahi are still gathered and consumed today, mostly from Lake Rotoiti. They are eaten raw or cooked in various ways. 77% of the participants believe kakahi have reduced in abundance.

Kakahi …is the most important on story, song and proverb. For instance there is an old saying tane moe whare, kurua te takataka; tane rou kakahi, aitia te ure (Man drowsing in the house smack his head, man skilled in dredging kakahi, marry him) – Hiroa, 1921

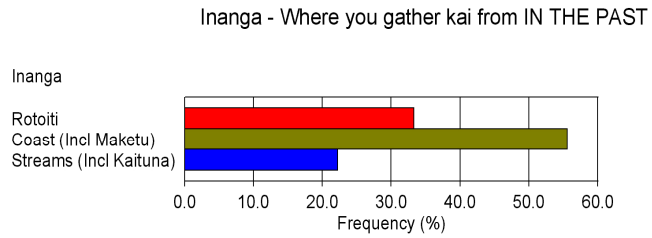
The kakahi is very tasteless and insipid (Hiroa, 1921).

It was cooked and fed to infants – it could be sucked like milk (Hiroa, 1921)

The only concern that my mum had, of course, when I brought kakahi back. She was really conscious of kakahi having a poisonous element, depending where you got it from.… kakahi was the main culprit perhaps in being certain that you did not get it from a place that is polluted from a swamp or anything else. So getting it from the river was good. The same thing happens here. The clearer the water and the lakes, the safer you are from getting kakahi (Informant A).

We used to live on kakahi. My mother used to cook a lot of kakahi, with bacon and something else - it would give them a bit of taste, it was just like eating cold water (Informant B).

Table 26: Inanga.



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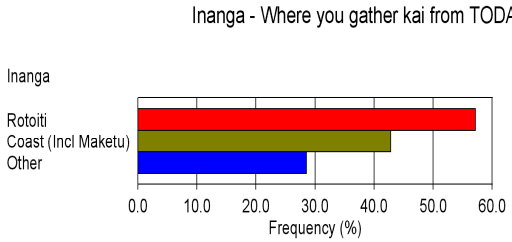

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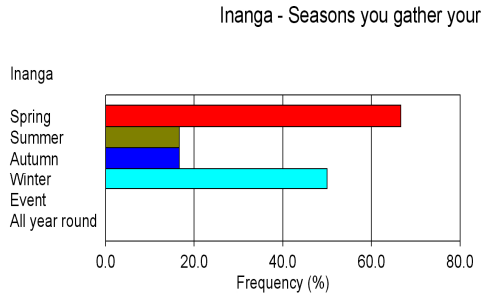

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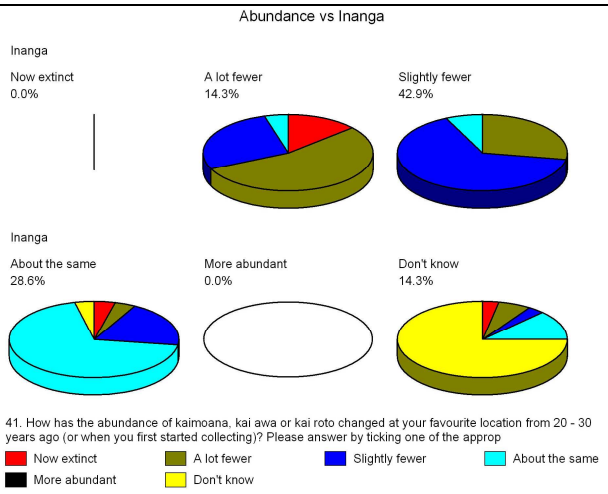
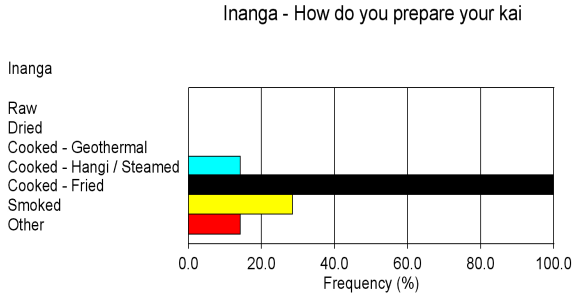




* Note: Multiple answer percentage-count totals not meaningful.

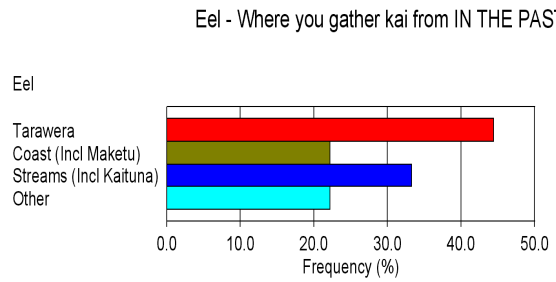
- 57% believe that inanga are fewer in number
- There are limited waterbodies from which inanga are gathered.
- It is always cooked.

Well, ever since I was a child my family went out using the old methods of catching inanga, koura, collecting kakahi, morihana, all the natural species from out of the lakes. And we just lived on that for breakfast, lunch and tea … And we never, ever came home without anything …If you want a feed of whitebait today you can sit around all day, which I have done, and it will take about a whole day just to catch a cupful (Informant E).

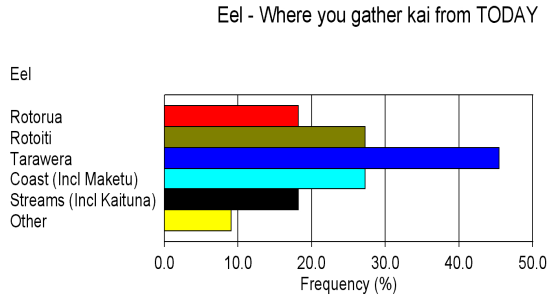
I mean, us as children, it was an enjoyment as well, but at that stage when you are very young you don't sort of realise you are providing for your family - food, so that was bringing in food, and my mother was very strict. She would come down and she would check us, and if any of the inanga would – well, they used to froth in the tub and sometimes they used to jump out. My mother would pick every one up. She would tell us - you are not to let one go into the grass. We had to make sure that nothing was being wasted (Informant E).

They used to get a lot of whitebait ... it is slim pickings these days. I, myself, never sort of experienced the sort of abundance that my parents sort of (Informant H).

Table 27: Eel.



* Note: Multiple answer percentage-count totals not meaningful.



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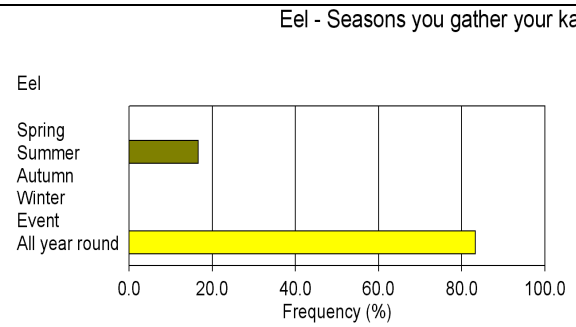

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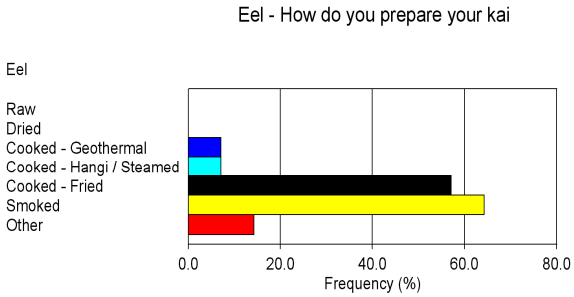


* Note: Multiple answer percentage-count totals not meaningful.

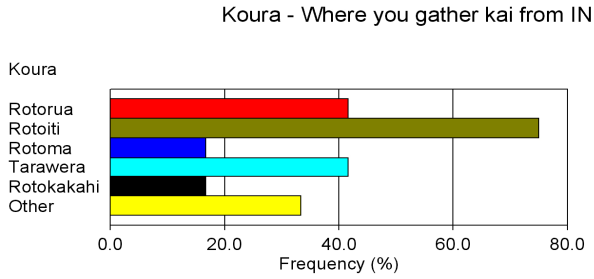
Eel is still gathered, predominantly from lake Tarawera, all year round. It is mostly fried or smoked. Eels are thought o have been stocked in the Te Arawa Lakes (Martin et al, 2007).

Each family that I knew … had a holding box for where we stocked our eels and so that we will have eels right throughout the winter. While the eels were in that box they fed themselves from the insects and whatever that came in through the box feeding, they never made fat but they were clear of anything in their insides, in their stomachs. So as far as eels were concerned, we had a lot of eels and we lived on the river (Informant A).

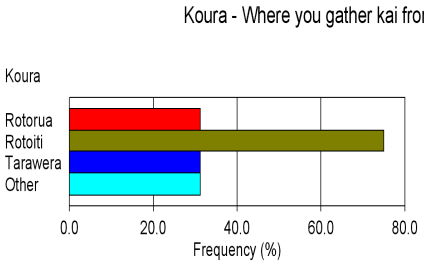
The only difference I know, … is the eels from Murupara …. Murupara are very thin skinned eels. Tarawera are very thin skinned but big and fat. But I guess you can tell the difference in kai from different places, you can identify them (Informant A).

Yes, eels. We used to get a lot of eels in Rotorua … and I used to go down the Kaituna River …I would go down the Kaituna with my uncles, and they taught me - showed me the holes and everything down there. Of course the weir that they built down at Okere Falls changed all that as well - it changed the places where the eels used to rest, because now it's a raging torrent nearly all the way down. Before it was a torrent with backwash in it and then that is where all the eels used to lie… Used to catch eels at Tarawera as well - in the lake as well as in the stream coming down from the tea rooms, the same way - would feel for them there. They were big eels….Yes, the eels are very, very big, yes, they are a good size. There is about 28 pound, the average size….Yes, well Tarawera - yes, they average 28. And so does Rerewhakaaitu - they are huge, because nobody fishes for them. And the same down the Kaituna River, you know, the eels I used to catch there with my hands were all in their 20 pounds - you know 20 pounders - big eels. Three eels and you had a load to bring home…I have caught eels in Rotoiti (Informant B).

Table 28: Koura.

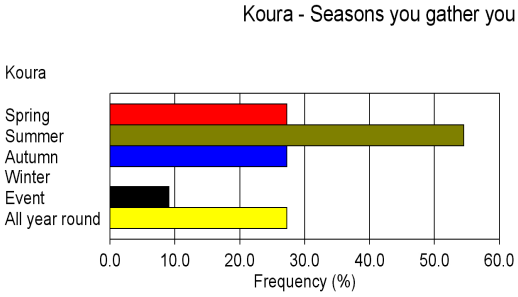


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.

They have also been recorded in lakes Okareka, Okataina, Rerewhakaaitu, Rotoehu, Rotoma, Tikitapu (Parkyn and Kusabs, 2007)



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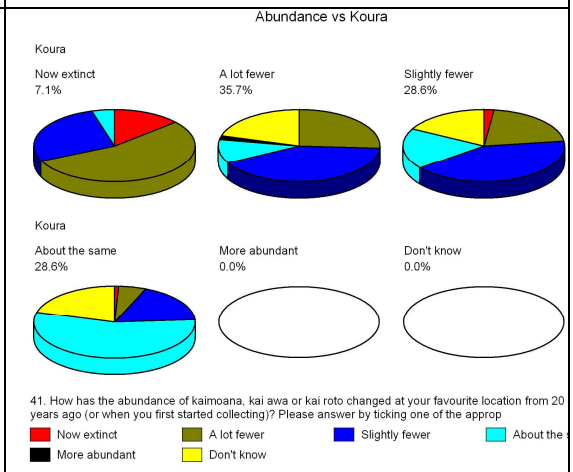
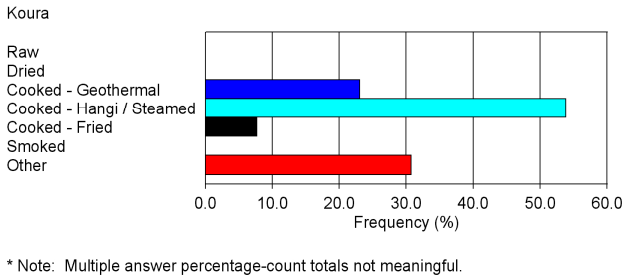




* Note: Multiple answer percentage-count totals not meaningful.

Maori Land Records show 152 individual ancestral fishing grounds in Lake Rotorua, 40 in Rotoiti, 19 in Lake Rotoehu, and 11 in Lake Rotoma (Stafford, 1994, 1996)

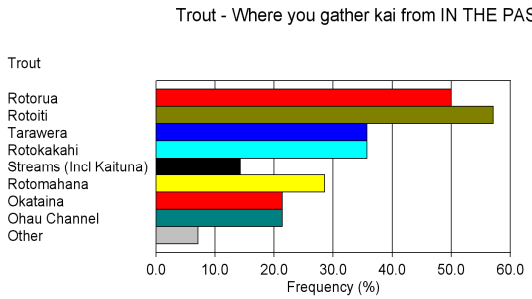
Mair (1923) knew of 700 fishing grounds in Lake Rotorua.

Koura are predominantly harvested from Lake Rotoiti, mostly in summer. 69% of participants believe there are fewer koura than there used to be.

Everybody ate bloody kouras. They wouldn't eat the ones from the sea though. Less there than in there were in the old days; there's less … We used to go out at night - rama koura and we used to catch them. You can't even see anything now because of the dirtiness of the water….Or either they're out in the deep and they can't come in because the weed is stopping them from coming in, maybe? …Nobody's been diving for them for years and years because nobody wants to swim in that dirty lake (Informant C).

Last time I had koura was at a tangi and that was this year, and the discussion that went on at the tangi table, at the hakere table, was great because we hardly ever see koura on the table, whereas previously it was quite common practice to have koura on there, now - I think it is the first tangi that I have been to in over 10 years where there was actually koura on the table at Ohinemutu ….Because, I suppose they're a delicacy in their own right, nothing was ever added to it to provide flavour because the flavour was already there in the koura (Informant J).

Table 29: Trout.



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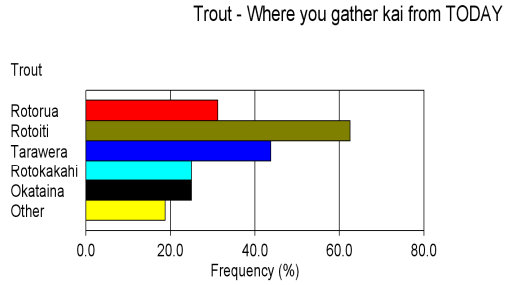

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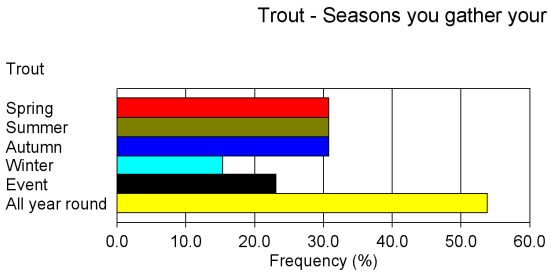
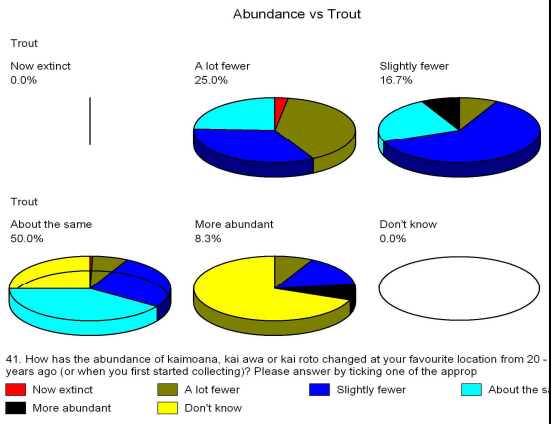
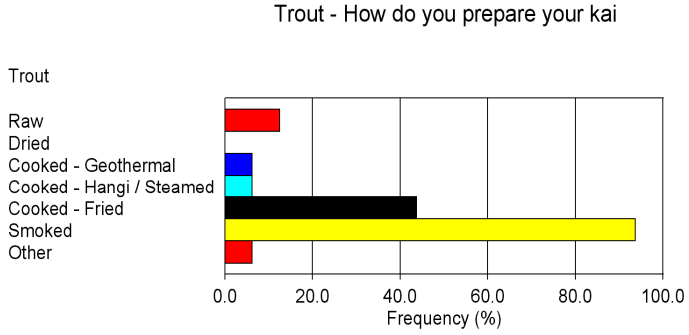


* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

Trout are widely fished, although the number of lakes were they are gathered from has reduced. They are collected all year round and mostly smoked. Most participants believe trout numbers are similar or have even increased in comparison to historic records.

We would go down and my grandfather was a keen fisherman, so we were always out and my grandfather was fishing every weekend, and he always came home with good trout and they were always lovely and fleshy and yes. So, and that was every weekend, my grandfather would come home with at least three or four trout and he wouldn't even be out on there that long when he would be fishing during the fishing season (Informant J).

6.3.4 Perceived changes in the abundance of species that are gathered

A number of questions on the Kai Consumption Survey sought to determine the reasons for the dietary changes. The quantitative data summarised in Table 3 suggest the declining abundance of aquatic species is likely to be one of the main causes of diet change. However interviewees also reported degradation of aquatic environments, societal change (more specifically working longer hours) and the introduction of licensing of fisheries as barriers to their engagement in mahinga kai activities. With respect to the quantities gathered Pakeha settlers described the abundance of kai as 'shoals of inanga". Also during the 1860s, Captain Gilbert Mair described Maori trapping of adult koaro in the Hamurana Stream (Rotorua) at night.

> *Two hours after the net was lowered 'several hundredweight of the fat little fish were emptied into the canoe….This process was repeated during the night till quite a ton weight had been obtained . . . Of course the introduction of trout was the death knell of the koaro'*[13]

> *An example of this productivity was at the opening of Tamatekapua at Ohinemutu in 1873 where a reputed 500 rohe (a rohe was roughly the equivalent of a modern sack) of dried koura and inanga were consumed (Hiroa, 1921)*

Other descriptions are found in historical text -

> *The people who lived inland had an enormous supply ….. until the Europeans introduced the trout and other fish. Now our fresh-water fish have almost entirely disappeared.*

> *Koura (crayfish) were found in great quantities in the lakes and rivers...…*

> *The whitebait went up the river like a company of soldiers in great numbers, keeping a column two or three feet wide.*

McDowall provided further descriptions of the losses that were experienced in the 1940s:

> *My grandfather, who farmed the banks of the Ohau from the early 1900s, took substantial [whitebait] catches – 20kg or more – from this river. When he took us whitebaiting in the 1940s, catches of 5 kg could be expected during good*

[13] McDowall (1984), p 91

> *runs. By then the Ohau River ran through fully developed pastoral country. He had in the early 1900s cleared his property of dense tawa forest. The streams had probably once supported banded kokopu and giant kokopu and masses of inanga when there was still forest. By the time I was there we only saw a few inanga and the odd banded kokopu in the tiny patch of remaining bush*[14].

A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining. In the 1930s, a number of factors were blamed for the decline in whitebait catches including: excessive take by whitebaiters; predation by sea birds, herrings, eels, trout; draining of swamps, backwaters, and creeks; or damage to estuarine spawning grounds by stock. By the 1990s a number of native fish species had disappeared from waterways or were in decline. A combination of factors was attributed to these losses including: afforestation, sedimentation and flooding, wetland drainage, river modifications, sewage, water abstraction (irrigation), and pollution arising from adjacent land uses.

6.3.5 Seasonality of kai gathering

Differences in seasonality also existed from place to place, for example, in Taupo inanga fishing began in September, while in Rotorua it was from December onwards.

> *The koura came in October and lasted from November to March. They ceased being fat in April. Inanga and kokopu were in season from December to February and perhaps to March; toitoi from May to September. Kakahi were obtained throughout the year but were best in winter (Hiroa, 1921).*

Although some whanau adhere to seasonal regimes, the technology (in particular the gear) available to fishers today means that resources can be gathered all year round. While all year availability provides a secure food supply for whanau, it will affect the abundance of species. The following Table has been compiled with the data from the Kai Consumption Survey and identifies the seasons when species are gathered today.

[14] McDowall (1984), p 79

Table 30: Seasonal kai gathering patterns today.

SPECIES	SUMMER	AUTUMN	WINTER	SPRING	MOST
Kakahi					66.7%all year
Morihana					66.7% winter
Cockles					45.5% all year
Pipi					53.8% summer
Toheroa					100% summer
Tuatua					50% all year
Lamprey					50% all year
Mutton birds					75% autumn
Pupu					66.7% summer
Eel					83.3% eel
Flounder					66.7% flounder
Paua					62.5% summer
Mussels					50% summer
Crayfish					55.6% summer
Oysters					57.1% summer
Seaweed					100% summer
Koura					54.5% summer
Watercress					50% spring
Puha					45.5% spring
Hapuka					100% all year
Mullet					75% all year
Kahawai					66.7 all year
Kingfish					57.1% summer
Gurnard					83.3% all year
Snapper					55.4% all year
Moki					75% all year
Shark					66.7% summer
Tarakihi					50% all year
Trevally					50% all year
Whitebait					66.7% spring
Trout					58% all year
Kina					63.6% summer

Key:

	All the seasons when gathering occurs		When the greatest concentration of gathering occurs

Although this research focuses on aquatic ecosystems, gathering birds was also regulated

> *But it was totally controlled - you never went out until somebody went up to check to see if they had enough to shoot, and they'd come back and say – "right, the season is open, you can go up", and then you were allowed about probably a month and a half, maybe two months, because that was the feeding period for the miro (Informant B).*

Informants also spoke of the seasonality of gathering -

> *We would go from August catching inanga and that would go for two-three months. I mean, the seasons have changed today, warmer climate change. But when the inanga ran it was just a mass of black running along the banks of the Ohau Channel, and we were just collecting tubs full, it was just continuous (Informant E).*

> *Then koura sort of came over the summer period - December, January, February and we caught rama koura - that was catching it along the shoreline, just with a fish and chip basket and using candles inside a huge fruit tin. So we were saving energy, you know, that was our light. And we always chose a full moon. Our parents knew - they sort of had this Maori calendar as to when was the best time to go out and they would tell us to go out and they would prepare everything for us and make sure we were safe, and they would tell us when to come home and when to go out (Informant E).*

> *During the summertime, we like to go out probably once a fortnight (Informant D).*

> *It was on a regular basis……we did the gathering of the koura at night…we would do rama koura and we would have a spotlight… and I would say in a summer we would probably have koura about, I suppose, four times in that summer period, and we would be looking at - say there would be enough to feed a family, so there was five of us and there was normally enough for two meals, so we are probably looking at, on average, I would say between - I would say probably about 60 koura at any one time (Informant J).*

It is important to realise the even today seasonality is a management technique that respects the life stages of kai species.

Yes, it was the summer months and it wasn't only simply because the water was warm, it was also a matter that you allowed the stocks to replenish themselves so that there was a period that they could - where I suppose the stocks could refill again, otherwise they would be greatly depleted (Informant J).

6.3.6 Processing of preferred species

The processing of kai species needs to be understood if all possible pathways of contaminants are to be identified.

Historically[15]

Koura *(crayfish) would be … dropped into the boiling water for a few seconds, then taken straight out and eaten, or the crayfish might be put into the steam hole for two or three minutes. Koura cooked in this way were beautiful.*

Fish *was generally steamed in a hangi, either in a tukohu or in a vessel, and meat or birds were also cooked in these steam holes.*

All the fish were steamed in a hangi, though some were dried and put away in a whata for future use.

Koeaea (whitebait), *like koura, needed very little cooking, and might be put for a minute or two in the boiling water, or steamed. In the old days the koeaea was only eaten fresh. It was caught in July, August, and early September.*

Inanga (Retropinna), *a small fish, was a favourite food of the Maori, and was eaten either fresh or dried. It was the relish eaten with the fern root.*

Shellfish *were eaten raw, or cooked for a very short time on hot coals. They might be placed in a heap, and a fire built round them. Or they might be dried and threaded on takiaho, a string of prepared fibre.*

Kuku *either cooked or eaten raw.*

[15] These descriptions were taken from Makereti (1938). We note that none of the interviewees used the term "koeaea".

The pipi *was eaten raw, dried, or cooked either on hot coals, or by steaming for a very short time.*

The eel *was generally cooked in a hangi… either cut into pieces, or cooked whole, encased in the leaves of the puwha (Sonchus oleraceus, var.), or sometimes bound spirally in the leaves of the harakeke (Phormium sp), and then placed on the hot stones of a hangi. Tuna cooked in this way was lovely, the outside skin getting quite pakawera, i.e., well browned and crackly. Tuna was considered a great delicacy.…Many are dried and put away for future use, or for taking to relatives for some special gathering. The people prepare teahi rara tuna, the fire for drying eels. The eels are laid on a frame made of green rods over the fire. If small, they are put on just as they are, but if large, they are opened out and kept open with small pieces of wood before they are laid on the fire (ka pawhara tia).*

The flesh of the dried ***shark*** *was considered a great delicacy. It had a very strong smell.*

From the Kai Consumption Survey we know that whanau today use a number of different methods to process the kai they gather.

Table 31: Number of respondents (as a %) that use different methods to process the kai they gather.

SPECIES	SMOKED	COOKED –	RAW	COOKED	COOKED	DRIED	OTHER
Kakahi	25	-	50	25	25	-	-
Morihana	33.3	33.3	-	33.3	66.7	-	-
Cockles	-	-	23.1	23.1	61.5	-	30.8
Pipi	-	7.7	23.1	15.4	46.2	-	38.5
Toheroa	-	-	33.3	66.7	66.7	-	-
Tuatua	-	-	33.3	33.3	66.7	-	-
Lamprey	-	-	-	-	-	-	-
Mutton birds	14.3	28.6	-	14.3	-	-	71.4
Pupu	-	-	-	-	75	-	25
Eel	64.3	57.1	-	7.1	7.1	-	14.3
Flounder	20	100	-	-	-	-	13.3
Paua	6.7	53.3	46.7	-	20	-	26.7
Mussels	17.6	47.1	76.5	5.9	11.8	-	29.4
Crayfish	6.7	33.3	26.7	20	46.7	-	20
Oysters	6.7	6.7	93.3	-	6.7	-	6.7
Seaweed	-		40	-	20	20	20
Koura	-	7.7	-	23.1	53.8	-	-
Watercress	-	7.7	15.4	30.8	53.8	-	38.5
Puha	-	15.4	-	23.1	38.5	-	38.5
Hapuka	45.5	81.8	-	-	-	-	18.2
Mullet	85.7	42.9	-	-	-	-	-
Kahawai	85.7	50	14.3	-	7.1	-	14.3
Kingfish	60	80	10	-	10	-	-
Gurnard	55.6	77.8	11.1	-	22.2	-	11.1
Snapper	81.3	75	31.3	-	12.5	-	12.5
Moki	57.1	71.4	-	-	-	-	28.6
Shark	28.6	71.4	-	-	-	14.3	14.3
Tarakihi	50	71.4	35.7	-	21.4	-	21.4
Trevally	37.5	62.5	12.5	-	25	-	37.5
Whitebait	28.6	100	-	-	14.3	-	14.3
Trout	93.8	43.8	12.5	6.3	6.3	6.3	-
kina	6.3	6.3	93.8	-	-	-	6.3

Observations

- Koura - the majority are steamed although a small percentage are now fried.

- Fish – a significant number of species are now smoked e.g., trout (93%), snapper (81.3%), mullet and kahawai (each 85.7%) and eel (64.3%). Frying fish seems to be the next most common means of processing although being steamed in a hangi, or boiled is still a common practice.

- Koeaea (whitebait) – is mainly fried although 28.6 % claim they smoke it.

- Shell-fish such as kina are still eaten raw (93.8%) Kuku were eaten raw by 76.5% of respondents while oysters are eaten raw by 93%. Many are still steamed but in contrast to the past practice, none of the respondents said they dried kaimoana. Only seaweed, shark and trout were dried by a minority of the respondents.

- The pipi are eaten raw, or cooked by steaming (geothermally or in a hangi). Respondents did not say they dried pipi.

- In contrast to the traditional way of processing eel (in a hangi) the majority of respondents smoke it or fry it. No one reported that they dried it.

  The pigeon – these were probably preserved in their own fat, because we don't get the same fat pigeon today as we did then. I remember shooting pigeon, it was just a ball of fat and inside would be a whole heap of fat inside the stomach itself…No, it was interesting growing up with the old people and how they regarded food - any food that you gathered.

6.3.7 Kai gathering – its contribution to wellbeing

The concept of mahinga kai extends beyond the nutritional value of species and its physical health benefits to encompass a range of cultural values. It describes species available locally and encompasses the cultural values attributed by whanau and hapu to these species as each is gathered, processed and distributed according to tikanga and kawa. Some of these values are discussed, albeit briefly, in the paragraphs below.

Whakapapa - Whakapapa is an important conceptualisation for Maori. Whakapapa connections to the lakes are evident in at least two ways:

1) collective ownership of lands and/or customary rights to fishing grounds and natural resources; and

2) the names of tūpuna/whanaunga or important iwi/hapū or events that have been given to geographical locations, landmarks, other such things.

The old time Maori …soon ascertained the parts of the lake where the various foods were most plentiful and most easily procured. These spots became the fishing grounds carefully marked and jealousy guarded by the various subtribes and families. They were given names and the most famous alluded to in song and story (Hiroa, 1921)

Whakapapa is also central to kai gathering, which like many other cultural activities, is built around collective action (Ireson 1992, 1996). This is highlighted in Rotorua Lakes where rights of manawhenua determine access to reserves and fishing grounds.

Our iwi and our hapu locally were very respectful people. We honoured everybody's rights when it came to hapu collecting from certain areas (Informant E).

We stayed within our boundaries. We were respectful and even the way we fished there was a lot of respect… No, that is gone. People are fishing over other boundaries. They have got this thing about the more they can catch, it is a money making proposition. The traditional values are going out the window, and it is sad to see (Informant E).

The current generations aspire to continue ahi kā, to perpetuate Te Arawa culture and identity which has always included the right to utilise specific resources (e.g., koura, kakahi) and practice certain activities primarily associated with the kai gathering. A few whānau in Lake Rotoiti epitomise this, by retaining the traditional way of gathering koura (tau koura).

Whanaungatanga - Whanaungatanga is an important process for the reinforcement of whakapapa links and the development of a close relationship with the lakes and the taonga they sustain. Whanaungatanga refers to the reciprocal support relationship between members of the same whānau, hapū and iwi. Through the co-existence and interaction amongst different generations and wider family networks, each of which has experienced different periods and aspects of Te Arawa history, interviewees have a broad knowledge of the social, cultural, environmental, and economic history of the Rotorua Lakes area, and of their own family's connection to the lakes. This knowledge has been generated through a range of social interactions with kaumatua and/or other whanaunga and friends from different generations. Tangihanga, hui and wānanga provide important occasions for comparing experiences, generating

information and affirming whakapapa and whanau ties. Such interactions continue to facilitate the transfer of mātauranga Māori, cultural values and traditions.

Wairuatanga - Te Arawa use different ways to feel spiritually connected with their takiwa.

> *Previously Utuhina or on the shores of Lake Rotorua would be where I would get cleansing and spiritual cleanliness, I can't do that now (Informant J).*

Gathering kai with whanau at a traditional fishing place, that they know was named by their tupuna and utilised by successive generations of their whanau, is one way.

Being able to contribute the kai that their takiwa is renowned for, to ceremonies and to manaaki manuhiri can also bring that connection:

> *I suppose where your wairua is uplifted and where you find strength because you are able to cleanse yourself there, that can't happen anymore. And those are the things that I think that I miss and that I am sad that my children don't have that opportunity to do those things. I mean, as a child, you know, you can spend all day running and just the feel of the water on you, you know, just because it is so cold, and just the freshness and how alive it makes you feel when you emerge yourself from the water (Informant J).*

Manaakitanga - Historically a surplus of food was gathered as surpluses enabled whanau to access other resources through bartering, trading and gifting, thus setting up reciprocal obligations (Makereti, 1938). During the year whanau visited neighbouring hapu, taking surplus food to share. Being able to gather abundant foods and thus able to engage in a range of economic practices ensured whanau had access to a variety of foods. Because of trade, however, people weren't restricted to kai immediately available to them from their local area but had access to a wide range of foods. Degradation of the lakes, however, meant that Te Arawa were denied access to a significant percentage of their traditional sites of kai gathering across Rotorua Lakes and streams.

> *At the large hui at Awahou in 1899 there were six hundred people from the Bay of Plenty and East Coast. The gathering lasted a week and koura was the chief food (Hiroa, 1921)*
>
> *A great present of koura was sent to Kawana Paipai in 1859 (Hiroa, 1921)*

As has already been mentioned –

At the opening of Tame te Kapua at Ohinemutu in 1873 it is said that at the feast were five hundred rohe of dried koura and inanga (Hiroa, 1921)

Durie (2004) contends that mauriora is dependent upon a secure cultural identity, and therefore diet changes can lead to loss of culture and identity. Having the ability to manaaki visitors by supplying kai sourced from one's takiwa means that the activities of fishing, and gathering other foods creates and maintains community ties and reinforces identity. Conversely the inability to manaaki guests and sustain whanaungatanga can lead to cultural loss. As informants explained -

At home we would share them out with all the families along the way and what was left over we dried. We dried for the winter (Informant B).

And that is what it is really about - the sharing, and that is what food gathering was about, or planting your gardens was the same. You didn't just plant for yourself, you planted for everybody.… they always shared everything… I've always had a garden… I always planted something (Informant B).

We dived for our people. We look after our people. Big tangis and all that. We look after our people (Informant C).

But sadly informants believed that the sharing culture is gone:

No, that has gone too. That is gone because in the old days there – because I was brought up by my mother and my grandfather. And every Sunday they used to come around – like the older ones – and drop off a piece of wild pork, some fish, some koura, eh. But that's gone. … now I take my kids; my son, my daughter and now my mokopuna down to the pa whenever there is a hui, whenever there is a tangi. But the rest of the kids – when we moved …they lost that connection (Informant M).

It was always enough to feed the family and then some left over to be able to give to people that came….Yes, so when taking from the lake it was always really important that we didn't just keep it for ourselves, that we shared it, particularly like koura, it was always made sure that my grandmother got some and both my sets of grandparents and aunties and, yes, there was always plentiful, enough for our family and some of our extended family (Informant J).

Matauranga Maori -

> *Yeah, but I think it is the younger generations that are – they are getting worse and worse because their parents aren't giving good – showing the good way. You know, they are obviously, "Oh, well, you know". Because to me, Papatuanuku and, you know, Tangaroa, you know, we are kaitiaki of them and if we don't look after them we can't collect from them or they can't look after us (Informant H).*

As has been previously stated, the activities of gathering and preparing kai serves the functions of passing on traditional knowledge from one generation to the next. Matauranga Maori is developed and transmitted through practices of food management, harvesting and preparation.

> *I suppose I learnt from - and my brother and sister did - we learnt from our father and our uncles, and it was really things that they had learnt. So it is really generational information that comes down, and it was always - the key was sustaining. You know, making it sustainable so that next year you could come back and there was still some more there (Informant J).*

> *As a child, I have never seen a morihana, I didn't even know that they existed until as I have got older and we have spoken about the morihana, but they used to say …they would just pick them straight up and eat them raw, (Informant J).*

A great deal of knowledge is needed in order to obtain kai - knowledge of techniques and also knowledge of ecosystems. If populations of aquatic species do not return, knowledge of the techniques of gathering these foods along with the associated ecological and cultural knowledge and the techniques of gathering will likely also begin to disappear. Historical text and evidentiary statements provide insights to the knowledge held by earlier generations:

> *There were expert men who understood all the movements of a school of fish. These men generally took up a position on the top of a hill near the sea, and looked out for any signs of a school of fish, and then passed on the sign to a party of men who were fishing in a canoe. The seas which surrounded New Zealand were teeming with fish. ..*

> *In Cook's First Voyage, page 57, Cook writes: "The seine, the large net which has already been noticed, is produced by their united labour, and is probably the joint property of the whole town. Their fishing hooks are of shell or bone,*

and they have baskets of wicker work to hold the fish." On page 48, he writes: "Early in the morning, the Indians (meaning Maori) brought in their canoes a prodigious quantity of mackerel, of which one sort were exactly the same with those caught in England. These canoes were succeeded by other canoes equally loaded with the same sort of fish, and the cargoes purchased were so great that everyone of the ship's company who could get salt cured as many as would serve him for a month's provision. These people frequently resort to the bay in parties to gather shellfish, of which it affords an incredible plenty. Indeed, wherever we went, whether on the hills or through the vales, in the woods or on the plains, we saw many wagon loads of shells in heaps, some of which appeared fresh, others very old."

Crozet in his Voyage, pp. 40–41, writes also of the abundance of many kinds of fish caught by the Maori, and of the art of the Maori in all that concerns fishing, and goes on to say: "Their fishing lines, as well as their nets of every description, are knotted with the same adroitness as those of the cleverest fishermen of our seaports. They manufacture seines five hundred feet long, and for want of corks to hold up the nets, they make use of a very light white wood, and for lead to weigh it down, they make use of very heavy round pebbles enclosed in a network sheath which runs along the bottom of the seine, etc."

Te aho hi ika, the lines used for fishing, were made from the finely dressed muka (fibre) of the flax. They were very strong, and often carried hooks to catch very large fish, such as the manga (barracuda), or the hapuku (groper).

In my district manuka grew near Lakes Rotoiti and Rotorua, and this became quite famous for making hooks. People came from the coast on purpose to get these manuka sticks, which the prevailing winds had blown almost into the shape of fish hooks.

As food species disappear from the dining table, the particular knowledge of how to prepare foods is also lost.

I used to also go and get mutton birds on Whale Island…I used to go every year and get mutton birds. I started when I was nine - I used to go over there with the old people. Then when I was 11 I was allowed to go on my own (Informant B).

We were working at six, doing allsorts of things, not just milking the bloody cows, but digging the garden and helping grandma do this and do that, and so

we had a working life, everyday was a working day. And by the time you are 11 you could do anything…Totally independent, you could look after the family, you could cook, do the housework, everything. And that is how it had to be, which I reckon was wonderful, that they taught us all these things. By the time I was 15 I was ready to marry - you know, that is what they said, I could marry at 15, because I could go to work and look after our family and look after children. So that is one of the sad things about today, young people haven't had the opportunity to do all those things (Informant B).

I found that catching fish was the easiest part. I used the long line most of the time. And it's hard to get these young kids, aye, because they were – I used to get them out on that boat; they never played up at me. They knew the rules; they play up, well, we stay another couple of weeks out there and they hated it. A lot of them used to get seasick. They didn't like – don't play up with him or he'll stay another week. And we'll have to eat fish for breakfast, fish for dinner, fish for tea. I've got a change today, boys - more fish! (Informant C).

Because of the continuity and frequency of kai gathering, people were readily able to monitor fluctuations in stock and environmental conditions. They were then able to build up tacit and local knowledge of the environment.

Tikanga Maori - Kai gathering was and is governed by tikanga. Generally, whānau members spanning two, or sometimes three generations, together collected different kai moana species from traditional mahinga kai areas.

Makereti (1938) tells us that historically -

- *When a fishing expedition was arranged, several canoes, each manned by several men, were placed under strict tapu.*

- *If a man was married, he kept away from his wife until all fishing operations were over.*

- *The first inanga caught in the season were always offered to the gods, and the rest of that first catch was used at a ceremonial feast, karakia being repeated by the Tohunga.*

- *Both men and canoes were under tapu, and each canoe would carry a mauri, … in a hidden part to maintain the tapu, and add mana to move the gods when an appeal was made asking protection for the ropu (company) from the many*

dangers at sea, and from the many beings who lived in the deep waters of Moana-nui-a Kiwa, the great ocean of Kiwa.

- *The first fish caught on an expedition was offered to Tangaroa as a thanksgiving, and it was done with the ceremony of karakia.*

- *The fish was then placed in the sea again, and this karakia was repeated asking that abundance of fish might be sent to fill their nets or bite on their hooks.*

- *The men who went on fishing expeditions had no food before they went, and none until after their return, when the tapu was taken off by a Tohunga.*

- *Even when fish was caught, and pulled up into the waka (canoe), it must not touch the top of the gunwale. If it did, it was considered to be an evil omen, aitua.*

- *When fish was placed in the canoe, it was laid in the way of the canoe, and not across it. If the fish were placed across and a man stepped over them, it was thought that some aitua (bad luck) would happen to him.*

- *No Maori went out fishing alone. Fishing … was done by a ropu or company of men.*

- *When men went fishing, and one of them had a new line, none of the others would throw out his line till after the new line had been wetted. When placing his bait on the hook or hooks, he would tuwha, spit on it, and after gathering up his line, he would pass it under his left kuwha (thigh). After this he would turn his face to the bow of his canoe, and throw his line over the left side of it, and as the line went out and got wet, he held it in his left hand, and picking up some sea water in the cup of his right hand, sprinkled this on the line. The first fish he caught would not be eaten, but kept to be given as an offering to the gods. This offering would be cooked on a fire which was specially kindled on his return to land, and the fish, which was divided into two parts, was offered to the spirits of his male ancestors, and to the spirits of his female ancestors.*

From the interviews we extracted skills, knowledge and tikanga that continue to be upheld today:

- location of fishing grounds;

- rights to fishing grounds;
- knowledge, location and impact of thermal resources including natural sources of contamination;
- how to read and understand the waters, and the dangerous places around the area;
- knowledge of the location of different habitats of species, knowledge of life stages of species, such as when to collect or leave to replenish and grow;
- how to get a 'feed' if needed;
- how to remove the skeleton from koura;
- how to make and mend equipment;
- diving – traditionally and with equipment;
- gathering in traditional way e.g., tau koura;
- seasonal information;
- boat handling and maintenance;
- karakia before gathering;
- ika mātua (the return of the first fish to Tangaroa);
- take enough for a 'feed', any excess is to be given away to those who can't get it;
- rāhui in event of accident or death.

Tikanga remains relevant today:

> *I mean, you just didn't go out - if we went out eeling we'd all stand in a group and my grandfather would do a karakia and ask Tangaroa to let us have some luck, and we always got heaps of luck - we had eels everywhere (Informant B).*

But there is also an obligation to teach the next generation:

> *Yes, no, but you've got to teach the ones that do it to share, that is the big issue. Today, if you don't go out and somebody goes - oh, stuff him - part of the whanau, you know, he doesn't go out. But you have got to learn to say – well, he's got to realise that they are not all the same. But the point of going out to get all this kai is to be able to share it with somebody else - there is no sense otherwise, there is no sense in going to get all this stuff because the joy is seeing the joy on other people's faces when you say "here", and that is when it's worth it. Otherwise you can hoard you bloody freezers up and whatever and it doesn't mean a damn thing (Informant B).*

Te Reo - That kai is instrumental to a culture is reflected in the Te Reo that pertain to fishing grounds, their names and the names of the landmarks by which they are located and the different species. Te Reo contains knowledge and is an expression of culture and identity. Yet Te Reo has been declining for many reasons, one of which may be attributed, in part, to changing lifestyles. When a valued species disappears from a local ecosystem, or the activities associated with a species decrease, the associated Te Reo drops out of usage. When 61% of the respondents confirmed that they would stop gathering if advised that species and sites were contaminated, the indirect cultural impacts that would ensue should this happen would represent a significant loss.

Cultural survival - This section of the report has attempted to describe how kai gathering is the glue that binds whanau, hapu and community together, providing a sense of identity that also serves as the vehicle for the transmission of values and knowledge. The degradation of the lakes and consequent impacts on mahinga kai was a significant issue in the Te Arawa claim as evidenced by statements in the Tribunal Report. Archived documents provide in-depth testimony concerning the cultural and spiritual significance of aquatic kai species and of the water bodies across Rotorua Lakes themselves while informants identified the need for education.

> *You have got to teach them, eh? You have got to get them interested (Informant A).*

> *But one of the things is – it is education of our people. Our people need to be educated now about their resources or tools so that our fishermen can test their own catch …They should be made to do that. I mean I don't mind being stopped on the lake and having my fish tested so it is safe for me and my family (Informant A).*

All I would like is for my children to have the opportunity to enjoy the lakes in the same manner that I did, and it is as simple as that. That my children and my grandchildren enjoy the same benefits that I did as a child, that they can grab the tyre from down the road and roll it into the lake and all 10 of them jump on it and I know that - you know, previously you would be worrying about their swimming ability, but now you worry about them putting their head under that water. So to take that away and to watch, you know, the neighbourhood kids, all 10 of them, be able to access that water again, that is what I would like to see (Informant J).

It was our playground, it fed us, it taught us a lot of things about, you know, like especially now, these days, our children don't realise – you know, because you have got to get in touch with nature now and these are like – it was an educational basket. You know, you could investigate and even the species along, you know, like the ducks and the – you know, there was like – the ducks that we used to like were those ones with the bright yellow eyes (Informant H).

Hauora Maori - The presence of kaumatua represents "intellectual capital". They are holders of a wealth of critical information about the past and can draw on this knowledge to provide accurate assessments of environmental condition, including changes over time, at a localised level. The results from the Kai Consumption Survey confirm that differences in behaviours, perceptions and knowledge are found with the different generations. Loss of relationships with the natural world could lead to grief. Many feel whakama when unable to fulfil the social roles expected of their age groups. At stake with the loss of kai gathering is not only cultural survival, but potentially the physical and mental wellbeing of whanau members.

So we walk along the shore to get down to Utahina, to walk along the shore is mainly - it is just covered up in lake weed, so it is really hard to see if they actually still exist on those shorelines.

So my children don't spend the time in the water that I would like them to because the water is what connects you to - you know, it is what makes us well. It is one of the things that makes us well and provides us strength, and so then where do my children go to? (Informant J).

6.4 Perception of the health of the lakes' environs

Questions sought information from interviewees about their perceptions of:

- What environmental impacts that act as barriers to gathering?

- What environmental activities have impacted the condition of sites from which kai is sourced?

- What activities have led them to change their gathering behaviours?

With increasing European settlement around the lakes in the late 1800s, forests were milled, agriculture was established and urban settlements were developed. Numerous conflicts developed between the new settlers and Te Arawa, whose capacity to provide kairoto from the lakes and koha for hospitality was diminished with deteriorating water quality and introductions of exotic species. Today, through degradation Te Arawa have been progressively alienated from the lakes, their taonga and their role as kaitiaki although a number of restorative initiatives are being implemented. In the following paragraphs we identify some of the activities impacting the health of the lakes:

Changing land uses- Native vegetation around the edges of Lakes Rotorua and Rotoiti was milled for timber and cleared for farming, and later septic tanks were installed. These developments resulted in an increased nutrient load flowing from the catchments into the lakes. Excess nitrogen and phosphorous led to the growth of blue-green algae in the lakes. In the paragraphs that follow we summarise many of the impacts of concern to Te Arawa.

Sewage - Pumping sewage effluent into the Kaituna River is offensive on medical, social, spiritual and cultural grounds.

> *I suppose out of all the lakes, I think Rotorua was the most damaged from the sewerage, because when I was growing up - you wouldn't believe, they had the sewerage - the town dump down by the lake (Informant B).*

> *If we believe the lake is polluted then it is, and that the food in it is polluted. But we've been eating it for years so we're probably all immune to it now. But if anybody else from our side probably came in from overseas, they probably get crook (Informant B).*

> *I suppose there always is health risks, when pollutants go into the lake, but the trouble with health risks is that they're not instantaneous, you know, it takes years for it to appear (Informant B).*

They pump the town sewerage up into the forest in towards the Tukurangi Pa and as far back as probably about up to here (Informant H).

It's not right down here with the quality of the kai, then it must be from Te Puke, in which I won't be afraid to say that Te Puke is – they're mongrels, their 'shit' - all right and that's honest (Informant K).

Forest Clearance - Many native fish live within the forests in steep, cold streams with rapids and pools, that still retain a heavy cover of native forest. These habitats support banded kokopu (in pools), short-jawed kokopu (needs plentiful instream cover to hide in), red-finned bully (in wider streams), longfin eel (needs deep pools, large bank overhangs, log piles), koaro (in clear streams), banded kokopu, and giant kokopu. Koaro which are now rare disappear from streams when the forest canopy is removed. In unmodified streams koaro may still be found. Forested streams are probably the habitat required for spawning lamprey.

The trees are gone, some of them are gone, some cut down. Plus we went to a barbecue down the lake, summer this year, and what surprised me was the bareness. Not only bare of, you know it, around the shoreline, but bare of people to when I was – eh? Because it was always covered in kids. And all the kids were actually by us at the barbecue, throwing stones into the lake, even though it was a nice warm day (Informant M).

Deterioration in Water Quality Many native freshwater fish thrive in cold, clear, actively running water as they need a constant, organically clean, thermally and chemically stable water supply (Hine and Boustead, 1974).

Informants described the changes in water quality across the region:

But I remember being able to go down to the rock and when I jumped in the water, the water was cold and it was just what you did on a summer day. Now if I went to jump into that water it would be luke warm, and so what is going on that as a child it used to be able to quench me and be able to sustain me that now actually it's like "I'm not even jumping in there", something is going on with it(Informant J).

I think if I wouldn't drink it, then why would I throw my children in to swim in it, and yet there was a time where I would have been quite happy to have drunk out of the Utuhina River (Informant J).

You can get any shellfish you like out of this one. But …they're slowly disappearing (Informant C).

And I looked down and it looked down and it looked like somebody had done some big, huge, washing, eh, there was all this froth, eh, you know? And I go, "Look at that". All along the shore it was just thick froth. And I said, "Well, nobody got a washing machine this big, so it must be something else". Which I felt sad for because there is a lot of history in those lakes; a lot of people swam, a lot of people died in that lake, a lot of wars on that lake, eh.… It is a lake of memories, good ones; memories of flowers, memories of people. And at the moment now, all they are is memories because you have got a whole lot of rubbish that is stuck in it, (Informant M).

We get 44 gallon drums, we get pallets, we get everything coming down the Utuhina Stream, but in our bay, which is right next to the Saint Faith's Church, I get all the tennis balls.…… He gets all the golf balls, which we can't work out because tennis balls are lighter than golf balls and yet they come further around to the yacht club – that is right next to the yacht club, yeah. And I think one day there we got over a thousand golf balls out of there. And so that is coming down the golf course up here, down the Utuhina (Informant D).

Without your water quality, food will never be sustainable from the lakes, waterways (Informant E).

Especially in summer time when the algae bloom gets at its worst, you know, and you see - because we frequent Lake Tarawera, when you see that yucky horrible greeny colour and Lake Rotomahana that totally, totally looks disgusting now …The colour and all those floating things and heaps of feathers and all that weed and the smell (Informant F).

Even Noho Kakahi get a lot of ugly looking floating algae looking things in there. Yeah, the colours have all changed. In Tarawera you could look over the jetty and look down and you could see the lake weed at the bottom and now you can't see anything full stop (Informant G).

I took my grandchildren for a swim down the lake, and I hadn't been to the lake for a while, and we were swimming around there for ages and I got some kouras and I knew they was hot so I let them go…. we were walking home and I go (sniff, sniff) something was stink, eh, and I smelt it and it was me, from

the lake. So I got home and from then I wouldn't go back in the lake (Informant M).

Yes, the smell from the lake [Rotorua] is so putrid. So, I mean, certainly as I got older as a teenager, I don't think it was just a teenage thing, I just think the quality in the lake just seemed to deteriorate at quite a rapid period, or maybe I became more - because as a child there was no problem in putting your head under the water, but now, and then if you go around (Informant J).

Bio-security – specific to Maketu, one species of concern was identified –

Starfish, but that's fallen off some of these big boaties. Those big boats, when they empty their ballasts and that's where those come from. You know, when they come over and then they collect the logs and they pump all their ballasts out (Informant C).

Irrigation - Extraction of flows to enable irrigation can cause rapid alterations in stream flows resulting in exposure of bank vegetation, and loss of fish habitats.

Disappearance of kaiora - Insects represent a source of food for freshwater fish. Native fish are deprived of this resource by forest clearance, agricultural pesticides, and competition from introduced fish. As early as 1920, the entomologist Tillyard reported to the Government that trout had caused serious declines in aquatic insects in the Rotorua–Taupo streams and lakes (Tillyard, 1920). Informants commented on other changes:

And I remember even getting some paua - oh, about maybe eight years ago I suppose – and you know, they were okay but then you take them out of the shell and you can actually see the discolouration in the shells and it is like it is from the quality of food that is keted and (Informant H).

I missed all that - beautiful, it was just natural. And the croaking of the frogs - we didn't even need a clock to wake us up in the morning. Five in the morning the frogs would croak and they would start in harmony and sing all these beautiful tunes - high and low, and that got us up - the frogs. See, you don't even hear a frog today, you don't see a frog, it must be affecting the environment (Informant E).

I mean the birdlife was one of the most beautiful things to watch and you could always tell with the seagulls when the inanga was running - the birds would tell you. Now you don't see that as often. We've lost that as well. The

birds will go to another area where it's peaceful and quiet, plus if you have the habitat taken away like your swamp lands taken, they will go elsewhere, and that's what's happened to the Ohau Channel because of the dredging and now it's like parkland (Informant E).

But the pauas, they are all stunted; they're all got to a certain size and that's it. They never grew any bigger. Everybody else, they say - oh, we got some big pauas. You can't get big pauas here. They only get to it once, I think, and that's it (Informant C).

Impact on wahi tohu

Maori used tohu within their natural environment as indicators of predictability. By using indicators that have evolved over time through trial and error, through a history of continual use, Te Arawa monitored the condition of the environment, shaped their behaviours accordingly, and if necessary protected it by applying a rahui – using tohu to understand predictability represents a traditional management technique akin to the contemporary practice of adaptive management. Sadly changes to many lakes mean that historical patterns and processes are changing to the extent that rainfall (and other climate patterns) and lakes are being described as unpredictable, meaning the application of tohu may be limited.

Dredging - As swamps have been drained, natural streams have been straightened and dredged, destroying the food resources, refuges, and spawning gravels of native fish. However some informants believed dredging was not necessary at Maketu:

Well, I thought – I told them that. I said, "well, you know, the only way you're going to get to this - is you're going to have to dredge this" He said, "you won't be able to do it." (Informant C).

Swamp Drainage - Before the clearance and drainage of the vast kahikatea forestlands, extensive tracts of swamp, with pools enclosed by flax and raupo, were a feature of the region. These habitats sustained inanga in vast numbers, shortfin eels, and giant kokopu. Maintaining swamps is vital to the productivity of whitebait fisheries. Areas of lowland fisheries have been lost to land clearance, drainage, and trampling by stock. Drainage was identified as a particular concern at Maketu.

Pine Forestry Practices - Pine forests replace native forests and create a new environment around streams that is not a substitute for native forest cover. Forestry practices of burning, bulldozing, road building, and hauling modify streams.

Rapids, riffles, flats, shallow gravels, deep pools, and overhanging banks that provide the habitats in which native fish forage, hide, and breed are modified or lost. Forestry practices can disturb stream banks and stream beds, and load stream flows with sediment. Forestry practices can alter the chemical composition of streams as slashed vegetation rots, as phosphorus, nitrogen, and potash enter streams after burning, as forests are sprayed with chemicals and fertilisers, as mills discharge effluents, and as toxins leach out of sawdust and waste woods.

> *We used to have native trees and native trees don't throw out pollen (Informant E).*

> *Rotorua, Rotoiti, they are all small lakes, they just can't handle it. I say it is caused through pollen, everything else has changed the quality of our water (Informant E).*

> *But it's not only the kai from the lakes that depleted a lot, it was also from the forestry…the trees getting cut down and the poison coming in (Informant G).*

Modifying Estuaries - Many species of native fish pass through estuaries that provide a crucial transitional habitat which reduces the shock to migrating fish of changing from fresh water to salt water (Dinamani and Hickman, 1980). Maketu has been impacted by landuses and the diversion of the Lower Kaituna River.

> *Put it back through the estuary. But you can't – they say, oh, it will open it up and it will just flush it – you'll never flush it because they've left it too long. She's silted up that high now; she'd be, well, you could walk across here; walk across the thing. Before you had to go down a bank; now you can walk straight off the bank and straight into the sea (Informant C).*

Impacts of river management

> *The environmental impacts that have now impacted on Maketu whereby in the early years everything was pristine, beginning from Rotorua/Ohau and then down here, and we have seen the changes over the 50 odd or more years. But what we valued most was, I guess what was coming from Rotorua, the freshwater and the marrying into the saltwater which created within the estuary here. And from that – from a human being sort of observation and within ourselves and our firm belief that the wairua of the water and both mean together it created a uniqueness in terms of Newton's, whatever you call it, the "mixing" and, of course, with the end result, resulted in the food bowl of Te Arawa (Informant K).*

It was the installing of the weir around about '89, we've lost the whitebait (Informant E).

In addition to the adverse effects of the Kaituna Cut, the wall at Rotoiti was identified as a concern:

But I'm not very happy with the wall that they put in. I think it's going to cause problems. Why I say that is that just from my own way of thinking is that when you put a wall up and the wall becomes a barrier between Lake Rotorua and Lake Rotoiti…when the river was flowing down through the lake it dragged Rotoiti with it … The current going down drags the Lake Rotoiti water with it and creates a movement up the top end of the lake, admit it takes a while but it does…But when you put a barrier in, Rotoiti becomes a swamp…And you are not going to have that water dragging the Rotoiti water with it because it's going down against the wall (Informant B).

Game Fish Introductions - Trout and other foreign fish species were introduced into the Te Arawa Lakes from the 1870s onwards by acclimatisation societies, local bodies and government departments.

In lakes and rivers trout compete with native fish for floating insects, aquatic larvae (especially dragonfly nymphs, fly, caddis, mayfly, and stonefly larvae), and native aquatic snails and molluscs, especially in winter when food sources are meagre. Small longfinned eels living amongst the river gravels feed on aquatic larvae (caddis and mayfly), snails, and midges; their food is so similar to those of trout that competition is likely (McDowall, 1989).

But not all introductions were negative:

Morihana was probably one of the most valued fish in Lake Rotorua or in any of the lakes, that was a real delicacy, morihana, but of course that was introduced.

Land intensification

Like other regions around New Zealand land intensification is a concern especially if land use is dairying:

And now the cows – because the cows don't come down but there must be seepage, you know, back into the river. Well, I think if you knocked the blimmen river back to the way it used to run, then you'll get them - they'll

come back. What they did, they blocked off the main river and then they opened up this new one. Well, since they opened that up, then you get very small ones (Informant C).

Informants described the obligations they believe rest with the landowner -

So my whakaaro is, where everybody has got a farm around here, wherever there is an outlet, that should be all tested. And if, say, people have got a farm there, as I was saying, they own that piece, but the land not the water. We do. The people of Rotorua. So what we must be protecting is all this. So if they have got a farm there say, "Okay, you guys, you get plenty of money out of that, so use some of that money to make sure your sediment doesn't reach the lake" (Informant M).

Government and council actions acting as barriers – including the impacts of fisheries regulation - Government regulation required Te Arawa to pay for licences to take trout and certain other introduced species from the lakes. This restricted the ability of Te Arawa to fish in a customary manner (such as with nets), restricted their food supplies and imposed a financial burden.

Informants described how they felt when regulation was introduced –

Once they started bringing in fishing licences. We were saying "well, what about us and our indigenous fish?" We could just take - you know, when we thought we owned the lakes and it was leased out to the Crown, to us it was our traditional fishing rights and it just felt our fishing right was being taken from us (Informant E).

Our old people said – "no way are we going to take compensation, because the day we take compensation we will lose our customary rights, we will lose our customary fishing grounds, we will lose it all", and they are true (Informant E).

As part of the Te Arawa Lakes Settlement Act 2006, however, the Crown has made regulations to empower the Trustees of the Te Arawa Lakes Trust to manage the customary and recreational food gathering of included species in the Te Arawa Lakes (refer to http://www.tearawa.iwi.nz/fisheries-regulations; see also http://www.niwa.co.nz/our-science/freshwater/our-services/freshwater-species-and-habitat-management/te_arawa_lakes).

Other resource laws - The statutes displaced Maori interests in the indigenous fauna and consequently Te Arawa lost their economic and social interests in the flora and fauna. Iwi and hapu lost rangatiratanga over the fauna of their whenua. Statutes protected the conditions for introduced fauna to thrive. As a result predatory game fish displaced native fish from lakes and waterways (Rowe and Kusabs, 2007). Spawning grounds of inanga and kokopu were and continue to be damaged by stock and logging. Maori lost their self-sustaining harvests.

Loss of riparian vegetation -

Historical text describe the natural vegetation around the lake. However informants raised the loss of vegetation as an issue.

Raupo, they've all disappeared around the lakes - it used to all around the lake. Poupou, which they used to use for making their whariki and all that. But it has all disappeared, you know, because when they disappear other things disappear. The homes for koura, they used to live in the poupou, under the roots. Well, they all disappeared so they've had to move somewhere else, and the raupo - they used to live in amongst the raupo and all that (Informant B).

I'd like to see all that stuff growing back again, especially the poupou and the raupo, I'd like to see it all back around the lake, and the lake a bit more cleaner than what it is. There is not really much we can do at the moment because all the silt at the bottom now, it is all built-up and I think it's going to stay murky for quite a long time. But I think once - give it another 20 years, as long as we clean the streams up, it will wash it all out (Informant B).

We used to walk through all the weeds and the raupo…. We used to go with our pitchforks and catch the morihana, eh? And it was like walking through a garden. So the key is, whoever is looking at this and they are trying to figure out how a person got a motor mower into the water …All the dust, the sediment comes up and blocks the view of the koura. But, when I was a kid you didn't have that. Years ago we would have cut a car tyre up, hammer it to a piece of wood, light it, and that is how we used to catch koura. And you could just walk like that and you would still see them (Informant M).

I don't know how they did it, but I am trying to figure out people can get a lawnmower into the water, eh? Because everything around has disappeared. Whereas we used to have to climb though it, eh? You know, you had the little

vines … you used those to swing out over the lake? Well, those are all gone. And, to me, the motor mower goes that far.. (Informant M).

Raupo was the cleanser of the waters (Informant E).

The chemicals were actually killing our raupo and our natural cleansers. When you look at a raupo you will see it has got a sponge like that goes into the water and it sort of sucks in all those nutrients (Informant E).

And this is what I've been telling the Environment Bay of Plenty and RDC. It was just all raupo until they started building homes. And what do the new owners want - a jetty instead. So they pull out all the raupo and up goes the jetties. See, you change your environment (Informant E).

It's one of the things that just sorts of just sneaks up on you though, the vegetation around the lake, just sort of a wee bit disappearing and then a wee bit disappearing (Informant G).

New settlements/subdivision - The lakes were removed from the ownership and management of Te Arawa.

It's absolutely beautiful. And this is why people are spending heaps of money coming to live in the bay, but they bring all their jetskis, they bring all their motorboats and it's just crazy over Christmas. They go round and round in circles - just about hitting each other. The noise is quite threatening too, because you can't hear your phone…(Informant E).

I suppose what you do notice is that as our population increases and as we are not so appreciative of our whenua, the repercussions are that our lakes pay for our non-appreciation. So as Rotorua has got bigger, Lake Rotorua has got - the quality of the water in Lake Rotorua has paid the price for development here, you know, and as our farms have got bigger and as our technology has got bigger and better, the prices have been paid with the whenua, particularly our water (Informant J).

Now the hundreds and hundreds of boats that are getting launched at our lakes. Fuel leaking into the water. Because we're on the jetty and you can just see all the fuel and the oil sitting on top, yeah, still dive through it. Curse them and dive in (Informant F).

All of the changes described above are relevant to this research as changes, directly and indirectly impact cultural practices, principles and tikanga associated with food gathering:

- Young people are growing up not learning the basic knowledge associated with kai species, fishing, boating and gathering.

- Whanau are "losing the taste" of kai.

From 30 down there wouldn't be a huge interest in it because it is not something that they have grown up with, but certainly from my age up, like, you know, if my grandmother was to - if you were to put a plate of koura in front of her, I think she would almost eat the shell from it. You know, that is the sort of level of delicacy it is for her, whereas if I were to put it in front of my son, he actually wouldn't be that impressed with it (Informant J).

- Kai generally was known to be good for health. There is a feeling that the younger generation don't know this, or if they do, they don't practice it.

- Fish and seafood is purchased more now, but often as fish and chips.

- Water quality is a concern for parents and therefore they are reluctant to let kids explore/play in aquatic environments unattended.

- Parents feel their children have missed something not growing up in an active hapū gathering environment.

- The context within which fundamental cultural practices such as whanaungatanga are learned have been impacted -

Generally I go with wider whanau, so we tend to do everything with my mother and father, my brothers and sisters, and even my grandmother. So generally there are four generations of us that are travelling out on these things, so, yes. Like, as an example, we go out to Lake Okataina, … which is where my great grandmother lies is over here, so she was buried over here, so it is sort of like when we are going out to these other areas it is generally like on a historical journey to learn about things about who we are.

Finally, the result of these environmental perceptions is uncertainty as to whether or not kai is contaminated from urban environment.

See, that is another thing we need to be watching to – is the taking of watercress from polluted streams and swamps and things like that. And we have got to be careful of taking watercress (Informant A).

No, no. I think the condition is still the same, except for the pipis. I just didn't like the pipis, whether it is the – I gave these to an old kuia and she said to me, "Oh, I put them in hot water and didn't get enough for a sandwich, they were see-through". But then I cleaned it out (Informant D).

Washed them out in a bucket and it was black, the water, so. But I know they are looking at diverting the cut, or putting it back through the cut. I do not know what they are going to do with the waterways over there. Yes. No, that is about all I really know about that area (Informant D).

It has got a muddy taste - it has to do with the taste, plus the look. I looked at the inanga and it used to be pure black and white when we were children - distinctive, because we used to make fish flies and then we found - there seemed to be a greeny looking yellowy stomach colouring of the inanga. It started to change colour and it didn't look right. I think it has a lot to do with the change - bland change of inangas to - often we see the pollen has got a lot to do, you see it come through here at the Ohau Channel today (Informant E).

I wouldn't take the risk of getting watercress from other areas because too many people are using sprays in the drains, the creeks running into the lakes (Informant E).

Whereas previously you would have quite healthy, and I don't know what healthy means, but they would - like the shell of the koura would be relatively strong and as the time went on the koura - like even when you eat you could, it was similar to a prawn in that when you broke it the flesh was still quite compact and still quite firm after you had cooked it, but recently if you - as you went on, the koura would actually become a lot more soft, like the flesh that you would be eating wouldn't be as firm and as sweet as it had been previously (Informant J).

Despite the level of environmental change and the potential for contamination, it needs to be acknowledged that lifestyles today leave little time for fishing activities.

6.5 Health and wellbeing of whanau members – the mixed methods and contradictions

Te Arawa continues to be dependent upon kai gathering both physically and culturally. Mahinga kai was the primary food source and the basis of an economy based on trade, barter and exchange. The transition from wild sourced kai to a western style of diet comprising commodity/convenience foods consequently impacted Te Arawa socially, culturally, economically and spiritually.

As part of the fisheries redress of the Te Arawa Settlement Act 2006 Te Arawa have their own fisheries regulations to manage their customary food gathering – Te Arawa Lakes (Fisheries) Regulations 2006. A Komiti Whakahaere has been established to coordinate the development of species management plans for each of 5 key mahinga kai species, namely koura, kakahi, koaro, smelt and tuna.

Toxic contamination and the resultant health impact on humans has received considerable research attention over the past three decades (Edelstein, 1988; Freudenburg, 1984; Perrow, 1984). This research seeks to explore the health risks of the changing kai gathering behaviours sourced by whanau and hapu in order to determine the ongoing risk of exposure to contaminants.

Changes to the relationship with the lakes have resulted in a range of health and wellbeing implications. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between the lakes and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

Physical health - Physical health is directly linked to the quantity and quality of food consumed, as well as the cultural, social and economic conditions within which individuals live. In the context of this research programme, physical health consequences arise from four factors:

1. changes in the nutritional value of foods consumed today compared to their traditional diet;

2. being denied access to gather also affects health by limiting the physical exercise associated with the act of gathering;

3. the risk of contamination of kai that is consumed;

4. the risk of contamination from the sites that kai is gathered from.

The loss of access and use of traditional resources is now recognised as being a contributor to a change to a western style of diet and the consequent rise in diet-related illnesses which from an economic perspective could cost society. However the converse is also of concern as for those whanau who still gather kai, there is a risk of exposure to contaminants from eating wild sourced kai.

An important health benefit of kai gathering results from the act of gathering itself – an activity that requires physical activity. The importance of exercise to general physical health is widely recognised.

> *The old man; threw us in the lake and taught us how to swim and we were about seven or eight. We used to come down here but then we were diving when we were about 10, 11. We were going out with the old man and diving, and we dived from then right through but only to feed the, like I say, again (Informant C).*

> *Well, I was lucky, I had the chance to be brought up on the shores of the lake. And during the summer I would go down there at 10 o'clock in the morning, after breakfast, jump off the boat when the whistles come, go back after lunch. That would be hard case. We were all sitting out in the boat, and the whistles all along the lake go. You know, like my cousin Fred, my cousin Johnny Mata, their father and then my mum, my koroua and them would whistle out. And then we would jump off, swim back and go for lunch and then meet you after 1 o'clock, come back down to the lake. And we were still there at night, light our fires and go home sometimes at 10, 11 o'clock at night, after we would get the run of koura (Informant M).*

> *It was our playground. Yeah. There was places – we had the clay rocks… We used to walk those every day, in the water (Informant M).*

> *Every time we went out. It never ran out, eh? We would go down and we would all meet down at the lakefront and play around and what- have-you, and then go out and then just dive, (Informant M).*

The comments confirm that Te Arawa, like other Maori, were physically active in the course of gathering kai. Although the amount of exercise that whanau get now as a result of gathering has declined, those surveyed reported engaging in some activity,

although the frequency of such activity has declined as gathering behaviours have changed.

However, it cannot be assumed that all gathering will be beneficial as the physical act of gathering resources could expose whanau to health risks as the sites where gathering occurs, specifically the waters and sediments, could be contaminated. The levels of contaminants in kai gathered and the environments in which they are found in the Rotorua lakes area, will be reported separately. In addition, models describing possible risk to tangata whenua will be developed as part of the risk assessment and communication component of this project.

> *It is common for those children today to have sore eyes or running eyes, diving into the water that has become contaminated by goodness knows what from up top (Informant A).*
>
> *I shot a lot of ducks. …We shoot the Green Lake and nobody shoots the Green Lake ….I need a mate now. I need a mate with a small boat so we just can put it into the Green Lake and set our maemae (Informant A).*
>
> *See, a lot of our rivers and waters were commonly used for washing clothes and they had their lines along the riverbanks. If you notice, you see their clothes hanging up, and of course if you go down to Kawerau, people are worried about the effects from the mill. Well they are still having that – ongoing problem with the bottom end of the Tarawera River (Informant A).*
>
> *And the safest place to swim is actually down at Tarua Road in the Aquatic (Informant M).*

Wellbeing - The benefits derived from being in natural settings are also gaining increased recognition (Kaplan and Kaplan 1977, 1982). In addition to the data on diseases within the family (using data obtained from the Kai Consumption Survey), the interviewees described the broader social, economic and cultural impacts resulting from the changing patterns of kai gathering and consumption on their wellbeing – as individuals, as whanau and as a collective. The comments of informants describe the contribution of gathering and eating kai on wellbeing.

Continuity of the relationship between tangata whenua and the lakes of the Rotorua region through many generations has been essential in the creation and maintenance of a powerful sense of place and whānau - reinforcing ancestral connections, identity, pride and ownership of the area. This relationship has also been the source of healthy kai that has sustained the whanau of Te Arawa. It also brings responsibility and

obligation for honouring and maintaining the kaitiakitanga, mātauranga, tikanga, and manaakitanga associated with aquatic environments. The lakes were and continue to be, the dominant 'environmental' context for work, leisure, culture, life and death. Indeed, many features of the lake environment provide a daily reminder to past events and people, reinforcing this strong sense of place-centered identity and kaitiakitanga. The lakes of the Rotorua region are both physical and emotional tūrangawaewae.

Having experienced a slow cultural transformation for generations, some hapu members feel/know their collective wairua has been damaged, which brings its own type of frustration and mamae. However, despite the many changes there are those who feel culturally and spiritually sound and have an optimistic view on hapu and cultural health. For them, asserting rangatiratanga is necessary if hapu and cultural health are to improve over the next generations. For many indigenous tribes, the primary goal is simply survival – politically, culturally and physically. While physical survival will always be dependent on the lands, freshwaters and seas within a tribal territory continuing to sustain life, cultural survival is predicated on the assumption that the tribe will continue to have the will and the capacity to preserve practices that sustain, strengthen and revitalize the iwi sense of identity.

> *We have got to treat all these other lakes the same as they are treating Rotorua and Rotoiti (Informant A).*

7. The next steps in the research process

7.1 Next steps

Using the site specific data and the species data that resulted from the Kai Consumption Survey, the next stage of the research has identified the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori. A summary of the sites and species from Te Arawa that were used to develop a sampling programme for investigation of contaminant levels is presented in Appendix 2. The analyses that have been undertaken will then enable the researchers to establish potential pathways of contaminant bioaccumulation via the food web, as well as potential risks based on present kai consumption patterns. This information will then be available to whanau from Te Arawa. It is at this stage that consideration needs to be given to how the data (and implementation) is to be disseminated.

7.2 Disseminating advice about contamination issues

> *Communicating the risks of environmental contaminants in the food chain to northern Aboriginal peoples poses significant challenges for communities at risk and environment and health professionals alike..… communication practice on this issue include increased fear and confusion in northern communities, changes in the dietary behaviour and traditional lifestyles of their residents, and associated impacts on their society, economy, and health. … The importance of this information is increasing as research begins to detect subtle health effects from exposure to these substances among newborns in some northern regions. Thus planning and evaluation are needed for risk communication, and possibly changes to the scale at which communication work is done in northern communities. Furgal et al., (2005).*

Furgal et al (2005) contends that some of the challenges associated with communicating contamination risks are unique to the specific issue and the context of communities. Te Arawa find themselves in a Catch 22 - as a result of trying to balance two potentially conflicting perspectives:

1. the health and wellbeing benefits that results from the continuing practice of gathering kai or conversely the impacts that arise when changing from a traditional lifestyle and diet; and

2. the adverse impacts on health and wellbeing arising from contamination of aquatic ecosystems and potentially the kai species themselves.

The cultural comprehension of what is "risky" behaviour is complex. Maori, like those in other indigenous communities, have limited experience with food safety issues of relevance to contaminants potentially found in foods they gather.

Understanding how indigenous communities perceive contaminants has significant impacts on the reception and effect of messages delivered. Usher et al., (1995) contend that communities may distrust the information they receive about contaminants in foods and their distrust could affect their reception of further explanations or clarifications. Furgal et al., (2003a) found that concerns over contaminants was not a determinant of food choice in one Labrador community, yet Kuhnlein et al., (2003) reported that 42% of women interviewed in five western Arctic communities indicated "concern over contaminants" as a reason why they did not serve more foods to their families. The objective of this research is to effectively convey to Maori the potential risk of gathering kai. Overseas research indicates a number of aspects need to be addressed.

The advice to be delivered - A minimal amount of work has been undertaken to identify the types of messages that elicit certain or desired responses. Usher et al., (1995) indicates that good messages are direct, simple, not condescending, put in a personal context, accurate, translated into local languages, delivered early and often, and build upon local understandings and knowledge of the issue.

> *What needs to happen is, as part of the discussion, is finding the alternative…. we are not simply saying that the message is "here is the problem, deal with it" actually "here's the problem but we have an alternative for you so that you can still continue to do the things that you and your family have always done" (Informant J).*

Materials to be presented - Numerous forms of materials have been used to communicate messages on contaminants and country food in North America including posters, fact sheets, reports, pamphlets, personal letters, radio public service announcements, radio call-in shows, regional video programs, door-to-door or face-to face communication, community meetings, school curriculum materials, and national live television broadcasts (Furgal et al., 2003b). From the Kai Consumption Survey we know that a range of media is likely to be needed.

Delivering the advice - To be effective a message has to be distributed through pathways that ensure it will reach and engage the target audience - in this instance, hapu members who gather kai. Furgal (1999) and Grondin and Carron (1999) in their work with northern hemisphere communities identified the need to consider both formal and informal pathways of delivery and information circulation. Data from the

Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by:

Formal networks: Health Protection Officers and Environmental Protection Officers.

Maori Health Workers.

Informal networks Whanau members.

While Maori have been active in developing relationships with resource management agencies, formalised relationships with the parties that can undertake the research necessary to understand contamination issues and deliver the messages may need to be developed.

> *Apart from the paper and the signs being out there, email is always a good communication tool, a text (Informant F).*

> *I suppose an exercise would good for our people, you know, to know what are the - which are the best weeds for the lake and which are the real pests so that we, yeah - a lot of our people don't know this. In some cases don't know the difference between the native weed and the pest weed (Informant F).Maori learn best by kanohi ki te kanohi, face to face discussion, and also being involved in the discussion. So not just simply saying "this is it, here it is", but saying "okay, this is it, here it is, what do you think the solutions are for you and your family". You know, so - and the other key is finding presenters that actually present in a medium that they take it on board, and that is the key (Informant J).*

Specificity - Vaughan (1995) and Slovic (2000) contend that personal experience, gender, age, socioeconomic status, and profession influence perceptions of risk. Understanding how Te Arawa see the issue is critical to ensure that the communication is best oriented towards their understandings and perspectives.

McGrath (2003) argues for a relationship based approach to exchanging knowledge on issues such as contaminants within and between communities. This will require scientists and communicators to understand the informal paths of information flow in communities so they can develop mechanisms that support and utilise these pathways to communicate information about contaminants.

> *One might argue that little true "communication" on the issues of contaminants, food, and health has taken place between scientists, health professionals, and Aboriginal residents in many northern communities; rather, a great deal of scientific information has simply been disseminated (Leiss, 1997).*

Understanding and developing ways to better communicate information on contaminants and their impacts on health is critical. Reports of contamination can undermine confidence of whanau in their environment and gathering of resources as a source of individual and collective well-being.

7.3 Implications for future management

The results of the Kai Consumption Survey show that the gathering and consumption of kai awa, kai roto and kai moana is highly complex. This is in terms of both the differences in availability of kai awa, kai roto and kai moana between hapu, the diversity of aquatic habitats, and the diversity within and between whanau. There is some indication that consumption levels are also related to the quality of kai awa, kai roto and kai moana that is available and the quality of aquatic ecosystems that they come into contact with when gathering. These results enable us to make a number of observations with respect to future management.

Sites from which kai is gathered - Where and when people gather kai is a function of the location of their work, the proximity of waterbodies, and other activities of a whanau. This is supported by Garaway (2005) who argues in relation to fishing that it is almost always combined with other activities. The Kai Consumption Survey confirmed that whanau are likely to go fishing in a nearby lake or stream thus reducing the time spent travelling between areas of work, home and collecting. For Te Arawa this means gathering from the lakes. Fortunately many in the community, aside from Te Arawa, are putting their hand up to protect the many waterbodies that support kai gathering.

Perceived changes in the abundance of species - If Maori are interacting with aquatic ecosystems on a regular basis they are ideally placed to observe changes – to sites and to species. Guidance is needed to ensure that their observations are part of a structured and robustly designed perception study so that they do not have their observations dismissed as being "anecdotal". However, the challenge will be that few agencies support perception based assessments – let alone prove that a species is at risk and in need of management intervention. The implementation of the Te Arawa Lakes Regulations (2006) includes development of species management plans by Te Arawa iwi members, through a Komiti Whakahaere. As part of these plans a

monitoring programme is likely to be initiated and will allow direct involvement of iwi members in reporting on changes in species abundance and distribution.

Kai gathering behaviours - There is a complex mosaic of uses and users of aquatic resources within a takiwa that collectively shape the livelihoods of whanau and hapu. Kai gathering cannot be classified as one activity. Instead, they are part of a complex combination of activities for a range of members in a household. As the survey shows whanau hunt, and tend fruit and vegetable gardens. The effort afforded to gather kai is not a homogenous activity – it is a flexible activity that is undertaken by different people, at different times, targeting different species from different waterbodies using a range of equipment. Collectively this confirms a complex relationship between humans and their environment. It is important that information continues to be collected to increase our understanding of these range of behaviours, including their aspirations.

Health and wellbeing of whanau members - Some informants explained that kaumatua represent valuable human and cultural capital: knowledgeable about kai gathering. While they may be disempowered by modern technologies they are well connected in the hapu and many continue to utilise their knowledge of mahinga kai.

7.4 Conclusion

This report has confirmed that the lakes and coast are integral to the cultural identity of the whanau of Te Arawa. It has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of both kai awa, kai roto and kai moana in the behaviours of whanau and hapu resident in the Rotorua Lakes Area.

The results from the Kaimoana Consumption Survey clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal that kai awa, kai roto and kai moana are vitally important to whanau and hapu in the Rotorua Lakes Area. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

Although the tendency with some contamination studies is to focus on the negative aspects whanau, despite witnessing degradation to valued taonga, articulated a positive vision for the future and we conclude this report with their words.

It would be wonderful to see the lakes come back to its pristine, clean quality (Informant E).

Nice clean, pristine – what I would like to see happen is my grandchildren or even their grandchildren dive in the lake and they can still see the same sparkle I did. And not put your foot on the bottom and then its dustier on the bottom of the lake than it is out of the lake. You know what I mean? (Informant M).

I think I'd like to see them cleaned up so that my kids don't have to go down every summer and read to see if there is a warning before they go swimming and that, you know. Be like when I was younger, used to just go down, you can swim, and an increase in the koura in our new clean lakes because I know they are getting scarcer and scarcer for those who do still go out and try catch them. I mean, I used to have fun using the scoop to catch them but I think the last time I went out it was a waste of time, didn't even get a pot full (Informant G).

But the amount of restorative work required cannot be overestimated –

That is what my wish is, to help the lakes. Because it is our food basket - treat it like that, and if you do, the quality – it's water, and water is sustainable - without water you can't do anything. You cannot even exist. My father said "take the sewage out of the lakes" and he fought through the Treaty of Waitangi to get the Rotorua District Council to take the sewage out. He proved the point, but when he died he said - it took him a lifetime. And it was so difficult because bureaucracy. He said – "You know, I've got mum to thank me. Mum was the one - she would help me. I would sit up late at night writing to the Crown. Nobody would listen to me". …So, that is my wish, that people will think twice about the environment and put more money into saving our lakes (Informant E).

The need for collaboration is recognised as an important strategy for realising the vision –

I see a positive future if all parties can work together and make sure that they are rowing the same boat and going on the same journey, and I mean, yes, if we get back to some of the fundamentals and, you know, and it can be something as little as starting to recycle properly so that those things aren't going into our lakes, simple stuff that if people within their homes start taking ownership for what is going on in their home and the things that they do as a

person and the impact on the environment, then if everybody started doing that, the benefits for Rotorua, we would see them in as short of a time as it has taken to pollute the lake (Informant J).

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We wish to thank the tangata whenua of Te Arawa / Rotorua Lakes for the opportunity to undertake this mahi with them. We are particularly indebted to all those who chose to participate in the research.

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Hera Smith coordinated the interaction between the research partners, helped facilitate focus groups and hui, commented on drafts of the questionnaire and the report, and coordinated collection of hair samples and completion of Kai Consumption Survey forms.

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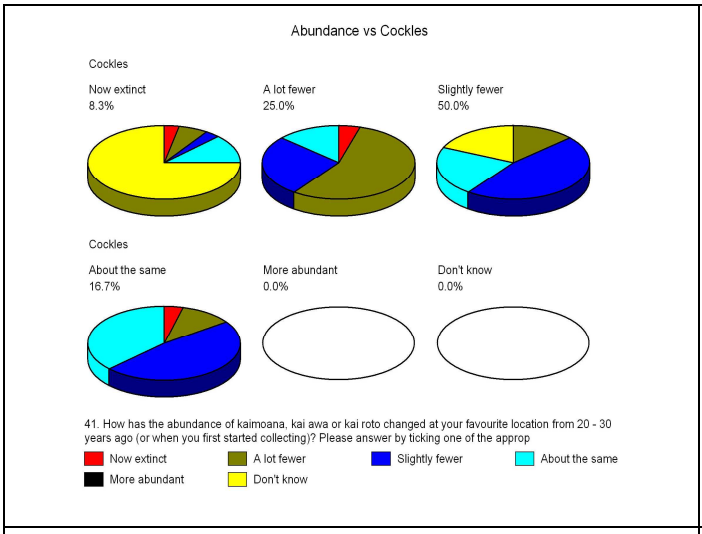
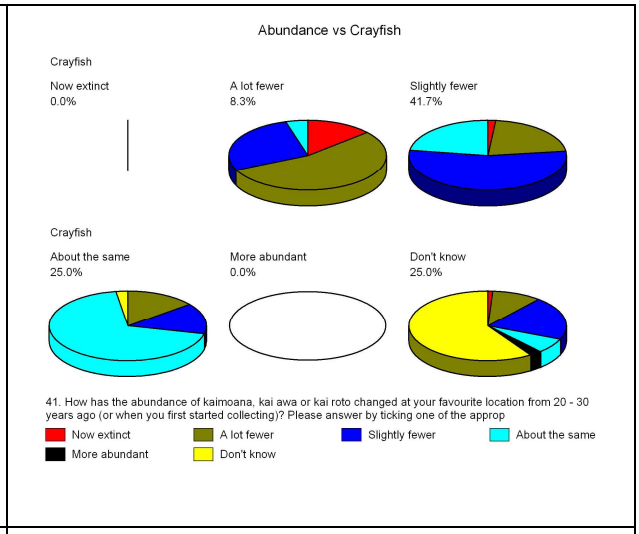
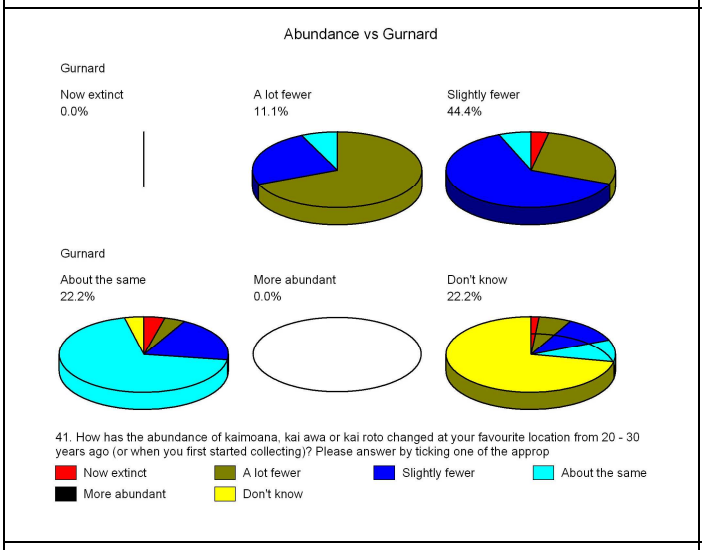
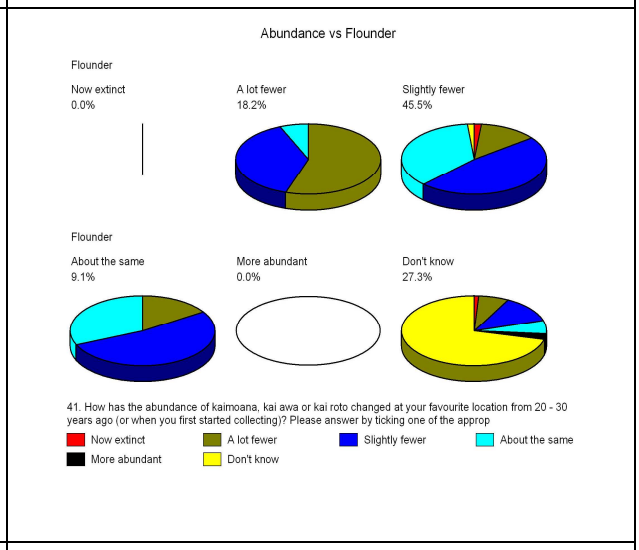
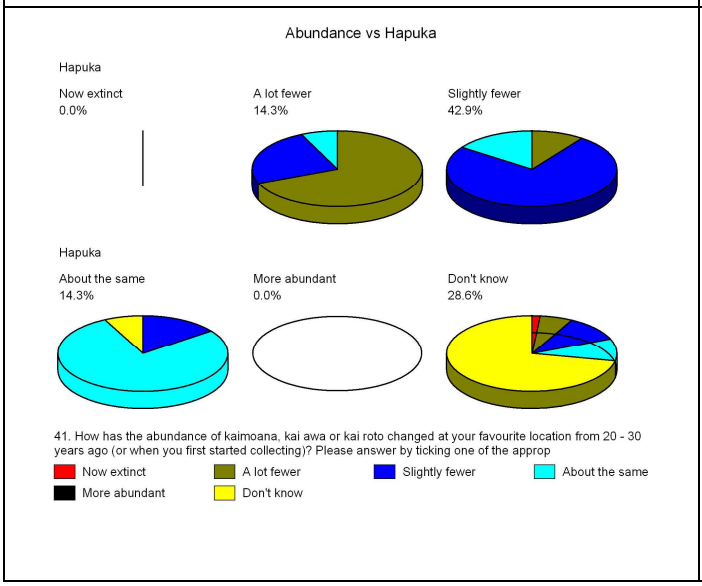
Appendix 1: Perception of changes in abundance of species

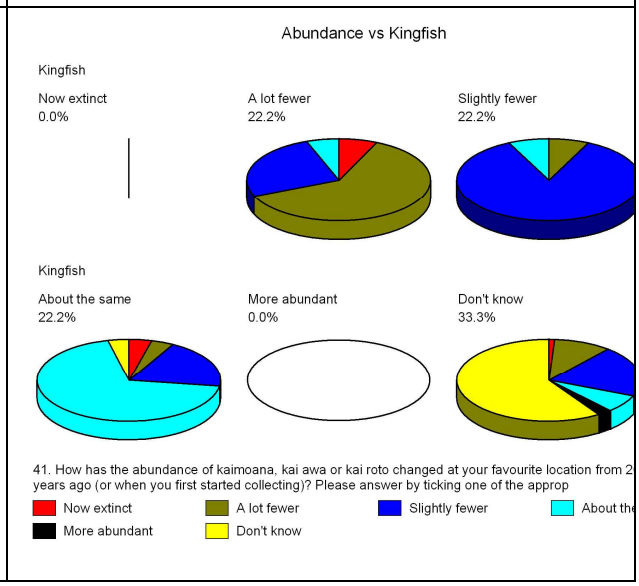


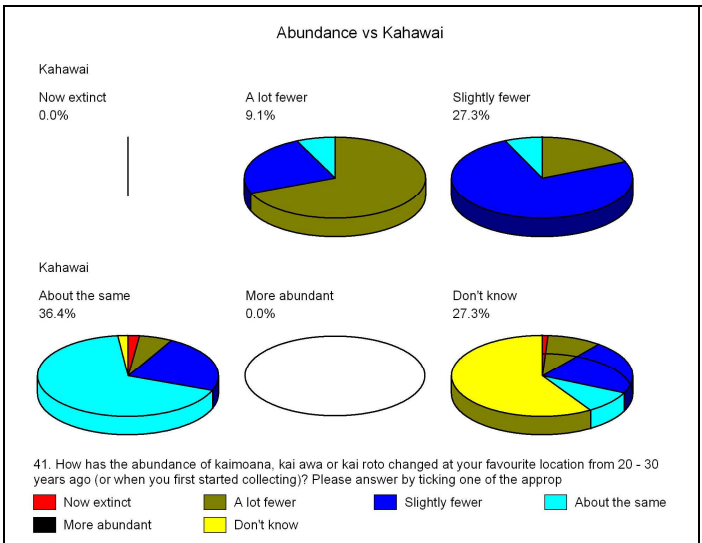


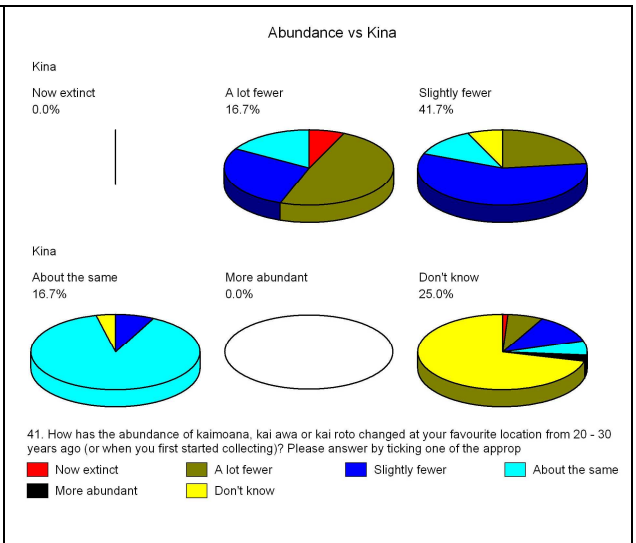


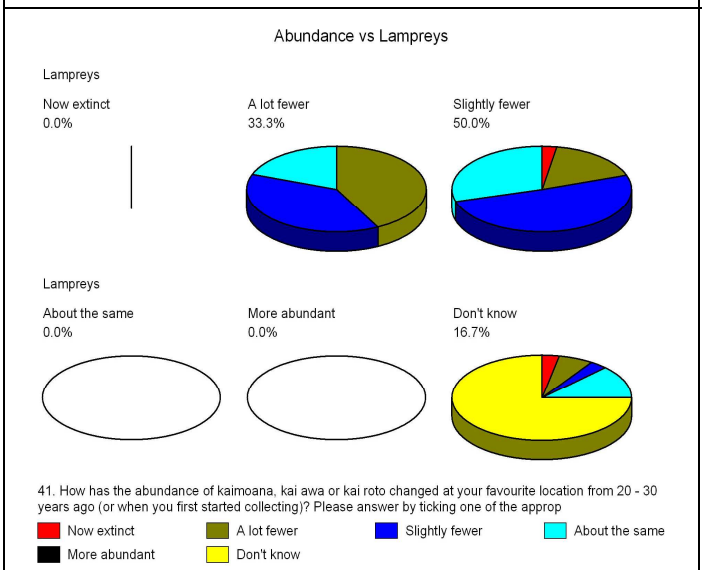


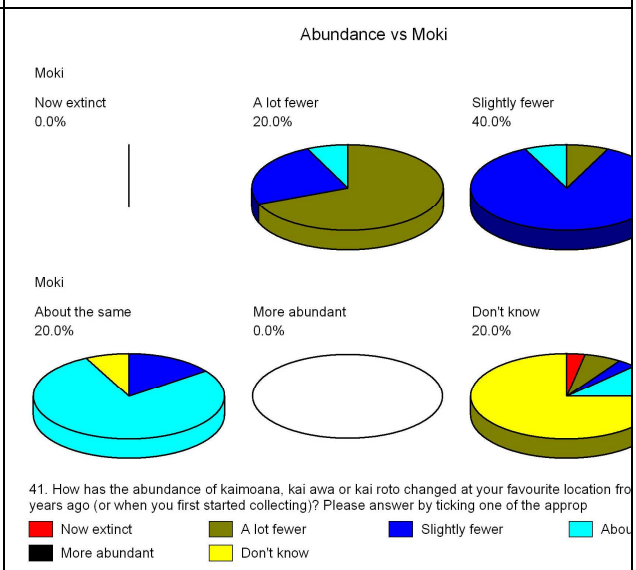


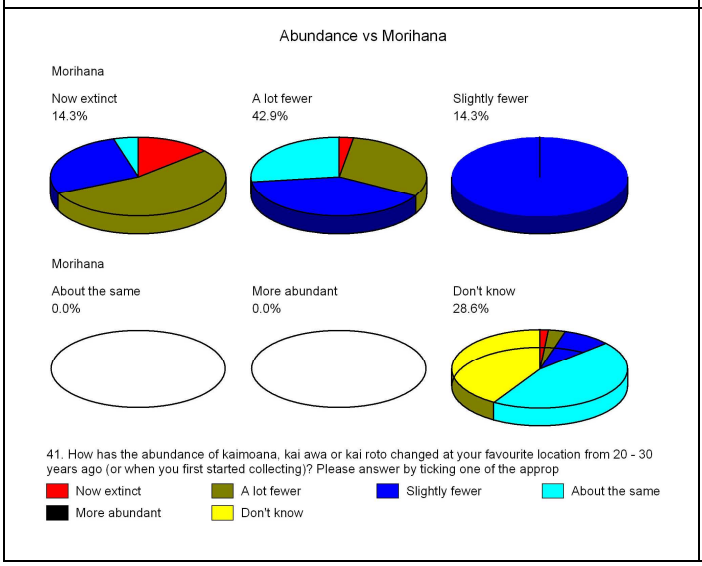


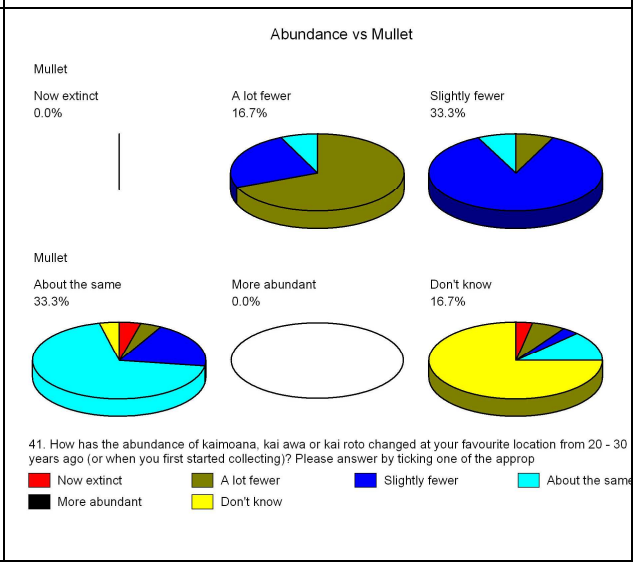

Abundance vs Kahawai
Kahawai
Now extinct
0.0%
A lot fewer
9.1%
Slightly fewer
27.3%
Kahawai
About the same
36.4%
More abundant
0.0%
Don't know
27.3%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

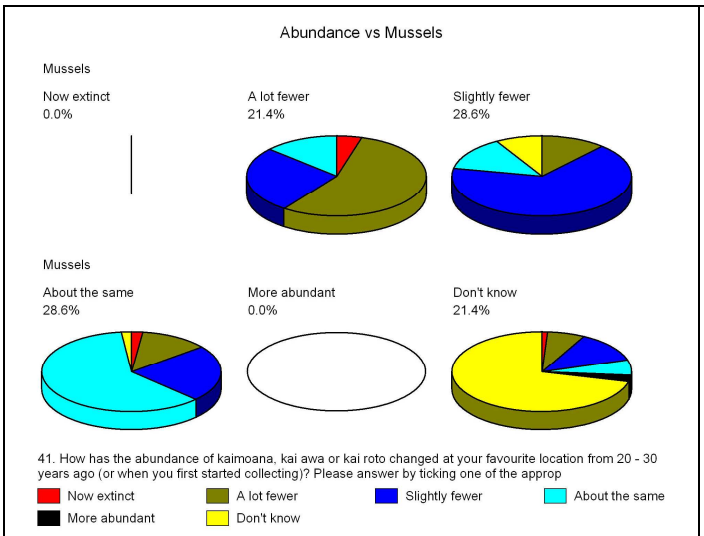

Abundance vs Kina
Kina
Now extinct
0.0%
A lot fewer
16.7%
Slightly fewer
41.7%
Kina
About the same
16.7%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

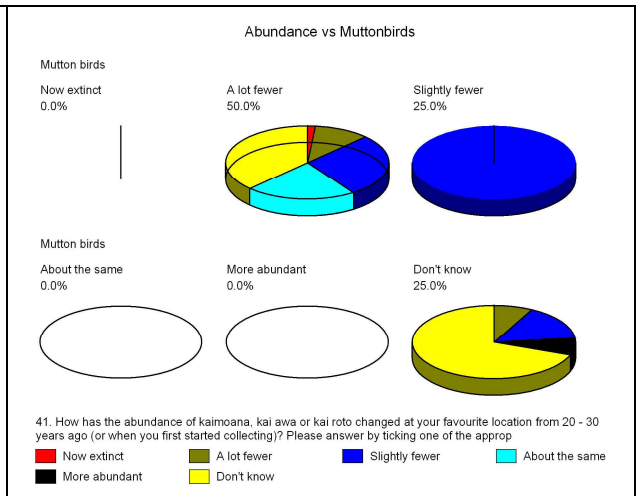

Abundance vs Lampreys
Lampreys
Now extinct
0.0%
A lot fewer
33.3%
Slightly fewer
50.0%
Lampreys
About the same
0.0%
More abundant
0.0%
Don't know
16.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

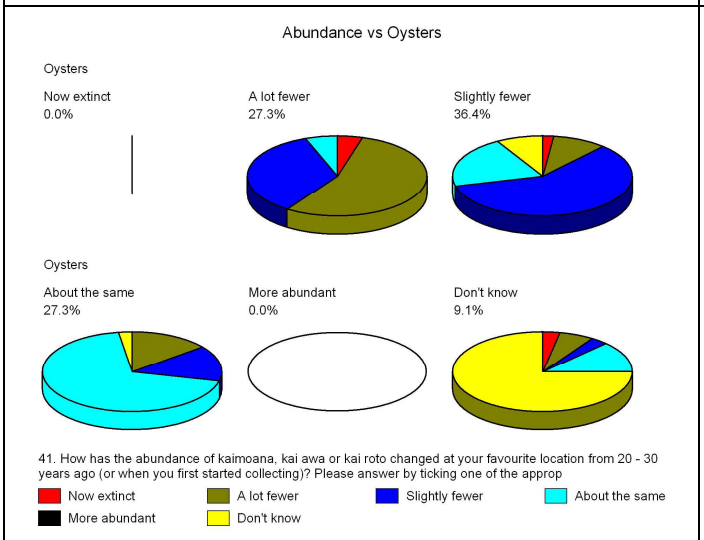

Abundance vs Moki
Moki
Now extinct
0.0%
A lot fewer
20.0%
Slightly fewer
40.0%
Moki
About the same
20.0%
More abundant
0.0%
Don't know
20.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location fro
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

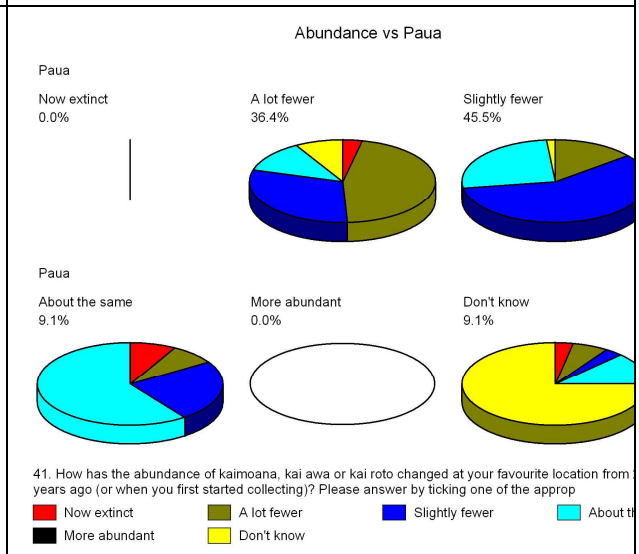

Abundance vs Morihana
Morihana
Now extinct
14.3%
A lot fewer
42.9%
Slightly fewer
14.3%
Morihana
About the same
0.0%
More abundant
0.0%
Don't know
28.6%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

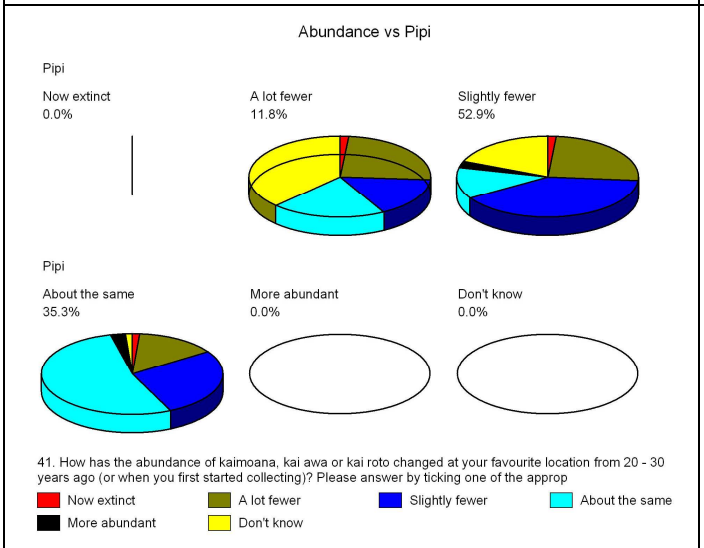

Abundance vs Mullet
Mullet
Now extinct
0.0%
A lot fewer
16.7%
Slightly fewer
33.3%
Mullet
About the same
33.3%
More abundant
0.0%
Don't know
16.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

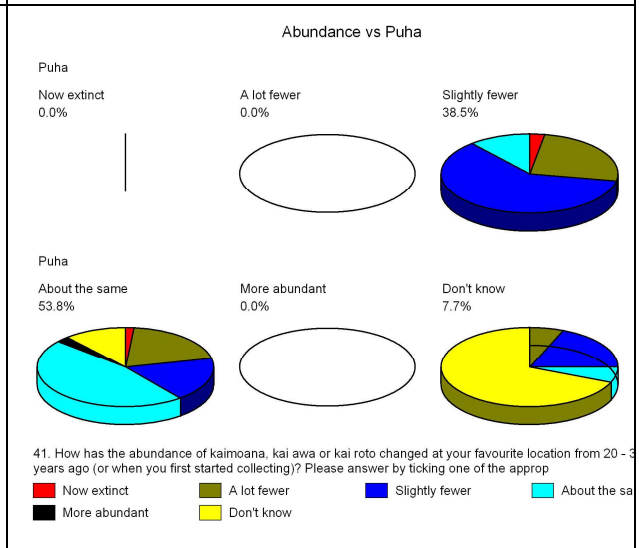

Abundance vs Mussels
Mussels
Now extinct
0.0%
A lot fewer
21.4%
Slightly fewer
28.6%
Mussels
About the same
28.6%
More abundant
0.0%
Don't know
21.4%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Muttonbirds
Mutton birds
Now extinct
0.0%
A lot fewer
50.0%
Slightly fewer
25.0%
Mutton birds
About the same
0.0%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

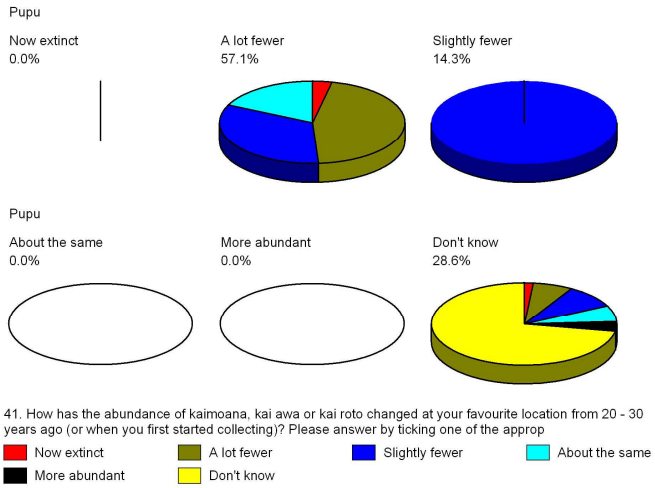

Abundance vs Oysters
Oysters
Now extinct
0.0%
A lot fewer
27.3%
Slightly fewer
36.4%
Oysters
About the same
27.3%
More abundant
0.0%
Don't know
9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Paua
Paua
Now extinct
0.0%
A lot fewer
36.4%
Slightly fewer
45.5%
Paua
About the same
9.1%
More abundant
0.0%
Don't know
9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know


Abundance vs Pipi
Pipi
Now extinct
0.0%
A lot fewer
11.8%
Slightly fewer
52.9%
Pipi
About the same
35.3%
More abundant
0.0%
Don't know
0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Puha
Puha
Now extinct
0.0%
A lot fewer
0.0%
Slightly fewer
38.5%
Puha
About the same
53.8%
More abundant
0.0%
Don't know
7.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 -
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

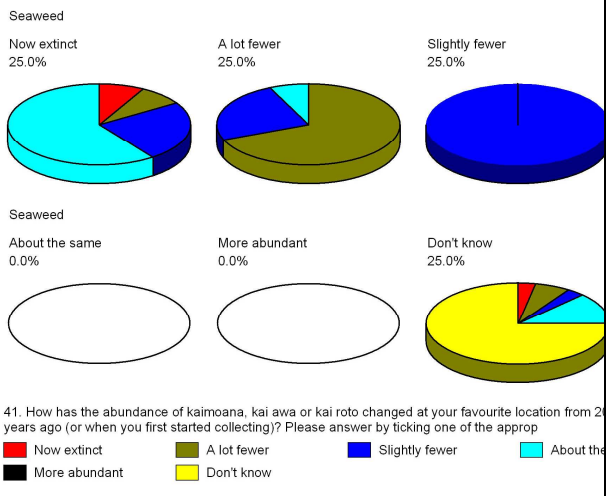
Abundance vs Pupu



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

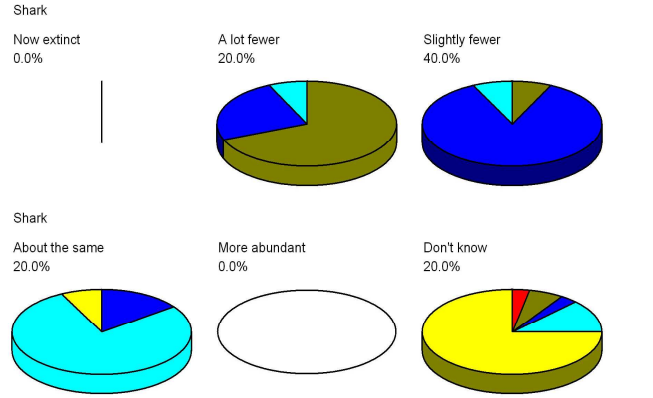
Abundance vs Seaweed



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 2
years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the
More abundant | Don't know

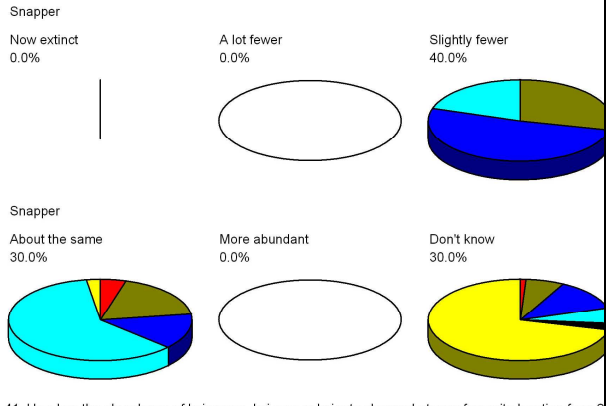
Abundance vs Shark



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

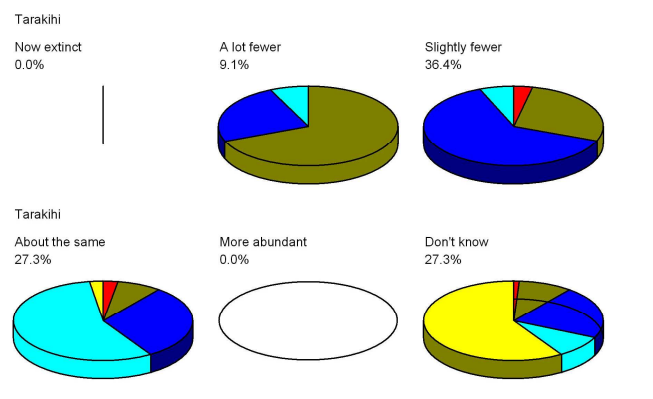
Abundance vs Snapper



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 2
years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About th
More abundant | Don't know

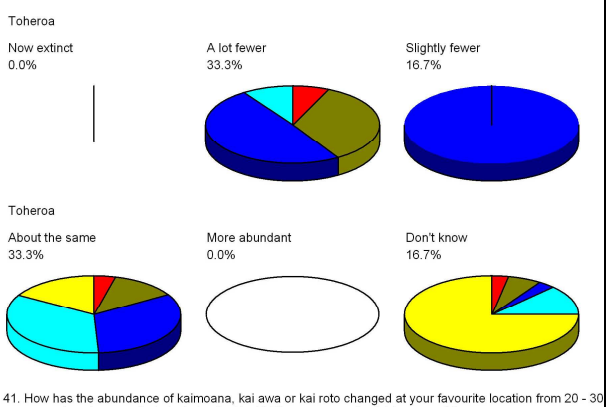
Abundance vs Tarakihi



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

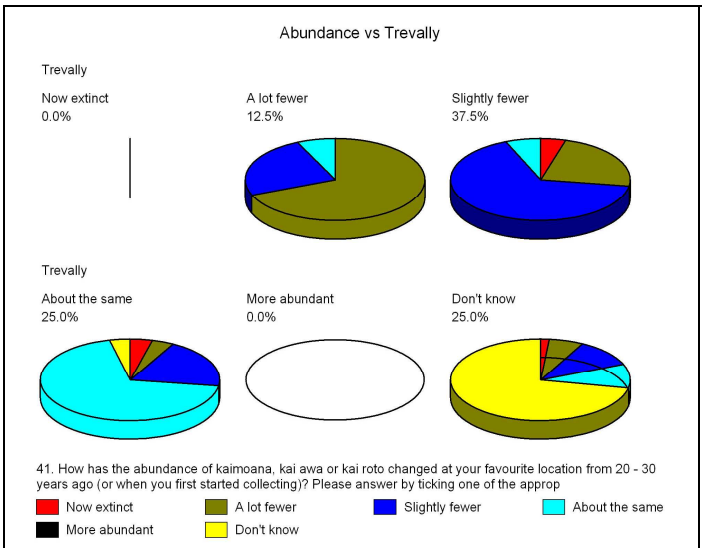
Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

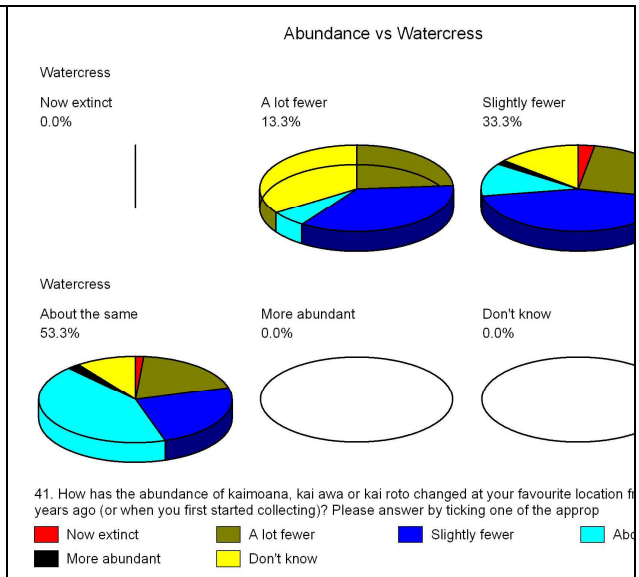
Abundance vs Toheroa

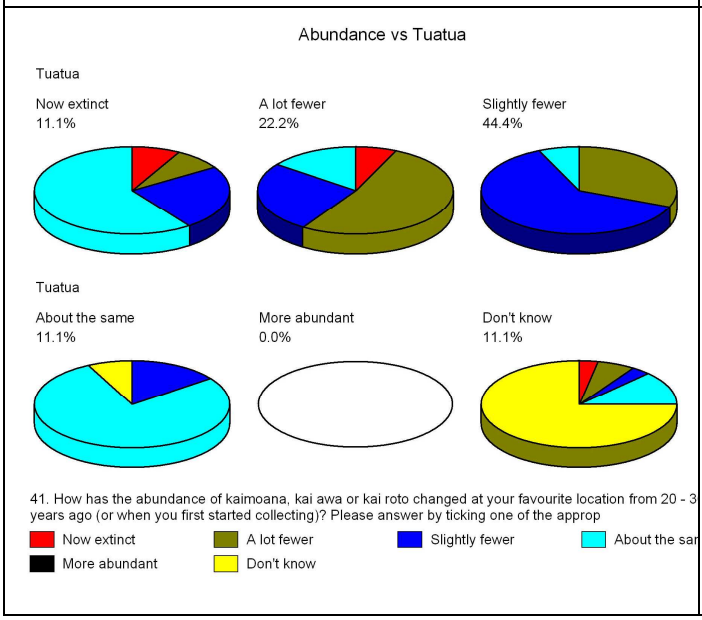


41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the sam
More abundant | Don't know


Abundance vs Trevally
Trevally
Now extinct
0.0%
A lot fewer
12.5%
Slightly fewer
37.5%
Trevally
About the same
25.0%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Watercress
Watercress
Now extinct
0.0%
A lot fewer
13.3%
Slightly fewer
33.3%
Watercress
About the same
53.3%
More abundant
0.0%
Don't know
0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location fr
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know


Abundance vs Tuatua
Tuatua
Now extinct
11.1%
A lot fewer
22.2%
Slightly fewer
44.4%
Tuatua
About the same
11.1%
More abundant
0.0%
Don't know
11.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 3
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

Appendix 2: Sites and species identified by iwi participants (number of respondents)

Kai	Rotorua	Rotoiti	Rotoma	Tarawera	Rotokakahi	Coast (incl Maketu)	Streams (incl Kaituna)	Ohau Channel	TOTAL
Trout	2	3		3	2	1	1	1	**13**
Koura	2	4	1	2				1	**10**
Pipi						7			**7**
Kakahi	1	3						1	**5**
Cockles						5			**5**
Tuatua						5			**5**
Inanga (Whitebait)		3				1	1		**5**
Eel		2				2	1		**5**
Kahawai						5			**5**
Kina						5			**5**
Paua						5			**5**
Mussels						5			**5**
Crayfish						5			**5**
Morihana (goldfish)		1	1	1	1				**4**
Watercress	1	3							**4**
Puha	2	2							**4**
Snapper						4			**4**
Flounder						4			**4**
Tarakihi						4			**4**
Pupu (mudsnail)						2	1		**3**
Kingfish						3			**3**
Moki						3			**3**
Shark						3			**3**
Oysters						3			**3**
Hapuka						2			**2**
Gurnard						2			**2**
Trevally						2			**2**
Seaweed						2			**2**
Lampreys						1			**1**
Mullet						1			**1**

Note: No gathering recorded from lakes Rotomahana, Rerewhakaaitu, Okareka, Okataina, Tikitapu or Rotoehu.

NIWA
Taihoro Nukurangi

A survey of wild kai consumption in the Te Arawa rohe

NIWA Client Report: HAM2010-096
August 2010

NIWA Project: HRC08201

A survey of wild kai consumption in the Te Arawa rohe

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Kyle Nelson[1]
Willie Emery[2]
Hera Smith[2]
Ngaire Phillips[3]

NIWA contact/Corresponding author

Ngaire Phillips

Prepared for

Te Arawa Lakes Trust

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[2] Te Arawa Lakes Trust
[3] NIWA, Hamilton

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Contents

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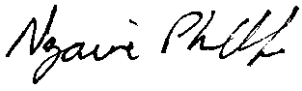

Dr Ngaire Phillips

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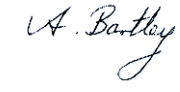


Executive Summary

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. Human health may be threatened either by the consumption of food (especially fish and shellfish) contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001). This research, funded by the New Zealand Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming. As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined, and pathways of potential contaminant uptake by tangata whenua investigated by analyzing relevant food-chain components.

Three Maori communities were involved in this research: Te Arawa: centred around the Te Arawa / Rotorua Lakes and Maketu coastal area; Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and Te Runanga o Arowhenua: centred on South Canterbury. The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts on the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

This report documents the results of the above research programme, specifically investigating the level of kai consumed by Te Arawa, whose whanau have resided in the Rotorua area for centuries. The lakes of the region were and remain taonga (treasures) for Te Arawa and are the foundation of their identity, cultural integrity, wairua, tikanga and kawa. For centuries the lakes have also been the mainstay of their economy as they and their margins were an important source of freshwater fish, waterfowl, and plants[1].

[1] For a detailed account of the traditional history of Te Arawa, see D M Stafford (1967) *A History of the Te Arawa People*, Auckland, Reed Books

On 18 December 2004, the Crown and Te Arawa signed a Deed of Settlement for Te Arawa Historical Claims and Remaining Annuity Issues over 14 lakes; Lakes Rotoehu, Rotomä, Rotoiti/Te Roto-Whaiti-i-kite-ai-a-Ihenga-i-Ariki- ai- a Kahumatamomoe, Rotorua / Rotorua-nui-a Kahumatamomoe , Ökataina / Te Moana i kataina a Te Rangitakaroro, Ökareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngähewa, Tutaeinanga, Ngäpouri/Opouri and Ökaro/Ngakaro.

With respect to the research design drawing on the earlier work of Bebbington (1999), importance of kai to whanau was examined using standard interview techniques according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

All of those interviewed for this research expressed a strong relationship with the lakes and the wider terrestrial and marine surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship. Two thirds of the participants spent their childhood in the middle of the North Island while 15.8% specifically identified Rotorua as the place where they spent their childhood.

A large variety of wild kai continues to be regularly collected, gifted, purchased and/or consumed. While whanau made use of many species, the centrality of koura and whitebait as a critical food source in the Rotorua Lakes is well known and is reflected in the initiatives to restore populations of taonga species. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in Rotorua Lakes region. Consistent with a kai gathering lifestyle:

- 42% grew their own vegetables;

- of the 42%, 21% of those who grew vegetables also grew fruit.

Having determined that all of respondents do consume different types of kai:

- 38% of respondents said they now only eat kai on special occasions; while

- 25.5% eat kai less than once a month; and

- 10% only eat kai 1-3 times per month.

In other words 73% eat kai 1-3 times per month or less. Of concern when reviewing the complete list of species and the frequency with which each was consumed, some respondents identified six species as being extinct (i.e., no longer present in the areas they gather kai from) – kakahi, cockles, koura, morihana, seaweed and tuatua.

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were then used as the basis for a sampling programme which examined contaminants in sediment and kai. Kai was gathered from 11 of the 14 waterbodies listed. The most highly used area was the coast as 52.4% said they gathered from Maketu followed by lakes Rotoiti (17.5%) and Tarawera (12%). There was no gathering by participants from lakes Rerewhakaaitu, Okareka, and Tikitapu.

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered. With respect to abundance, 56% felt that "fewer" stocks were available today, specifically, 22% of respondents believed that across all species gathered there were now a "lot fewer" available while another 33% believed that abundance was "slightly fewer".

There are little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation we assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats in the lakes, especially Rotorua. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, we can conclude that all respondents still consume kai awa, kai roto, or kai moana. In comparison to historic levels, the following conclusions can be drawn:

- The quantities available are substantially lower than historic levels and the levels desired by whanau who wish to engage in mahinga kai practices. The species that possibly approach

adequate abundance are mussels, which respondents confirmed were available and often sourced from the supermarket or takeaway.

> *You don't go out and get any watercress anymore, your river has become Pak'n Save (Informant M).*
>
> *I mean, we have got to the stage we are feeling directed to go to supermarkets and buy from there, it is more convenient (Informant E).*
>
> *We get our bulk food from the supermarket, whether that's vegetables, it's fish, seafood. Everything comes from the supermarkets. It is totally different today. We have no control over that. We aren't able to go out and get koura like how we did - it is a thing of the past (Informant E).*

- For almost every species, the majority of respondents believed that the abundance of populations was declining.

- The majority of kai species are now only consumed on special occasions.

- The quantities of kai consumed have steadily decreased:

    - from approximately 241g historically;

    - to about 94.1g in the mid twentieth century;

    - to approximately 36.2g today (which is similar to the average New Zealand consumption rate).

Part of the reduction in quantities consumed can be attributed to environmental degradation. A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining. In the 1930s, a number of factors were blamed for the decline in whitebait catches including: excessive take by whitebaiters; predation by sea birds, herrings, eels, trout; draining of swamps, backwaters, and creeks; or damage to estuarine spawning grounds by stock. By the 1990s a number of native fish species had disappeared from waterways or were in decline. A combination of factors was attributed to these losses including: afforestation, sedimentation and flooding, wetland drainage, river modifications, sewage, water abstraction (irrigation), and pollution arising from adjacent land uses. All of these changes directly and indirectly impact cultural practices, principles and tikanga associated with food gathering:

- Young people are growing up not learning the basic knowledge associated with kai species, fishing, boating and gathering.

- Whanau are "losing the taste" of kai.

From 30 down there wouldn't be a huge interest in it because it is not something that they have grown up with, but certainly from my age up, like, you know, if my grandmother was to - if you were to put a plate of koura in front of her, I think she would almost eat the shell from it. You know, that is the sort of level of delicacy it is for her, whereas if I were to put it in front of my son, he actually wouldn't be that impressed with it (Informant J).

- Kai generally was known to be good for health. There is a feeling that the younger generation don't know this, or if they do, they don't practice it.

- Fish and seafood is purchased more now, but often as fish and chips.

- Water quality is a concern for parents and therefore they are reluctant to let kids explore/play in aquatic environments unattended.

- Parents feel their children have missed something not growing up in an active hapū gathering environment.

- The context within which fundamental cultural practices such as whanaungatanga are learned has been impacted.

Finally, the result of these environmental perceptions is uncertainty as to whether or not kai is contaminated from within the urban environment.

Despite the level of environmental change and the potential for contamination, it also needs to be acknowledged that lifestyles today leave little time for fishing activities.

Changes to the health of the lakes and consequently the relationship of Te Arawa with the lakes have resulted in a range of health and wellbeing implications for Te Arawa whanui. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between the lakes and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

- 63.1% of respondents indicated they knew where to get advice about contamination issues.
- Only 26.4% (and two specific age groups – those in their 40s and 70s) did not know where to go to obtain information.

This study has confirmed that the lakes are integral to the cultural identity of the whanau of Te Arawa. It has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of kai awa, kai roto and kai moana in the behaviours of whanau and hapu resident in the Rotorua Lakes Area. The results clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal, that kai awa, kai roto and kai moana are vitally important to whanau and hapu in Rotorua Lakes. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

1. Introduction

1.1 Background

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. In the aquatic environment, contaminants transported by the air and in the water are highly likely to be deposited in sediments, where in turn, fish and shellfish are exposed. Contaminants are generally stored in the lipids of biota and can be biomagnified up the food-chain. Human health may be threatened either by the direct consumption of fish and shellfish contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001).

Concerns about the potential accumulation of contaminants in fish and other wildlife, which commonly form a component of indigenous peoples' diets, and their consequent potential effects on human health, has led to a worldwide proliferation of studies examining the effect of environmental contaminants on fish, wildlife and communities. For example, leading international indigenous contaminant research programmes, e.g., the Northern Contaminants Programme (NCP) and the Effects on Aboriginals from the Great Lakes Environment (EAGLE) Project were established in response to concerns regarding the exposure of humans to elevated levels of contaminants in the traditional subsistence diets of indigenous peoples. Research to date has shown that certain indigenous communities have elevated contaminant levels due to exposure through their traditional diet (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999; Van Oostdam et al., 2003). In addition, fish and wildlife are used as indicators of the health of the ecosystems.

The impact of environmental contamination on the resident "wild kai", and in turn, on Māori iwi/hapū consuming them, has not been investigated to date. A recent review of wild food in New Zealand identified gaps in knowledge of contaminants in non-commercial wild-caught foods, especially in terms of consumption levels (and hence exposure) (Turner et al., 2005). A resulting draft position paper identified a need for information and education on contaminants in kai (NZFSA 2005). In response, the National Institute for Water and Atmospheric Research (NIWA), in conjunction with Tipa & Associates and iwi research partners, Ngāti Hokopu ki Hokowhitu, Te Arawa Lakes Trust and Te Runanga o Arowhenua initiated a programme of research to investigate the contaminant levels and risk to Maori health associated with 'wild kai' – food gathered from the sea (kai moana), rivers (kai awa), and lakes (kai roto). This

research, funded by the Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

1.2 Research Rationale

Traditionally, Maori had their own knowledge systems of how the environment contributed to health and well-being. Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming.

As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined.

While it could be argued that contamination of wild kai has the potential to directly impact the physical health of Maori, the impacts of contamination and/or loss of an important cultural activity on wellbeing are also explored during the course of the project. Maori associate their well-being as individuals and as members of whanau, hapu and iwi, with maintaining the health of the natural environment (Durie 1994, 1998, Panelli and Tipa 2007, 2008). Maori strongly believe that the whenua and tangata are inextricably intertwined, and when one of these becomes unbalanced, the other equally suffers (Harmsworth and Warmenhoven 2002; Sims and Thompson-Fawcett 2002). Therefore, the sustainability of the natural environment and the long-term well-being of Maori are seen by some Maori as one and the same thing (Panelli and Tipa 2007). This is consistent with conceptualisation of wellbeing proposed by other indigenous communities (Adelson 2000, Greiner et al., 2005, McLennan 2003, McLennan and Khavarpour 2004, McGregor et al., 2003). Customary and recreationally gathered "wild kai" resources are therefore of significant cultural, recreational and economic importance in both traditional and contemporary Maori society (Waitangi Tribunal 1983, 1984, 1987, 1988, 1989, 1991, 1992, 1995, 1998)[2].

The majority of the international research in the area of contaminants in the traditional diets of indigenous peoples has primarily focused on the levels and health effects of exposure to heavy metals and organochlorine contaminants through the consumption of marine fish and mammals in peoples from the northern hemisphere, i.e., the Inuit

[2] The evidence submitted to the Tribunal by Iwi, and the summary reports from the Tribunal itself provide a graphic depiction of the significance of gathering kai for whanau, hapu and iwi.

people of northern Alaska, Canada and Greenland (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999). Research to date has shown that certain Inuit communities have elevated contaminant levels (e.g., mercury, lead and chlordane) due to exposure through their traditional diet (Van Oostdam et al., 2003).

It is unlikely that contemporary Maori communities have been exposed through their diet of "wild kai" to the levels of organochlorine contaminants as high as those observed in indigenous populations residing in the northern hemisphere (due to occurrence of large mammals in the customary diet of Inuit). However, the impact of environmental contamination on the resident "wild kai" and, in turn, on Māori iwi and hapu consuming them, has not been investigated to date. In addition, while existing consumptive advice is available for some species of relevance to Māori, this advice is based on average national consumptive patterns and doesn't account for potentially higher consumption rates of specific traditionally harvested foods by Māori, with its concomitant elevated exposure risk. Māori utilise kai from rivers, lakes and the oceans (as well as the land).

This research aims to identify and communicate the risks posed by the presence of environmental contaminants in the kai moana, kai roto and kai awa to the Maori communities that gather these resources. Major outcomes of the research will be development of a generically applicable risk assessment framework, and Maori-targeted risk communication strategies. It is envisaged that the research will be of interest to the wider Maori community, non-Maori, public health providers, as well as indigenous peoples worldwide for whom fish and shellfish constitute a major part of their diets.

1.3 Research aim

The overall aim of our research project is:

> *To determine to what extent locally available kai moana, kai roto, kai awa, and the associated aquatic environments pose a health risk to tangata whenua.*

Successful frameworks for undertaking research in a manner that is culturally acceptable, and which ensures the protection of intellectual property rights, were developed between NIWA and Ngāti Hokopu and Te Arawa during the HRC and FRST funded programmes 'The Revitalisation and Enhancement of Matauranga

Hauora of Aquatic Environments (C01X0226)' and 'Sustainability and Management Framework for Te Arawa Lakes' Customary Fisheries (CO1X0305)'.

Memoranda of Understanding between NIWA and Ngāti Hokopu ki Hokowhitu, Te Arawa and Te Runanga o Arowhenua have been established to formally record the expectations of conduct between NIWA and the respective parties with respect to the present research.

Three Maori communities were involved in the overall research:

- Te Arawa: centred around the Rotorua Lakes.
- Ngāti Hokopu ki Hokowhitu: centred around Whakatane.
- Te Runanga o Arowhenua: centred on South Canterbury.

These communities were selected on the basis of previous contact (and research projects underway) with key researchers. Permission was obtained and confirmed by a sub-contractual agreement.

The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

There are four main stages to the research project:

1. Objective 1: The first stage involves interviewing key informants and undertaking a survey to identify what kai moana species are harvested and eaten by iwi/hapu members from Ngāti Hokopu, Te Arawa and Te Runanga o Arowhenua, and the aquatic environments they are currently sourced from.

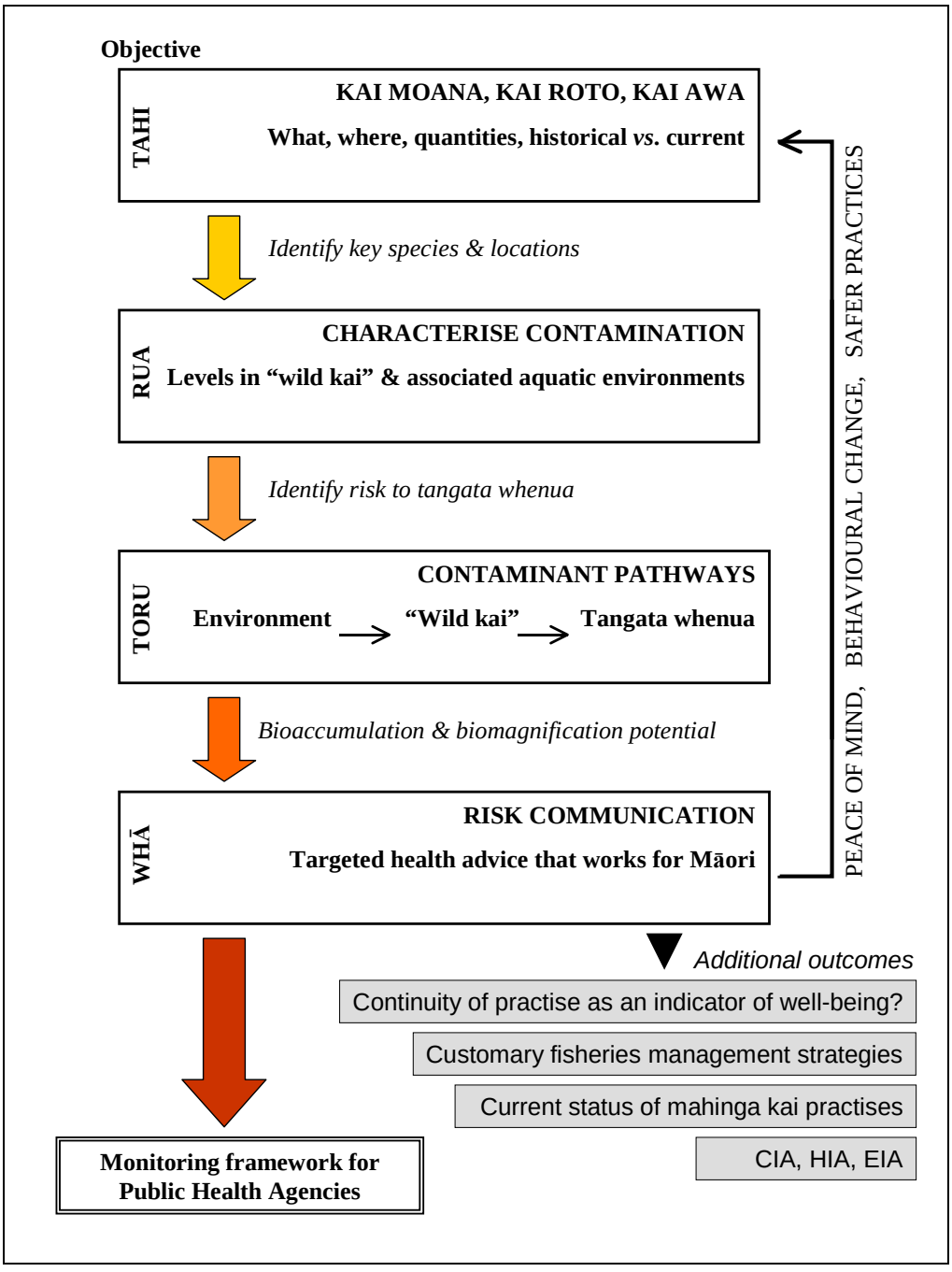
2. Objective 2: The second stage identifies the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori.

3. Objective 3: This stage establishes potential pathways of contaminant bioaccumulation via the food web utilising methyl mercury as an example of a bioaccumulative contaminant.

4. Objective 4: This stage identifies the potential health risks associated with the collection and consumption of contaminated “wild kai”, and develops risk consumption advice specifically targeted at Maori, that will take into consideration both the benefits and risks associated with eating kai moana, kai roto and kai awa.

Figure 1 provides a graphic representation of the identified research priorities, the objectives, and possible outputs.

Figure 1: Research priorities, the objectives, and possible outputs.



The first objective of the research (to provide a description of the kai moana, kai roto and kai awa collection, processing and consumption patterns of iwi/hapu members) is clearly a precursor to Objectives 2–4. This first stage identifies:

- What types of kai have been collected and/or eaten in the last 2–3 generations (e.g., species, life-stage, abundance)?
- Where were/are they harvested from and when (e.g., location, ecosystem, season, time of day, life-stage)?
- How is kai moana stored and processed for consumption?

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by whanau in and around the Rotorua Lakes and the potential effects of environmental contamination on their physical, spiritual and cultural well being.

To elicit the data needed we included methods that have been used previously with hapu around New Zealand. This consisted of focus groups and hui, followed by interviews. For this objective it was important to assemble a group of willing participants with knowledge and experience of kai gathering in the takiwa (area) and rohe.

1.4 Report Structure

This report has been divided into a number of sections:

Section 1: Sets out the background and the aims of this study.

Section 2: Describes the methodology that was used.

Section 3: Provides some information on Te Arawa and their rohe in the Central North Island, in particular around the Rotorua Lakes.

Section 4: Outlines international developments within which the research is situated, specifically:

4.1 indigenous communities and participatory approaches to management and research;

4.2 contemporary wellbeing research, and implications for this study;

4.3 international observations of the impact of changing diets;

4.4 effects of contaminants on health;

4.5 Maori conceptualisations of health and wellbeing.

Section 5: Introduces the empirical analysis by outlining the quantitative research results; specifically with respect to contemporary patterns of gathering. This chapter is informed by the Kaimoana Consumption Survey.

Section 6: Based on the results, develops a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It provides a brief comparative analysis by discussing the contemporary patterns alongside historic traditional patterns. It pulls together the qualitative and quantitative research results and identifies main themes that are then discussed in the context of international literature.

Section 7: Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

2. Methodology and Data Analysis

There is growing recognition of the significance of aquatic habitats and the resources found within them that sustain indigenous communities. Yet this recognition has not been accompanied by investigations to increase understanding of the specific contribution of aquatic habitats and resources to the health and wellbeing of communities depending on these resources.

Drawing on the earlier work of Bebbington (1999), importance to whanau was examined according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

This section of the report outlines the methodology employed, but starts with a description of the Maori community studied.

2.1 Study area

This report details the results of one case study: Te Arawa. Participants living in and around the Rotorua Lakes were recruited from Te Arawa whanui. Availability to take part in the research was the only exclusion criterion, although the preference was for key informants to be active kai gatherers. The study was undertaken under Ethics Approval MEC/07/07/088 and all participants gave written informed consent.

2.2 Methodology

The research team utilised two research methodologies to contrast the instrumental and hermeneutic role of aquatic resources as a source of kai awa, kai roto and kai moana. The first was a quantitative survey of wild kai consumption using a questionnaire, while the second incorporated participatory research techniques via a focus group and a series of qualitative interviews.

The survey followed once the interviews were complete. This was to ensure that the sites and species about which data was sought in the questionnaire were identified by the hapu, and not predetermined by researchers.

2.3 Quantitative survey - Kaimoana consumption survey

The Kaimoana Consumption Survey questionnaire was adapted from a range of other studies (including diet surveys, fish consumption surveys, traditional use surveys, surveys of the health of indigenous communities and perception/preference surveys). The survey questionnaire was approved as part of the Ethics Committee approval process, with minor modifications to reflect differences between the 2 iwi groups. The species and sites listed in the questionnaire were specific to the Rotorua Lakes area and are based on those identified during the interviews. The Te Arawa Lakes Trust reviewed and amended the survey to reflect the kai that is in their rohe.

2.3.1 Kaimoana consumption: quantifying importance of sites and species

We examined consumption using a food frequency questionnaire with frequency categories ranging from less than once per month to one or more times per day. Consumption is one of the principal means by which the importance of kai awa, kai roto and kai moana and the intimate and dependent relationship with aquatic environments from which they are sourced can be determined.

2.3.2 Existing estimates

Kaimoana consumption records in New Zealand are sparse. Estimates were derived using data from the questionnaire by calculating the amount consumed and the frequency of consumption.

2.3.3 Seasonal variation

Some species of kai awa, kai roto and kai moana are seasonal resources while others are open access. Seasonality is explained in historical literature recognising that tikanga and kawa was attuned and responsive to the life-cycle of the different species. Therefore, questions in the survey identified where possible seasonal patterns of contemporary gathering.

2.3.4 The impact of kai awa, kai roto and kai moana on whanau and hapu livelihoods

Arguably there is a need for a broader understanding of the importance of aquatic resources as a source of kai beyond the simplistic statements of mahinga kai that often

accompanies ecologically based descriptions of aquatic ecosystems. The questionnaire sought to address this need by analysing the complex relationship that whanau have with waterbodies found in their takiwa.

2.3.5 Other data

Other data gathered included:

1. demographic information, such as data on the prevalence of certain medical conditions, lifestyle factors including risk-related behaviours, and family history;

2. self-reported health status using generic, health-related quality of life questions;

3. kai gathering locations; and

4. perceptions held by whanau members about the importance of aquatic ecosystems and species, and their assessment of the health of these resources.

2.4 Qualitative methods

The qualitative methods used here address the first of the research objectives as stated in Section 1.3 above. Methods involved an introductory hui, a focus group session, follow-up interviews, informal discussions with many people and reviewing secondary data sources (documents).

2.4.1 Literature review

An examination of relevant literature was undertaken for four reasons

1. to provide a more comprehensive understanding of historical resource use and patterns of activity in the study community;

2. to gain an appreciation of the changes to the aquatic habitats over time, as perceived by Te Arawa participants;

3. to identify the changes over successive generations that have impacted on kai gathering behaviours; and

4. to address issues of concern with respect to waterbodies.

Qualitative data were collected from published and unpublished documents, from libraries, the Waitangi Tribunal (evidence to the Tribunal and reports from the Tribunal), statutory and iwi plans, and statutory planning documents. Internet searches also yielded further material.

2.4.2 Participatory methods

Before commencing working with Te Arawa whanui, an introductory presentation was given at a hui of Te Arawa at Te Papaiouru Marae and the participatory nature of the research was outlined. At the start of all interactions (focus group and interviews) the roles and obligations of participants and researchers were discussed.

Focus group - A focus group was convened in mid 2008 which was attended by approximately thirty participants. The participants were engaged in a guided discussion lasting 1–1.5 hours. The focus group followed the framework of questions presented in Box 1. This session focused on gaining a broad understanding of the spatial extent and description of aquatic resources from which kai awa, kai roto and kai moana were sourced, and the overall importance of each waterbody and species to whanau and hapu. Maps were used to record information about species, locations and other relevant information but given the numbers in attendance, map work was limited.

In depth semi-structured interviews - In the months following the focus group meetings, 13 follow-up interviews were conducted. The purpose of these interviews was to collect additional and more detailed data related to the location and types of kai collected and consumed, and factors that may have influenced gathering.

The questions used for the focus group were also used to guide the interviews that probed more deeply into the personal experiences, thoughts and feelings of the individuals. The intention was to identify and explore the diversity and complexity of relationships and gain a comprehensive understanding of the changes to aquatic environments and the emergent issues seen as potentially impacting health and wellbeing as perceived by different individuals. Interviews were carried out with 13 individual resident in and around the Rotorua Lakes. Each interviewee was identified by the Te Arawa Lakes Trust.

BOX 1: QUESTIONS AT THE FOCUS GROUP and INTERVIEWS

Species of kai

- What (species of kai) did you gather when you were young?
- What places can you remember visiting to gather kai when you were growing up?
- Did you collect year round or seasonally?
- Can you recall any places that you were told not to go to for kai?
- Were there any times / occasions that you were unable to gather kai?
- How long did it take to gather the kai that you needed?
- What (species of) kai do you gather today? What places do you use today?
- Do you gather kai year round or is it seasonal?
- What events / conditions etc. stop you from gathering kai?
- How often would you or someone in your whanau go out to gather kai?
- How long does it take to gather kai compared to when you were younger?
- What species / sites have you lost over the years? When and why did you stop using them?

Behaviours with kai

- Is kai shared? With whom? Has this changed over your lifetime?
- How was kai prepared? Has this changed?
- What methods are used to collect kai? Has this changed?

Condition of kai

- What quantities were taken when you were younger? What quantities are taken today?
- What was the condition of the kai when you are younger? How does this compare with what is taken today?

Observed and known changes

- What changes to the experience of gathering kai have you observed? How has this affected you and your whanau? How have you adapted to these changes?
- What changes to the habitats have you observed and how have these affected you?
- What sort of things would you like to see happen in the aquatic environment you associate with and why?
- Are you happy with your current level of access to kai that you value? What are the main barriers you face today?

Wider benefits of gathering kai

- What do you like about being able to go and gather kai?
- When you gather kai are you with other whanau or hapu members?
- What rules or beliefs do you follow with respect to gathering kai?
- Do you feel any special attachment to the places from which you gather your kai?

Health risks

- Do you know of any health risks associated with gathering kai?
- If you were told not to gather kai from an area because of the health risks would you still gather from there?
- What type of information would you need to help you decide whether to gather kai from an unsafe site?

There were four principal outputs: a map documenting the types, locations, and quantities of kai moana collected and consumed by those present; the transcripts from the interviews; a revised questionnaire for future use; and this report.

2.5 Qualitative data analysis

In summary, informants were interviewed and interacted with in different fora, and their written documents (both historic and contemporary) and submissions provided further context for interpreting their values, practices, activities and concerns. Accessing multiple sources of data was one of the methodological tools employed to ensure the validity of data collected.

Lincoln and Guba (1985, 224-225) contend that the role of data analysis is "to 'make sense' of the data in ways that will, firstly, facilitate the continuing unfolding of the research, and secondly, lead to a maximal understanding of the phenomenon being studied in its context. There were two aspects to the data analysis:

1. firstly to identify sites and resources to be sampled for analysis of contaminant levels; and

2. secondly, the analysis involved identifying, sorting and grouping data from very detailed individual transcripts to identify key themes. The methods of data collection resulted in a considerable quantity of raw data being gathered, and data from a variety of sources had to be systematically analysed.

Data were coded and categorised to enable similar themes to be distilled. Some of the themes had been established *a priori* based on key issues that had emerged while reading related literature and undertaking preliminary discussions when scoping the research topic and negotiating entry to the three communities. Principal categories that were identified represent the headings under which the research findings are presented in sections 5 and 6.

2.6 Quantitative data analysis

The questionnaire was constructed on Survey Pro 5 (Apian Software Inc) and all data were entered into this programme. The results that are reported in section 5 and discussed in section 6 have been produced using the Survey Pro reporting functions. Microsoft Excel was used to construct two of the graphs.

2.7 Summary of methods applied

The methods applied to enable us to understand kai gathering behaviours over different time periods are set out in Table 1.

Table 1: Methods used during the course of the research.

Pre-European	19th Century post	20th Century up to	Present day
Manuscripts		Interviews	Interviews
Cultural maps	Cultural maps		Review of literature
Historical texts	Historical texts	Evidence to the	Kai Consumption
	Evidence to the Waitangi	Photographs	Maps
Evidence to the	Paintings		Photographs

3. Study Group: Te Arawa

> *If you look at Rotorua – the name of Rotorua – if you follow that trail that is actually the history of the Te Arawa waka, eh. You see, when they came up and got to Rotoiti… and that is where Ihenga saw the lake and then called it the long narrow lake…. Then he came across here and he saw this big huge lake, Te Rotorua, the second lake, and he named it after his Uncle Kahu Mata Moemoe, who was Tamata Kapua's son, who was the kaihautu on the waka Te Arawa when it came across. So what you have there – and if you listen …Then you go down here and you go to the cockabullies of Okere, then you go to the Te Heke Heke of the Kaituna, to the rapids of the Kaituna…. at Maketu …where the waka of Te Arawa landed, eh. .. It's a journey of history… So you are taking the journey from here, all the way around there. And there is a lot. That is only one of many.. ... And they are memories that are buried now by sediment (Informant M).*

Te Arawa arrived at Maketu around 1350 (Stafford, 1967). Te Arawa is a confederation of iwi which are descended from the crew of the Arawa canoe. From Maketu the voyagers and their succeeding generations moved inland occupying the central part of the North Island. This means Te Arawa have resided in the Rotorua area for centuries and the lakes of the region were and remain taonga (treasures) for Te Arawa. They are the foundation of their identity, cultural integrity, wairua, tikanga and kawa. The numerous lakes of the Rotorua district as shown in Figure 2 are found in hill country approximately 80 kilometres south of Tauranga, and 50 kilometres west of Whakatane[3]. The lakes of the Rotorua district remain the centre of Te Arawa settlement. For centuries the lakes have also been the mainstay of their economy as the lakes and their margins were an important source of freshwater fish, waterfowl, and plants[4].

The Te Arawa Maori Trust Board was established in 1924, pursuant to Section 27 of the Native Land Amendment Act and the Native Land Claims Adjustment Act 1922, and operated under the Maori Trust Board's Act 1955. Fifteen hapu were represented on the Board as well as one seat allocated for Tumataunenga which acknowledged the returned serviceman of Te Arawa who served in the First or Second World Wars, totalling 19 representatives. Initial membership of the Board was based on ownership

[3] Historically attention has focused primarily upon the three largest lakes of the area; Rotorua, Rotoiti, and Tarawera. During the 1918 Native Land Court investigation of title to the Rotorua lakes, counsel for the applicants informed the court that he had only prepared the applications for Rotoiti and Rotorua, but that he would attend to the others in due time. However, the Court's inquiry was abandoned, and a settlement was negotiated that applied to Rotorua, Rotoiti, Tarawera, Rotoehu, Rotoma, Okataina, Okareka, Rerewhakaitu, Rotomahana, Tikitapu, Ngahewa, Tutaeinanga, Opouri, and Ngakaro. 'Minutes of the Rotorua Lakes Case: Application for Investigation of Title to the Bed of Rotorua Lake', 16 October 1918, p 137, cl 174, NA Wellington.

[4] For a detailed account of the traditional history of Te Arawa, see Stafford (1967).

of the 14 Te Arawa lakes, which surround the Rotorua district, and this remained the structure of the Board.

On 18 December 2004, the Crown and Te Arawa signed a Deed of Settlement for Te Arawa Historical Claims and Remaining Annuity Issues over 14 lakes; Lakes Rotoehu, Rotomä, Rotoiti/Te Roto- Whaiti-i-kite-ai-a-Ihenga-i-Ariki- ai- a Kahumatamomoe, Rotorua / Rotorua-nui-a Kahumatamomoe , Ökataina / Te Moana i kataina a Te Rangitakaroro, Ökareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngähewa, Tutaeinanga, Ngäpouri/Opouri and Ökaro/Ngakaro.

The settlement was made up of 4 components of a "redress package", one of which was the Cultural Redress recognizing Te Arawa traditional, historical, cultural and spiritual association with the lakes covered in the settlement, including the transfer of 13 lakebeds.

Te Arawa Lakes Trust (formerly Te Arawa Maori Trust Board) is the new governance entity to receive and manage the redress on behalf of Te Arawa, to ensure that the benefits of the settlement will be available to all registered members of Te Arawa, wherever they live.

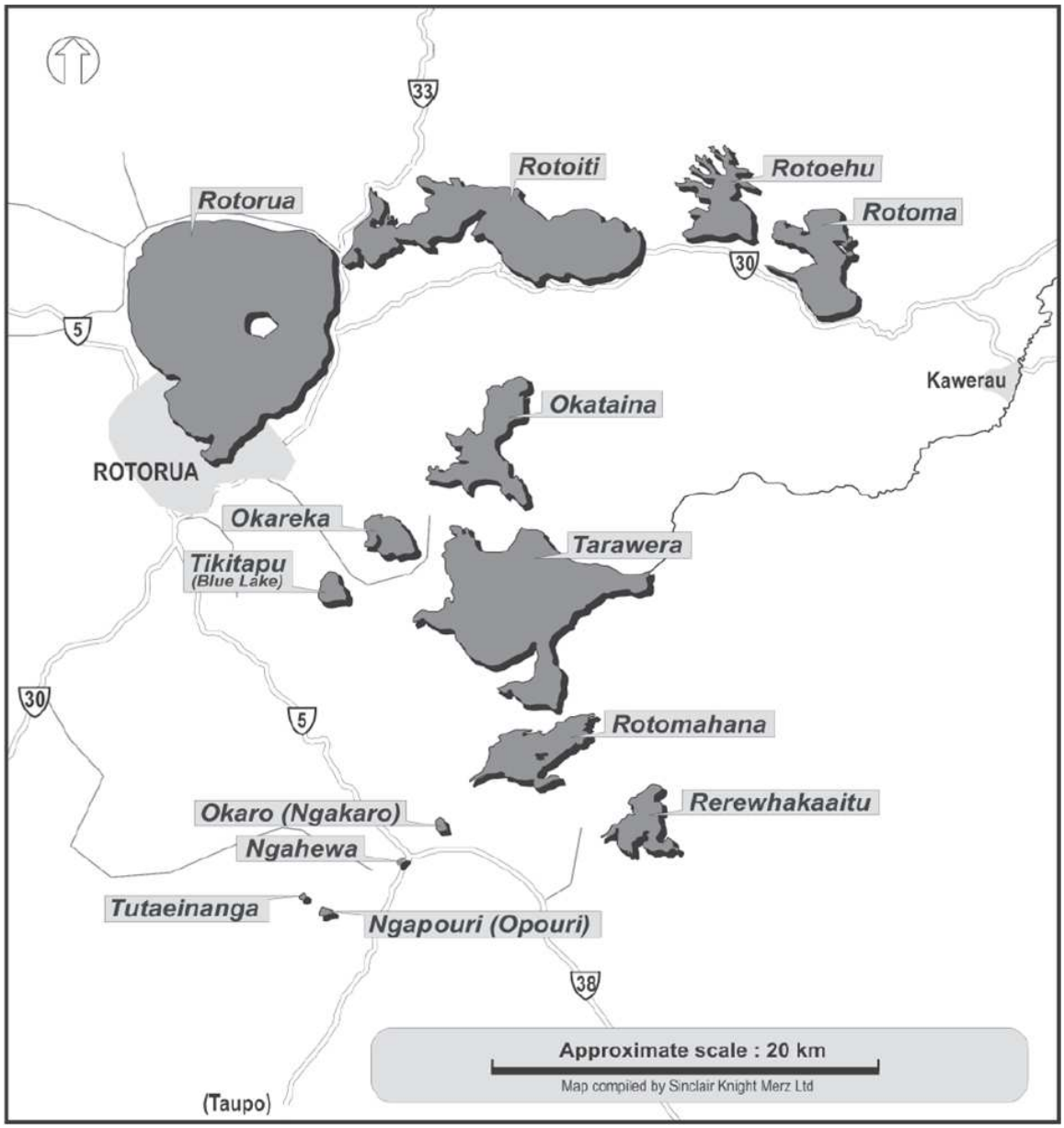


Figure 2: Map of the Te Arawa lakes.

Implementation of this project saw NIWA and its subcontractors working with representatives of Te Arawa Lakes Trust. The Trust had two champions - individuals who helped facilitate the focus groups and the interviews.

> *All these lakes are historical to this country. The history of these lakes is actually the history of this country (Informant M).*

4. International developments relevant to the research

Consistent with the need for the present research to be examined in a context of international literature and academic thought, this section seeks to position the research design and data analyses within contemporary writings from four related areas:

- indigenous communities and participatory approaches to management;
- contemporary wellbeing research, and implications for this study;
- international observations of the impact of changing diets and effects of contaminants on health; and
- Maori conceptualisations of health and wellbeing.

4.1 Indigenous communities and their participation in management

This research sought to utilise participatory research methods. Participation is seen as a means of affording affected parties the opportunity to articulate their interests, enhancing the quality of information available to decision makers; enhancing the potential for support of decisions by enabling early and meaningful involvement; and affecting one's destiny as the opportunity to participate in decisions is a key element of self-empowerment and self-actualisation (Fenge, 1994). In the context of this research project, in addition to collecting environmental contamination data, the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana are examined, and empirical data collected for use by whanau and hapu.

Participatory approaches to environmental management received emphasis initially in the Brundtland report (WCED 1987) and in Agenda 21, at the 1992 ‘Earth Summit’. Perhaps the greatest significance of these fora lay in the acknowledgement that sustainable development would require new approaches to environmental management, and that effective environmental management would need to be differentially negotiated within individual states, even within individual communities. In effect, this research will also result in a range of cultural values and perspectives of particular aquatic locations being documented and available to each Maori community to inform local processes of management should they so choose.

Pimbert and Pretty (1997) contend that new partnerships and connectedness between different interests is required in environmental management and argue that

participatory processes must be locally grounded which will likely require different solutions for different places. This research will facilitate new participatory processes between environmental managers, public health managers, science agencies and Maori. Despite the increase in participatory initiatives, Pimbert and Pretty (1997) also warn that the call for peoples' participation risks becoming a catch-cry and part of the conventional rhetoric without delivering meaningful outcomes for participants. This warning reinforced the desire of the researchers to deliver a meaningful and effective process for application by Maori and outputs such as those listed in Figure 1 for use by Maori and resource managers.

The drive for greater participation has been paralleled by a concerted drive by indigenous communities to reassert their customary and Treaty rights to access and use land and water resources and greater recognition of the knowledge held within communities including indigenous communities (Western et al, 1994, Pinkerton 1989, 1992, Notzke 1994, Berkes and Folke 1998). Although a range of terms are used, often interchangeably, Berkes (1999) defines indigenous knowledge as that knowledge held by indigenous peoples and traditional ecological knowledge as a subset of that – a practical knowledge of species and beliefs regarding human interaction with the ecosystem. Menzies and Butler (2008) list the attributes of traditional ecological knowledge as cumulative (from long term intergenerational interaction), dynamic (informed by a customary lifestyle but not unchanging), providing a historical understanding of change, local, holistic (viewing all elements as interconnected), embedded (in a unique matrix of local, cultural, historical and traditional elements), moral and spiritual. In order to understand the changes to the diets of successive generations of Maori, the research team was dependent on key informants being experienced and knowledgeable (with indigenous knowledge and/or traditional ecological knowledge) about kai gathering.

Sadly, Maori, like other indigenous communities have witnessed the destruction of valued environments and their alienation from the resource bases upon which their cultures and identities are constructed (Berkes 1991, 1994, 1999). Documenting the changes that have been experienced in the Rotorua Lakes region and the impacts on whanau and hapu, including a profound sense of loss, was therefore vital.

The growth of interest in the knowledge held by indigenous communities is related to the wider shift within resource management to an ecosystem based management approach (Menzies and Butler, 2003) and recognises that indigenous communities understand the way species interrelate and how ecosystems work as a whole. It recognises that indigenous communities have a well developed understanding of the local environment and their own impacts on local ecosystems. The data collected via the interviews and questionnaire confirmed the proposition of Berkes (1999, page 33)

that the "use of traditional knowledge may benefit development by providing more realistic evaluations of local need, environmental constraints and natural resource production systems".

Initiatives involving the incorporation and/or application of indigenous knowledge are emerging around the world as resource managers seek to engage with indigenous communities. New Zealand has also experienced the drive for greater participation, including greater recognition of the beliefs, values and practices of Maori. In 1991, the Resource Management Act 1991 became the governing legislation for resource use in New Zealand (Davis and Threfall 2006). Two sections are of particular relevance.

Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including "the relationship of Maori and their cultures and traditions with their ancestral lands, water, sites, *wahi tapu* and other *taonga*" (section 6(e)). Gathering from tribal lands and waters, species that are often accorded the status of "taonga", clearly falls within the gambit of section 6(e) and is thus a matter of national importance.

Pursuant to section 7(a) decision-makers are required to have particular regard to *kaitiakitanga*. The Act presently defines kaitiakitanga as:

> *The exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

The responsibilities of Tangata Kaitiaki are to protect the integrity of resources (including the kai species identified by informants). This requires Maori to focus on long term environmental results, which are likely to include healthy ecosystems with abundant populations of valued kai species that are able to sustain cultural uses well into the future. Despite these encouraging and potentially enabling provisions, often there is little guidance given to managers and regional bodies seeking to meet the obligations to indigenous communities (a challenge Maori confront in New Zealand). This research seeks to produce outputs that will guide both Maori and non-Maori resource managers.

4.2 Contemporary wellbeing research: implications for this study

For indigenous communities food is not just a resource for sustenance as many might understand it in western contexts (Slocum 2007). Rather, Panelli and Tipa (2007,

2008) argue, that food needs to be understood in a wider cultural context that interweaves complex indigenous cultural and environmental relations.

Panelli and Tipa (2007, 2008) contend that to identify these relationships primarily by a particular bio-physical character (e.g., forests, coasts and waterways) misses the range of spiritual, physical, social, material, cultural, economic and political relationships that might be involved in any one case. The complexity of these relationships must be appreciated before the significance of an 'individual' phenomenon or activity (such as food or food gathering) might even begin to be approached (let alone the cultural or health implications of such things). They further contend that to consider kai gathering without this contextual understanding would diminish its cultural value and the rich dimensions that underpin whanau and hapu experiences of identity and well-being. The results of the Kai Consumption Survey reported in subsequent sections of this report support the proposition that individual experiences of interviewees vary as lives are influenced by a complex combination of: cultural beliefs, values and uses; a history of colonization, loss of lands, alienation from their lands, waters and resources; and contemporary interactions with a dominant non-Maori world that is based primarily on capitalist, western values (Panelli and Tipa, 2008). The range of perceptions, preferences and the experiences of members of Te Arawa that emerged from the analysis of data collected for the present research are set out in sections 5 – 7 of this report.

Indigenous communities have traditionally been resource users and developers (O'Regan 1984, Notzke 1994). They used natural and physical resources for subsistence (physical survival) and sustenance (spiritual survival). Internationally there are calls to recognize and protect cultural knowledge and practices that are 'fundamental for food security and well being' (FAO 2007). Gombay (2005: 418) explains the significance of this stance, and when describing the Inuit argues that when they:

> *hunt, fish, or gather food the material and immaterial worlds blend together, with layer upon layer of meaning and understanding. The getting of country foods is about understanding the land in which one lives. It is about building an awareness and knowledge of one's place in the natural world ….*

The gathering, exchange and consumption of kai are also significant cultural activities for Maori. Complex associations with the environment and mahinga kai have developed over centuries and include social, economic, psychological, spiritual and physical dimensions that are an intrinsic part of health and well-being of whanau members. Diversity is wide (as evidenced by the individual variation from the survey results) but this is considered acceptable within whanau and hapu. The data collected

helps explain how sourcing kai from lands and waters reaffirms firstly, connectedness with the lands and waters to which one has whakapapa, and secondly ensures continuity of practices initiated and valued by tupuna. In the Maori context, kai gathering practices also enable social and environmental responsibilities to be fulfilled. To be denied the opportunity to manaaki visitors to one's home and marae would have consequential adverse effects on the health and well-being of Maori – a point that may be experienced beyond the individual and whanau level.

4.3 Maori conceptualisations of health and wellbeing

Durie (1994) introduced *Te Whare Tapa Whā* - a four sided house - or the four cornerstones of health; these being: *hinengaro* (mental well-being), *wairua* (spiritual well-being), *whanau* (family well-being) and *tinana* (physical well-being) which was subsequently adopted by the Ministry of Health (2006). Durie (2004) then proposed a second conceptualisation, *Te Pae Mahutonga*, which he contends represents the fundamental components of health promotion - *Mauriora*, *Waiora*, *Toiora* and *Te Oranga*. He explains that: *Mauriora* is dependent on a secure cultural identity; *Waiora* refers to healthy air, land and water environments which requires a balance between use and development and protection; *Toiora* focuses on personal behaviours and responsiblities; and *Te Oranga* recognises that health promotion (in particular increasing well-being) requires increased participation by Maori in societal affairs.

Another conceptualsation, by Pere (1997) emphasises reciprocity and interconnection between individual selves and wider social interests. In this sense, each experience of well-being would vary from place to place reflecting *whenua* (earth), *turangawaewae* (standplace), *whanaungatanga* (kinship), *whanau* (family), *wairua* (spirit), *hinengaro* (mind, heart), *whatumanawa* (feelings) and *tinana* (body). This conceptualisation by Pere helps explain connections between specific understandings of *whenua* and the social and cultural relations developed in particular places.

Panelli and Tipa (2008) explain how many Maori express a strong affinity for the earth and adhere to basic principles regarding their relationship with other aspects of creation and quote Crengle (2002) who explains all parts of the environment are related to one another and exist within a mutually inter-dependent whole. Deriving economic or social benefit from resource utilisation (recognised as contributors to wellbeing), must be carefully balanced.

Initiation of the current research programme and exploring the contribution of kai gathering to health and wellbeing is predicated on the belief that understandings of health and well-being can be enhanced by explicit conceptualisations that align spiritual, social and cultural elements in connection with bio- physical bases.

4.4 Effects of contaminants on health

While some agencies and researchers contend that people everywhere are exposed to chemical contaminants in the environment, international studies confirm that the majority of exposure to contaminants comes from food, with the consumption of contaminated fish identified as the largest single source of exposure in Canada (Health Canada 1997). Of concern, fish constitutes a significant dietary source of protein for many populations worldwide, especially indigenous communities.

Traditionally, the diet of many indigenous communities (including Maori) consisted of fish, game, waterfowl, and plants sourced from local lands, waters and coasts. Contemporary diets, in contrast, are likely to be a combination of traditional food items and more easily accessed commodity or convenience foods. Despite the change to convenience foods, traditional foods continue to underpin cultural identity for many indigenous communities. Delormier and Kuhnlein (1999) explain how changes experienced by Eastern James Bay Cree have affected diet, traditional food use, and nutrition. They contend that the reduced use of traditional food by younger generations, changes in fish consumption as a result of contamination, and increased incidence of obesity, diabetes, and cardiovascular disease within communities, represent particular socio-cultural concerns. Exploration of these issues and the longer term impacts has necessitated examination of the current diet and food consumption patterns of the Cree. The nature and extent of the risk that Maori confront in New Zealand is unknown but this research attempts to assess the risk.

If food is a major route of human exposure to many persistent toxic environmental contaminants the present research hypothesised that the consumption rates of aquatic species by Maori could represent a significant risk of exposure given their potential higher rates of consumption of these foods. The information gathered through the interviews and the questionnaire therefore had to enable the research team to establish whether there were any correlations between the contaminant levels measured in the participants' tissues (hair) (a separate component) and the fish or shellfish species they consumed in the past year. While such a relationship could not be considered as defining a direct cause:effect relationship, it would increase our understanding of the possible exposure risk to tangata whenua. We have also developed a model of potential contaminant accumulation pathways between participants and the kai they consume and calculation of relative risk, based on measured contaminant levels in kai species, their associated environments and consumers. Furthermore, the data had to enable the research team to assess the levels of contaminants in the respective fish and shellfish species consumed, by identifying important species and harvesting locations. These data were subsequently used to develop a sampling plan for kai species and associated environmental parameters. The results of these strands of research are to be presented elsewhere.

In risk management, the focus is on ensuring that mitigation strategies are culturally appropriate yet rarely are Maori perspectives or knowledge explicitly included in determining the hazards or health outcomes to be considered in the risk assessment. In the absence of explicit procedures to apply health risk assessment in Maori communities, the data derived from the questionnaires and interviews will contribute to the development of a health risk assessment model. Again using data gathered from this stage, we will develop Maori-focused guidelines with respect to the consumption of wild sourced kai and will also explore the appropriateness of existing information dissemination tools for effectively communicating risk.

5. Research results

In this section of the report we start by providing a description of the contemporary mahinga kai practices of whanau and hapu across the Rotorua Lakes region that has been extracted from secondary data sources, interviews with whanau members and the Kai Consumption Survey.

5.1 Background of participants

All respondents to the Kai Consumption Survey were Maori residing in the Rotorua Lakes region. All of those interviewed for this research expressed a strong relationship with the lakes and the wider terrestrial and aquatic surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship.

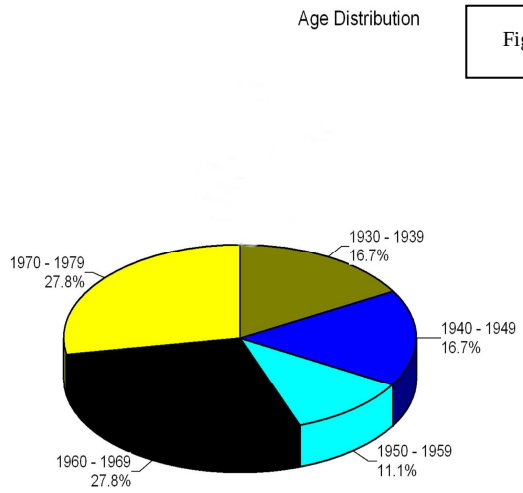


Figure 3

Only a limited number of participants have completed the survey to date (Figure 3):

- 5 are aged 20-29 years
- 5 are aged 40-49 years
- 2 are aged 50-59 years
- 3 was aged 70-79 years
- 3 was aged 80-89 years

Of the 18 participants 8 were female and 10 were male, and 1 did not answer the question.

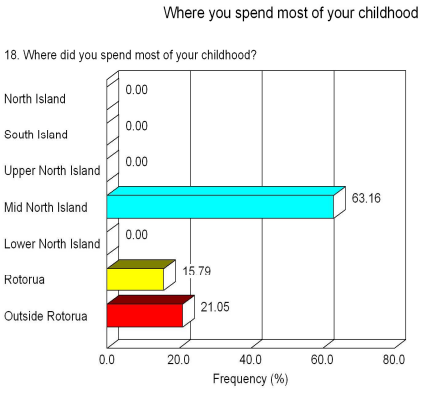


Figure 4

Two thirds of the participants spent their childhood in the middle of the North Island while 15.8% identified Rotorua as the place where they spent their childhood Figure 4).

The most explicit strands of the relationship with the lakes, are whakapapa, birthplace/wāhi whenua, childhood experiences, livelihood, recreation and kai gathering. Cultural values, principles, and tikanga such as kaitiakitanga, manaakitanga, mana and tino rangatiratanga help describe the importance of kai gathering for individuals and provide common bonds and experiences that provide a sense of common identity that connects them physically and spiritually to the lakes region.

5.2 Patterns of kai consumption

5.2.1 Introduction

A large variety of kai continues to be regularly collected, gifted, purchased and/or consumed. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in Rotorua Lakes region. The range of species that are consumed are listed in Table 2.

Table 2: A list of foods that are still consumed today by Te Arawa living in the Rotorua Lakes region.

Toheroa	Morihana	Gurnard	Lampreys	Crayfish	Whitebait
Tuatua	Pipi	Snapper	Mutton birds	Oysters	Trout
Watercress	Cockles	Moki	Eel	Pupu	Kina
Puha		Shark	Flounder	Seaweed	Paua
		Tarakihi	Hapuka	Freshwater crayfish	Mussels
			Mullet	Trevally	Butterfish
			Kahawai		Freshwater mussels
			Kingfish		

We would also have rotten corn, and that was after harvesting, and we used to put the rotten corn into bags .. so that the rats would not get into the bag and make a hole, otherwise we'd lose all our rotten corn. And the rotten corn would be hanging off a huge willow tree which was sort of flowing over the Ohau Channel, and we would be getting rotten corn at a different time of the year (Informant E).

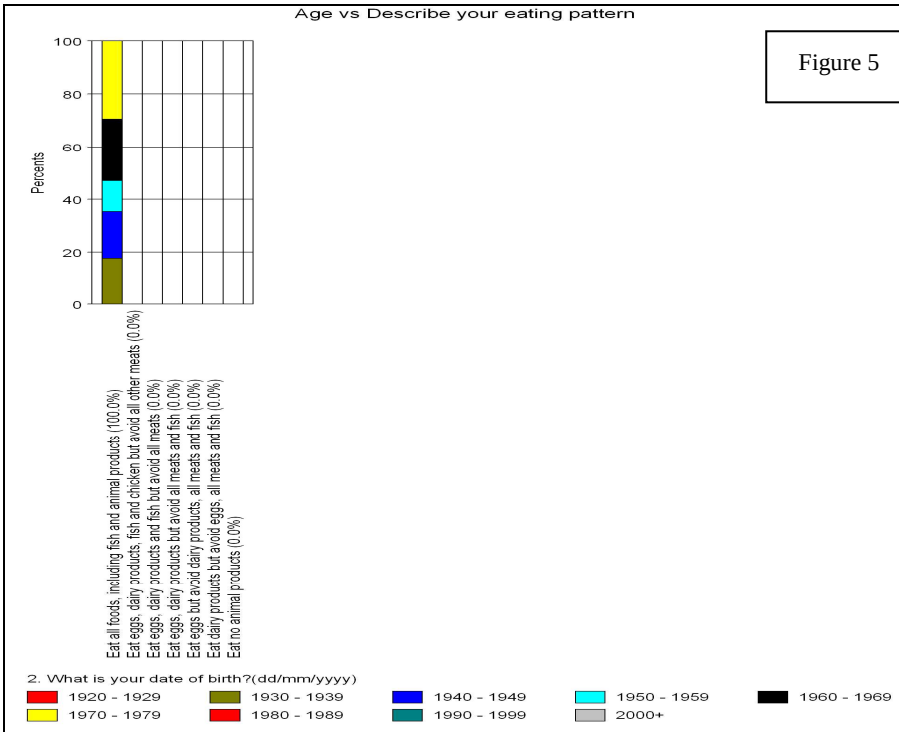


Figure 5

All participants eat all foods, including fish, meat and all dairy products (Figure 5).

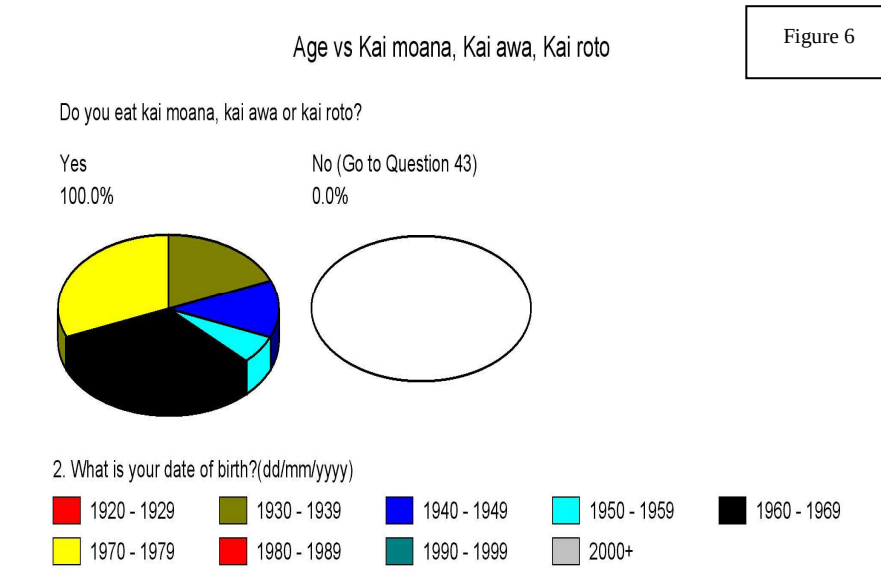


Figure 6

All participants eat kai moana, kai awa or kai roto (Figure 6).

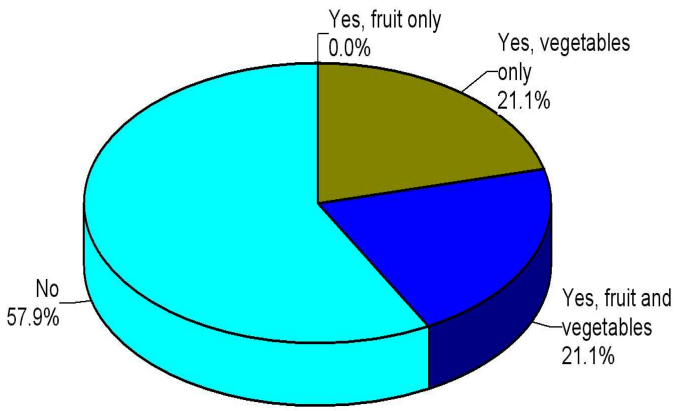


Figure 7

Consistent with a kai gathering lifestyle:

- 42% grew their own vegetables.
- Of the 42%, 21% of those who grew vegetables also grew fruit (Figures 7).

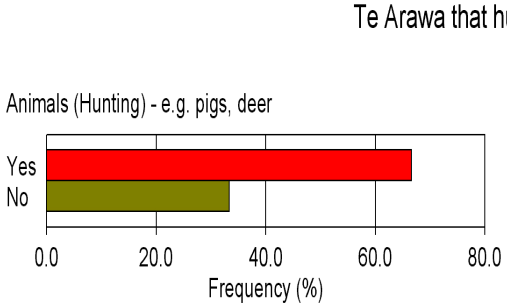


Figure 8

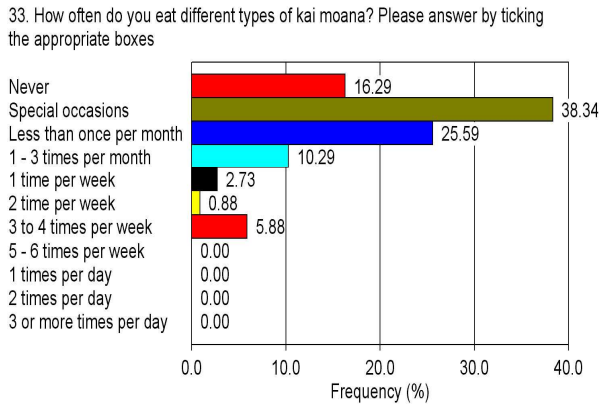
Approximately 66% of respondents hunted.

Yeah, we hunted a lot. Yeah, we hunted a lot but it was mostly at Tarawera, all those sort of things we hunted there. But the lakes were pretty good - those lakes were always pretty clean. The Rotokakahi was always clean – it's still clean but it's starting to – the weed is starting to blanket it now…especially Tarawera where we used to go hunting. You could go in there – we used to go in there and get some watercress for our tea, you know, to cook up with our tucker, you know. Not any more. I don't know why. But I think DOC, I think, poisoned a lot of them. The streams – we used to get a lot of it and it was beautiful watercress from Tarawera (Informant C).

I mean, even our parents - we owned gardens, we grew our own vegetables, our own fruit. We had sections - three acre sections, two acre sections, one acre sections - huge sections. We would have our chooks, we would have everything. Our parents - I know my father was disgusted when he first saw baked beans and spaghetti and everyone was eating that, and he's saying "what's the matter with people, don't they know how to use a spade anymore?" You know, and that is what they were so used to - using their hands to create work and then producing food (Informant E).

How often do you eat different types of kai moana

Figure 9



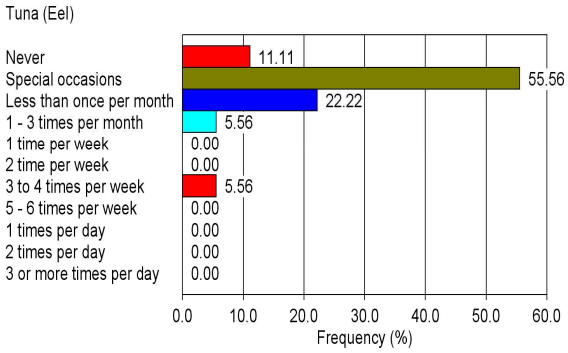
Having determined that all of respondents do consume different types of kai:

- 38% of respondents said they now only eat kai on special occasions; while
- 25.5% eat kai less than once a month; and
- 10% only eat kai 1-3 times per month (Figure 9).

In other words 73% eat kai 1-3 times per month or less.

Amount of Eel consumed

Figure 10

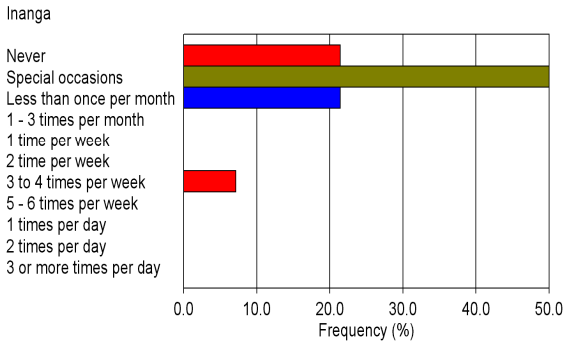


Figures 10 - 15 illustrate how often the various species are consumed:

- Only 5% of those eating eel have this food 1-3 times per month in contrast to 56% who eat eel on special occasions.
- It was of concern therefore that 57% of the respondents believed that there were now "fewer" eels present.

Amount of whitebait consumed

Figure 11



For whitebait, 50% of the respondents indicated they consumed these species at special occasions while another 20% have it less than once per month and another 20% **never** consume whitebait.

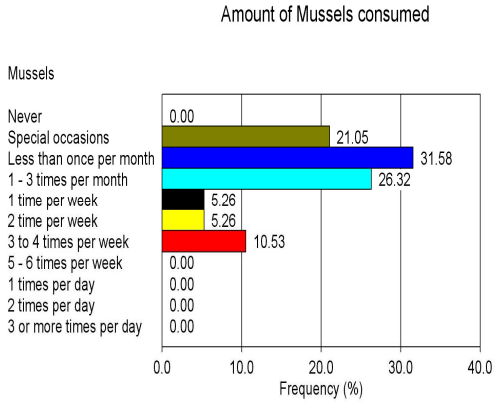


Figure 12

Marine mussels are consumed weekly – specifically once or twice per week by 10.5% and 3-4 times per week by another 10.5%.

Respondents observed that mussels can now be easily accessed from supermarkets.

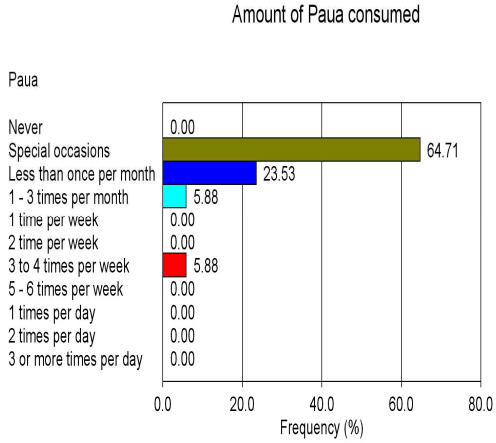


Figure 13

64.7% of respondents only eat paua on special occasions and other 23% less than once per month.

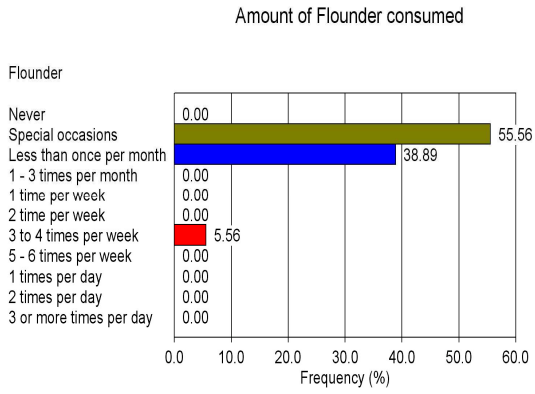


Figure 14

As with the other species flounder (55.5%) was consumed mainly on special occasions.

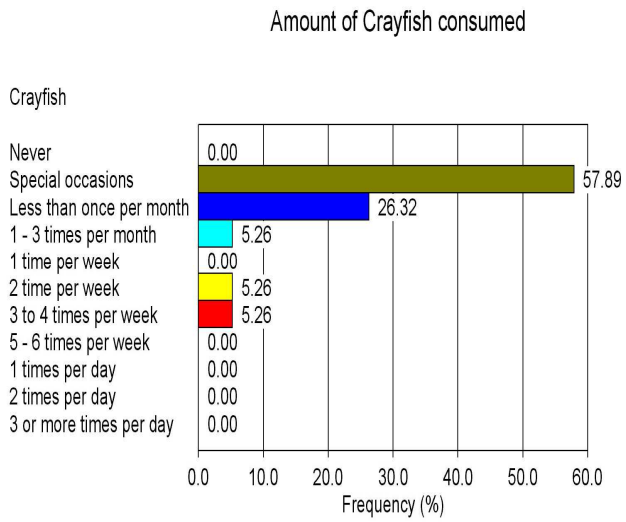


Figure 15

Similarly crayfish was mainly consumed on special occasions by 57.9%.

As whanau explained -

> *We took kai from the river in the way of eels and kakahi and trout. Of course, trout being an introduced species, we made full use of their being available (Informant A).*

Of concern when reviewing the complete list of species and the frequency with what each was consumed, some respondents identified six species as being extinct (i.e., no longer present in the areas they gather from) – kakahi, cockles, koura, morihana, seaweed and tuatua.

How respondents prepare their kai also has health implications. It was accepted that although many would prepare their own kai, others would purchase fish at take-aways, and supermarkets (as either fresh or tinned fish). Figures 16-20 illustrate the difference between age groups.

Figure 16

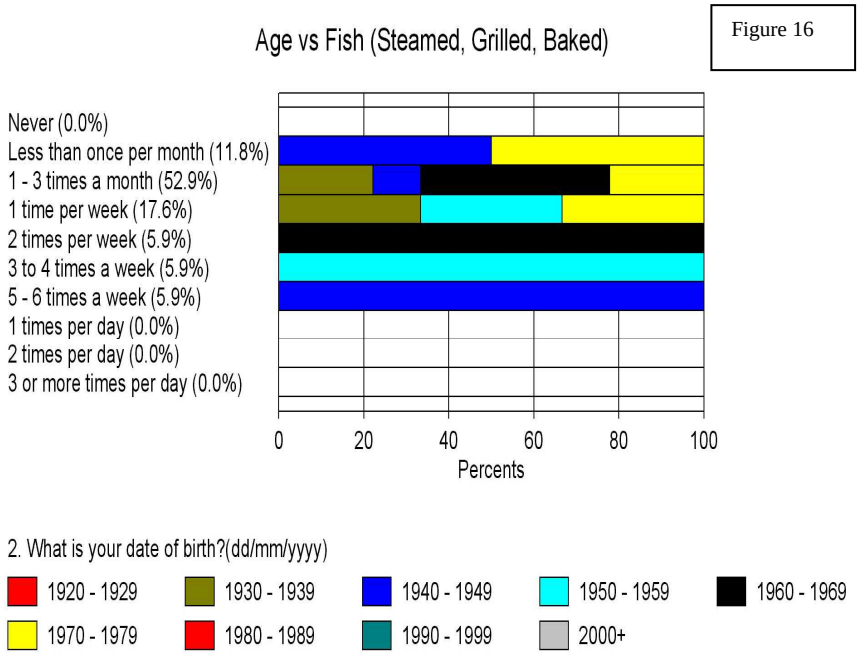
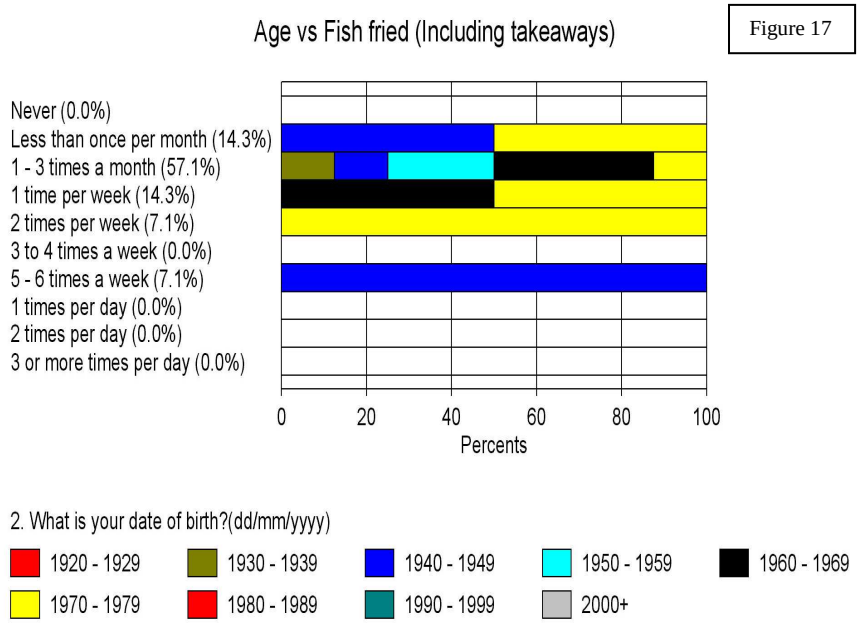


Figure 17



52.9% of respondents consumed steamed, grilled or baked fish 1-3 times per month while another 17.6% recorded consuming at least once per week. Another 17.7% eat fish more than once per week.

Those who eat fish 5-6 times per week were all in their 60s while those eating it 3-4 times per week were all in their 50s.

Today convenience foods can be purchased from a variety of sources and is available:

- as tinned fish;
- as fresh fish available in the deli of a supermarket; and
- as fish and chips at a takeaway store.

The graphs at left confirm that:

- Fried fish is consumed frequently and by 28% of respondents at least once per day.

- 57% eat fried fish at least 1-3 times per month.

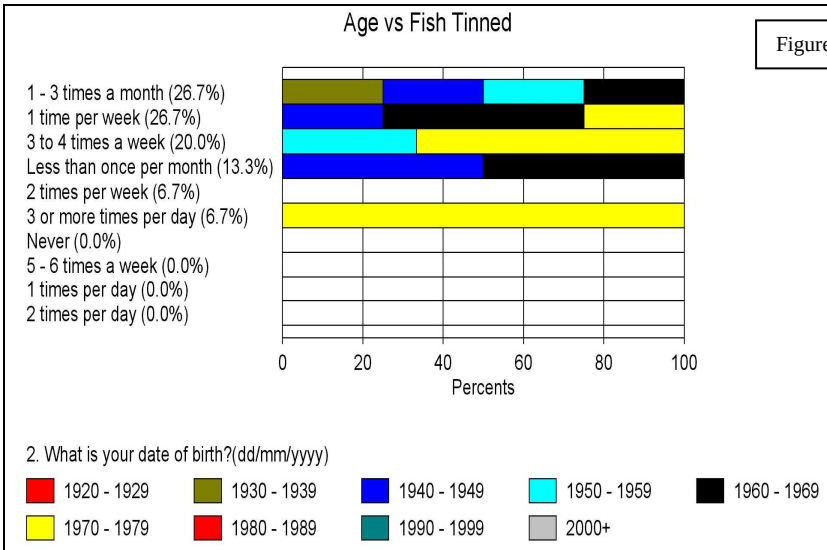


Figure 18

Interestingly Kaumatua consume fried fish and tinned fish 1-3 times per month. In contrast those aged in their 30s were all weekly consumers of tinned fish.

We wanted to determine how dependent whanau were on kai. A question therefore asked if kai moana was the main source of food for the whanau.

37% of informants agreed with this statement (21% agreeing strongly). Those who agreed were aged 40 years and older. In contrast those aged in their thirties were either neutral or disagreed.

In fact 36.8% spread across four age groups disagreed or strongly disagreed – in other words, despite the historic dependency of the lakes for sustenance, kai was not the main source of food for their family.

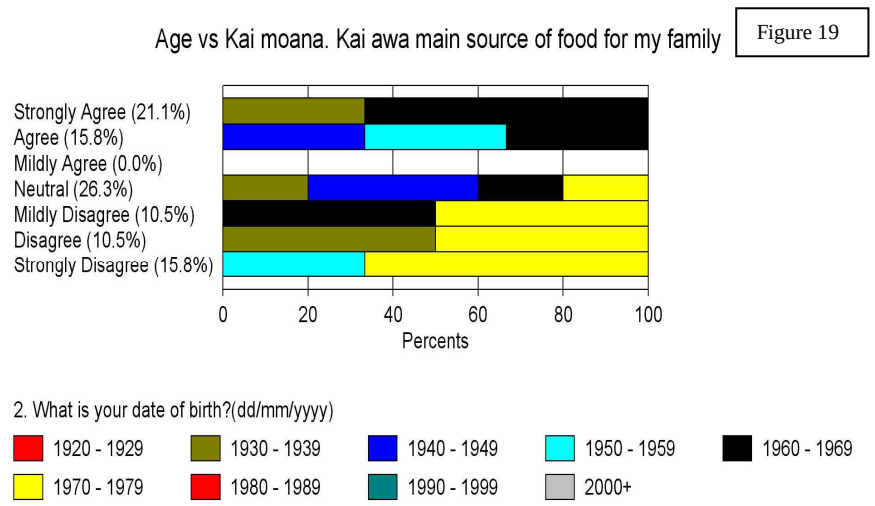


Figure 19

Questions sought to identify changes from a traditional kai dominated diet to a western style diet (Figure 20). It was of concern that 30.8% of respondents eat meat pies, pasties, quiche or savouries at least weekly, and all are aged in their 30s and 40s.

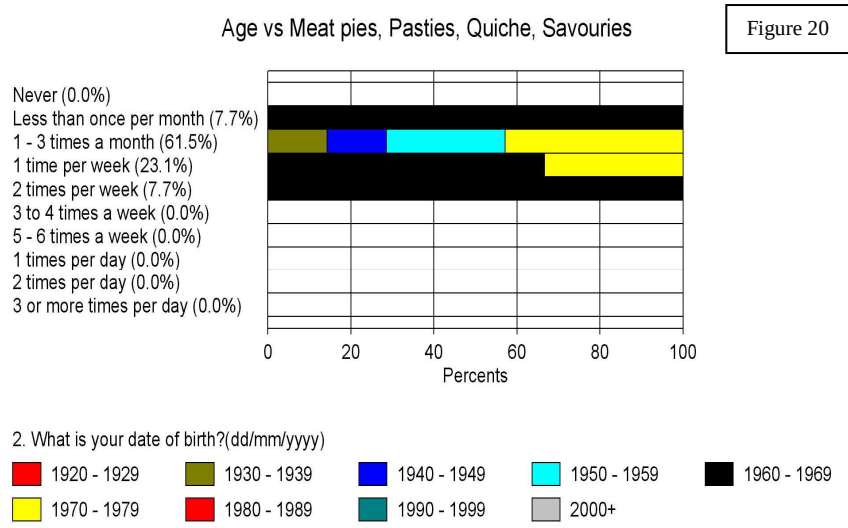


Figure 20

5.2.2 Estimates of the quantity of kai consumed

This research investigates the risk of contamination from eating wild sourced kai. A key consideration is the amount of kai that they are actually consuming, along with the levels of contaminant present. We calculated consumption rates by examining:

- the frequency or number of times they consume kai; and
- the quantity per sitting.

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week. From the data collected we also know that they consumed approximately 219g of fish per sitting[5].

5.2.3 Sites at which kai gathering and other activities are undertaken

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were used as the basis for a sampling programme which examined contaminants in sediment and kai species. Figures 21 and 22 below confirm kai was gathered from 11 of the 14 waterbodies listed. The most highly used area was the coast as 65.05% said they gathered from Maketu followed by lakes Rotoiti (21.04%) and Tarawera (14.39%). There was no gathering by participants from lakes Rerewhakaaitu, Okareka, and Tikitapu.

[5] This is discussed more fully in section 6.3.1

Figure 21

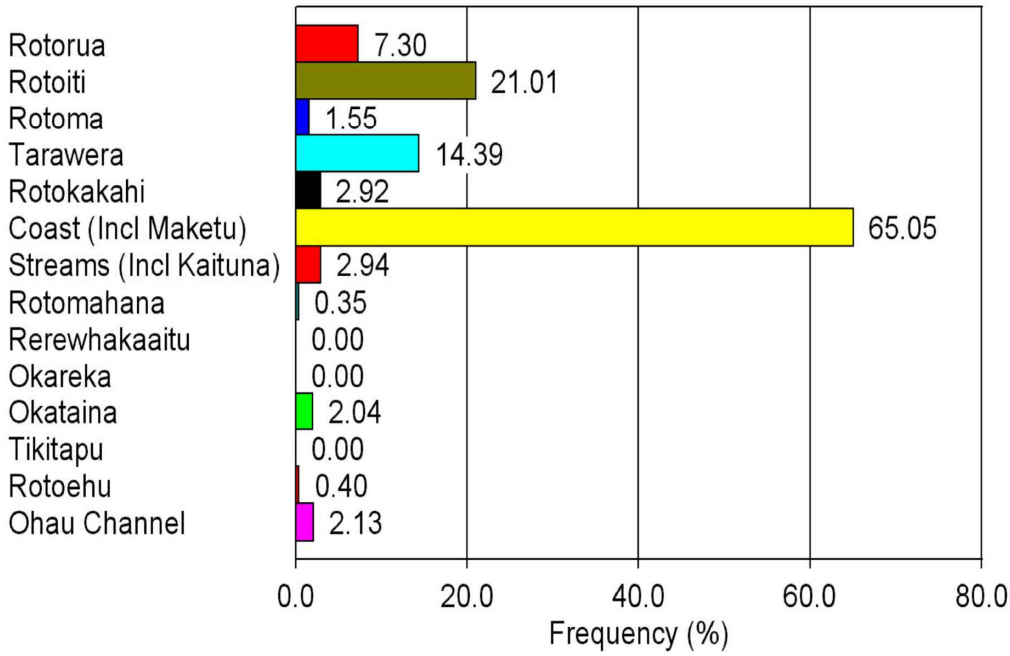
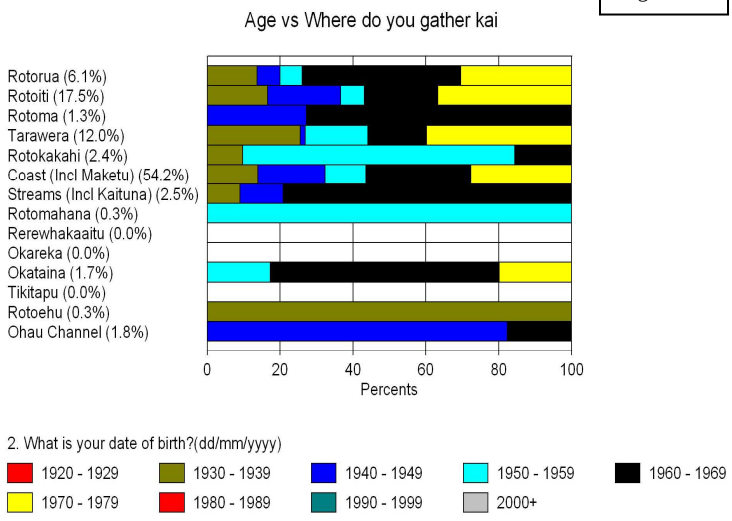


Figure 22



Of the sites listed in the Figures at left (Figure 22):

With respect to ages:

- those that gathered from Rotoehu were in their 70s.
- those that gathered from Rotomahana were in their 50s.
- all age groups were represented amongst the gatherers in Lakes Rotorua, Rotoiti, Tarawera, and the coast.

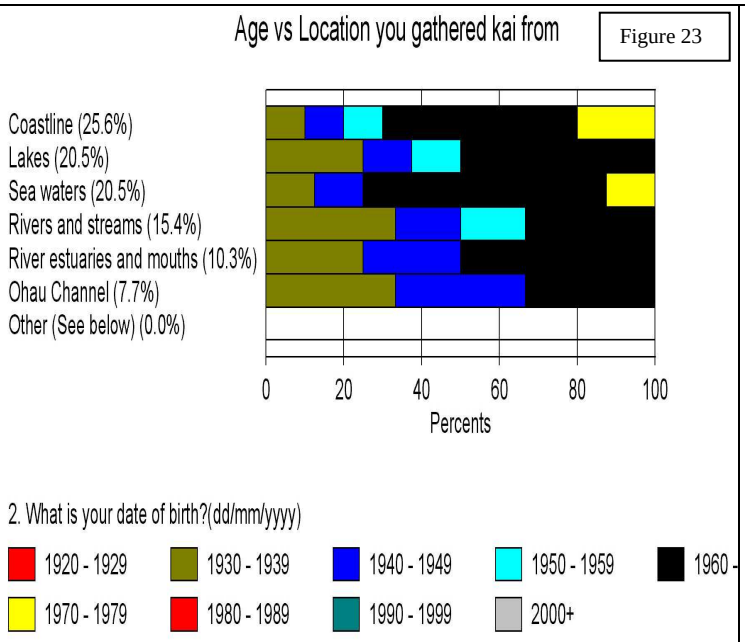


Figure 23 suggests that those in their 30s prefer kaimoana or marine species as gathering occurs at the coast or at sea. This result could also be a reflection of their mobility and possibly access to boats.

In contrast kaumatua gather from all habitat types.

In Figure 24 we show where each of the species are gathered. Most freshwater species are gathered from a range of sites (other than kakahi). Many more coastal species are gathered than freshwater species, although some species (inanga, eels) are gathered in both areas. Figure 25 shows the proportion of individuals that gather each species. Trout, koura, pipi, mussels, kahawai, cockles, snapper and kina are gathered by at least 70% of participants.

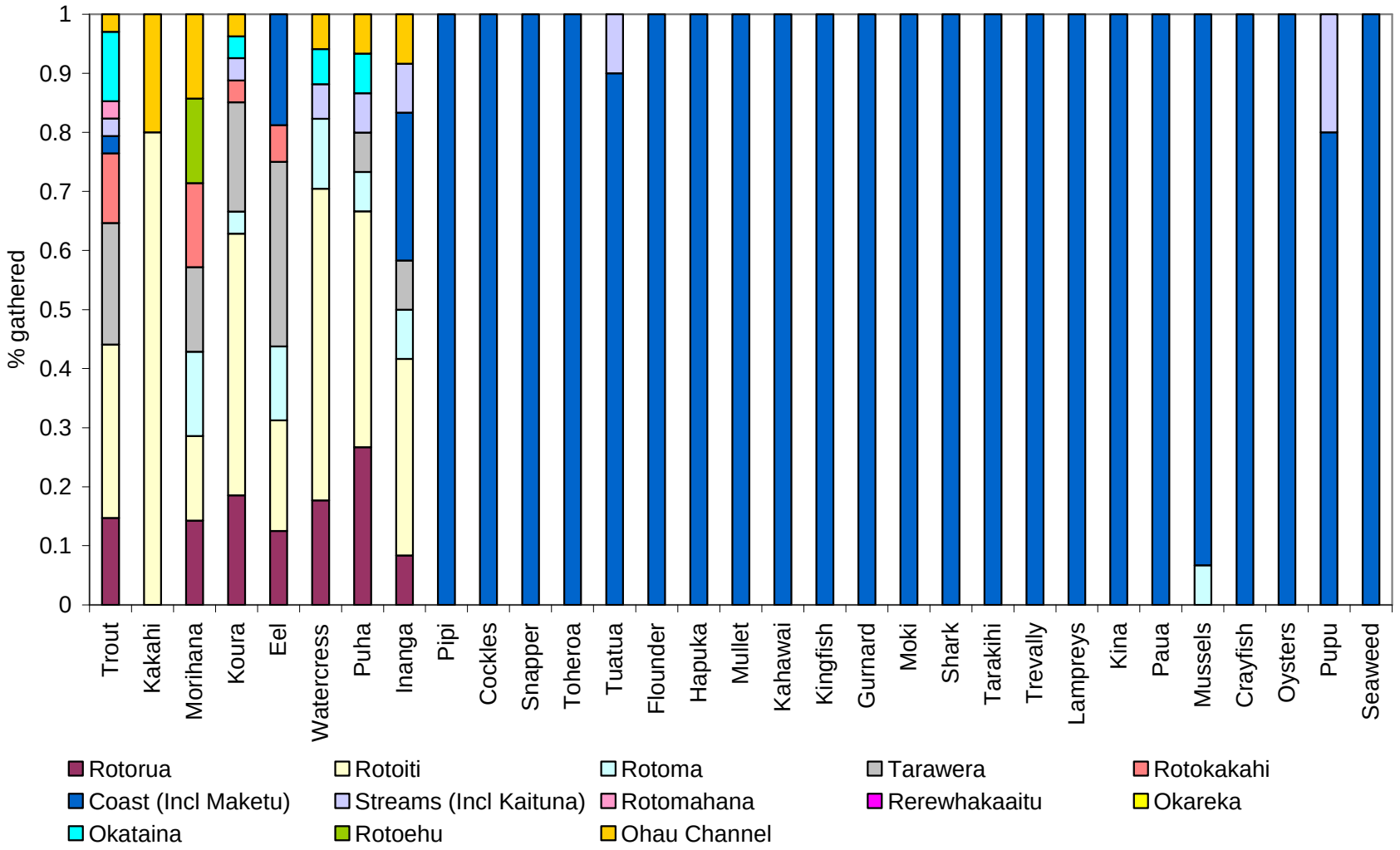


Figure 24: Relative proportions of sites from which the different species of kai were gathered.

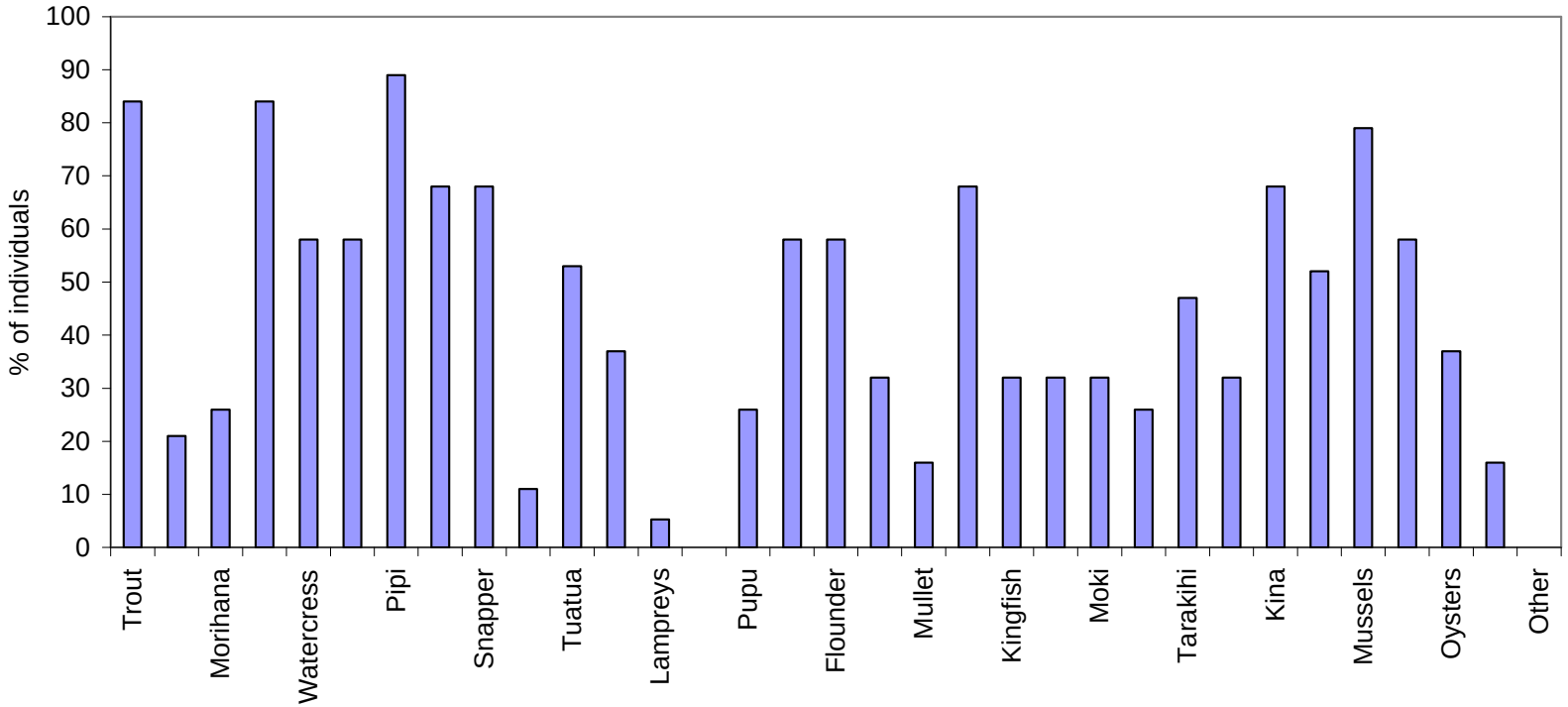


Figure 25: Percentage of individuals who gather each species.

5.2.4 Other sources of kai

This project is about the risk of exposure to contaminants as a result of kai gathering. If there are concerns about the safety of kai consumed, and people are consuming kai that has been gifted, it is important for them to know where the kai comes from.

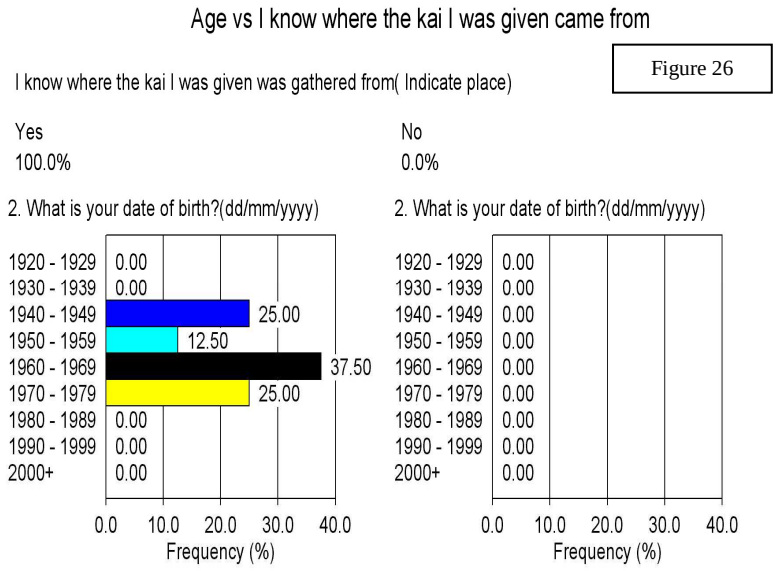


Figure 26

All respondents indicated that they did know the source of the kai they were gifted (Figure 26).

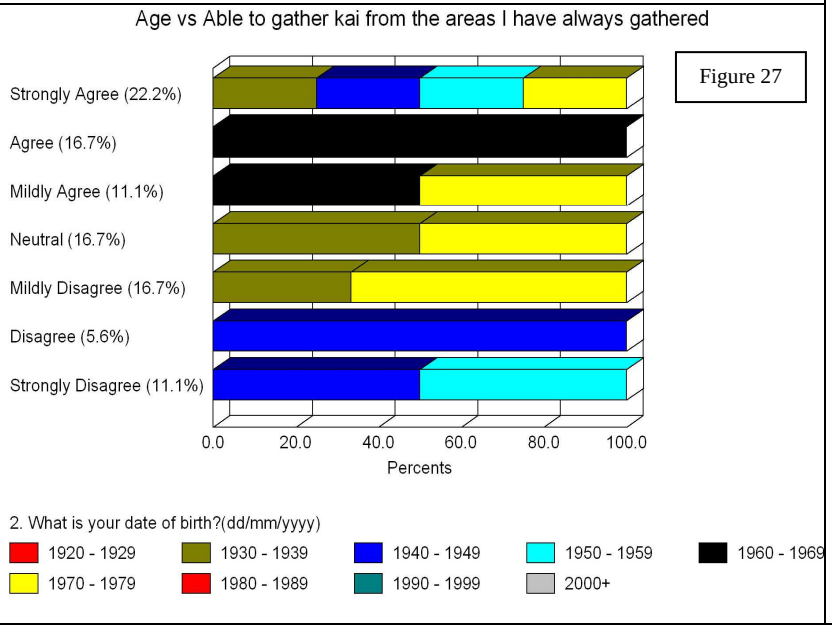


Figure 27

Assuming the sites whanau gather from would change if the condition of the site was degraded; respondents were asked if they were able to gather from the sites that they have always gathered from (Figure 27).

- 50% agree that they can.
- 33% say that they cannot.

No trends can be detected when looking at the respective age groups, although those aged in their 40s all agreed with the statement.

Tangata whenua have witnessed and experienced a range of changes to the local waterbodies and their relationship with them in the last few decades. One of the changes witnessed concerns the abundance of kai available. This is considered in the next section.

5.2.5 Perceived changes in the abundance of species that are gathered

If kai are to be promoted as a beneficial source of food, sufficient quantities of healthy stocks need to be available in order to sustain gathering. The Consumption Survey asked whanau to provide an assessment of the stocks of various species gathered and whether or no abundance had changed. Table 3 presents a summary of these results.

Table 3: Changes in the abundance of species (as a percentage of respondents)[6].

Species	A lot fewer	Slightly fewer	About the same	More abundant
Kakahi	22.2	44.4	-	11
Morihana	42.9	14.3	-	-
Cockles	25.5	50	16.7	8.3
Pipi	11.8	52.9	35.3	-
Toheroa	23.3	16.7	33.3	-
Tuatua	22.2	44.4	11	-
Lamprey	33	50.5	-	-
Mutton birds	50	25	-	-
Pupu	57.1	14.3	-	-
Eel	28.6	28.6	21	-
Flounder	18.2	45.5	0.1	-
Paua	36.4	45.5	9.1	-
Mussels	21.4	28.6	28.6	-
Crayfish	8.3	41.7	25	-
Oysters	27.3	36.4	27.3	-
Seaweed	25	25	-	-
Koura	7.1	35.7	25	-
Watercress	13	33.3	28.6	-
Puha	0	38.5	53.3	-
Hapuka	14.3	42.9	14.3	-
Mullet	16.7	33.5	33.3	-
Kahawai	9.1	27.3	36.4	-
Kingfish	22.2	22.2	22.2	-
Gurnard	11	44	22	-
Snapper	0	40	3	-
Moki	20	40	20	-
Shark	20	40	20	-
Tarakihi	9.1	36.4	27.3	-
Trevally	12.5	37.5	25	-
Whitebait	14.3	42.9	28.6	-
Trout	25	16.7	50	8.3
Kina	16.7	41.7	16.7	-

[6] Perceptions with respect to individual species are summarised in Table 8 with graphs included as **Appendix 1**

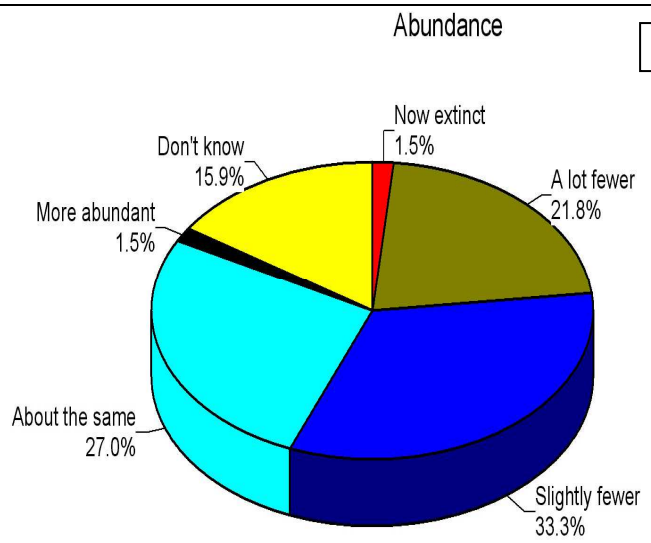


Figure 28

With respect to abundance, 56% felt that "fewer" stocks were available today, specifically, 22% of respondents believed that across all species gathered there were now a "lot fewer" available while another 33% believed that abundance was "slightly fewer"(Figure 28).

As stated earlier 1.5% believed that a number of species – including morihana and koaro were extinct (i.e., no longer present at those places previously gathered from).

5.2.6 Kai gathering behaviours

It cannot be assumed that all kai consumed is gathered by the respondents. Questions in the survey therefore asked about purchasing kai and sought to understand if it was shared within the whanau and wider community.

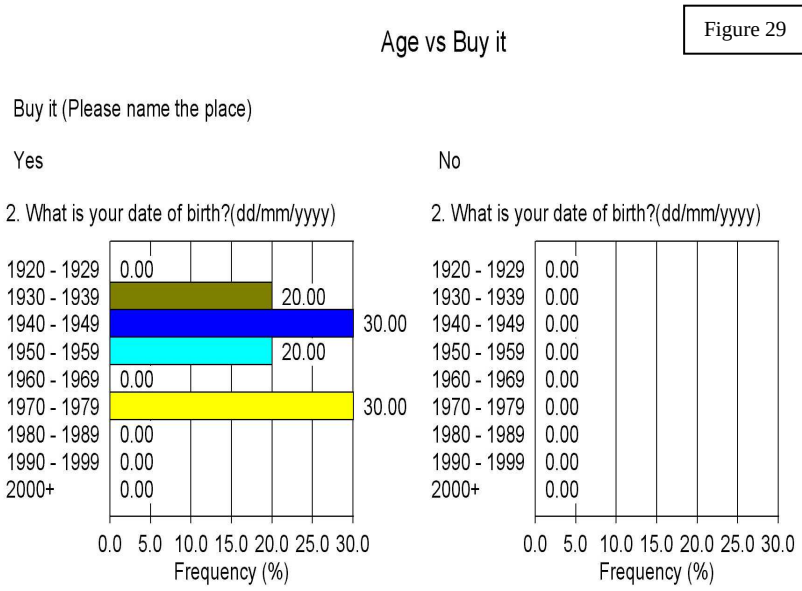


Figure 29

All respondents buy some of their kai (Figure 29).

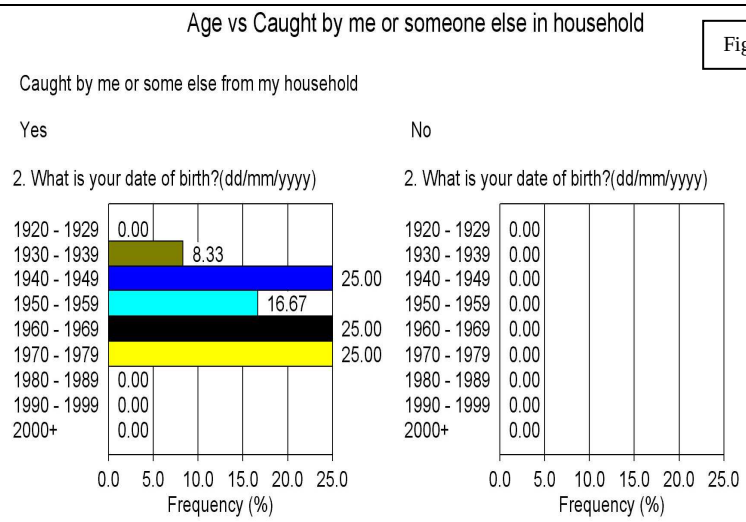


Figure 30

All respondents confirmed that they or someone in their household caught their own kai (Figure 30).

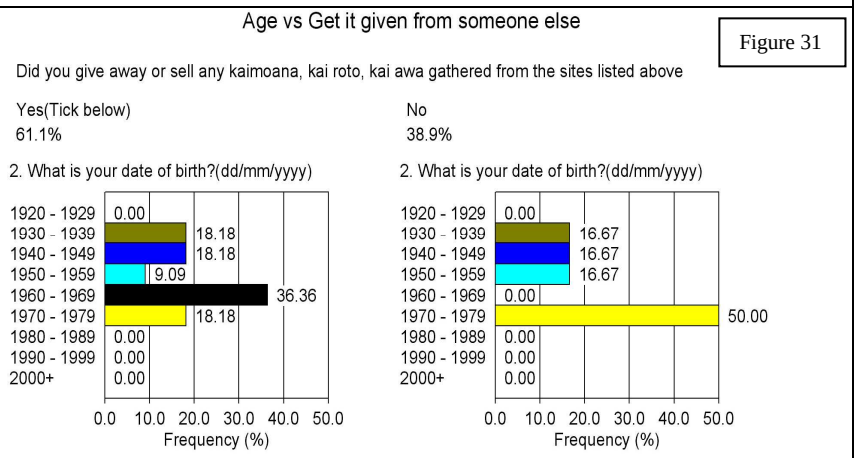


Figure 31

61% of participants said that they also were also given kai (Figure 31).

Aside from knowing how to gather kai, whanau need to know how to prepare the respective species.

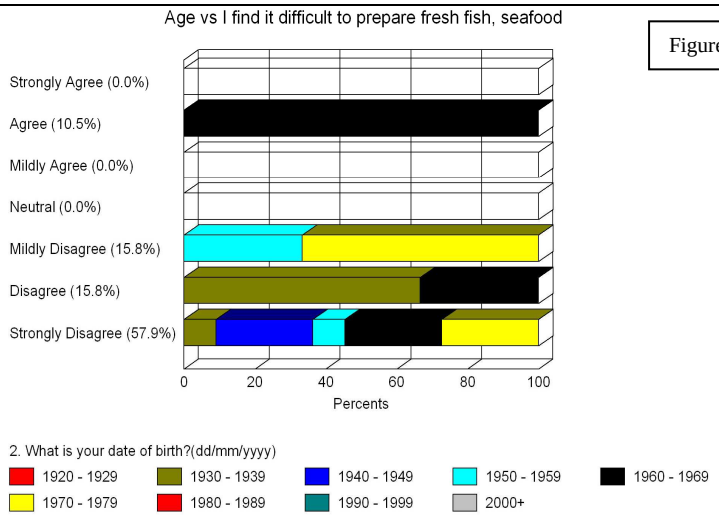


Figure 32

90% of respondents disagreed with the statement (58% strongly disagreeing) that it was difficult to prepare fresh fish and seafood. In other words 90% knew how to prepare their kai (Figure 32).

Of note however was the difference between generations, those that agreed with the statement – i.e., they find kai difficult to prepare - were all aged in their 40s.

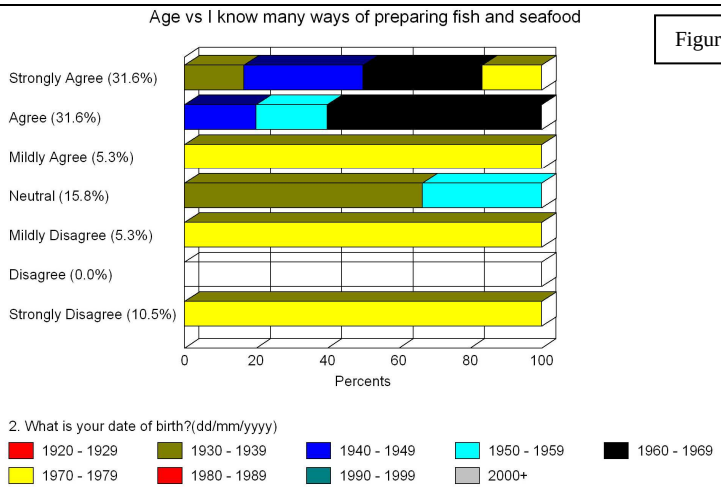


Figure 33

68.7% of respondents know many ways of preparing kai (Figure 33). In contrast, those aged in their 30s replied that they definitely did not know multiple ways of preparing kai.

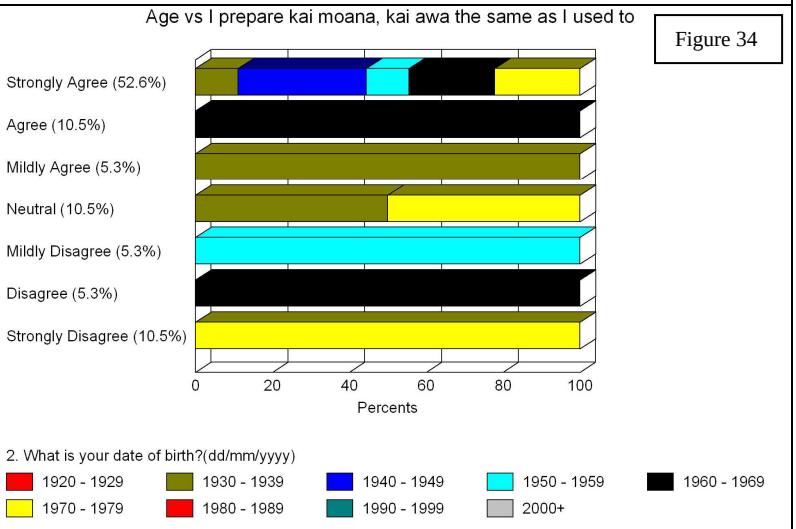


Figure 34

52.6% (across all age groups) strongly agree they prepare kai the same way that they have always done (Figure 34). In fact, 68% of respondents indicated they prepared their kai the same way as they have always done.

5.2.7 Perception of the environment

Yeah, about 60 years ago, beautiful, high and wide and I guess you got the incoming tide from the ocean and the outflow and that, you know. Well, look, it's just quite natural, eh, how you got the Kaituna coming down, you know, and pushing up and you got the foreshore, both doing justice to the estuary and that's how it used to be (Informant K).

The lake was our playground that is all we had. Along Kotu during the summer and we never went anywhere else. We walked it, we swam it, we sailed it, we played in it (Informant M).

Maori experience environments and central to their continued interaction and utilisation of environments will be their perception of the good health of such areas. A number of questions in the survey asked for them to give an assessment of the condition of the sites from which they gather kai.

Figure 35

Responses were mixed when asked about the condition of sites (Figure 35), with:

- 52.7% believing sites to be in good condition while
- another 31% did not provide an assessment.
- Only 16% appeared to believe that sites from which they gather are not in a good condition.

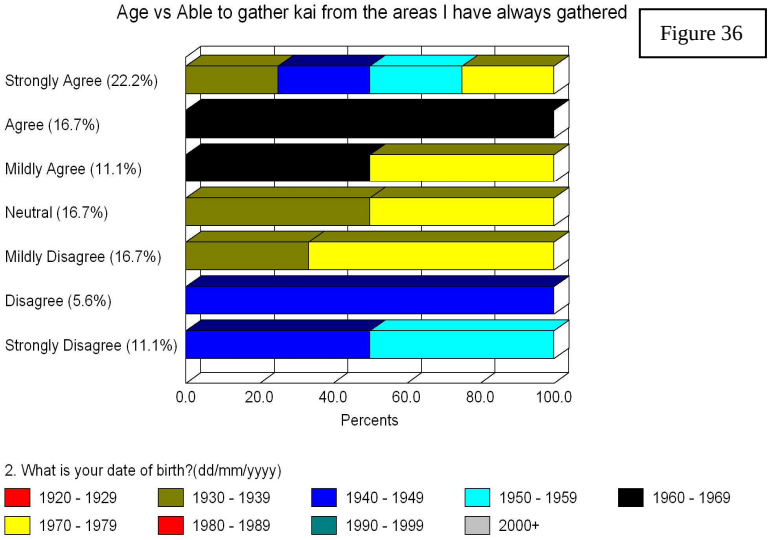


Figure 36

This is supported by the assessment by 50% of respondents who believe that kai could be gathered from the same sites that have always been accessed (Figure 36).

With respect to age differences those who believed they could no longer gather from the sites they have previously been able to were aged in their 50s and 60s.

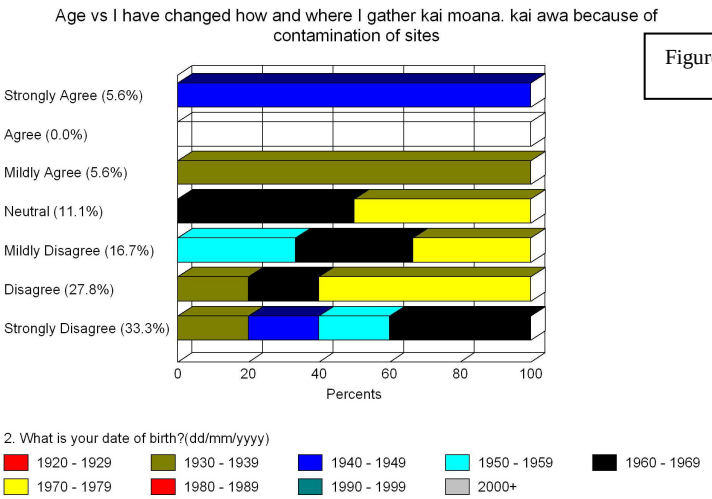


Figure 37

Responses were also mixed when asked about changing the sites they gather from as a result of perceived contamination at the sites (Figure 37):

- Only 11% agreed that they had changed their gathering behaviour.
- In contrast 77.8% across all age groups disagreed.

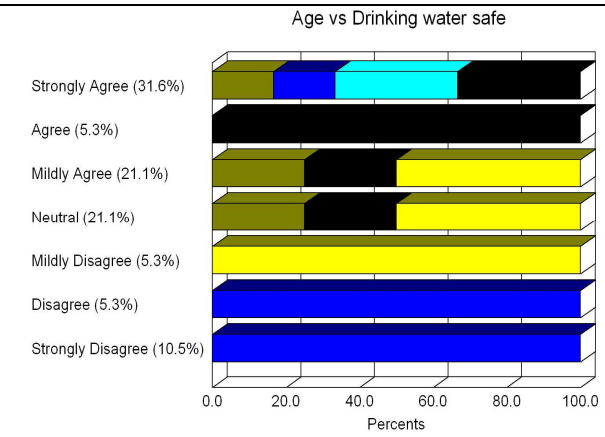


Figure 38

The majority of participants (58%) believed that their drinking water was safe (Figure 38). However, 21% did not comment.

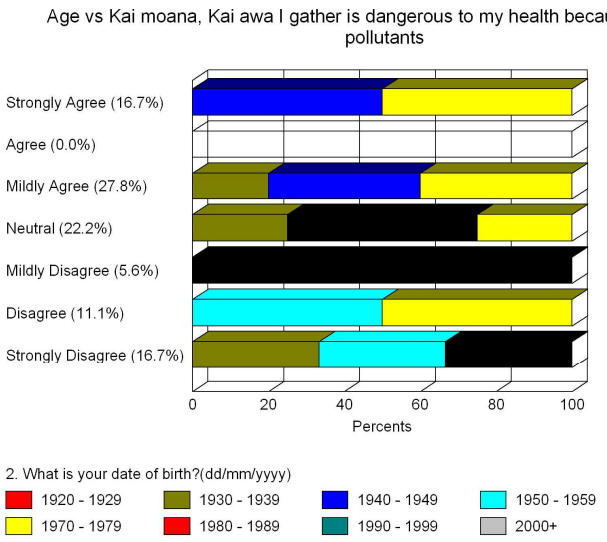


Figure 39

In relation to pollutants (Figure 39):

- 44.5% strongly disagreed with the statement that the kai gathered was dangerous to human health because of pollutants with (16.7 strongly disagreeing)
- However 22% did not provide an assessment.

With respect to age differences all respondents in their 60s agreed with the statement – that kai is dangerous because of pollutants.

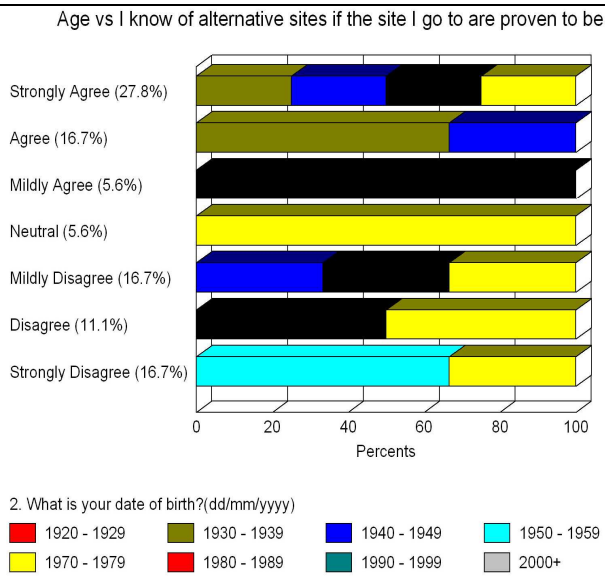


Figure 40

No clear trends emerged when asked if kai gathering was dangerous to the health of respondents because of pollutants or toxins.

However, if a site is contaminated then the expectation would be that alternative sites would be used.

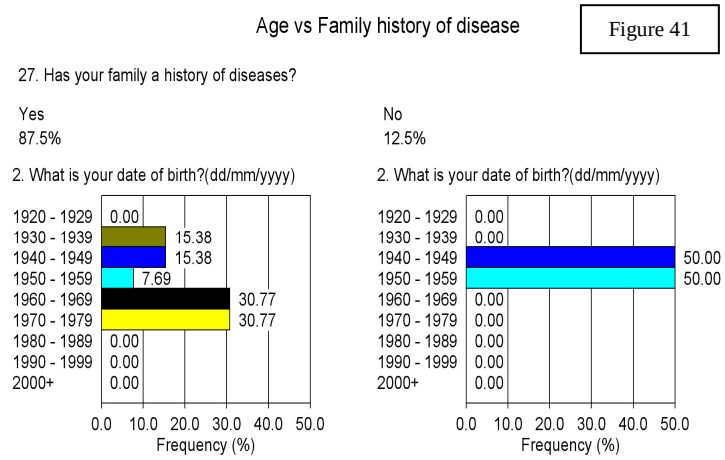
However only 50% knew of alternative sites that they could use (Figure 40). 27.8% strongly agreed with the statement that they would use alternative sites.

All respondents aged in their 70s knew of alternate sites.

5.2.8 Health of whanau members – Self Reported Rates of Diseases

Participants were asked to self report diseases prevalent in the family (Figures 41 and 42).

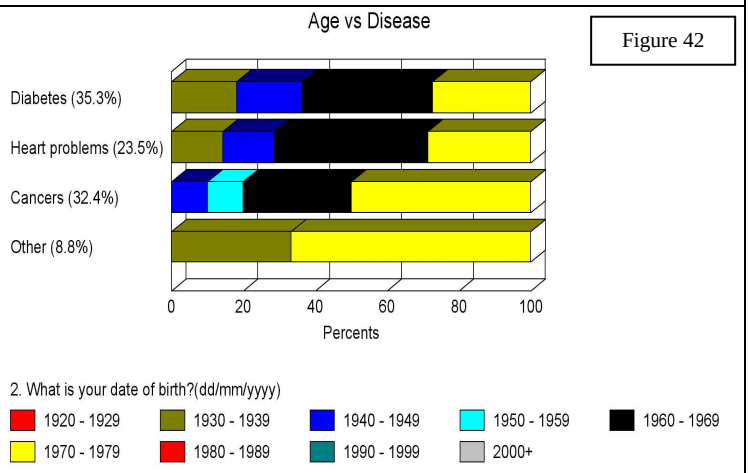
Figure 41



The lowest reported incidence of disease was among those in their 50s (at 7.69%) while those aged in their 60s and 70s each scored 15.38% which contrasts with a rate of 31% for those aged in their 30s and 40s.

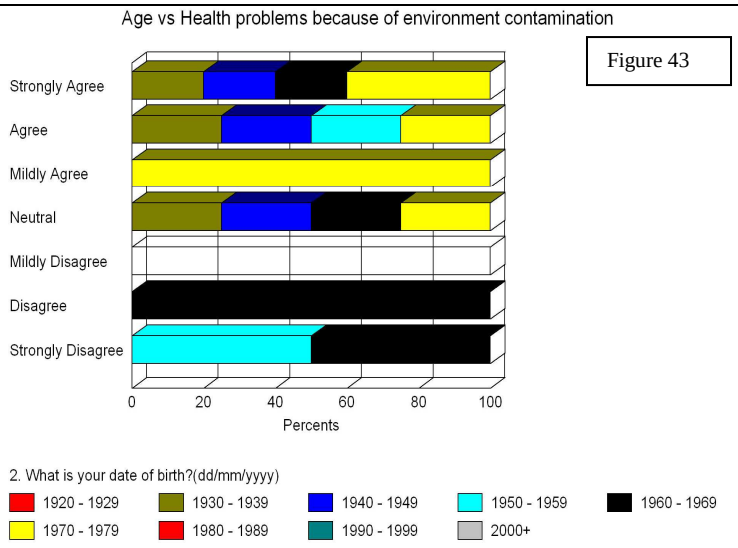
- 87.5% reported that there was a history of disease in their family.
- 35.3% of participants, across four age groups, reported a history of diabetes within their whanau.
- 32.4% of participants, across four age groups, reported a history of cancers within their family.
- 23.5% of respondents, reported heart problems (Figure 42).

Figure 42



Despite the prevalence of illness in their whanau (at above average rates) 84.2% of the individuals participating rated their health as good, very good or excellent (Figure 43). No one rated their health as poor.

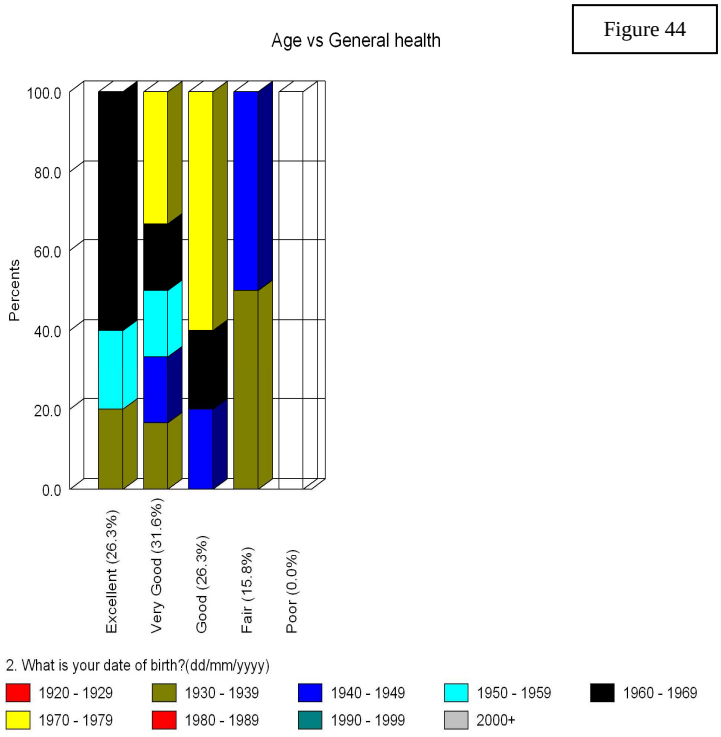
Figure 43



Two questions in the survey asked if respondents believed their health problems could be attributed to environmental contamination or more specifically water contamination (Figure 43).

With respect to environmental contamination, 61% of participants across most age groups agreed with the statement that health problems can be attributed to contamination.

Figure 44

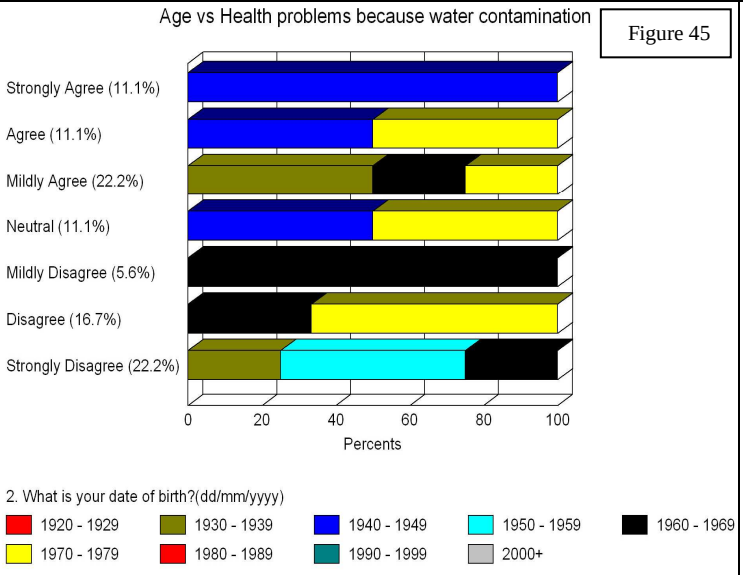


Other age group observations (Figure 44):

- The eldest participant considered their health as excellent.
- Those aged in the 70s and 60s were the only ones to rate their health as fair.
- The greatest variation was in the 70+ years age group with participants rating their health fair, very good or excellent.

As expected, the youngest participants (aged in their 30s and 40s) considered their health very good or good.

Figure 45



Interestingly 44.5% of participants disagreed with contaminated water being the source of their health problems while an equal number agreed.

The "casting vote" lies with the 11.1% who provided no comment (Figure 45).

5.2.9 Disseminating advice about contamination issues

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

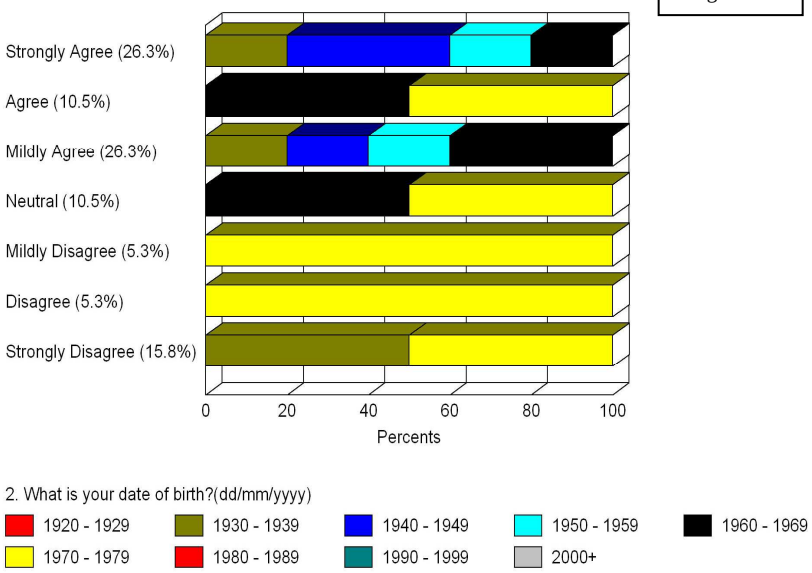


Figure 46

63.1% of respondents indicated they knew where to get advice about contamination issues (Figure 46).

Only 26.4% (and two specific age groups – those in their 40s and 70s) did not know where to go to obtain information.

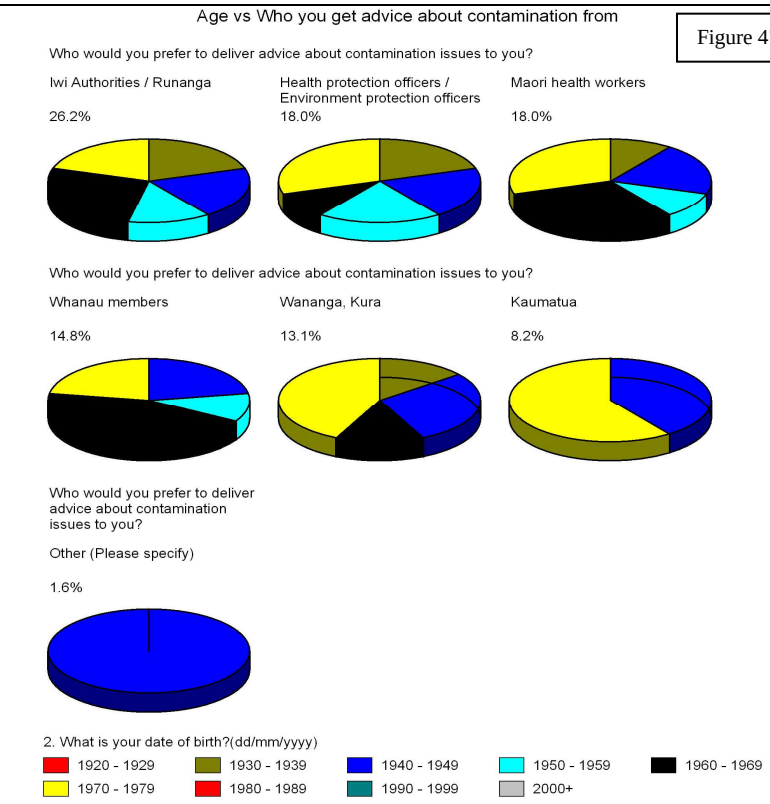


Figure 47

There is a slightly higher preference for iwi authorities/runanga to deliver the information (26.2%), although HPOs/EPOS, Maori health workers, whanau members and whananga were also considered important (Figure 47).

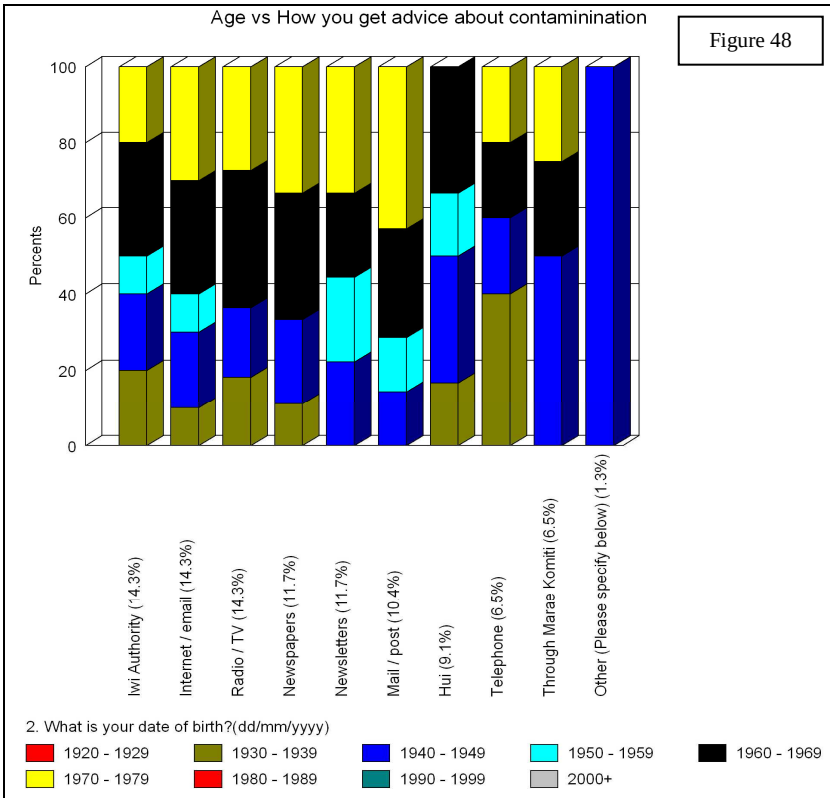


Figure 48

Similarly there was no clear preference with respect to the means of communicating contaminant information, which in fact suggests that a range of media should be used. About 9 different media were supported evenly (Figure 48).

However, when reviewing the means of communicating we need to be cognisant of the equipment needed by whanau.

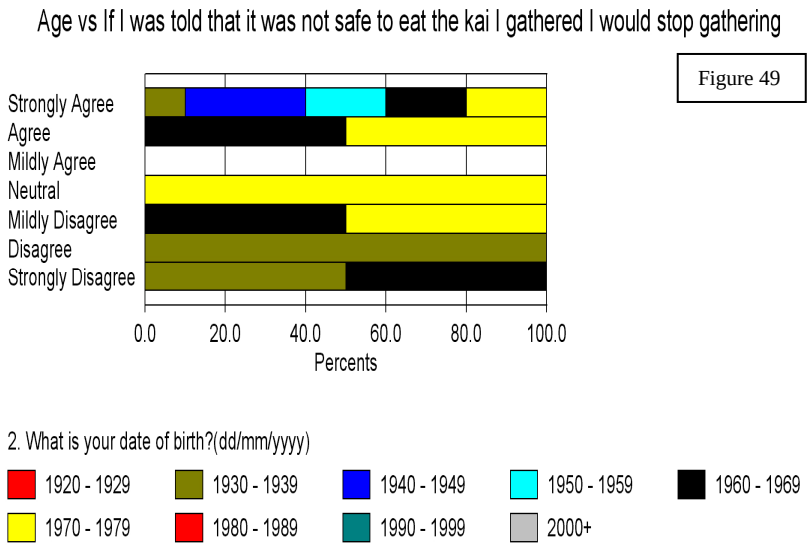


Figure 49

The final result (Figure 49) concerns the long-term outcome of this programme and the need to communicate health risk. Importantly, 63.6% of respondents (across all age groups) indicated they would stop gathering kai if advised that kai was not safe.

In the section that follows we discuss the implications for Te Arawa of the results presented in this chapter.

6. Discussion - understanding the socio-economic-cultural importance of kai to whanau and hapu

> *Indigenous relationships to the land are based in cultural practices. Harvesting of traditional foods is a central, material part of this relationship. A key problem for indigenous peoples occurs when, because of the practices of competing world views such as those often held by colonial states, practising these material connections becomes difficult. Problems ensue. These problems include issues related to health and well-being, and a disruption of well-established life-ways. (Fediuk and Thom, 2003, p 1)*

The discussion in this chapter compares traditional and contemporary consumption patterns of kai gathering, processing and consumption, the health of significant sites, and summarises environmental change over the last 160 years to identify drivers of the transitions from a traditional kai based diet to a western diet. Insights, firstly, concerning the impact of dietary changes and secondly, the ongoing risk of exposure to contaminants and the impacts of this risk on the health and wellbeing of whanau are discussed in the wider political / social / cultural context in order to give a more complete reporting of cultural-environment relations.

From the histories of Te Arawa and written manuscripts, descriptions of lifestyle heavily dependent of kai gathering emerges. The resources available from these lakes were crucial for sustaining the livelihoods of Te Arawa whanui prior to European settlement. Kai gathering was the basis of an economy and culture before contact with Europeans. In this chapter we distinguish kai gathering in three time periods:

- pre European settlement through until late nineteenth century using mostly information sourced from secondary sources;
- twentieth century up until the 1970s and 1980s – using information sourced from interviews with members of Te Arawa whanui; and
- the present - using information obtained from:
    - the interviews with members of Te Arawa whanui;
    - the kai consumption survey; and
    - monitoring reports of EBoP, research reports and statutory plans.

6.1 Structure of this chapter

Te Arawa have continually asserted their right to have their mahinga kai and cultural practices protected. However, many whanau in Rotorua Lakes have witnessed the degradation of valued habitats and experienced significant barriers to gathering kai. They continue to express their concerns in a variety of forums. This chapter follows the format of Chapter 5 and discusses:

- patterns of kai consumption;
- estimates of the quantity of kai consumed;
- sites from which kai is gathered;
- perceived changes in the abundance of species;
- kai gathering behaviours;
- perception of the environment;
- health and wellbeing of whanau members; and
- disseminating advice about contamination issues.

6.2 Traditional patterns of gathering

> *At 1840, Lakes Rotoehu, Rotomā, Rotoiti, Rotorua, Ōkataina, Ōkareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngāhewa, Tutaeinanga, Ngāpouri, and Ōkaro were rich in resources. These included extensive indigenous fauna and flora that provided food, shelter, and economic resources for Te Arawa as well as the means to provide for manuhiri (visitors) and others in the district. The lakes were also primary transport routes for the area. To Te Arawa, the lakes were taonga, and their relationship to the lakes and environs was and continues to be the foundation of their identity, cultural integrity, wairua, tikanga and kawa.*

The evidence of Captain Gilbert Mair, before the Native Land Court during its 1918 inquiry, explained the significance of aquatic resources, (as apart from birds and rats), that the Rotorua district was seen to be unsuitable for cropping. This resulted in fishing assuming greater importance to Te Arawa. Mair listed the various species of

fish caught in the Rotorua lakes including: kakahi (a kind of freshwater mussel), kokopu, koaro (fish similar to small trout), koura (freshwater crayfish), and inanga (whitebait)[7].

Rights to water fowl were held by particular hapu, and were sustainably managed. Kawa (shags) and seagulls, which nested on the lakes' margins, were also managed as were plants such patches of raupo growing along the lake shore[8]. Overall, the list of food items, materials, and other resources relied on by Central North Island Māori including Te Arawa to sustain themselves is substantial. Listed below are some that have been referred to in written text and statements –

Fish and crustacea including:

> eels of different kinds, koura (freshwater crayfish), inanga or whitebait, kōaro, kokopu, kakahi (freshwater mussel), karehe (freshwater pipi), toitoi (common bully), ngorungoru, pahore, mataitai (foodstuff from the sea, generally).

Birds including:

> ducks, kaka, kiwi, kakapo, kukupa and kereru (pigeons), tui, taiko (petrels), mutton birds, matuku (bitterns), kahu, weak.

Other fauna including:

> kerewai (a green beetle, found in manuka scrub), kiore (rats), and [as a later introduction] pigs.

Plant products including:

> flax, kakaho, raupo, paopao (another type of reed), kiekie, toetoe, aruhe (fern root), putere (raupo root), mānuka [used for medicine and also for constructing koneke and shelters], tahara, mingimingi, kaponga bark [for medicine], tutu and koromiko [for medicine], makaikai/maikaika tubers (a kind of potato), kohekohe, pukeatea, rewarewa, mangeao, puriri, wharangi, kotukutuku, makomako, kaponga-mamuka, tawhero, mawa, kawakawa, piripiri [these last 13 all having medicinal uses], ti kouka shoots, berries (tawa, hinau, titoki, makomako, kotukutuku, rohutu, poporo, karaka, miro, tutu), young fern fronds (moku, paretao and pikopiko), rarauhe (bracken),

[7] Evidence of Gilbert Mair, ibid, pp 191–196
[8] Evidence of Wiremu Maihi Ereatara, ibid, p 306

tāwhara fruit and flowers [both used for food], huahua, tupakihi, tawhara, puha, watercress, and [cultivated] kumara, hue (gourds), and taro.

Timber including:

totara, puriri, tanekaha, pohutukawa, white pine.

Other materials such as:

paru [for dyeing fibre], kokowai (red ochre), sulphur [used for medicinal purposes].

Other natural resources:

water, geothermal resource [both with multiple uses including spiritual].

Another comprehensive description of the species sourced from the Rotorua Lakes area is provided by Makereti in “Old Time Maori” (originally published in 1938).

Table 4: Species traditionally gathered from across the Rotorua Lakes region sourced from the writings of Makereti (1938).

SPECIES				
Koeaea (whitebait)	Kokopu (*Galaxias*)	Upokororo (grayling)	Eel	Koura (crayfish)
Inanga/smelt (*Retropinna retropinna*)	Tamure (schnapper)	Trevally	Kahawai	Kumukumu (gurnard)
Kingfish	Mangopare	Pepeke	Kapeta	Parore
Mangotara	Koheriri (horse mackeral)	Kutorotoro (sandfish)	Tutahuna	Tarakihi
Mango (shark)	Hapuka (groper)	Kanae (mullet)	Warehou (sea bream)	Moki
Manga (barracuda)	Tuangi (cockles)	Kuku (mussels)	Karengo (*Laminaria*)	Rimurehia / rehia – edible seaweed
Paua (*Haliotis*)	Kina (*Echinus*)	Tio (oysters)	Pipi	Kotukutuku (*Fuchsia excorticata*)
Aruhe (bracken fern)	Poporo berries (*Solanum aviculare*)	Hakeke (*Polyporus*) – an edible fungus	Kakahi (freshwater mussel, *Echyridella menziesi*i)	Toitoi (*Gobiomorphus gobioides*)
Kumara	Tutu – the berries of the puho (*Coraria ruscifolia*)	Harore (*Agaricus adiposus*)	Kiore – rat (*mus esculens*)	Pig
Para twahti, para reka or para (*Marratia fraxinea*)	Berries of the karaka tree (*Corynocarpus laevigata*)	Pungapunga – pollen of raupo (*Typha sp.*) koreirei – roots of the raupo	Many different bird species	Potato
Tawa berries (*Beilschmiedia tawa*)	Ti kouka or whanaka (*Cordyline australis*)	Puwha (*Sonchus oleraceus*)	Tawhara – part of the kiekie (*Freycinetia banksii*)	Fruit of the Hinau tree (*Elaeocarpus dentatus*)
Taro	Fruit of tumingi (*Cyathodes acerosa*)	Roots of pohue (*Convolvulus sepium*)	Te korito – heart of Nikau palm (*Areca sapida*)	Fruit of the Makomako (*Aristotelia racemosa*)
Young fronds of the fern Moku (*Asplenium bulbiferum*)				

Makereti (1938) also describes how the respective species were gathered.

Shellfish

Shellfish was an important food, and many species were found in the sand of the beach when the tide was out. The varieties are too numerous to mention. All shellfish were collected by women and not by men.

Kuku, mussels, were taken from the rocks by hand and collected in baskets.

Paua (Haliotis)… is taken from the rocks by hand, and the inside is taken out and beaten to soften it before it is cooked on hot coals or in a hangi.

Kina (Echinus)... is generally eaten raw. It is usually collected at the same time as the paua.

Tio, oysters of two kinds, were found on the coast. One kind is rather small and has a rough and crinkled shell, and is found on rocks. The other is much larger, and has a comparatively smooth shell, and lives in mud. The Maori did not care a great deal for oysters, as he did for other shell-fish.

Pipi grows all over New Zealand, generally in sand banks or in sandy mud, and was a favourite food.

Freshwater fish

Koura …..They used the paepae, a dredge net, and also whakaweku, bunches of fronds of raurahe (bracken) sunk to the bottom of the lake, or tau, bunches of fern tied to a post.….Our people also ruku koura, that is, dived for crayfish, going to the bottom of the lake and bringing them up between both hands.

Inanga (Retropinna retropinna) was taken in great quantities in most of our lakes with the kupenga, or seine net. They were also taken in an oval hoop net with a long wooden handle which went right across the net, and also in a small conical scoop net. The fishers who used these small nets waded near the shore. But the big net was generally used in the old days in Lake Taupo and Lake Rotorua, Lake Rotokakahi, and other lakes...

Toitoi (Gobiomorphus gobioides) is a small fish caught in the lakes, and like inanga was taken in nets…. Toitoi was also called titarakura and other names.

Pahore was another small fish found in the lakes like the toitoi.

Koeaea or whitebait was much thought of, and it is one of the nicest of all small fish….

Kokopu (Galaxias) was an important food among the people who lived inland..… The kokopu was generally taken on dark nights in summer and autumn….. Its flavour was not unlike whiting, and there were about six varieties.

The upokororo or grayling, of which there were the tirango, kutikuti, and rehe, were caught in traps when they were going up rivers after a flood while the water was still dirty. The upokororo was also taken in nets and by other means.

The Maori sometimes caught the patiki or flounder with a spear. The spear was made with a point at the end which was barbed. It was not unlike the spear used for catching birds.

Kakahi, the fresh-water mussel.

Eels were taken in a hinaki, eel trap, set at a pa tuna (eel weir), and with a bob, spear, or even with the hand..…

Marine species

The mango (shark) was taken, not only to eat, but for the teeth. The teeth of the mako shark, or some of its species, were used as ornaments and as cutting implements.

There were also hapuku (groper), tamure (schnapper), kanae (mullet), warehou (sea bream), moki, kahawai, kumukumu (gurnard), and other fish.

Sea crayfish were also taken by diving. Men and women were clever at the work of ruku koura, that is diving for crayfish among the rocks of the sea.

Kahawai (Arripis salar) was caught by trawling.

Hapuku (groper), another favourite fish, was also caught by trawling.

Kanae (mullet) was another favourite, which to me tasted like the mackerel I have eaten in England.

Whai or sting-ray was taken with a wooden spear.

Wheke or octopus if small were taken by hand from among the rocks. Should the wheke twine its many legs round the arm of the catcher, he puts his other hand underneath the body.

Seaweed

Karengo (Laminaria sp.) was a seaweed which grew on flat clayey tidal rocks. It grew in plenty on the east coast of New Zealand.

Rimurehia or rehia was an edible seaweed, gathered in the sea close to the shore, or on the beach, and cooked in a hangi and eaten.

Rimiparo was another seaweed gathered and cooked and eaten in the same way. In the summer it was sometimes eaten cold.

Plant species

The pungapunga, the yellow pua, or pollen of the raupo (Typha angustifolia) was mixed into cakes with water and baked. The pungapunga was gathered in summer when the plant was in full flower, and was obtained by shaking the dense flowering spikes gently. Raupo grows in swamps by the edge of streams and rivers and lakes. It has a sweetish taste. The middle part of the white succulent roots of the raupo, called koreirei, was also favoured as a food. It was generally eaten raw during the summer season.

The roots of the pohue (Convolvulus sepium) were dug up out of the ground, cooked in a hangi and eaten. The root was long and tough, and got after much trouble. It was quite good to eat.

6.3 Contemporary species

Many of valued species gathered historically that were of high nutritional value are no longer available in quantities sufficient to enable them to be a primary food source. The species identified during the interviews include:

Kakahi	Morihana	Cockles	Pipi
Toheroa	Tuatua	Lamprey	Mutton birds
Pupu	Eel	Flounder	Paua
Mussels	Crayfish	Oysters	Seaweed
Koura	Watercress	Puha	Hapuka
Mullet	Kahawai	Kingfish	Gurnard
Snapper	Moki	Shark	Tarakihi
Trevally	Whitebait	Trout	Kina

As Table 3 confirmed most species are perceived to be "fewer" in abundance and many iconic species are now only consumed on special occasions. The decline of the freshwater resources is of particular concern to Te Arawa. In addition to the reduced numbers, the condition of the kai may be compromised as well. Most distressing and representing a significant cultural loss, is the possible loss of entire species e.g., koaro, and morihana from some streams and lakes.

While whanau made use of many species, the centrality of koura and whitebait as a critical food source in the Rotorua Lakes is well known and is reflected in the initiatives to restore populations of taonga species. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round.

Food security implies adequate access to affordable, high quality foods that are culturally acceptable. However, introduced aquatic species were not seen by Te Arawa as substitutes of equivalent cultural, spiritual or nutritional value. This is supported by the fact that trout is not eaten by 11% of respondents. However if trout is the abundant species and requires less catch effort than the declining indigenous species gathered historically, it is inevitable that some substitution occurs. It is clear from our research that whanau currently gather kai at quantities less than they did historically and at quantities less that they desire. This is discussed in the next section.

6.3.1 Estimates of the quantity of kai consumed

There is little data available to enable calculation of pre-European (historic) contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. From Makereti (1938) we know:

Two meals were taken each day, the first about 9 a.m., and the other about 4 p.m..…

For the calculation set out below in Table 5 we have assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats in the lakes, especially Rotorua. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

It started to change - in the 70s. Okawa Bay was established in 1971 and it became a subdivision and when you look there, it is all a mixture of all nationalities, whereas Mourea is the old hapu (Informant E).

In the late 1970s, early 1980s when the seaweed and the little maggots, eh, in the lakes start to stink. And that, you know, gradually got worse and as the seaweed went away the stink remained, (Informant M).

The Kai Consumption Survey asked respondents to identify quantities of various types of kai consumed. For taonga species, the following calculations for the quantities for the respective species are considerably less:

	Contemporary consumption of whitebait	**Equals 5.7g per person per day**
	Contemporary consumption of mussels	**Equals 16.9g per person per day**
	Contemporary consumption of kakahi	**Equals 0.3g per person per day**
	Contemporary consumption of koura	**Equals 2.5 per person per day**
	Contemporary consumption of trout	**Equals 10.9g per person per day**

With respect to contemporary consumption, from the Kai Consumption Survey, all respondents still consume kai awa, kai roto, or kai moana. For the comparative analysis in Table 5 we have extracted the quantities of fish consumed from the Kai Consumption Survey data as well as the frequency data.

Table 5: Estimates of the quantity of kai consumed.

Kai consumption historically	Kai consumption up in twentieth century 1970s, 1980s	Contemporary kai consumption
Assumptions The data for estimating the quantity per sitting is that relating to "fish streamed or grilled[9]". At least one meal of "kai gathered" per day per person. Because of the abundance compared to the present, at least 10% more per setting would be consumed compared to today's per sitting estimates. 219.44g per sitting per day. Plus 10%.	Assumptions The data for estimating the quantity per sitting is that relating to "fish steamed or grilled". At least 3 meals of "kai" per week per person. The quantity per sitting would be the same as today's per sitting estimates of 219.44g.	Assumptions The data for estimating the quantity per sitting is that relating to "fish steamed or grilled". The quantity per sitting would be the same as today's per sitting estimates of 219.44g. Special occasions are estimated to be 6 per year. Less than once a month is estimated at 9 per year (which accounts for 11.8% of respondents). 52.9% eat kai 1-3 times per month. 17.6% eat kai once a week per month. 5.9% eat kai twice per week. 5.9% eat kai 3-4 per week. 5.9% eat kai 5-6 per week.
Equals 241.38g per person per day	**Equals 94.05g per person per day**	**Equals 36.20g per person per day. This is similar to the average New Zealand consumption of 32.87g per person per day (Kim and Smith, 2006).**

For the taonga species, the following observations can be made

The quantities available fall far short of historic levels and the levels desired by whanau who wish to engage in mahinga kai practices. The species that possibly approach adequate abundance are mussels which respondents confirmed were available and often sourced from the supermarket or takeaway.

You don't go out and get any watercress anymore, your river has become Pak'n Save (Informant M).

[9] It is assumed that the "fish fillets" estimate would apply for butterfish, greenbone, kanakana, eels, founder, hapuka, mullet, kahawai, kingfish, gurnard, snapper, moki, shark, trevally and trout.

I mean, we have got to the stage we are feeling directed to go to supermarkets and buy from there, it is more convenient (Informant E).

We get our bulk food from the supermarket, whether that's vegetables, it's fish, seafood. Everything comes from the supermarkets. It is totally different today. We have no control over that. We aren't able to go out and get koura like how we did - it is a thing of the past (Informant E).

- For almost every species, the majority of respondents believed that the abundance of populations was declining.
- The majority of kai species are now only consumed on special occasions.
- The quantities of kai consumed have steadily decreased:
    - from approximately 241g historically;
    - to about 94g in the mid twentieth century;
    - to approximately 36g today.

These observations are supported by the statements of whanau -

Last time I had a feed of koura…. was six years ago (Informant B).

I haven't had one [koura] this year. I haven't had one this year. You see, like now what has – you know, you have got the sediment, you have got all the paru in the lake. The other thing you also got is the bottles, eh? And so guys are using those for koura, eh. Used to, but now the hapu have stopped all that – told those guys, eh? You know, and the only place you can get real good eating koura is here and here (Informant M).

Yet for some whanau consuming kai remains a treat and one kaumatua described the behaviours of his mokopuna:

Man, you ought to see them with bloody kinas. They eat kinas…Kinas, mussels, anything like that; they'll get into them (Informant C).

6.3.2 Sites at which kai gathering and other activities are undertaken

Historically different parts of the region were renowned for supplying prized resources. Often sites from which specific resources were gathered would be given a name e.g., it is recorded that in Lake Okataina each of the best mussel beds had its own name.

In the paragraphs that follow we summarise the features of some the lakes, plus the Kaituna River and Maketu that appear in historic references. Makereti (1938) explains:

> *Fishing grounds belonged to the hapu which owned the land going down to a lake or along a river, and were marked by posts as described in the account of sea fishing. In Lake Rotorua about half-way between Owhata on the mainland and Mokoia Island was such a post, called Hinewhata. My ancestors Wahiao and his father Umukaria who lived at Owhata used this post for tying their fishing nets on when they were getting inanga, and they also tied on bunches of fern for catching koura, or crayfish.*
>
> *In the old days inanga was taken by the hapu of Tuhourangi from Otamakari on the north of Tarawera Lake, Owhaia and Te Puna north of Tarawera, Te Manuka at the same place, Waitangi to the north-west, Parahamutu, Rahuiroa, Terapatiki, Matakana, all near by, from Kariri and Punaromia, from Waitoharuru (Wairoa Falls), and Karikaria close by, from Hawaiki on the south-west of Tarawera Lake, from Taneroa, from Whangaruru on the peninsula, from Te Ariki, from Tutaiinanga on Paeroa block, from Motutawa, and from all round Rotokakahi Lake at Okareka, on the west side of Otaku. All these were ancient fishing grounds.*
>
> *My people in the Lakes district, at Rotorua, Rotoiti, Okataiua, Tarawera, Rotokakahi, and other lakes, took the koura in many ways.*

In recent decades concern has been expressed at the deteriorating condition of the lakes, in particular Lake Rotorua where weed growths, scum, algae blooms, sedimentation and mud build up on the lake-bed, and poor water clarity have been experiences. During the 1970s it was recognised that water quality was deteriorating in Lake Rotorua because of increased nutrient loads - notably from treated sewage, streams draining pasture, and aerial top-dressing (Hamilton, 2003).

During the 1980s lake water quality targets for Lake Rotorua were adopted by the regional council, the decision was made to stop directly discharging treated sewage to

the lake, and nutrient load targets were set for sewage-derived nutrients. These initiatives saw improvements in lake water clarity, nutrient and chlorophyll concentrations from the early 1990s, but since then lake water quality has again deteriorated. Most of the decline is attributed to increasing nitrate in streams that drain agricultural land and the amount of nitrates that are locked up in the lake bed sediments.

This impacts a range of uses, including kai gathering. The outflow of Lake Rotorua is through the Ohau Channel which leads into Lake Rotoiti which in turn flows out and down the Kaituna River that flows about 50 km to enter the sea near Maketu. Degradation in one waterbody inevitably degrades others connected to it. Dr Edward White[10] explained that Lake Rotoiti shows significant “deterioration for a lake as large as Rotoiti. I see no prospect of either arresting this deterioration or of restoring the lake, without reducing the quantity of nutrients entering Lake Rotorua".

Ohau Channel

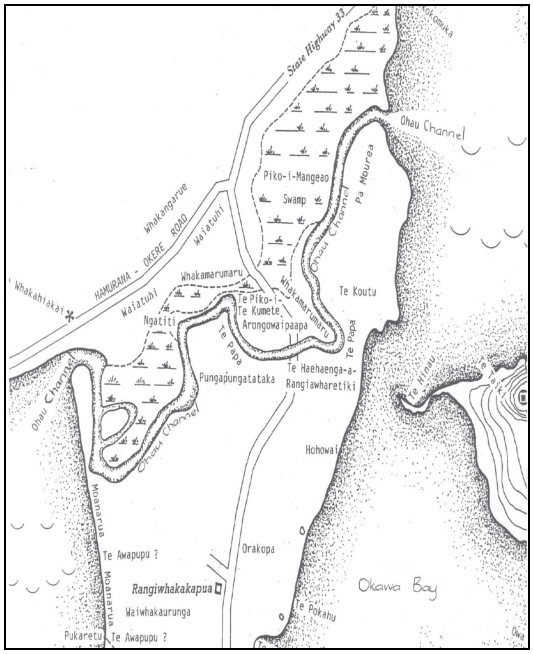
Whitebait were a commercial resource, being sold and traded. Mair reported that from around 1860 to 1919 he had seen Ngati Pikiao netting koaro in the Ohau channel Figure 48), sun-drying them, storing them for winter use, and bartering them profitably with West Coast tribes.

A resource kete from Environment Bay of Plenty (EBOP, 2010a, b) provides statements from a kaumatua who recalls her early childhood days living beside the Ohau Channel.

[10] Dr White was leader of the Freshwater Section of the Dept. of Scientific and Industrial Research who gave evidence to the Waitangi Tribunal on the health of Lake Rotoiti.

A crystal, clear, swift flowing river fringed with raupo, manuka scrub, grassy banks and paddocks, overhanging willows and dotted here and there with the odd domestic wharf, boatshed and kainga. It was a haven for wildlife, a rich food basket, a natural environment of wetlands and a place of historical and spiritual significance. It was a 'paradise' especially in the warmer months. Children would spend all their time swimming against the strong current, diving off banks, catching cockabullies in the shallows, hunting for frogs and tadpoles in the swamps, paddling the old Māori river canoes up and down and hunting for the best jackstones on the beds of shingle. Even then there were signs of human activity and land use upstream and downstream that would soon impact on this idyllic waterway. From the mouth at Lake Rotorua to the outlet at Lake Rotoiti, the river twisted and turned carrying a strong current of crystal clear waters, which provided a host of water activities including trout-fishing, boating and swimming in contrast to the traditional methods of fishing for inanga and koura and the gathering of kakahi.

Figure 50: The area around the Ohau Channel.



Swamps teemed with frogs and tadpoles while kotare above waited patiently to swoop down on unsuspecting prey. Noisy pukeko made untidy nests in the dense raupo, and fantails flitted among the manuka while the shy matuku stood still and erect perfectly camouflaged against a background of rushes and sedges. Pied stilts picked their way along the muddy flats while water rats hid among the debris and undergrowth.

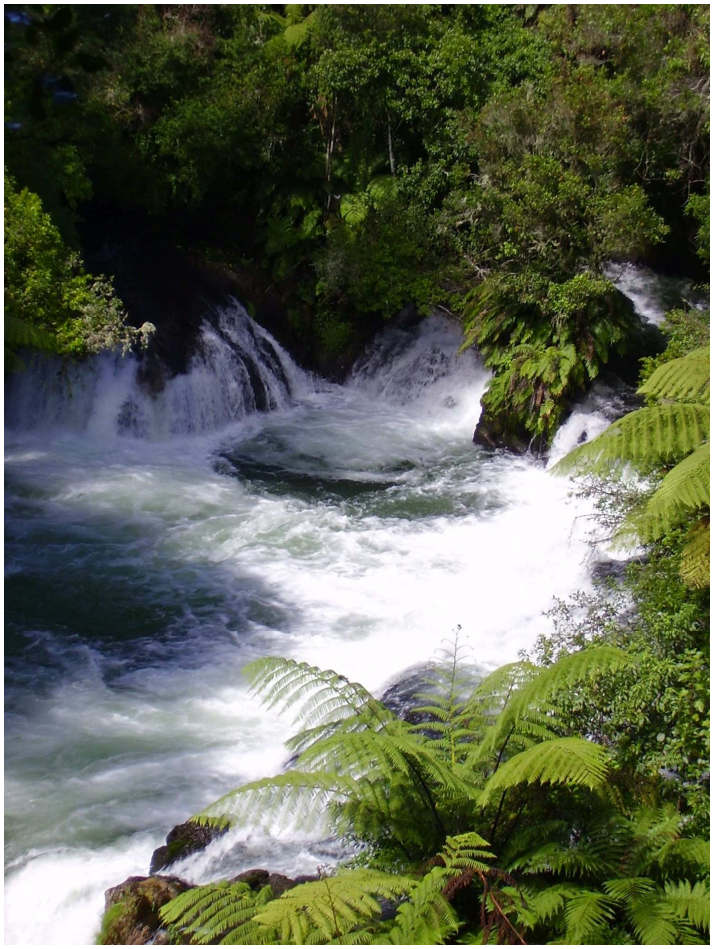
The old red, painted, wooden bridge that spanned the main road from Rotorua to Tauranga was a popular 'hangout' for the local swimming and diving champions. Many households drew water from the channel for domestic use and the washing of clothes in the river was a normal activity. Food scraps and other rubbish were often thrown unwittingly into the river.

Night hunting for koura or 'hi koura' was popular with the kids, who used long manuka sticks baited with threaded worms to entice the koura out of their holes in the banks. As soon as a koura attached itself to the bait the stick would be slowly drawn up to the surface and grabbed with bare hands or netted.

It's getting worse. 70s, 80s – it's getting worse. It got to the stage where my mother and father said "I don't want you going swimming because it's polluted" (Informant E).

Kaituna

The Kaituna River is famous for the pools in its upper reaches, the Okere falls not far from Lake Rotoiti and for the rapids and waterfalls. It discharges to the Maketu Estuary on the coast of the Bay of Plenty. Historically the river was valued for aquatic recreation, for gathering duck, and plants of many kinds (many of special value and importance, some species being rare) that grew along its banks. These were used for medicinal purposes, weaving, dyeing.



The place called Te Wai-i-rangi, (a lovely clear pool from which the river flows on into a green tunnel of vegetation), was, the place where those returning from battle would go to bathe and remove the tapu. Burial caves line the river in the steep gorge reaches.

Maketu

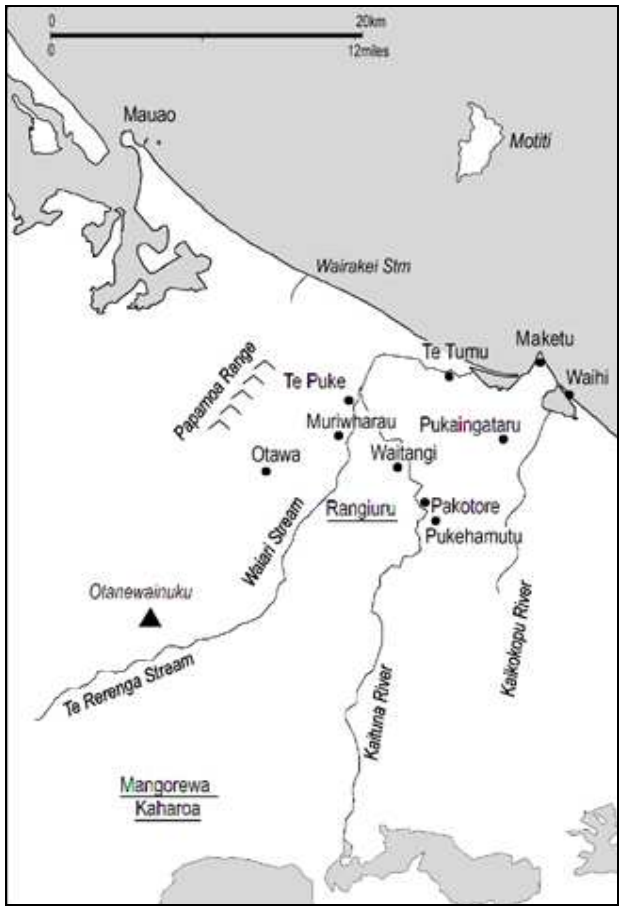
> *The tribes or hapu who owned land down to the sea would own the fishing rights for some distance out to sea. A stake would be put in at each end to mark the boundary line on each side, and these might be a few miles, or many miles apart. The stakes prevented any outsider from fishing in the waters. Only the members of the hapu, or of the several sub-hapu, who owned the land would have any right here. The Maori had names for each fishing rock, ground, or bank which belonged to a hapu, and called them all by name. Some of them were eight or ten miles out in the deep water. The Maori knew all the signs of a good fishing ground.*
>
> *Their fishing grounds were sometimes five, eight, or more miles away.*

Maketu remains important as a place where tupuna walked.[11] It was identified as the site of Tokaparore/Takaparore, the rock (or possibly anchor stone) to which the Te Arawa waka was tied when it first arrived. The Maketu Estuary has always been significant for Te Arawa. The stern anchor of the waka is said to have been placed at Te Awahou, roughly where the Kaituna River flows out to sea today following the diversion cut that was made in 1957. The bow anchor was set down at about the place where the Kaituna River used to flow out to sea at Maketu. The importance of Maketu to Te Arawa therefore can be traced back to their arrival in New Zealand.

The Kaituna River and the estuary at Maketu, were rich in kai awa and kaimoana respectively, providing fish, shellfish, eels, fresh-water crayfish (koura) and many other kinds of food.

Dr Ballara's evidence (Ballara, 2004) to the Waitangi Tribunal noted the range of natural resources in the Maketu area and its strategic importance as a point where communications routes converged. Figure 52 shows the area in the vicinity of Maketu.

Figure 51: The Maketu area.



[11] Don Stafford and Raewyn Bennett evidence to Waitangi Tribunal.

After the Kaituna River diversion cut was made the main flow of the river no longer ran through the estuary, and the resultant deterioration is of concern to Te Arawa. In the context of the present research this is significant given there is a perception that shellfish there may not be fit for human consumption because of contamination issues arising from the lack of flushing.

The health of aquatic resources has impacted kai gathering. Although the alienation of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and believed that the most damaging changes have occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change. Yet, as the interviews and Kai Consumption Survey show, many Te Arawa continue to gather and consume kai awa, kai roto and kai moana. But as the following tables show patterns of usage have changed.

Table 6: Numbers of lakes from which different species gathered[12].

Species	Historical	Today
Trout	12	9
Mussels	6	2
Morihana	-	-
Koura	10	8
Watercress	5	6
Puha	-	-
Inanga	3	7
Lamprey	2	1
Eel	5	6

While Table 6 suggests that the distribution of all species has changed, this information needs to be considered alongside Table 7 which provides greater clarification as to how the different lakes have been impacted by changes in gathering patterns. The increased fishing pressure on Lake Rotoiti is evident as the number gathering at Rotoiti have increased across all species. The other obvious changes are the decreased levels of gathering across all species in Rerewhakaaitu and from the streams in the area.

[12] These numbers are based on the results of the Kai Consumption Survey and refer specifically to the sites of gathering, not from species distribution surveys that tell us the sites where these species are known to be.

Table 7: Trends in the number of respondents gathering different species at each of the lakes.

Lake	Watercress	Trout	Kakahi	Inanga	Koura	Eel
Rotoiti	↑	↑	↑	↑	-	↑
Tarawera	-	↑	↓	↑	↓	↑
Rotorua	↑	↓	↓	↑	↓	↑
Rotokakahi	-	↓	-	-	↓	↑
Okataina	↑	↑	-	-	↓	-
Rotomahana	-	↓	-	-	↓	-
Rotoma	↑	↓	-	↑	↓	-
Rerewhakaaitu	↓	↓	↓	-	↓	-
Okareka	-	-	-	-	-	-
Rotoehu	-	-	-	-	-	↓
Ohau Channel	↑	↑	↑	↑	↓	-
Streams	↓	↓	↓	↓	↓	↓
Coast	-	↓	↓	↓	-	↑
Tikitapu	-	↓	-	-	-	-

Table 8 that follows focuses on 3 of the lakes – Rotorua, Rotoiti and Tarawera and shows the magnitude of the changes. Although those gathering inanga from the lakes shows an increase we are unsure whether they mean whitebait or the adult stage.

Table 8: Changes (shown as a %) in the number of respondents gathering different species at each of the lakes.

	Rotorua	Rotoiti	Tarawera
Trout	↓ 18.7	↑ 5.40	↑ 8.10
Mussels	↓ 33.3	↑ 33.3	↓16.70
Morihana	-	-	-
Koura	↓ 10.4	same	↓ 10.40
Watercress	↑ 42.0	↑ 20.3	-
Puha	↓ 9.80	↑ 8.30	↓ 7.70
Inanga	↑ 14.3	↑ 23.8	↑ 14.3
Lamprey	-	-	-
Eel	↑ 18.20	↑ 16.2	↑

In the tables that follow, we present information for each of the lakes and provide a relative ranking (present and past (in brackets) of the importance of gathering activities for each species across all lakes.

Figure 52: An aerial photograph showing the location of the respective lakes.

An aerial view of Lake Rotorua

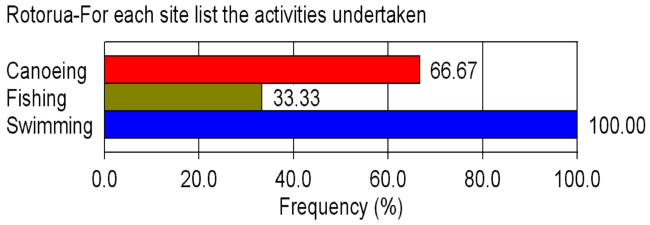
Table 9: Summary of Lake Rotorua.

Trends in gathering activity		**Present day rankings**	
Trout	↓ 18.7	Trout	3rd (2nd)
Kakahi	↓ 33.3	Kakahi	- (2nd)
Koura	↓ 10.4	Koura	2nd (2nd)
Watercress	↑ 42.0	Watercress	2nd (2nd)
Puha	↓ 9.80	Puha	2nd (1st)
Inanga	↑ 14.3	Inanga	3rd (-)
Eel	↑ 18.20	Eel	4th (-)

I wouldn't touch watercress in the Lake Rotorua, …, I just think it is too suspect …I don't know that there is a lot of watercress around - like I think there is where the natural springs are, I think there is watercress there, but as you are coming around Lake Rotorua, I shouldn't imagine that there would be that many spots left to actually pick watercress from anymore (Informant J).

They used to catch inanga around the edge of the lake….But now you don't see that, I mean not only that, the water is so murky you can't see them, but yes, we used to catch a lot of inanga, I tell you (Informant B).

Other activities: 33% of those who go to the lake fish. In contrast everyone who goes to the lake swims.



Rotorua now, we haven't swum there for ages (Informant A).

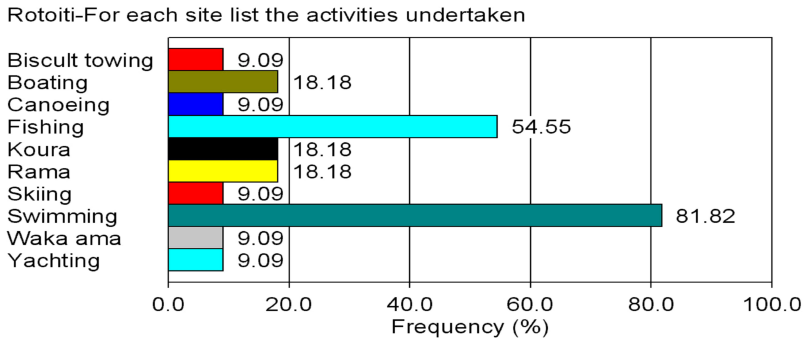
I wouldn't swim in it. I had EBOP down there just over the winter. They actually took photos of the amount of junk that came out of that lake onto our back lawn. So I wouldn't – I get a lot of tourists coming down to our village and they ask can they go for a swim. I just say, "No, don't bother" (Informant D).

Photos of Lake Rotoiti

Table 10: Summary of Lake Rotoiti.

Trends in gathering activity		Present day rankings	
Trout	↑ 5.40	Trout	1st (1st)
Kakahi	↑ 33.3	Kakahi	1st (1st)
Koura	same	Koura	1st (1st)
Watercress	↑ 20.3	Watercress	1st (1st)
Puha	↑ 8.30	Puha	1st (2nd)
Inanga	↑ 23.8	Inanga	1st (2nd)
Lamprey	-	Lamprey	-
Eel	↑ 16.2	Eel	2nd (3rd)

Other activities: Clearly a range of activities are undertaken, including a range of recreational activities. Fishing and gathering koura, including rama koura, feature strongly**.**



Setting a 'tau' in the lake was the most popular method of gathering this delicacy [koura]. *During the summer months bundles of raurauhe were cut, tied together and left to dry. These were then tied to a long main line and dropped into the lake bottom at about six metre intervals. Marker poles stood in the lake to identify the place of each family's tau. After a few weeks the ferns would be carefully drawn up out of the lake and shaken onto a korapa. In no time a large quantity would be caught and taken home for the 'weekend lunch or dinner'.* (Makereti, 1938)

Rotoiti, we have been known to swim … even in recent years, we come back and my kids jump out of the car, dive into it. We know full well that the lake is not well and it is so hot they just duck into the lake there and have a jump around and duck back in (Informant A).

Then you had puha …. We used to just go around the hills, all over the place collecting puha. And then there was watercress, all the creeks running into Lake Rotoiti were full of watercress. (Informant E)

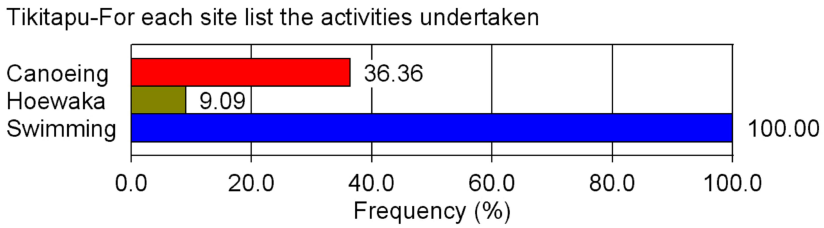
Photos of Lake Tikitapu

Lakes Tikitapu (foreground), Tarawera (left background), and Rotomahana(centre background) are all visible in this eastward-looking view.

Table 11: Summary of Lake Tikitapu.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	-	Kakahi	-
Morihana	-	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities: Everyone who goes to the lake swims. Canoeing is another popular activity.



Tikitapu, the Little Blue Lake …is the most picturesque lake in the district and owes much of its attractiveness to the magnificent forest which clothes the hills on its northern and western sides.
Raupo (Typha sp.) occurs in small quantity at the north end of the lake; it is so extremely rare in the district, that the whare are usually constructed of sedges and grasses.
We were mostly at Lake Tarewera and Lake Tikitapu…In summer time we'd probably be out at Tikitapu probably once, at least once a week (Informant F).

Photos of Maketu

Table 12: Summary for Maketu.

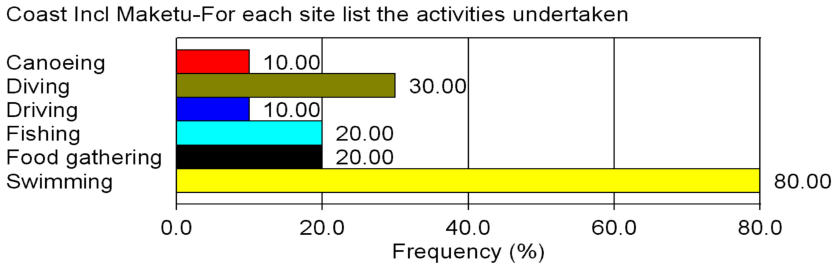
The kina and paua, crayfish and we go fishing and the main species are kahawai, snapper and gurnard fish…. Usually every long weekend we'd head to the coast for that. But since the fuel increases and so and so it's not as often… (Informant F).

Because when the whole river was coming through here, I remember I've been coming here since the 50s, as a kid, and all the fishing boats used to come in here …But all the fish used to come in here…..There stingrays, there were sharks, there were – everything was coming through here, kahawai and everyone just fishing here at the outlet. And now they're all fishing up at the cut .. Well, there's only pipi at the moment because all our tuangi have gone and pupus that we used to have in abundance have all disappeared (Informant K).

Trends in gathering		Present day rankings	
Trout	↓	Trout	6th
Kakahi	↓	Kakahi	- (4th)
Morihana	↓	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	↓	Puha	- (3rd)
Inanga	↓	Inanga	2nd (1st)
Lamprey	↓	Lamprey	1st (1st)
Eel	↑	Eel	3rd

It was in abundance, it was growing so fast that even our people couldn't keep up with it (Informant K).

Other activities Maketu is a popular swimming site.



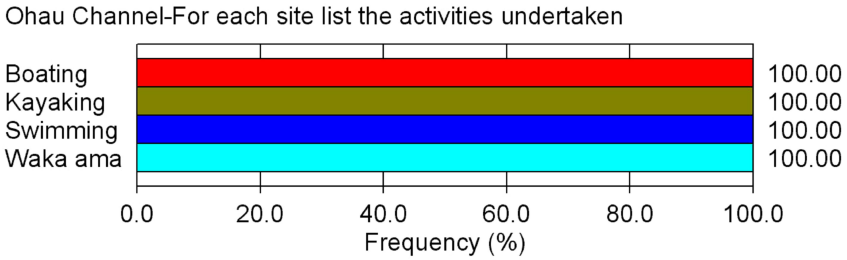
… the return of the estuary is vitally important and it's only because of the food bowl … It'll be entirely different. The outflow would be different and therefore it would – it'll only create a channel in certain areas. A channel will be created, so it wouldn't be the pristine that you'd want once upon a time. So that's the – which is very sad that it cannot be brought back the way that we wanted to ….But there's not enough volume of water actually coming through the system, actually it's only a trickle, and very disappointing really – very disappointing that way (Informant K).

Another area we used to frequent was the Maketu… especially in the summer you would want to go over there and collect pipi and mussels, and also we got family at Motiti Island, so it would give us any reason to go to the beach because it was a good - Newdicks was quite a popular place back then… I hardly see cockles now…Maybe even like try to increase the flow a little bit so that it is – well, you know, I do not know whether to narrow it or add some rock or that sort of - - -(Informant H).

Trout fishing in the Ohau Channel

The Ohau Channel today

Table 13: Summary for Ohau Channel.

<table>
<tr><td rowspan="10">My mother used to go out and she would get into her garden and she'd get all these worms, and she would bundle these worms up using a needle and thread. She would thread through the worm and create a bundle, and that is what we would use for our bait to catch the koura in the Channel - at the end of a willow stick. Oh, we used to love it because we would just quietly watch the koura grab the worm and then we would put the stick up and then catch it with a fish and chip container (Informant E).</td><td colspan="2">Trends in gathering activity</td><td colspan="2">Present day rankings</td></tr>
<tr><td>Trout</td><td>↑</td><td>Trout</td><td>-</td></tr>
<tr><td>Kakahi</td><td>↑</td><td>Kakahi</td><td>2nd</td></tr>
<tr><td>Morihana</td><td>-</td><td>Morihana</td><td>-</td></tr>
<tr><td>Koura</td><td>↓</td><td>Koura</td><td>8th (8th)</td></tr>
<tr><td>Watercress</td><td>↑</td><td>Watercress</td><td>6th</td></tr>
<tr><td>Puha</td><td>↑</td><td>Puha</td><td>6th</td></tr>
<tr><td>Inanga</td><td>↑</td><td>Inanga</td><td>8th</td></tr>
<tr><td>Lamprey</td><td>-</td><td>Lamprey</td><td>-</td></tr>
<tr><td>Eel</td><td>↓</td><td>Eel</td><td>-</td></tr>
<tr><td colspan="5">Other activities - The channel is still used for a range of recreational activities.
 
</td></tr>
<tr><td colspan="5">The Ohau Channel. I always felt that was my birth place, and my bedroom was right against the Channel and it was paradise. We saw a lot of things that other people just talk about, but we experienced everything on the Channel, and that was our food basket as well as Lake Rotoiti and Lake Rotorua ….We have lost that current - it was a very swift current flowing through the Ohau Channel and the children - we used to challenge that flow of water when we were swimming because half the year we would be in the Ohau Channel swimming. We spent a lot of time swimming, back and forwards from Lake Rotorua, down to Lake Rotoiti. We were the best swimmers … I put it back to we were born on the Ohau Channel - we were natural swimmers (Informant E).

Ducks and birds - when I was living on the Ohau Channel we had the Mataku, beautiful. We had the Shag and they would sit in the trees just watching down on the Ohau. When everything started happening, like the inanga would run, well, you would just see them darting down onto the water.. And the crying, it was something I missed when I went away from home - the call of the birds and the cry - it is something totally different. You could hear the water flowing past your home. My bedroom was right against the Ohau Channel, and that was a sincere sound, it is a sound you don't often hear (Informant E).</td></tr>
<tr><td colspan="5">Other kai consumption survey results: All those who gather at the Ohau Channel have changed how they gather kai because of contamination of sites they used to gather from.</td></tr>
</table>

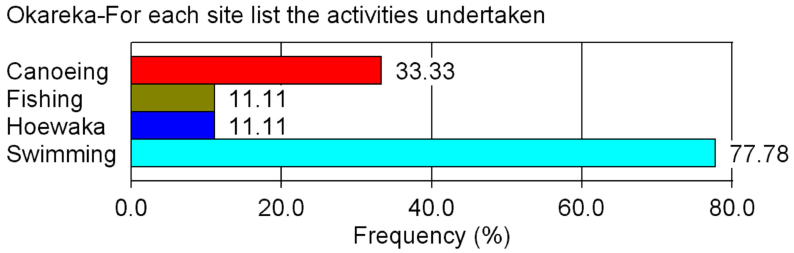
Photos of Lake Okareka

Table 14: Summary of Lake Okareka.

There is no gathering at the lake as it is wai tapu.

Trends in gathering activity		Present day rankings	
Trout	-	Trout	-
Kakahi	-	Kakahi	--
Morihana	-	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - As with the other lakes Okareka is popular for swimming.



The biggest ones [koura] *I have struck here in the Rotorua Lakes, when I used to dive the lakes, was Lake Okareka … Water skiing "Blue Lake….. Okareka, Rotoiti and Tarawera" (Informant D).*

And also the Green Lake, even though you are not supposed to fish in the Green Lake because of our links to that area, you can get access to those areas (Informant H)..

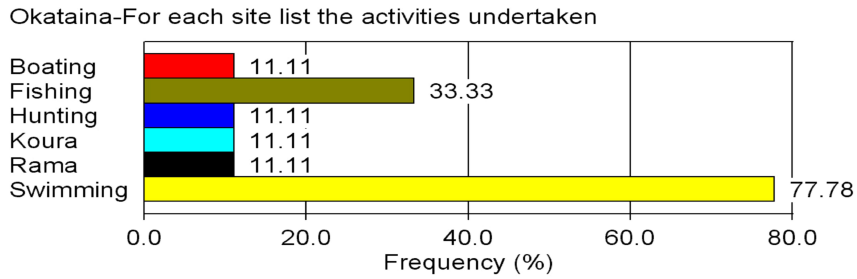
There are those beautiful picturesque moments that - like, I love going down to Lake Okataina and Lake Okareka, in summer they are the places that are a little bit hard to reach, I think, are probably a little bit more worth the effort to get there (Informant J).

Photos of Lake Okataina

Table 15: Summary of Lake Okataina.

Trends in gathering activity		Present day rankings	
Trout	↑	Trout	5th (6th)
Kakahi	↑	Kakahi	--
Koura	↓	Koura	7th (7th)
Watercress	-	Watercress	5th
Puha	-	Puha	5th
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - are very similar to the results for Rotoiti.



So, yes, so generally there are a lot of us and, like, when we went out here to Okataina there was a whole heap of us, so it is just something that we do as a family. Yes, so I suppose that is the beauty of your water is it always connects you in one way or another, and so, yes, that is why we tend to do things in droves, and also it is always more fun when there are heaps of you when you are going out swimming. You know, my children aren't fighting with each other and I have got all these other people to help (Informant J).

Other kai consumption survey results: All those who gather at the lake have not changed how they gather kai because of contamination of sites they used to gather from. All those who gather believe the kai gathered is not dangerous because of pollutants.

Photos of Lake Rotokakahi

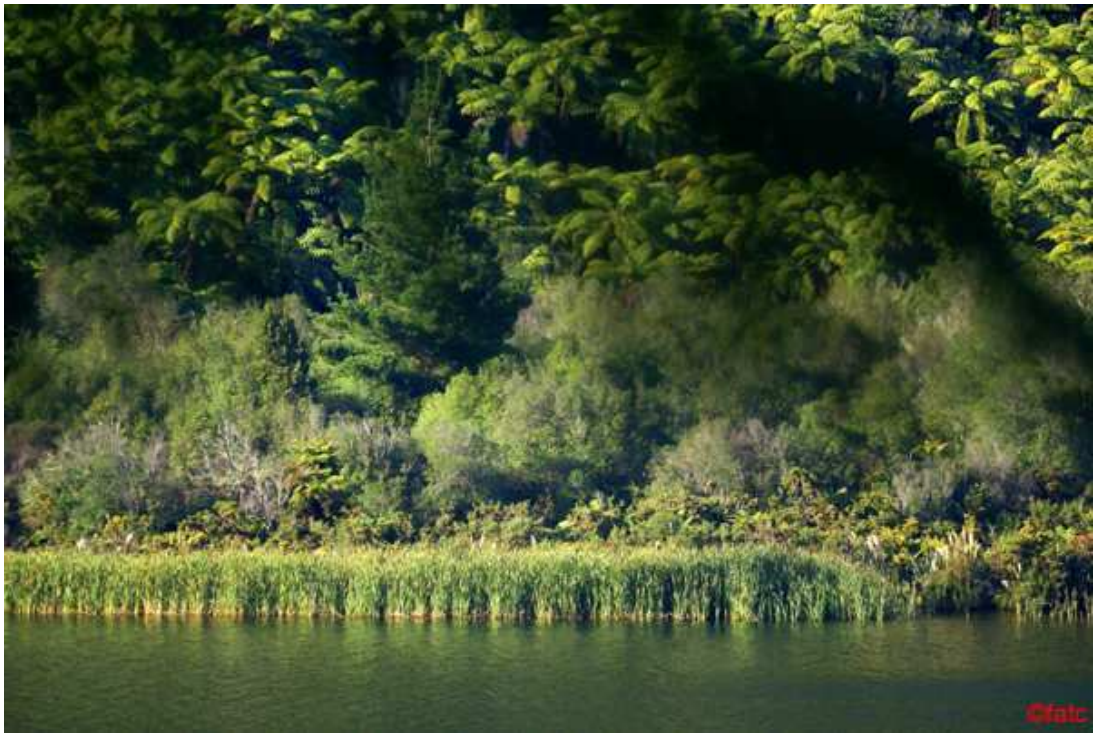
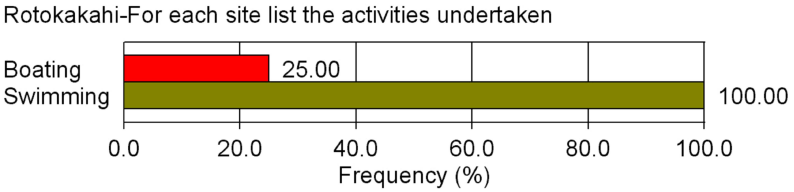


Table 16: Summary of Lake Rotokakahi.

Trends in gathering activity		Present day rankings	
Trout	↑	Trout	4th (4th)
Kakahi	-	Kakahi	-
Morihana	-	Morihana	- (2nd)
Koura	↓	Koura	5th (5th)
Watercress	-	Watercress	
Puha	-	Puha	
Inanga	-	Inanga	
Lamprey	-	Lamprey	
Eel	↑	Eel	6th

Other activities - All those that go to the lake swim there while a quarter of them go there for boating.



Other kai consumption survey results:

All those who gather at the lake have not changed how they gather kai because of contamination of sites they used to gather from.

Photos of Lake Rotomahana

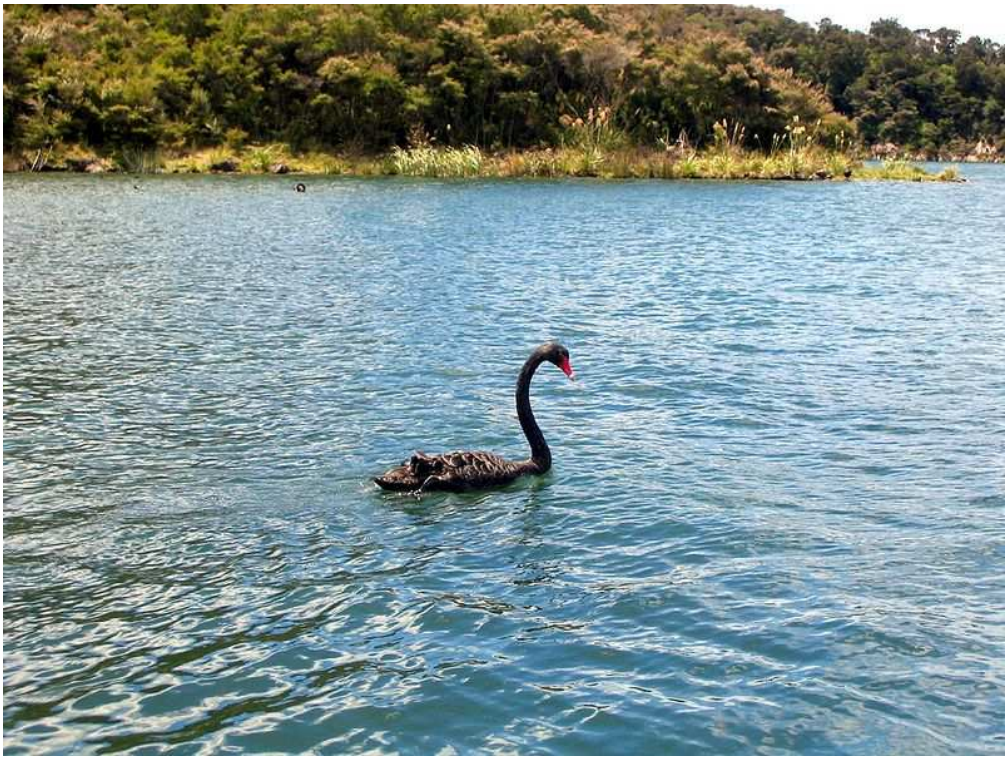
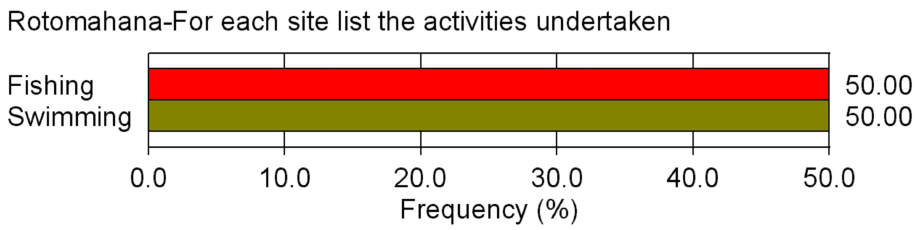


Table 17: Summary of Lake Rotomahana.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	- (5th)
Kakahi	-	Kakahi	-
Morihana		Morihana	-
Koura	↓	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	- (3rd)
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - Swimming and fishing are the two activities at Rotomahana.



Rotomahana is a funny lake, it is coloured all the time. Some places it is green. But I think Rotomahana you may have to be careful of (Informant A).

Rotomahana, they swim there (Informant A).

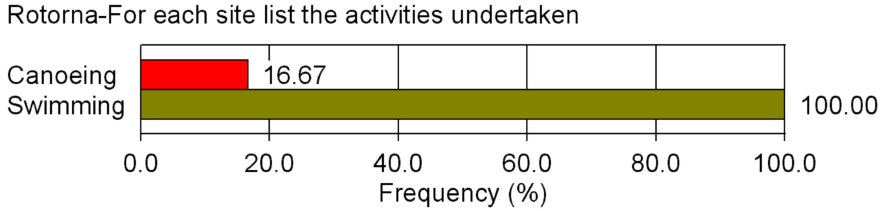
Rotomahana is of small size, its greatest diameter being less than a mile. From the numerous swamps which surround it the absence of wood, the dirty green colour of the water and the stunted aquatic vegetation which certainly exists under unfavourable circumstances the first view of this remarkable lake is strangely disappointing (Kirk 1872).

Photos of Lake Rotoma

Table 18: Summary of Lake Rotoma.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	-	Kakahi	-
Morihana		Morihana	- (2nd)
Koura	↓	Koura	4t (4th)
Watercress	↑	Watercress	3rd (4th)
Puha	↑	Puha	3rd (3rd)
Inanga	↑	Inanga	4th
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - All those who go to Rotoma go swimming.



I suppose the ones where there has been minimal development has always been - the lakes are still in a very similar quality, like Lake Rotoma, when I go out there I have swam and I have jumped off the rock or the cliff out there. It is still really similar to how I remember it as a child. The water quality, you know, it is beautiful, but as you are getting into more densely populated areas you really notice the poor quality of the lakes and the effect that that population has had on them (Informant J).

Because that is where all the morihana used to be in that lake, mind you they were in all the lakes but the Rotoma was known for that (Informant F).

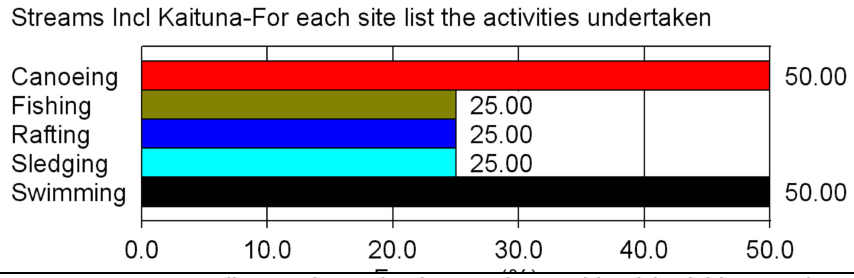
It was certainly Lake Rotorua and going down the Utuhina Stream…. and every now and then we would go out to - more often than not - Lake Rotoma to swim at the point and my grandfather was a keen fisherman, so there was a fishing club out at Lake Rotomahana that I used to go to as a child as well… (Informant J).

Fishing for whitebait on the Kaituna River (1931)

Table 19: Summary for streams.

Species gathered today	**Trends in gathering activity**		**Present day rankings**	
	Trout	↓	Trout	7th (7th)
	Kakahi	↓	Kakahi	-
	Morihana	-	Morihana	-
	Koura	↓	Koura	6th (6th)
	Watercress	↓	Watercress	4th (3rd)
	Puha	↓	Puha	4th
	Inanga	↓	Inanga	7th (3rd)
	Lamprey	↓	Lamprey	- (2nd)
	Eel	↓	Eel	5th (2nd)

Other activities



That Purenga stream… was yellow …down the bottom has a bit of bad history where council was allowing the raw sewerage to go out into the lake; years of it built up (Informant A).

Hamurana is crystal clear and it is full of phosphorous and, of course, the lake programme has to do something about that, (Informant A).

Utuhina - *even the flow of the river is quite different, so it would be good to have testing from the river because, I think, as you are coming further downstream and into the Lake, just the whole vegetation, … when I put my feet into the ground of the river on the Utuhina River, it is revolting. It is not like a clay, it is not even a mud. I can't even describe it. But it has that type of feeling to it (Informant J).*

I wouldn't let my children swim in there. The quality of the water is disgusting and it is unsafe. …. I can remember swimming in the Utuhina Stream as a child and it was lovely and clean and fresh, now to hop in it you can feel all the clay and all the silt that sits on the bottom and it is not very nice (Informant J).,
I think to go out in the areas I used to as a child where we used to gather - and I am talking about Rotorua predominantly - to gather koura, I don't believe there is any. So having gone down just to probably, I don't know, about five years ago, having gone down to take the children through the experience, there weren't actually any koura in places that we used to go to as children. So the rama koura did … I think even if we had have come across koura, I wouldn't have let the children eat them anyway (Informant J).

The Utuhina River between the Utuhina Bridge … when I was growing up it was a pristine river at that time….The river flow was excellent, clarity was excellent. We could even drink out of it …I learnt how to swim in the river, and I did all right, too, as a swimmer. Did no formal training. Because it had a good current, it had a good flow and you could actually just swim at a constant pace and stay in the same area. And we had a swing across the trees, because the trees used to – oh, we had willow trees but they sort of intertwined and you could – we had a swing.. but it was mainly our playground there ….And there was like little hotspots in the river, too. Like there was a lot of thermal underneath and it was in that whole area, so you had to sort of know where to put your foot and all the rest of it, and you were warned of areas where you shouldn't go and swim. But it was great (Informant H).

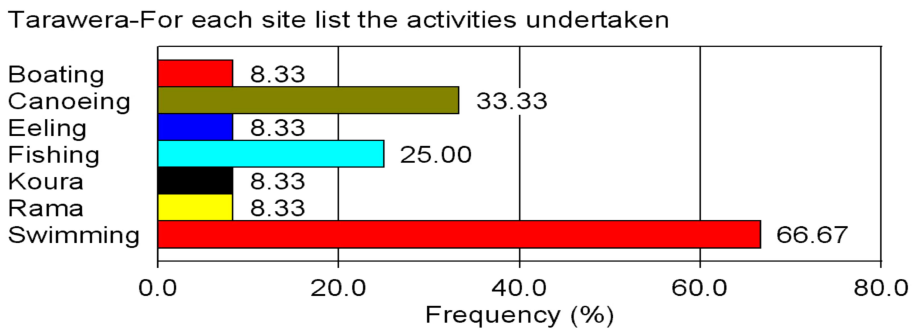
That silt build-up .. It would stick to your feet and then it was sort of like, "Oh, I want to go to the Aquatic now". Probably to Hamurana and Hamurana Springs there. That is still a nice river to swim in. Even now we still take our kids out there, because it is a nice spring and we went to the origin of that spring, as well, you know, just to show the kids, you know? (Informant H).

Photos of Lake Tarawera

Table 20: Summary for Lake Tarawera.

Trends in gathering activity		Present day rankings	
Trout	↑ 8.10	Trout	7th (3rd)
Kakahi	↓ 16.70	Kakahi	- (3rd)
Morihana	-	Morihana	- (2nd)
Koura	↓ 10.40	Koura	6th (3rd)
Watercress	-	Watercress	4th
Puha	-	Puha	4th (3rd)
Inanga	↑ 14.3	Inanga	7th
Lamprey	-	Lamprey	-
Eel	↑	Eel	1st (3rd)

Other activities - Eeling is specifically identified as an activity. Swimming and recreational activities are popular.



Tarawera, although the lake appears to be clear it still has its problems. We still have algae bloom over there …Tarawera, yes, but I would be very cautious in the summer time when the weather is hot and the algae starts to come up to the surface. We have that problem in Tarawera, although we are not treated as high a risk of other lakes, but I think the council is on to it (Informant A).

We would go to Tarawera where generally most of the swimming .. So, you know, I don't allow my children to wet their hair in the water in Lake Rotorua, I don't know, it is just certainly not the same sort of quality that I remember as a child and I wouldn't - Lake Tarawera is not so bad, but the inlet where we used to go to as a child to collect koura, there is a whole oil - I suppose because there's the big boats that sort of launch there, I think that it has had an impact. So where we used to previously go to get koura at that inlet, from last having had a look, and my husband went down and he had the goggles and the snorkels and had a really good look around, we couldn't find any, and that is just in the inlet area, but we haven't gone any further to have a look at that to see the impact on it. But, just in the areas we used to go immediately to because it was easy access, we haven't been able to find any of that - particularly koura - in those areas (Informant J).

Table 21: Summary of Lake Rotoehu.

Trends in gathering		Present day rankings	
Trout	-	Trout	-
Kakahi	-	Kakahi	-
Morihana	-	Morihana	- (2nd)
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	↓	Eel	- (4th)

Other kai consumption survey results
All those who gather from the lake have changed how they gather kai because of contamination of sites they used to gather from.

Table 22: Summary of Lake Rerewhakaaitu.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	↓	Kakahi	- (5th)
Morihana	-	Morihana	-
Koura	↓	Koura	-
Watercress	↓	Watercress	- (5th)
Puha	↓	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

When recounting their early lives interviewees described how interaction with the lakes occurred on a daily basis. Most days, interaction involved gathering kai for personal consumption or sharing. This was a commonplace group/whānau activity that permeated households and the community.

Table 23: Present day ratings of lakes on the basis of number of respondents gathering species from the lakes (1 = highest number of gatherers, 8 = lowest number of gatherers).

	Ratings							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Trout	Rotoiti	Tarawera	Rotorua	Rotokakahi	Okataina	Coast	Streams	Maketu
Kakahi	Rotoiti	Ohau	-	-	-	-	-	-
Morihana	-	-	-	-	-	-	-	-
Koura	Rotoiti	Rotorua	Tarawera	Rotoma	Rotokakahi	Streams	Okataina	Ohau
Watercress	Rotoiti	Rotorua	Rotoma	Streams	Okataina	Ohau	-	-
Puha	Rotoiti	Rotorua	Rotoma	Streams	Okataina	Ohau	-	-
Inanga	Rotoiti	Coast	Rotorua	Rotoma	Tarawera	Tarawera	Streams	Ohau
Lamprey	Coast	-	-	-	-	-	-	-
Eel	Tarawera	Rotoiti	Coast	Rotorua	Streams	Rotokakahi	-	-

Across all species we can obtain an average rating for the present day usage of the lakes. The results confirm the significance of Lakes Rotoiti, Rotorua and Tarawera. The average ratings for present day gathering are:

Rotoiti 1.14

Rotorua 2.67

Tarawera 3.40

Rotoma 3.50

Coast 4.00

Rotokakahi 5.00

Streams 5.50

Okataina 5.50

Ohau Channel 6.00

Rotomahana, Rerewhakaaitu, Rotoehu –
not gathered

We are also able to prepare rankings based on historic use. These are shown in Table 24.

Table 24: Historic ratings of lakes on the basis of numbers gathering species**.**

	Ratings							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Trout	Rotoiti	Rotorua	Tarawera	Rotokakahi	Rotomahana	Okataina	Streams	
Kakahi	Rotoiti	Rotorua	Tarawera	Coast	Rerewhakaaitu	Ohau	-	-
Morihana	Rotoiti	Rotorua	-	-	-	-	-	-
Koura	Rotoiti	Rotorua	Tarawera	Rotoma	Rotokakahi	Streams	Okataina	Ohau
Watercress	Rotoiti	Rotorua	Streams	Rotoma	Rerewhakaaitu	-	-	-
Puha	Rotorua	Rotoiti	Rotoma	-	-	-	-	-
Inanga	Coast	Rotoiti	Streams					
Lamprey	Coast	Streams	-	-	-	-	-	-
Eel	Tarawera	Streams	Rotoiti	Rotoehu	-	-	-	-

The average rankings for past gathering are as follows:

Rotoiti 1.57

Rotorua 1.83

Rotoehu 2.00

Tarawera 2.50

Coast 2.67

Rotomahana 3.00

Rotoma 3.25

Rotokakahi 3.67

Streams 4.50

Rerewhakaaitu 5.00

Okataina 6.50

Ohau Channel 7.00

The present day ranking confirms the importance of the coast and the higher ranking accorded Rotoma. In contrast, Rotoehu, Rotomahana, Rotokakahi, Rerewhakaaitu and the streams appear to have slipped in the numbers of gatherers using them.

6.3.3 Mahinga kai and taonga species

The main species harvested by Maori in the lakes prior to European settlement included:

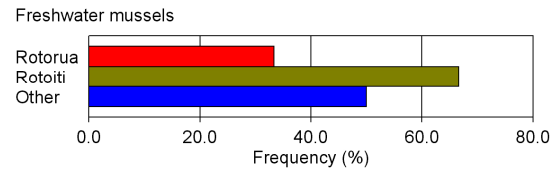
- The juvenile (inanga) and adult (kokopu) stages of the koaro.
- Adult common bully (toitoi).
- Eels (in Lake Tarawera).
- Koura and kakahi.

Fishing grounds for inanga, kokopu and toitoi were clearly marked, and actively managed (Phillips et al., 2007a). Informants also confirmed the importance of the respective kai species.

> *But it was sustainable, you know, it filled us up and fed us, and of course Inanga. Which was one of the staple diets during those days too, because they used to dry them as well eat them fresh. So, no, it was - I think everybody in Rotorua used to live on crayfish, especially the Maori families - crayfish and kakahi, way back in those days. But Lake Rotorua was clear when I was going out - clear as crystal and you could see - when we used to go and get morihana, you could see the schools and they were huge schools of morihana swimming all around the lake, all around the lakefront and they used to breed in the raupo (Informant B).*

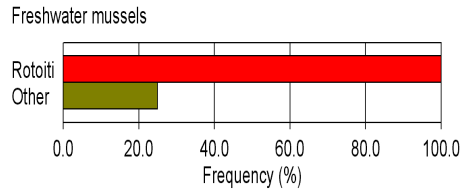
A management framework for customary fisheries in the Rotorua lakes has been developed through a joint project between NIWA and the Te Arawa Lakes Trust (Phillips et al., 2007a; see also http://www.niwa.co.nz/our-science/freshwater/our-services/freshwater-species-and-habitat-management/te_arawa_lakes). The outputs from that programme include tools, monitoring methods, and guidelines for managing culturally significant mahinga kai and taonga species. Data collected from our study will be useful in augmenting existing knowledge and is detailed below.

Table 25: Kakahi.

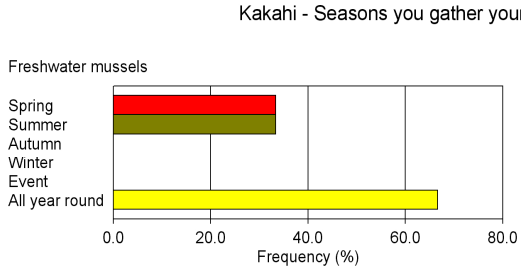


* Note: Multiple answer percentage-count totals not meaningful.

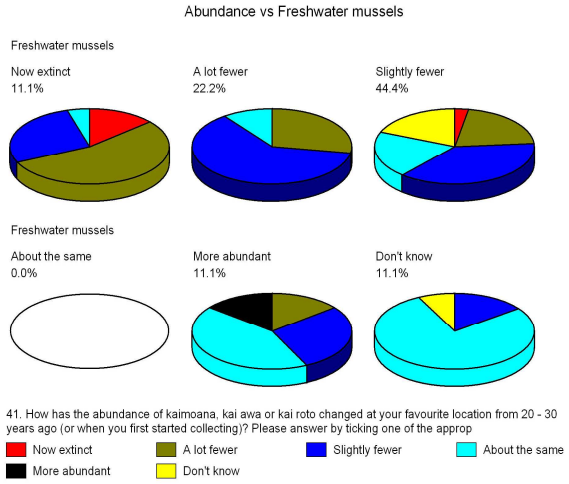
Also recorded in Rerewhakaaitu, Rotoehu, Rotokakahi, Rotoma, Tarawera (Phillips et al., 2007b)

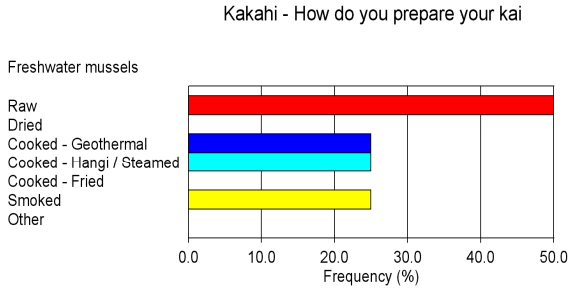


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

Kakahi are still gathered and consumed today, mostly from Lake Rotoiti. They are eaten raw or cooked in various ways. 77% of the participants believe kakahi have reduced in abundance.

Kakahi …is the most important on story, song and proverb. For instance there is an old saying tane moe whare, kurua te takataka; tane rou kakahi, aitia te ure (Man drowsing in the house smack his head, man skilled in dredging kakahi, marry him) – Hiroa, 1921

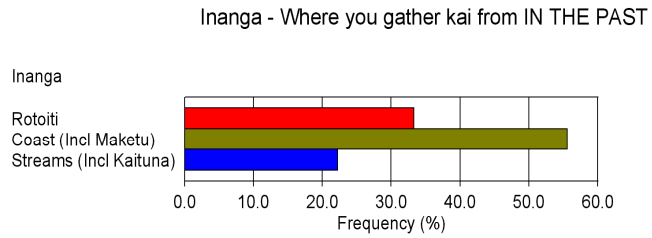
The kakahi is very tasteless and insipid (Hiroa, 1921).

It was cooked and fed to infants – it could be sucked like milk (Hiroa, 1921)

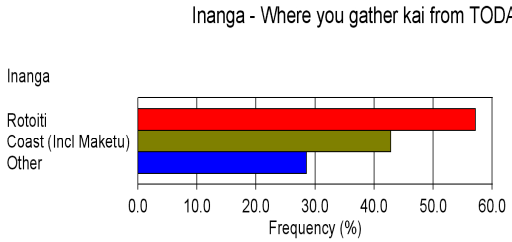
The only concern that my mum had, of course, when I brought kakahi back. She was really conscious of kakahi having a poisonous element, depending where you got it from.… kakahi was the main culprit perhaps in being certain that you did not get it from a place that is polluted from a swamp or anything else. So getting it from the river was good. The same thing happens here. The clearer the water and the lakes, the safer you are from getting kakahi (Informant A).

We used to live on kakahi. My mother used to cook a lot of kakahi, with bacon and something else - it would give them a bit of taste, it was just like eating cold water (Informant B).

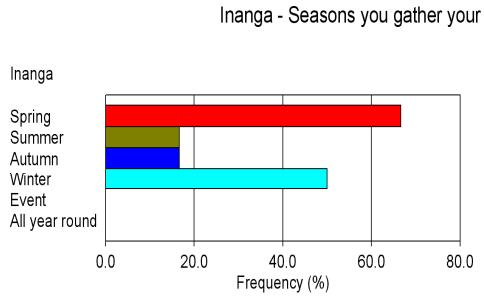
Table 26: Inanga.



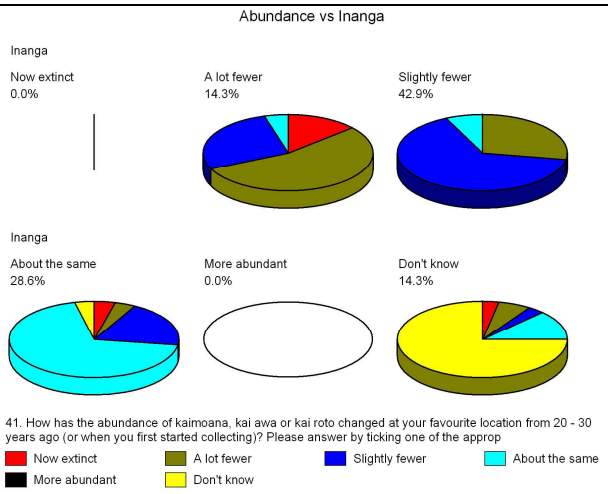
* Note: Multiple answer percentage-count totals not meaningful.

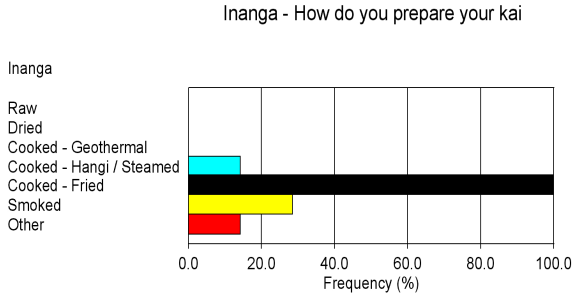


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

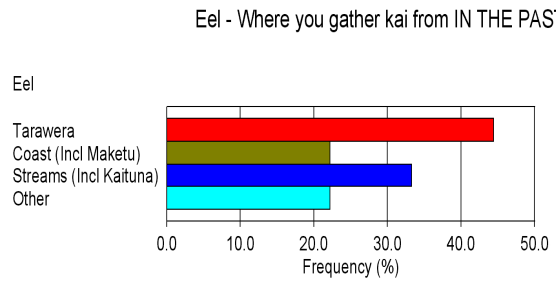
- 57% believe that inanga are fewer in number
- There are limited waterbodies from which inanga are gathered.
- It is always cooked.

Well, ever since I was a child my family went out using the old methods of catching inanga, koura, collecting kakahi, morihana, all the natural species from out of the lakes. And we just lived on that for breakfast, lunch and tea … And we never, ever came home without anything …If you want a feed of whitebait today you can sit around all day, which I have done, and it will take about a whole day just to catch a cupful (Informant E).

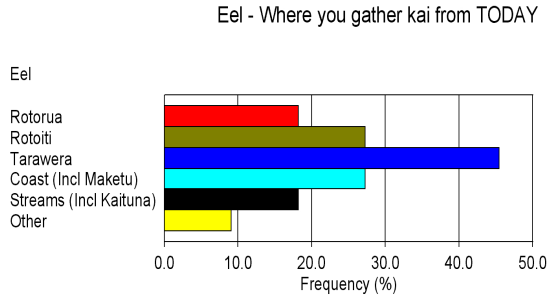
I mean, us as children, it was an enjoyment as well, but at that stage when you are very young you don't sort of realise you are providing for your family - food, so that was bringing in food, and my mother was very strict. She would come down and she would check us, and if any of the inanga would – well, they used to froth in the tub and sometimes they used to jump out. My mother would pick every one up. She would tell us - you are not to let one go into the grass. We had to make sure that nothing was being wasted (Informant E).

They used to get a lot of whitebait ... it is slim pickings these days. I, myself, never sort of experienced the sort of abundance that my parents sort of (Informant H).

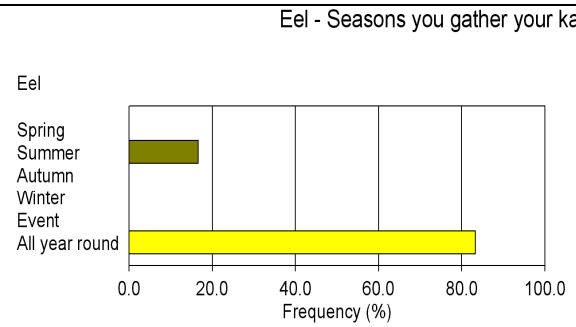
Table 27: Eel.



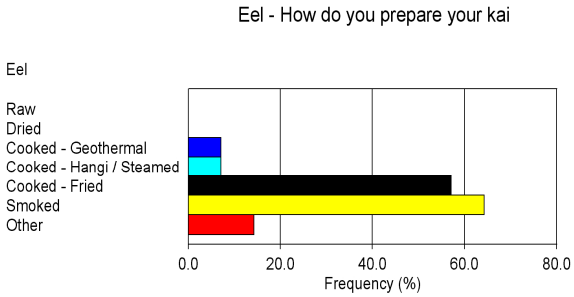
* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.

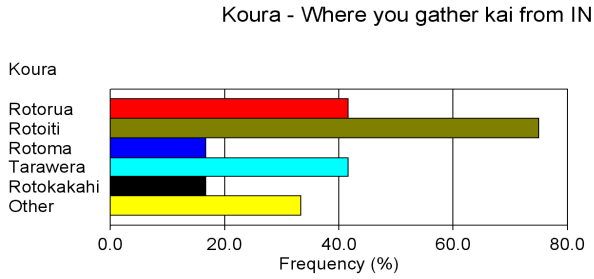
Eel is still gathered, predominantly from lake Tarawera, all year round. It is mostly fried or smoked. Eels are thought o have been stocked in the Te Arawa Lakes (Martin et al, 2007).

Each family that I knew … had a holding box for where we stocked our eels and so that we will have eels right throughout the winter. While the eels were in that box they fed themselves from the insects and whatever that came in through the box feeding, they never made fat but they were clear of anything in their insides, in their stomachs. So as far as eels were concerned, we had a lot of eels and we lived on the river (Informant A).

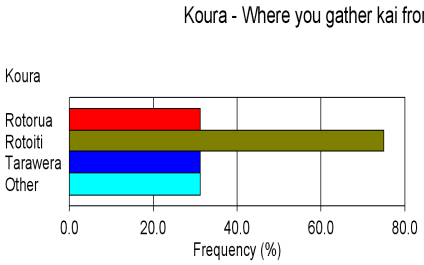
The only difference I know, … is the eels from Murupara …. Murupara are very thin skinned eels. Tarawera are very thin skinned but big and fat. But I guess you can tell the difference in kai from different places, you can identify them (Informant A).

Yes, eels. We used to get a lot of eels in Rotorua … and I used to go down the Kaituna River …I would go down the Kaituna with my uncles, and they taught me - showed me the holes and everything down there. Of course the weir that they built down at Okere Falls changed all that as well - it changed the places where the eels used to rest, because now it's a raging torrent nearly all the way down. Before it was a torrent with backwash in it and then that is where all the eels used to lie… Used to catch eels at Tarawera as well - in the lake as well as in the stream coming down from the tea rooms, the same way - would feel for them there. They were big eels….Yes, the eels are very, very big, yes, they are a good size. There is about 28 pound, the average size….Yes, well Tarawera - yes, they average 28. And so does Rerewhakaaitu - they are huge, because nobody fishes for them. And the same down the Kaituna River, you know, the eels I used to catch there with my hands were all in their 20 pounds - you know 20 pounders - big eels. Three eels and you had a load to bring home…I have caught eels in Rotoiti (Informant B).

Table 28: Koura.

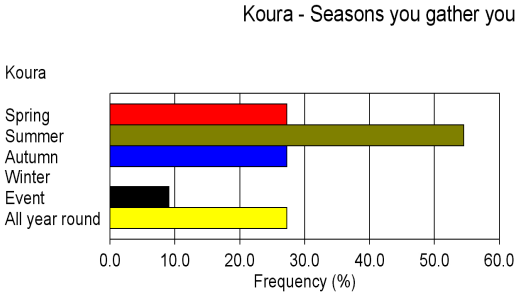


* Note: Multiple answer percentage-count totals not meaningful.

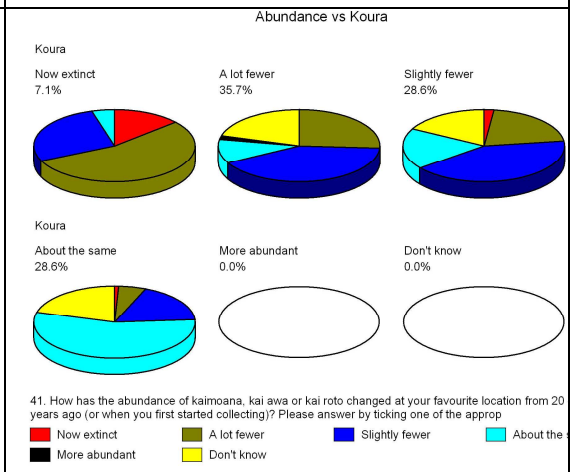


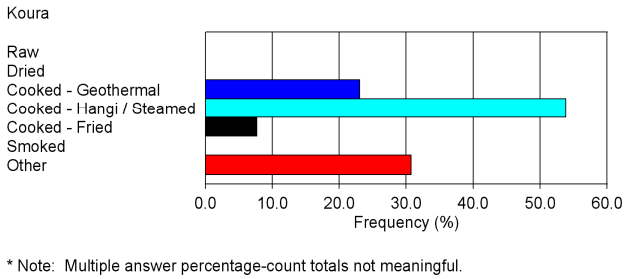
* Note: Multiple answer percentage-count totals not meaningful.

They have also been recorded in lakes Okareka, Okataina, Rerewhakaaitu, Rotoehu, Rotoma, Tikitapu (Parkyn and Kusabs, 2007)



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

Maori Land Records show 152 individual ancestral fishing grounds in Lake Rotorua, 40 in Rotoiti, 19 in Lake Rotoehu, and 11 in Lake Rotoma (Stafford, 1994, 1996)

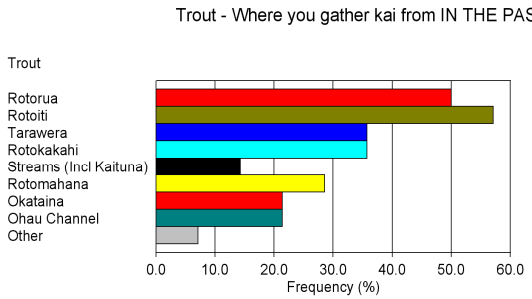
Mair (1923) knew of 700 fishing grounds in Lake Rotorua.

Koura are predominantly harvested from Lake Rotoiti, mostly in summer. 69% of participants believe there are fewer koura than there used to be.

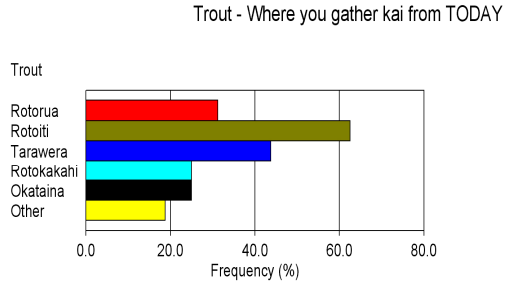
Everybody ate bloody kouras. They wouldn't eat the ones from the sea though. Less there than in there were in the old days; there's less … We used to go out at night - rama koura and we used to catch them. You can't even see anything now because of the dirtiness of the water….Or either they're out in the deep and they can't come in because the weed is stopping them from coming in, maybe? …Nobody's been diving for them for years and years because nobody wants to swim in that dirty lake (Informant C).

Last time I had koura was at a tangi and that was this year, and the discussion that went on at the tangi table, at the hakere table, was great because we hardly ever see koura on the table, whereas previously it was quite common practice to have koura on there, now - I think it is the first tangi that I have been to in over 10 years where there was actually koura on the table at Ohinemutu ….Because, I suppose they're a delicacy in their own right, nothing was ever added to it to provide flavour because the flavour was already there in the koura (Informant J).

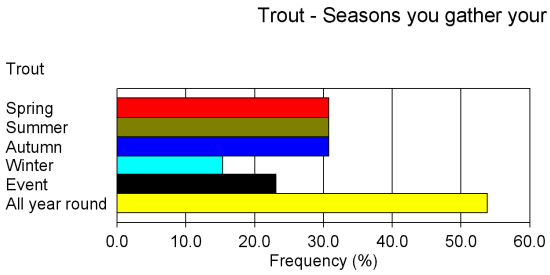
Table 29: Trout.



* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.



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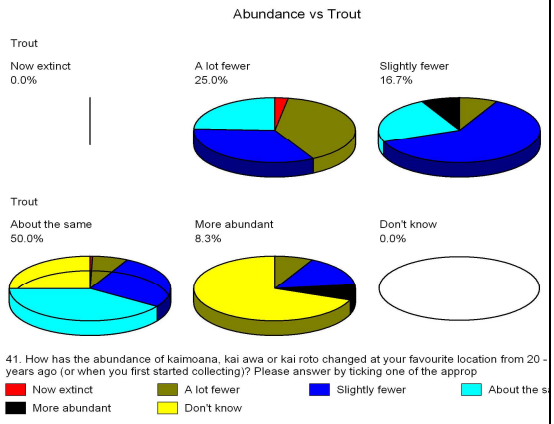

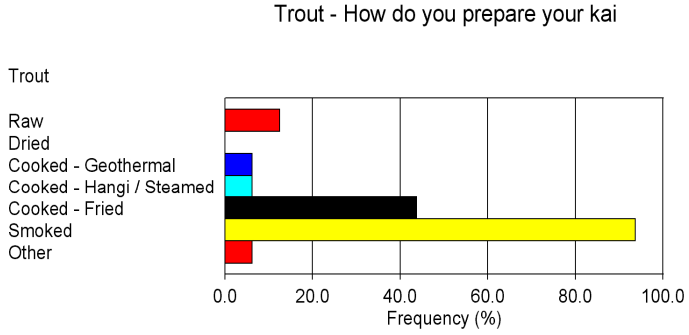

* Note: Multiple answer percentage-count totals not meaningful.

Trout are widely fished, although the number of lakes were they are gathered from has reduced. They are collected all year round and mostly smoked. Most participants believe trout numbers are similar or have even increased in comparison to historic records.

We would go down and my grandfather was a keen fisherman, so we were always out and my grandfather was fishing every weekend, and he always came home with good trout and they were always lovely and fleshy and yes. So, and that was every weekend, my grandfather would come home with at least three or four trout and he wouldn't even be out on there that long when he would be fishing during the fishing season (Informant J).

6.3.4 Perceived changes in the abundance of species that are gathered

A number of questions on the Kai Consumption Survey sought to determine the reasons for the dietary changes. The quantitative data summarised in Table 3 suggest the declining abundance of aquatic species is likely to be one of the main causes of diet change. However interviewees also reported degradation of aquatic environments, societal change (more specifically working longer hours) and the introduction of licensing of fisheries as barriers to their engagement in mahinga kai activities. With respect to the quantities gathered Pakeha settlers described the abundance of kai as 'shoals of inanga". Also during the 1860s, Captain Gilbert Mair described Maori trapping of adult koaro in the Hamurana Stream (Rotorua) at night.

> *Two hours after the net was lowered 'several hundredweight of the fat little fish were emptied into the canoe….This process was repeated during the night till quite a ton weight had been obtained . . . Of course the introduction of trout was the death knell of the koaro'*[13]

> *An example of this productivity was at the opening of Tamatekapua at Ohinemutu in 1873 where a reputed 500 rohe (a rohe was roughly the equivalent of a modern sack) of dried koura and inanga were consumed (Hiroa, 1921)*

Other descriptions are found in historical text -

> *The people who lived inland had an enormous supply ….. until the Europeans introduced the trout and other fish. Now our fresh-water fish have almost entirely disappeared.*

> *Koura (crayfish) were found in great quantities in the lakes and rivers...…*

> *The whitebait went up the river like a company of soldiers in great numbers, keeping a column two or three feet wide.*

McDowall provided further descriptions of the losses that were experienced in the 1940s:

> *My grandfather, who farmed the banks of the Ohau from the early 1900s, took substantial [whitebait] catches – 20kg or more – from this river. When he took us whitebaiting in the 1940s, catches of 5 kg could be expected during good*

[13] McDowall (1984), p 91

> *runs. By then the Ohau River ran through fully developed pastoral country. He had in the early 1900s cleared his property of dense tawa forest. The streams had probably once supported banded kokopu and giant kokopu and masses of inanga when there was still forest. By the time I was there we only saw a few inanga and the odd banded kokopu in the tiny patch of remaining bush*[14].

A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining. In the 1930s, a number of factors were blamed for the decline in whitebait catches including: excessive take by whitebaiters; predation by sea birds, herrings, eels, trout; draining of swamps, backwaters, and creeks; or damage to estuarine spawning grounds by stock. By the 1990s a number of native fish species had disappeared from waterways or were in decline. A combination of factors was attributed to these losses including: afforestation, sedimentation and flooding, wetland drainage, river modifications, sewage, water abstraction (irrigation), and pollution arising from adjacent land uses.

6.3.5 Seasonality of kai gathering

Differences in seasonality also existed from place to place, for example, in Taupo inanga fishing began in September, while in Rotorua it was from December onwards.

> *The koura came in October and lasted from November to March. They ceased being fat in April. Inanga and kokopu were in season from December to February and perhaps to March; toitoi from May to September. Kakahi were obtained throughout the year but were best in winter (Hiroa, 1921).*

Although some whanau adhere to seasonal regimes, the technology (in particular the gear) available to fishers today means that resources can be gathered all year round. While all year availability provides a secure food supply for whanau, it will affect the abundance of species. The following Table has been compiled with the data from the Kai Consumption Survey and identifies the seasons when species are gathered today.

[14] McDowall (1984), p 79

Table 30: Seasonal kai gathering patterns today.

SPECIES	SUMMER	AUTUMN	WINTER	SPRING	MOST
Kakahi					66.7%all year
Morihana					66.7% winter
Cockles					45.5% all year
Pipi					53.8% summer
Toheroa					100% summer
Tuatua					50% all year
Lamprey					50% all year
Mutton birds					75% autumn
Pupu					66.7% summer
Eel					83.3% eel
Flounder					66.7% flounder
Paua					62.5% summer
Mussels					50% summer
Crayfish					55.6% summer
Oysters					57.1% summer
Seaweed					100% summer
Koura					54.5% summer
Watercress					50% spring
Puha					45.5% spring
Hapuka					100% all year
Mullet					75% all year
Kahawai					66.7 all year
Kingfish					57.1% summer
Gurnard					83.3% all year
Snapper					55.4% all year
Moki					75% all year
Shark					66.7% summer
Tarakihi					50% all year
Trevally					50% all year
Whitebait					66.7% spring
Trout					58% all year
Kina					63.6% summer

Key:

	All the seasons when gathering occurs		When the greatest concentration of gathering occurs

Although this research focuses on aquatic ecosystems, gathering birds was also regulated

> *But it was totally controlled - you never went out until somebody went up to check to see if they had enough to shoot, and they'd come back and say – "right, the season is open, you can go up", and then you were allowed about probably a month and a half, maybe two months, because that was the feeding period for the miro (Informant B).*

Informants also spoke of the seasonality of gathering -

> *We would go from August catching inanga and that would go for two-three months. I mean, the seasons have changed today, warmer climate change. But when the inanga ran it was just a mass of black running along the banks of the Ohau Channel, and we were just collecting tubs full, it was just continuous (Informant E).*

> *Then koura sort of came over the summer period - December, January, February and we caught rama koura - that was catching it along the shoreline, just with a fish and chip basket and using candles inside a huge fruit tin. So we were saving energy, you know, that was our light. And we always chose a full moon. Our parents knew - they sort of had this Maori calendar as to when was the best time to go out and they would tell us to go out and they would prepare everything for us and make sure we were safe, and they would tell us when to come home and when to go out (Informant E).*

> *During the summertime, we like to go out probably once a fortnight (Informant D).*

> *It was on a regular basis……we did the gathering of the koura at night…we would do rama koura and we would have a spotlight… and I would say in a summer we would probably have koura about, I suppose, four times in that summer period, and we would be looking at - say there would be enough to feed a family, so there was five of us and there was normally enough for two meals, so we are probably looking at, on average, I would say between - I would say probably about 60 koura at any one time (Informant J).*

It is important to realise the even today seasonality is a management technique that respects the life stages of kai species.

Yes, it was the summer months and it wasn't only simply because the water was warm, it was also a matter that you allowed the stocks to replenish themselves so that there was a period that they could - where I suppose the stocks could refill again, otherwise they would be greatly depleted (Informant J).

6.3.6 Processing of preferred species

The processing of kai species needs to be understood if all possible pathways of contaminants are to be identified.

Historically[15]

Koura *(crayfish) would be … dropped into the boiling water for a few seconds, then taken straight out and eaten, or the crayfish might be put into the steam hole for two or three minutes. Koura cooked in this way were beautiful.*

Fish *was generally steamed in a hangi, either in a tukohu or in a vessel, and meat or birds were also cooked in these steam holes.*

All the fish were steamed in a hangi, though some were dried and put away in a whata for future use.

Koeaea (whitebait), *like koura, needed very little cooking, and might be put for a minute or two in the boiling water, or steamed. In the old days the koeaea was only eaten fresh. It was caught in July, August, and early September.*

Inanga (Retropinna), *a small fish, was a favourite food of the Maori, and was eaten either fresh or dried. It was the relish eaten with the fern root.*

Shellfish *were eaten raw, or cooked for a very short time on hot coals. They might be placed in a heap, and a fire built round them. Or they might be dried and threaded on takiaho, a string of prepared fibre.*

Kuku *either cooked or eaten raw.*

[15] These descriptions were taken from Makereti (1938). We note that none of the interviewees used the term "koeaea".

The pipi *was eaten raw, dried, or cooked either on hot coals, or by steaming for a very short time.*

The eel *was generally cooked in a hangi… either cut into pieces, or cooked whole, encased in the leaves of the puwha (Sonchus oleraceus, var.), or sometimes bound spirally in the leaves of the harakeke (Phormium sp), and then placed on the hot stones of a hangi. Tuna cooked in this way was lovely, the outside skin getting quite pakawera, i.e., well browned and crackly. Tuna was considered a great delicacy.…Many are dried and put away for future use, or for taking to relatives for some special gathering. The people prepare teahi rara tuna, the fire for drying eels. The eels are laid on a frame made of green rods over the fire. If small, they are put on just as they are, but if large, they are opened out and kept open with small pieces of wood before they are laid on the fire (ka pawhara tia).*

The flesh of the dried ***shark*** *was considered a great delicacy. It had a very strong smell.*

From the Kai Consumption Survey we know that whanau today use a number of different methods to process the kai they gather.

Table 31: Number of respondents (as a %) that use different methods to process the kai they gather.

SPECIES	SMOKED	COOKED –	RAW	COOKED	COOKED	DRIED	OTHER
Kakahi	25	-	50	25	25	-	-
Morihana	33.3	33.3	-	33.3	66.7	-	-
Cockles	-	-	23.1	23.1	61.5	-	30.8
Pipi	-	7.7	23.1	15.4	46.2	-	38.5
Toheroa	-	-	33.3	66.7	66.7	-	-
Tuatua	-	-	33.3	33.3	66.7	-	-
Lamprey	-	-	-	-	-	-	-
Mutton birds	14.3	28.6	-	14.3	-	-	71.4
Pupu	-	-	-	-	75	-	25
Eel	64.3	57.1	-	7.1	7.1	-	14.3
Flounder	20	100	-	-	-	-	13.3
Paua	6.7	53.3	46.7	-	20	-	26.7
Mussels	17.6	47.1	76.5	5.9	11.8	-	29.4
Crayfish	6.7	33.3	26.7	20	46.7	-	20
Oysters	6.7	6.7	93.3	-	6.7	-	6.7
Seaweed	-		40	-	20	20	20
Koura	-	7.7	-	23.1	53.8	-	-
Watercress	-	7.7	15.4	30.8	53.8	-	38.5
Puha	-	15.4	-	23.1	38.5	-	38.5
Hapuka	45.5	81.8	-	-	-	-	18.2
Mullet	85.7	42.9	-	-	-	-	-
Kahawai	85.7	50	14.3	-	7.1	-	14.3
Kingfish	60	80	10	-	10	-	-
Gurnard	55.6	77.8	11.1	-	22.2	-	11.1
Snapper	81.3	75	31.3	-	12.5	-	12.5
Moki	57.1	71.4	-	-	-	-	28.6
Shark	28.6	71.4	-	-	-	14.3	14.3
Tarakihi	50	71.4	35.7	-	21.4	-	21.4
Trevally	37.5	62.5	12.5	-	25	-	37.5
Whitebait	28.6	100	-	-	14.3	-	14.3
Trout	93.8	43.8	12.5	6.3	6.3	6.3	-
kina	6.3	6.3	93.8	-	-	-	6.3

Observations

- Koura - the majority are steamed although a small percentage are now fried.

- Fish – a significant number of species are now smoked e.g., trout (93%), snapper (81.3%), mullet and kahawai (each 85.7%) and eel (64.3%). Frying fish seems to be the next most common means of processing although being steamed in a hangi, or boiled is still a common practice.

- Koeaea (whitebait) – is mainly fried although 28.6 % claim they smoke it.

- Shell-fish such as kina are still eaten raw (93.8%) Kuku were eaten raw by 76.5% of respondents while oysters are eaten raw by 93%. Many are still steamed but in contrast to the past practice, none of the respondents said they dried kaimoana. Only seaweed, shark and trout were dried by a minority of the respondents.

- The pipi are eaten raw, or cooked by steaming (geothermally or in a hangi). Respondents did not say they dried pipi.

- In contrast to the traditional way of processing eel (in a hangi) the majority of respondents smoke it or fry it. No one reported that they dried it.

  The pigeon – these were probably preserved in their own fat, because we don't get the same fat pigeon today as we did then. I remember shooting pigeon, it was just a ball of fat and inside would be a whole heap of fat inside the stomach itself…No, it was interesting growing up with the old people and how they regarded food - any food that you gathered.

6.3.7 Kai gathering – its contribution to wellbeing

The concept of mahinga kai extends beyond the nutritional value of species and its physical health benefits to encompass a range of cultural values. It describes species available locally and encompasses the cultural values attributed by whanau and hapu to these species as each is gathered, processed and distributed according to tikanga and kawa. Some of these values are discussed, albeit briefly, in the paragraphs below.

Whakapapa - Whakapapa is an important conceptualisation for Maori. Whakapapa connections to the lakes are evident in at least two ways:

1) collective ownership of lands and/or customary rights to fishing grounds and natural resources; and

2) the names of tūpuna/whanaunga or important iwi/hapū or events that have been given to geographical locations, landmarks, other such things.

The old time Maori …soon ascertained the parts of the lake where the various foods were most plentiful and most easily procured. These spots became the fishing grounds carefully marked and jealousy guarded by the various subtribes and families. They were given names and the most famous alluded to in song and story (Hiroa, 1921)

Whakapapa is also central to kai gathering, which like many other cultural activities, is built around collective action (Ireson 1992, 1996). This is highlighted in Rotorua Lakes where rights of manawhenua determine access to reserves and fishing grounds.

Our iwi and our hapu locally were very respectful people. We honoured everybody's rights when it came to hapu collecting from certain areas (Informant E).

We stayed within our boundaries. We were respectful and even the way we fished there was a lot of respect… No, that is gone. People are fishing over other boundaries. They have got this thing about the more they can catch, it is a money making proposition. The traditional values are going out the window, and it is sad to see (Informant E).

The current generations aspire to continue ahi kā, to perpetuate Te Arawa culture and identity which has always included the right to utilise specific resources (e.g., koura, kakahi) and practice certain activities primarily associated with the kai gathering. A few whānau in Lake Rotoiti epitomise this, by retaining the traditional way of gathering koura (tau koura).

Whanaungatanga - Whanaungatanga is an important process for the reinforcement of whakapapa links and the development of a close relationship with the lakes and the taonga they sustain. Whanaungatanga refers to the reciprocal support relationship between members of the same whānau, hapū and iwi. Through the co-existence and interaction amongst different generations and wider family networks, each of which has experienced different periods and aspects of Te Arawa history, interviewees have a broad knowledge of the social, cultural, environmental, and economic history of the Rotorua Lakes area, and of their own family's connection to the lakes. This knowledge has been generated through a range of social interactions with kaumatua and/or other whanaunga and friends from different generations. Tangihanga, hui and wānanga provide important occasions for comparing experiences, generating

information and affirming whakapapa and whanau ties. Such interactions continue to facilitate the transfer of mātauranga Māori, cultural values and traditions.

Wairuatanga - Te Arawa use different ways to feel spiritually connected with their takiwa.

> *Previously Utuhina or on the shores of Lake Rotorua would be where I would get cleansing and spiritual cleanliness, I can't do that now (Informant J).*

Gathering kai with whanau at a traditional fishing place, that they know was named by their tupuna and utilised by successive generations of their whanau, is one way.

Being able to contribute the kai that their takiwa is renowned for, to ceremonies and to manaaki manuhiri can also bring that connection:

> *I suppose where your wairua is uplifted and where you find strength because you are able to cleanse yourself there, that can't happen anymore. And those are the things that I think that I miss and that I am sad that my children don't have that opportunity to do those things. I mean, as a child, you know, you can spend all day running and just the feel of the water on you, you know, just because it is so cold, and just the freshness and how alive it makes you feel when you emerge yourself from the water (Informant J).*

Manaakitanga - Historically a surplus of food was gathered as surpluses enabled whanau to access other resources through bartering, trading and gifting, thus setting up reciprocal obligations (Makereti, 1938). During the year whanau visited neighbouring hapu, taking surplus food to share. Being able to gather abundant foods and thus able to engage in a range of economic practices ensured whanau had access to a variety of foods. Because of trade, however, people weren't restricted to kai immediately available to them from their local area but had access to a wide range of foods. Degradation of the lakes, however, meant that Te Arawa were denied access to a significant percentage of their traditional sites of kai gathering across Rotorua Lakes and streams.

> *At the large hui at Awahou in 1899 there were six hundred people from the Bay of Plenty and East Coast. The gathering lasted a week and koura was the chief food (Hiroa, 1921)*
>
> *A great present of koura was sent to Kawana Paipai in 1859 (Hiroa, 1921)*

As has already been mentioned –

At the opening of Tame te Kapua at Ohinemutu in 1873 it is said that at the feast were five hundred rohe of dried koura and inanga (Hiroa, 1921)

Durie (2004) contends that mauriora is dependent upon a secure cultural identity, and therefore diet changes can lead to loss of culture and identity. Having the ability to manaaki visitors by supplying kai sourced from one's takiwa means that the activities of fishing, and gathering other foods creates and maintains community ties and reinforces identity. Conversely the inability to manaaki guests and sustain whanaungatanga can lead to cultural loss. As informants explained -

At home we would share them out with all the families along the way and what was left over we dried. We dried for the winter (Informant B).

And that is what it is really about - the sharing, and that is what food gathering was about, or planting your gardens was the same. You didn't just plant for yourself, you planted for everybody.… they always shared everything… I've always had a garden… I always planted something (Informant B).

We dived for our people. We look after our people. Big tangis and all that. We look after our people (Informant C).

But sadly informants believed that the sharing culture is gone:

No, that has gone too. That is gone because in the old days there – because I was brought up by my mother and my grandfather. And every Sunday they used to come around – like the older ones – and drop off a piece of wild pork, some fish, some koura, eh. But that's gone. … now I take my kids; my son, my daughter and now my mokopuna down to the pa whenever there is a hui, whenever there is a tangi. But the rest of the kids – when we moved …they lost that connection (Informant M).

It was always enough to feed the family and then some left over to be able to give to people that came….Yes, so when taking from the lake it was always really important that we didn't just keep it for ourselves, that we shared it, particularly like koura, it was always made sure that my grandmother got some and both my sets of grandparents and aunties and, yes, there was always plentiful, enough for our family and some of our extended family (Informant J).

Matauranga Maori -

> *Yeah, but I think it is the younger generations that are – they are getting worse and worse because their parents aren't giving good – showing the good way. You know, they are obviously, "Oh, well, you know". Because to me, Papatuanuku and, you know, Tangaroa, you know, we are kaitiaki of them and if we don't look after them we can't collect from them or they can't look after us (Informant H).*

As has been previously stated, the activities of gathering and preparing kai serves the functions of passing on traditional knowledge from one generation to the next. Matauranga Maori is developed and transmitted through practices of food management, harvesting and preparation.

> *I suppose I learnt from - and my brother and sister did - we learnt from our father and our uncles, and it was really things that they had learnt. So it is really generational information that comes down, and it was always - the key was sustaining. You know, making it sustainable so that next year you could come back and there was still some more there (Informant J).*

> *As a child, I have never seen a morihana, I didn't even know that they existed until as I have got older and we have spoken about the morihana, but they used to say …they would just pick them straight up and eat them raw, (Informant J).*

A great deal of knowledge is needed in order to obtain kai - knowledge of techniques and also knowledge of ecosystems. If populations of aquatic species do not return, knowledge of the techniques of gathering these foods along with the associated ecological and cultural knowledge and the techniques of gathering will likely also begin to disappear. Historical text and evidentiary statements provide insights to the knowledge held by earlier generations:

> *There were expert men who understood all the movements of a school of fish. These men generally took up a position on the top of a hill near the sea, and looked out for any signs of a school of fish, and then passed on the sign to a party of men who were fishing in a canoe. The seas which surrounded New Zealand were teeming with fish. ..*

> *In Cook's First Voyage, page 57, Cook writes: "The seine, the large net which has already been noticed, is produced by their united labour, and is probably the joint property of the whole town. Their fishing hooks are of shell or bone,*

and they have baskets of wicker work to hold the fish." On page 48, he writes: "Early in the morning, the Indians (meaning Maori) brought in their canoes a prodigious quantity of mackerel, of which one sort were exactly the same with those caught in England. These canoes were succeeded by other canoes equally loaded with the same sort of fish, and the cargoes purchased were so great that everyone of the ship's company who could get salt cured as many as would serve him for a month's provision. These people frequently resort to the bay in parties to gather shellfish, of which it affords an incredible plenty. Indeed, wherever we went, whether on the hills or through the vales, in the woods or on the plains, we saw many wagon loads of shells in heaps, some of which appeared fresh, others very old."

Crozet in his Voyage, pp. 40–41, writes also of the abundance of many kinds of fish caught by the Maori, and of the art of the Maori in all that concerns fishing, and goes on to say: "Their fishing lines, as well as their nets of every description, are knotted with the same adroitness as those of the cleverest fishermen of our seaports. They manufacture seines five hundred feet long, and for want of corks to hold up the nets, they make use of a very light white wood, and for lead to weigh it down, they make use of very heavy round pebbles enclosed in a network sheath which runs along the bottom of the seine, etc."

Te aho hi ika, the lines used for fishing, were made from the finely dressed muka (fibre) of the flax. They were very strong, and often carried hooks to catch very large fish, such as the manga (barracuda), or the hapuku (groper).

In my district manuka grew near Lakes Rotoiti and Rotorua, and this became quite famous for making hooks. People came from the coast on purpose to get these manuka sticks, which the prevailing winds had blown almost into the shape of fish hooks.

As food species disappear from the dining table, the particular knowledge of how to prepare foods is also lost.

I used to also go and get mutton birds on Whale Island…I used to go every year and get mutton birds. I started when I was nine - I used to go over there with the old people. Then when I was 11 I was allowed to go on my own (Informant B).

We were working at six, doing allsorts of things, not just milking the bloody cows, but digging the garden and helping grandma do this and do that, and so

we had a working life, everyday was a working day. And by the time you are 11 you could do anything…Totally independent, you could look after the family, you could cook, do the housework, everything. And that is how it had to be, which I reckon was wonderful, that they taught us all these things. By the time I was 15 I was ready to marry - you know, that is what they said, I could marry at 15, because I could go to work and look after our family and look after children. So that is one of the sad things about today, young people haven't had the opportunity to do all those things (Informant B).

I found that catching fish was the easiest part. I used the long line most of the time. And it's hard to get these young kids, aye, because they were – I used to get them out on that boat; they never played up at me. They knew the rules; they play up, well, we stay another couple of weeks out there and they hated it. A lot of them used to get seasick. They didn't like – don't play up with him or he'll stay another week. And we'll have to eat fish for breakfast, fish for dinner, fish for tea. I've got a change today, boys - more fish! (Informant C).

Because of the continuity and frequency of kai gathering, people were readily able to monitor fluctuations in stock and environmental conditions. They were then able to build up tacit and local knowledge of the environment.

Tikanga Maori - Kai gathering was and is governed by tikanga. Generally, whānau members spanning two, or sometimes three generations, together collected different kai moana species from traditional mahinga kai areas.

Makereti (1938) tells us that historically -

- *When a fishing expedition was arranged, several canoes, each manned by several men, were placed under strict tapu.*

- *If a man was married, he kept away from his wife until all fishing operations were over.*

- *The first inanga caught in the season were always offered to the gods, and the rest of that first catch was used at a ceremonial feast, karakia being repeated by the Tohunga.*

- *Both men and canoes were under tapu, and each canoe would carry a mauri, … in a hidden part to maintain the tapu, and add mana to move the gods when an appeal was made asking protection for the ropu (company) from the many*

dangers at sea, and from the many beings who lived in the deep waters of Moana-nui-a Kiwa, the great ocean of Kiwa.

- *The first fish caught on an expedition was offered to Tangaroa as a thanksgiving, and it was done with the ceremony of karakia.*

- *The fish was then placed in the sea again, and this karakia was repeated asking that abundance of fish might be sent to fill their nets or bite on their hooks.*

- *The men who went on fishing expeditions had no food before they went, and none until after their return, when the tapu was taken off by a Tohunga.*

- *Even when fish was caught, and pulled up into the waka (canoe), it must not touch the top of the gunwale. If it did, it was considered to be an evil omen, aitua.*

- *When fish was placed in the canoe, it was laid in the way of the canoe, and not across it. If the fish were placed across and a man stepped over them, it was thought that some aitua (bad luck) would happen to him.*

- *No Maori went out fishing alone. Fishing … was done by a ropu or company of men.*

- *When men went fishing, and one of them had a new line, none of the others would throw out his line till after the new line had been wetted. When placing his bait on the hook or hooks, he would tuwha, spit on it, and after gathering up his line, he would pass it under his left kuwha (thigh). After this he would turn his face to the bow of his canoe, and throw his line over the left side of it, and as the line went out and got wet, he held it in his left hand, and picking up some sea water in the cup of his right hand, sprinkled this on the line. The first fish he caught would not be eaten, but kept to be given as an offering to the gods. This offering would be cooked on a fire which was specially kindled on his return to land, and the fish, which was divided into two parts, was offered to the spirits of his male ancestors, and to the spirits of his female ancestors.*

From the interviews we extracted skills, knowledge and tikanga that continue to be upheld today:

- location of fishing grounds;

- rights to fishing grounds;
- knowledge, location and impact of thermal resources including natural sources of contamination;
- how to read and understand the waters, and the dangerous places around the area;
- knowledge of the location of different habitats of species, knowledge of life stages of species, such as when to collect or leave to replenish and grow;
- how to get a 'feed' if needed;
- how to remove the skeleton from koura;
- how to make and mend equipment;
- diving – traditionally and with equipment;
- gathering in traditional way e.g., tau koura;
- seasonal information;
- boat handling and maintenance;
- karakia before gathering;
- ika mātua (the return of the first fish to Tangaroa);
- take enough for a 'feed', any excess is to be given away to those who can't get it;
- rāhui in event of accident or death.

Tikanga remains relevant today:

> *I mean, you just didn't go out - if we went out eeling we'd all stand in a group and my grandfather would do a karakia and ask Tangaroa to let us have some luck, and we always got heaps of luck - we had eels everywhere (Informant B).*

But there is also an obligation to teach the next generation:

> *Yes, no, but you've got to teach the ones that do it to share, that is the big issue. Today, if you don't go out and somebody goes - oh, stuff him - part of the whanau, you know, he doesn't go out. But you have got to learn to say – well, he's got to realise that they are not all the same. But the point of going out to get all this kai is to be able to share it with somebody else - there is no sense otherwise, there is no sense in going to get all this stuff because the joy is seeing the joy on other people's faces when you say "here", and that is when it's worth it. Otherwise you can hoard you bloody freezers up and whatever and it doesn't mean a damn thing (Informant B).*

Te Reo - That kai is instrumental to a culture is reflected in the Te Reo that pertain to fishing grounds, their names and the names of the landmarks by which they are located and the different species. Te Reo contains knowledge and is an expression of culture and identity. Yet Te Reo has been declining for many reasons, one of which may be attributed, in part, to changing lifestyles. When a valued species disappears from a local ecosystem, or the activities associated with a species decrease, the associated Te Reo drops out of usage. When 61% of the respondents confirmed that they would stop gathering if advised that species and sites were contaminated, the indirect cultural impacts that would ensue should this happen would represent a significant loss.

Cultural survival - This section of the report has attempted to describe how kai gathering is the glue that binds whanau, hapu and community together, providing a sense of identity that also serves as the vehicle for the transmission of values and knowledge. The degradation of the lakes and consequent impacts on mahinga kai was a significant issue in the Te Arawa claim as evidenced by statements in the Tribunal Report. Archived documents provide in-depth testimony concerning the cultural and spiritual significance of aquatic kai species and of the water bodies across Rotorua Lakes themselves while informants identified the need for education.

> *You have got to teach them, eh? You have got to get them interested (Informant A).*

> *But one of the things is – it is education of our people. Our people need to be educated now about their resources or tools so that our fishermen can test their own catch …They should be made to do that. I mean I don't mind being stopped on the lake and having my fish tested so it is safe for me and my family (Informant A).*

All I would like is for my children to have the opportunity to enjoy the lakes in the same manner that I did, and it is as simple as that. That my children and my grandchildren enjoy the same benefits that I did as a child, that they can grab the tyre from down the road and roll it into the lake and all 10 of them jump on it and I know that - you know, previously you would be worrying about their swimming ability, but now you worry about them putting their head under that water. So to take that away and to watch, you know, the neighbourhood kids, all 10 of them, be able to access that water again, that is what I would like to see (Informant J).

It was our playground, it fed us, it taught us a lot of things about, you know, like especially now, these days, our children don't realise – you know, because you have got to get in touch with nature now and these are like – it was an educational basket. You know, you could investigate and even the species along, you know, like the ducks and the – you know, there was like – the ducks that we used to like were those ones with the bright yellow eyes (Informant H).

Hauora Maori - The presence of kaumatua represents "intellectual capital". They are holders of a wealth of critical information about the past and can draw on this knowledge to provide accurate assessments of environmental condition, including changes over time, at a localised level. The results from the Kai Consumption Survey confirm that differences in behaviours, perceptions and knowledge are found with the different generations. Loss of relationships with the natural world could lead to grief. Many feel whakama when unable to fulfil the social roles expected of their age groups. At stake with the loss of kai gathering is not only cultural survival, but potentially the physical and mental wellbeing of whanau members.

So we walk along the shore to get down to Utahina, to walk along the shore is mainly - it is just covered up in lake weed, so it is really hard to see if they actually still exist on those shorelines.

So my children don't spend the time in the water that I would like them to because the water is what connects you to - you know, it is what makes us well. It is one of the things that makes us well and provides us strength, and so then where do my children go to? (Informant J).

6.4 Perception of the health of the lakes' environs

Questions sought information from interviewees about their perceptions of:

- What environmental impacts that act as barriers to gathering?

- What environmental activities have impacted the condition of sites from which kai is sourced?

- What activities have led them to change their gathering behaviours?

With increasing European settlement around the lakes in the late 1800s, forests were milled, agriculture was established and urban settlements were developed. Numerous conflicts developed between the new settlers and Te Arawa, whose capacity to provide kairoto from the lakes and koha for hospitality was diminished with deteriorating water quality and introductions of exotic species. Today, through degradation Te Arawa have been progressively alienated from the lakes, their taonga and their role as kaitiaki although a number of restorative initiatives are being implemented. In the following paragraphs we identify some of the activities impacting the health of the lakes:

Changing land uses- Native vegetation around the edges of Lakes Rotorua and Rotoiti was milled for timber and cleared for farming, and later septic tanks were installed. These developments resulted in an increased nutrient load flowing from the catchments into the lakes. Excess nitrogen and phosphorous led to the growth of blue-green algae in the lakes. In the paragraphs that follow we summarise many of the impacts of concern to Te Arawa.

Sewage - Pumping sewage effluent into the Kaituna River is offensive on medical, social, spiritual and cultural grounds.

> *I suppose out of all the lakes, I think Rotorua was the most damaged from the sewerage, because when I was growing up - you wouldn't believe, they had the sewerage - the town dump down by the lake (Informant B).*

> *If we believe the lake is polluted then it is, and that the food in it is polluted. But we've been eating it for years so we're probably all immune to it now. But if anybody else from our side probably came in from overseas, they probably get crook (Informant B).*

> *I suppose there always is health risks, when pollutants go into the lake, but the trouble with health risks is that they're not instantaneous, you know, it takes years for it to appear (Informant B).*

They pump the town sewerage up into the forest in towards the Tukurangi Pa and as far back as probably about up to here (Informant H).

It's not right down here with the quality of the kai, then it must be from Te Puke, in which I won't be afraid to say that Te Puke is – they're mongrels, their 'shit' - all right and that's honest (Informant K).

Forest Clearance - Many native fish live within the forests in steep, cold streams with rapids and pools, that still retain a heavy cover of native forest. These habitats support banded kokopu (in pools), short-jawed kokopu (needs plentiful instream cover to hide in), red-finned bully (in wider streams), longfin eel (needs deep pools, large bank overhangs, log piles), koaro (in clear streams), banded kokopu, and giant kokopu. Koaro which are now rare disappear from streams when the forest canopy is removed. In unmodified streams koaro may still be found. Forested streams are probably the habitat required for spawning lamprey.

The trees are gone, some of them are gone, some cut down. Plus we went to a barbecue down the lake, summer this year, and what surprised me was the bareness. Not only bare of, you know it, around the shoreline, but bare of people to when I was – eh? Because it was always covered in kids. And all the kids were actually by us at the barbecue, throwing stones into the lake, even though it was a nice warm day (Informant M).

Deterioration in Water Quality Many native freshwater fish thrive in cold, clear, actively running water as they need a constant, organically clean, thermally and chemically stable water supply (Hine and Boustead, 1974).

Informants described the changes in water quality across the region:

But I remember being able to go down to the rock and when I jumped in the water, the water was cold and it was just what you did on a summer day. Now if I went to jump into that water it would be luke warm, and so what is going on that as a child it used to be able to quench me and be able to sustain me that now actually it's like "I'm not even jumping in there", something is going on with it(Informant J).

I think if I wouldn't drink it, then why would I throw my children in to swim in it, and yet there was a time where I would have been quite happy to have drunk out of the Utuhina River (Informant J).

You can get any shellfish you like out of this one. But …they're slowly disappearing (Informant C).

And I looked down and it looked down and it looked like somebody had done some big, huge, washing, eh, there was all this froth, eh, you know? And I go, "Look at that". All along the shore it was just thick froth. And I said, "Well, nobody got a washing machine this big, so it must be something else". Which I felt sad for because there is a lot of history in those lakes; a lot of people swam, a lot of people died in that lake, a lot of wars on that lake, eh.… It is a lake of memories, good ones; memories of flowers, memories of people. And at the moment now, all they are is memories because you have got a whole lot of rubbish that is stuck in it, (Informant M).

We get 44 gallon drums, we get pallets, we get everything coming down the Utuhina Stream, but in our bay, which is right next to the Saint Faith's Church, I get all the tennis balls.…… He gets all the golf balls, which we can't work out because tennis balls are lighter than golf balls and yet they come further around to the yacht club – that is right next to the yacht club, yeah. And I think one day there we got over a thousand golf balls out of there. And so that is coming down the golf course up here, down the Utuhina (Informant D).

Without your water quality, food will never be sustainable from the lakes, waterways (Informant E).

Especially in summer time when the algae bloom gets at its worst, you know, and you see - because we frequent Lake Tarawera, when you see that yucky horrible greeny colour and Lake Rotomahana that totally, totally looks disgusting now …The colour and all those floating things and heaps of feathers and all that weed and the smell (Informant F).

Even Noho Kakahi get a lot of ugly looking floating algae looking things in there. Yeah, the colours have all changed. In Tarawera you could look over the jetty and look down and you could see the lake weed at the bottom and now you can't see anything full stop (Informant G).

I took my grandchildren for a swim down the lake, and I hadn't been to the lake for a while, and we were swimming around there for ages and I got some kouras and I knew they was hot so I let them go…. we were walking home and I go (sniff, sniff) something was stink, eh, and I smelt it and it was me, from

the lake. So I got home and from then I wouldn't go back in the lake (Informant M).

Yes, the smell from the lake [Rotorua] is so putrid. So, I mean, certainly as I got older as a teenager, I don't think it was just a teenage thing, I just think the quality in the lake just seemed to deteriorate at quite a rapid period, or maybe I became more - because as a child there was no problem in putting your head under the water, but now, and then if you go around (Informant J).

Bio-security – specific to Maketu, one species of concern was identified –

Starfish, but that's fallen off some of these big boaties. Those big boats, when they empty their ballasts and that's where those come from. You know, when they come over and then they collect the logs and they pump all their ballasts out (Informant C).

Irrigation - Extraction of flows to enable irrigation can cause rapid alterations in stream flows resulting in exposure of bank vegetation, and loss of fish habitats.

Disappearance of kaiora - Insects represent a source of food for freshwater fish. Native fish are deprived of this resource by forest clearance, agricultural pesticides, and competition from introduced fish. As early as 1920, the entomologist Tillyard reported to the Government that trout had caused serious declines in aquatic insects in the Rotorua–Taupo streams and lakes (Tillyard, 1920). Informants commented on other changes:

And I remember even getting some paua - oh, about maybe eight years ago I suppose – and you know, they were okay but then you take them out of the shell and you can actually see the discolouration in the shells and it is like it is from the quality of food that is keted and (Informant H).

I missed all that - beautiful, it was just natural. And the croaking of the frogs - we didn't even need a clock to wake us up in the morning. Five in the morning the frogs would croak and they would start in harmony and sing all these beautiful tunes - high and low, and that got us up - the frogs. See, you don't even hear a frog today, you don't see a frog, it must be affecting the environment (Informant E).

I mean the birdlife was one of the most beautiful things to watch and you could always tell with the seagulls when the inanga was running - the birds would tell you. Now you don't see that as often. We've lost that as well. The

birds will go to another area where it's peaceful and quiet, plus if you have the habitat taken away like your swamp lands taken, they will go elsewhere, and that's what's happened to the Ohau Channel because of the dredging and now it's like parkland (Informant E).

But the pauas, they are all stunted; they're all got to a certain size and that's it. They never grew any bigger. Everybody else, they say - oh, we got some big pauas. You can't get big pauas here. They only get to it once, I think, and that's it (Informant C).

Impact on wahi tohu

Maori used tohu within their natural environment as indicators of predictability. By using indicators that have evolved over time through trial and error, through a history of continual use, Te Arawa monitored the condition of the environment, shaped their behaviours accordingly, and if necessary protected it by applying a rahui – using tohu to understand predictability represents a traditional management technique akin to the contemporary practice of adaptive management. Sadly changes to many lakes mean that historical patterns and processes are changing to the extent that rainfall (and other climate patterns) and lakes are being described as unpredictable, meaning the application of tohu may be limited.

Dredging - As swamps have been drained, natural streams have been straightened and dredged, destroying the food resources, refuges, and spawning gravels of native fish. However some informants believed dredging was not necessary at Maketu:

Well, I thought – I told them that. I said, "well, you know, the only way you're going to get to this - is you're going to have to dredge this" He said, "you won't be able to do it." (Informant C).

Swamp Drainage - Before the clearance and drainage of the vast kahikatea forestlands, extensive tracts of swamp, with pools enclosed by flax and raupo, were a feature of the region. These habitats sustained inanga in vast numbers, shortfin eels, and giant kokopu. Maintaining swamps is vital to the productivity of whitebait fisheries. Areas of lowland fisheries have been lost to land clearance, drainage, and trampling by stock. Drainage was identified as a particular concern at Maketu.

Pine Forestry Practices - Pine forests replace native forests and create a new environment around streams that is not a substitute for native forest cover. Forestry practices of burning, bulldozing, road building, and hauling modify streams.

Rapids, riffles, flats, shallow gravels, deep pools, and overhanging banks that provide the habitats in which native fish forage, hide, and breed are modified or lost. Forestry practices can disturb stream banks and stream beds, and load stream flows with sediment. Forestry practices can alter the chemical composition of streams as slashed vegetation rots, as phosphorus, nitrogen, and potash enter streams after burning, as forests are sprayed with chemicals and fertilisers, as mills discharge effluents, and as toxins leach out of sawdust and waste woods.

> *We used to have native trees and native trees don't throw out pollen (Informant E).*

> *Rotorua, Rotoiti, they are all small lakes, they just can't handle it. I say it is caused through pollen, everything else has changed the quality of our water (Informant E).*

> *But it's not only the kai from the lakes that depleted a lot, it was also from the forestry…the trees getting cut down and the poison coming in (Informant G).*

Modifying Estuaries - Many species of native fish pass through estuaries that provide a crucial transitional habitat which reduces the shock to migrating fish of changing from fresh water to salt water (Dinamani and Hickman, 1980). Maketu has been impacted by landuses and the diversion of the Lower Kaituna River.

> *Put it back through the estuary. But you can't – they say, oh, it will open it up and it will just flush it – you'll never flush it because they've left it too long. She's silted up that high now; she'd be, well, you could walk across here; walk across the thing. Before you had to go down a bank; now you can walk straight off the bank and straight into the sea (Informant C).*

Impacts of river management

> *The environmental impacts that have now impacted on Maketu whereby in the early years everything was pristine, beginning from Rotorua/Ohau and then down here, and we have seen the changes over the 50 odd or more years. But what we valued most was, I guess what was coming from Rotorua, the freshwater and the marrying into the saltwater which created within the estuary here. And from that – from a human being sort of observation and within ourselves and our firm belief that the wairua of the water and both mean together it created a uniqueness in terms of Newton's, whatever you call it, the "mixing" and, of course, with the end result, resulted in the food bowl of Te Arawa (Informant K).*

It was the installing of the weir around about '89, we've lost the whitebait (Informant E).

In addition to the adverse effects of the Kaituna Cut, the wall at Rotoiti was identified as a concern:

But I'm not very happy with the wall that they put in. I think it's going to cause problems. Why I say that is that just from my own way of thinking is that when you put a wall up and the wall becomes a barrier between Lake Rotorua and Lake Rotoiti…when the river was flowing down through the lake it dragged Rotoiti with it … The current going down drags the Lake Rotoiti water with it and creates a movement up the top end of the lake, admit it takes a while but it does…But when you put a barrier in, Rotoiti becomes a swamp…And you are not going to have that water dragging the Rotoiti water with it because it's going down against the wall (Informant B).

Game Fish Introductions - Trout and other foreign fish species were introduced into the Te Arawa Lakes from the 1870s onwards by acclimatisation societies, local bodies and government departments.

In lakes and rivers trout compete with native fish for floating insects, aquatic larvae (especially dragonfly nymphs, fly, caddis, mayfly, and stonefly larvae), and native aquatic snails and molluscs, especially in winter when food sources are meagre. Small longfinned eels living amongst the river gravels feed on aquatic larvae (caddis and mayfly), snails, and midges; their food is so similar to those of trout that competition is likely (McDowall, 1989).

But not all introductions were negative:

Morihana was probably one of the most valued fish in Lake Rotorua or in any of the lakes, that was a real delicacy, morihana, but of course that was introduced.

Land intensification

Like other regions around New Zealand land intensification is a concern especially if land use is dairying:

And now the cows – because the cows don't come down but there must be seepage, you know, back into the river. Well, I think if you knocked the blimmen river back to the way it used to run, then you'll get them - they'll

come back. What they did, they blocked off the main river and then they opened up this new one. Well, since they opened that up, then you get very small ones (Informant C).

Informants described the obligations they believe rest with the landowner -

So my whakaaro is, where everybody has got a farm around here, wherever there is an outlet, that should be all tested. And if, say, people have got a farm there, as I was saying, they own that piece, but the land not the water. We do. The people of Rotorua. So what we must be protecting is all this. So if they have got a farm there say, "Okay, you guys, you get plenty of money out of that, so use some of that money to make sure your sediment doesn't reach the lake" (Informant M).

Government and council actions acting as barriers – including the impacts of fisheries regulation - Government regulation required Te Arawa to pay for licences to take trout and certain other introduced species from the lakes. This restricted the ability of Te Arawa to fish in a customary manner (such as with nets), restricted their food supplies and imposed a financial burden.

Informants described how they felt when regulation was introduced –

Once they started bringing in fishing licences. We were saying "well, what about us and our indigenous fish?" We could just take - you know, when we thought we owned the lakes and it was leased out to the Crown, to us it was our traditional fishing rights and it just felt our fishing right was being taken from us (Informant E).

Our old people said – "no way are we going to take compensation, because the day we take compensation we will lose our customary rights, we will lose our customary fishing grounds, we will lose it all", and they are true (Informant E).

As part of the Te Arawa Lakes Settlement Act 2006, however, the Crown has made regulations to empower the Trustees of the Te Arawa Lakes Trust to manage the customary and recreational food gathering of included species in the Te Arawa Lakes (refer to http://www.tearawa.iwi.nz/fisheries-regulations; see also http://www.niwa.co.nz/our-science/freshwater/our-services/freshwater-species-and-habitat-management/te_arawa_lakes).

Other resource laws - The statutes displaced Maori interests in the indigenous fauna and consequently Te Arawa lost their economic and social interests in the flora and fauna. Iwi and hapu lost rangatiratanga over the fauna of their whenua. Statutes protected the conditions for introduced fauna to thrive. As a result predatory game fish displaced native fish from lakes and waterways (Rowe and Kusabs, 2007). Spawning grounds of inanga and kokopu were and continue to be damaged by stock and logging. Maori lost their self-sustaining harvests.

Loss of riparian vegetation -

Historical text describe the natural vegetation around the lake. However informants raised the loss of vegetation as an issue.

Raupo, they've all disappeared around the lakes - it used to all around the lake. Poupou, which they used to use for making their whariki and all that. But it has all disappeared, you know, because when they disappear other things disappear. The homes for koura, they used to live in the poupou, under the roots. Well, they all disappeared so they've had to move somewhere else, and the raupo - they used to live in amongst the raupo and all that (Informant B).

I'd like to see all that stuff growing back again, especially the poupou and the raupo, I'd like to see it all back around the lake, and the lake a bit more cleaner than what it is. There is not really much we can do at the moment because all the silt at the bottom now, it is all built-up and I think it's going to stay murky for quite a long time. But I think once - give it another 20 years, as long as we clean the streams up, it will wash it all out (Informant B).

We used to walk through all the weeds and the raupo…. We used to go with our pitchforks and catch the morihana, eh? And it was like walking through a garden. So the key is, whoever is looking at this and they are trying to figure out how a person got a motor mower into the water …All the dust, the sediment comes up and blocks the view of the koura. But, when I was a kid you didn't have that. Years ago we would have cut a car tyre up, hammer it to a piece of wood, light it, and that is how we used to catch koura. And you could just walk like that and you would still see them (Informant M).

I don't know how they did it, but I am trying to figure out people can get a lawnmower into the water, eh? Because everything around has disappeared. Whereas we used to have to climb though it, eh? You know, you had the little

vines … you used those to swing out over the lake? Well, those are all gone. And, to me, the motor mower goes that far.. (Informant M).

Raupo was the cleanser of the waters (Informant E).

The chemicals were actually killing our raupo and our natural cleansers. When you look at a raupo you will see it has got a sponge like that goes into the water and it sort of sucks in all those nutrients (Informant E).

And this is what I've been telling the Environment Bay of Plenty and RDC. It was just all raupo until they started building homes. And what do the new owners want - a jetty instead. So they pull out all the raupo and up goes the jetties. See, you change your environment (Informant E).

It's one of the things that just sorts of just sneaks up on you though, the vegetation around the lake, just sort of a wee bit disappearing and then a wee bit disappearing (Informant G).

New settlements/subdivision - The lakes were removed from the ownership and management of Te Arawa.

It's absolutely beautiful. And this is why people are spending heaps of money coming to live in the bay, but they bring all their jetskis, they bring all their motorboats and it's just crazy over Christmas. They go round and round in circles - just about hitting each other. The noise is quite threatening too, because you can't hear your phone…(Informant E).

I suppose what you do notice is that as our population increases and as we are not so appreciative of our whenua, the repercussions are that our lakes pay for our non-appreciation. So as Rotorua has got bigger, Lake Rotorua has got - the quality of the water in Lake Rotorua has paid the price for development here, you know, and as our farms have got bigger and as our technology has got bigger and better, the prices have been paid with the whenua, particularly our water (Informant J).

Now the hundreds and hundreds of boats that are getting launched at our lakes. Fuel leaking into the water. Because we're on the jetty and you can just see all the fuel and the oil sitting on top, yeah, still dive through it. Curse them and dive in (Informant F).

All of the changes described above are relevant to this research as changes, directly and indirectly impact cultural practices, principles and tikanga associated with food gathering:

- Young people are growing up not learning the basic knowledge associated with kai species, fishing, boating and gathering.

- Whanau are "losing the taste" of kai.

From 30 down there wouldn't be a huge interest in it because it is not something that they have grown up with, but certainly from my age up, like, you know, if my grandmother was to - if you were to put a plate of koura in front of her, I think she would almost eat the shell from it. You know, that is the sort of level of delicacy it is for her, whereas if I were to put it in front of my son, he actually wouldn't be that impressed with it (Informant J).

- Kai generally was known to be good for health. There is a feeling that the younger generation don't know this, or if they do, they don't practice it.

- Fish and seafood is purchased more now, but often as fish and chips.

- Water quality is a concern for parents and therefore they are reluctant to let kids explore/play in aquatic environments unattended.

- Parents feel their children have missed something not growing up in an active hapū gathering environment.

- The context within which fundamental cultural practices such as whanaungatanga are learned have been impacted -

Generally I go with wider whanau, so we tend to do everything with my mother and father, my brothers and sisters, and even my grandmother. So generally there are four generations of us that are travelling out on these things, so, yes. Like, as an example, we go out to Lake Okataina, … which is where my great grandmother lies is over here, so she was buried over here, so it is sort of like when we are going out to these other areas it is generally like on a historical journey to learn about things about who we are.

Finally, the result of these environmental perceptions is uncertainty as to whether or not kai is contaminated from urban environment.

See, that is another thing we need to be watching to – is the taking of watercress from polluted streams and swamps and things like that. And we have got to be careful of taking watercress (Informant A).

No, no. I think the condition is still the same, except for the pipis. I just didn't like the pipis, whether it is the – I gave these to an old kuia and she said to me, "Oh, I put them in hot water and didn't get enough for a sandwich, they were see-through". But then I cleaned it out (Informant D).

Washed them out in a bucket and it was black, the water, so. But I know they are looking at diverting the cut, or putting it back through the cut. I do not know what they are going to do with the waterways over there. Yes. No, that is about all I really know about that area (Informant D).

It has got a muddy taste - it has to do with the taste, plus the look. I looked at the inanga and it used to be pure black and white when we were children - distinctive, because we used to make fish flies and then we found - there seemed to be a greeny looking yellowy stomach colouring of the inanga. It started to change colour and it didn't look right. I think it has a lot to do with the change - bland change of inangas to - often we see the pollen has got a lot to do, you see it come through here at the Ohau Channel today (Informant E).

I wouldn't take the risk of getting watercress from other areas because too many people are using sprays in the drains, the creeks running into the lakes (Informant E).

Whereas previously you would have quite healthy, and I don't know what healthy means, but they would - like the shell of the koura would be relatively strong and as the time went on the koura - like even when you eat you could, it was similar to a prawn in that when you broke it the flesh was still quite compact and still quite firm after you had cooked it, but recently if you - as you went on, the koura would actually become a lot more soft, like the flesh that you would be eating wouldn't be as firm and as sweet as it had been previously (Informant J).

Despite the level of environmental change and the potential for contamination, it needs to be acknowledged that lifestyles today leave little time for fishing activities.

6.5 Health and wellbeing of whanau members – the mixed methods and contradictions

Te Arawa continues to be dependent upon kai gathering both physically and culturally. Mahinga kai was the primary food source and the basis of an economy based on trade, barter and exchange. The transition from wild sourced kai to a western style of diet comprising commodity/convenience foods consequently impacted Te Arawa socially, culturally, economically and spiritually.

As part of the fisheries redress of the Te Arawa Settlement Act 2006 Te Arawa have their own fisheries regulations to manage their customary food gathering – Te Arawa Lakes (Fisheries) Regulations 2006. A Komiti Whakahaere has been established to coordinate the development of species management plans for each of 5 key mahinga kai species, namely koura, kakahi, koaro, smelt and tuna.

Toxic contamination and the resultant health impact on humans has received considerable research attention over the past three decades (Edelstein, 1988; Freudenburg, 1984; Perrow, 1984). This research seeks to explore the health risks of the changing kai gathering behaviours sourced by whanau and hapu in order to determine the ongoing risk of exposure to contaminants.

Changes to the relationship with the lakes have resulted in a range of health and wellbeing implications. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between the lakes and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

Physical health - Physical health is directly linked to the quantity and quality of food consumed, as well as the cultural, social and economic conditions within which individuals live. In the context of this research programme, physical health consequences arise from four factors:

1. changes in the nutritional value of foods consumed today compared to their traditional diet;

2. being denied access to gather also affects health by limiting the physical exercise associated with the act of gathering;

3. the risk of contamination of kai that is consumed;

4. the risk of contamination from the sites that kai is gathered from.

The loss of access and use of traditional resources is now recognised as being a contributor to a change to a western style of diet and the consequent rise in diet-related illnesses which from an economic perspective could cost society. However the converse is also of concern as for those whanau who still gather kai, there is a risk of exposure to contaminants from eating wild sourced kai.

An important health benefit of kai gathering results from the act of gathering itself – an activity that requires physical activity. The importance of exercise to general physical health is widely recognised.

> *The old man; threw us in the lake and taught us how to swim and we were about seven or eight. We used to come down here but then we were diving when we were about 10, 11. We were going out with the old man and diving, and we dived from then right through but only to feed the, like I say, again (Informant C).*

> *Well, I was lucky, I had the chance to be brought up on the shores of the lake. And during the summer I would go down there at 10 o'clock in the morning, after breakfast, jump off the boat when the whistles come, go back after lunch. That would be hard case. We were all sitting out in the boat, and the whistles all along the lake go. You know, like my cousin Fred, my cousin Johnny Mata, their father and then my mum, my koroua and them would whistle out. And then we would jump off, swim back and go for lunch and then meet you after 1 o'clock, come back down to the lake. And we were still there at night, light our fires and go home sometimes at 10, 11 o'clock at night, after we would get the run of koura (Informant M).*

> *It was our playground. Yeah. There was places – we had the clay rocks… We used to walk those every day, in the water (Informant M).*

> *Every time we went out. It never ran out, eh? We would go down and we would all meet down at the lakefront and play around and what- have-you, and then go out and then just dive, (Informant M).*

The comments confirm that Te Arawa, like other Maori, were physically active in the course of gathering kai. Although the amount of exercise that whanau get now as a result of gathering has declined, those surveyed reported engaging in some activity,

although the frequency of such activity has declined as gathering behaviours have changed.

However, it cannot be assumed that all gathering will be beneficial as the physical act of gathering resources could expose whanau to health risks as the sites where gathering occurs, specifically the waters and sediments, could be contaminated. The levels of contaminants in kai gathered and the environments in which they are found in the Rotorua lakes area, will be reported separately. In addition, models describing possible risk to tangata whenua will be developed as part of the risk assessment and communication component of this project.

> *It is common for those children today to have sore eyes or running eyes, diving into the water that has become contaminated by goodness knows what from up top (Informant A).*
>
> *I shot a lot of ducks. …We shoot the Green Lake and nobody shoots the Green Lake ….I need a mate now. I need a mate with a small boat so we just can put it into the Green Lake and set our maemae (Informant A).*
>
> *See, a lot of our rivers and waters were commonly used for washing clothes and they had their lines along the riverbanks. If you notice, you see their clothes hanging up, and of course if you go down to Kawerau, people are worried about the effects from the mill. Well they are still having that – ongoing problem with the bottom end of the Tarawera River (Informant A).*
>
> *And the safest place to swim is actually down at Tarua Road in the Aquatic (Informant M).*

Wellbeing - The benefits derived from being in natural settings are also gaining increased recognition (Kaplan and Kaplan 1977, 1982). In addition to the data on diseases within the family (using data obtained from the Kai Consumption Survey), the interviewees described the broader social, economic and cultural impacts resulting from the changing patterns of kai gathering and consumption on their wellbeing – as individuals, as whanau and as a collective. The comments of informants describe the contribution of gathering and eating kai on wellbeing.

Continuity of the relationship between tangata whenua and the lakes of the Rotorua region through many generations has been essential in the creation and maintenance of a powerful sense of place and whānau - reinforcing ancestral connections, identity, pride and ownership of the area. This relationship has also been the source of healthy kai that has sustained the whanau of Te Arawa. It also brings responsibility and

obligation for honouring and maintaining the kaitiakitanga, mātauranga, tikanga, and manaakitanga associated with aquatic environments. The lakes were and continue to be, the dominant 'environmental' context for work, leisure, culture, life and death. Indeed, many features of the lake environment provide a daily reminder to past events and people, reinforcing this strong sense of place-centered identity and kaitiakitanga. The lakes of the Rotorua region are both physical and emotional tūrangawaewae.

Having experienced a slow cultural transformation for generations, some hapu members feel/know their collective wairua has been damaged, which brings its own type of frustration and mamae. However, despite the many changes there are those who feel culturally and spiritually sound and have an optimistic view on hapu and cultural health. For them, asserting rangatiratanga is necessary if hapu and cultural health are to improve over the next generations. For many indigenous tribes, the primary goal is simply survival – politically, culturally and physically. While physical survival will always be dependent on the lands, freshwaters and seas within a tribal territory continuing to sustain life, cultural survival is predicated on the assumption that the tribe will continue to have the will and the capacity to preserve practices that sustain, strengthen and revitalize the iwi sense of identity.

> *We have got to treat all these other lakes the same as they are treating Rotorua and Rotoiti (Informant A).*

7. The next steps in the research process

7.1 Next steps

Using the site specific data and the species data that resulted from the Kai Consumption Survey, the next stage of the research has identified the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori. A summary of the sites and species from Te Arawa that were used to develop a sampling programme for investigation of contaminant levels is presented in Appendix 2. The analyses that have been undertaken will then enable the researchers to establish potential pathways of contaminant bioaccumulation via the food web, as well as potential risks based on present kai consumption patterns. This information will then be available to whanau from Te Arawa. It is at this stage that consideration needs to be given to how the data (and implementation) is to be disseminated.

7.2 Disseminating advice about contamination issues

> *Communicating the risks of environmental contaminants in the food chain to northern Aboriginal peoples poses significant challenges for communities at risk and environment and health professionals alike..… communication practice on this issue include increased fear and confusion in northern communities, changes in the dietary behaviour and traditional lifestyles of their residents, and associated impacts on their society, economy, and health. … The importance of this information is increasing as research begins to detect subtle health effects from exposure to these substances among newborns in some northern regions. Thus planning and evaluation are needed for risk communication, and possibly changes to the scale at which communication work is done in northern communities. Furgal et al., (2005).*

Furgal et al (2005) contends that some of the challenges associated with communicating contamination risks are unique to the specific issue and the context of communities. Te Arawa find themselves in a Catch 22 - as a result of trying to balance two potentially conflicting perspectives:

1. the health and wellbeing benefits that results from the continuing practice of gathering kai or conversely the impacts that arise when changing from a traditional lifestyle and diet; and

2. the adverse impacts on health and wellbeing arising from contamination of aquatic ecosystems and potentially the kai species themselves.

The cultural comprehension of what is "risky" behaviour is complex. Maori, like those in other indigenous communities, have limited experience with food safety issues of relevance to contaminants potentially found in foods they gather.

Understanding how indigenous communities perceive contaminants has significant impacts on the reception and effect of messages delivered. Usher et al., (1995) contend that communities may distrust the information they receive about contaminants in foods and their distrust could affect their reception of further explanations or clarifications. Furgal et al., (2003a) found that concerns over contaminants was not a determinant of food choice in one Labrador community, yet Kuhnlein et al., (2003) reported that 42% of women interviewed in five western Arctic communities indicated "concern over contaminants" as a reason why they did not serve more foods to their families. The objective of this research is to effectively convey to Maori the potential risk of gathering kai. Overseas research indicates a number of aspects need to be addressed.

The advice to be delivered - A minimal amount of work has been undertaken to identify the types of messages that elicit certain or desired responses. Usher et al., (1995) indicates that good messages are direct, simple, not condescending, put in a personal context, accurate, translated into local languages, delivered early and often, and build upon local understandings and knowledge of the issue.

> *What needs to happen is, as part of the discussion, is finding the alternative…. we are not simply saying that the message is "here is the problem, deal with it" actually "here's the problem but we have an alternative for you so that you can still continue to do the things that you and your family have always done" (Informant J).*

Materials to be presented - Numerous forms of materials have been used to communicate messages on contaminants and country food in North America including posters, fact sheets, reports, pamphlets, personal letters, radio public service announcements, radio call-in shows, regional video programs, door-to-door or face-to face communication, community meetings, school curriculum materials, and national live television broadcasts (Furgal et al., 2003b). From the Kai Consumption Survey we know that a range of media is likely to be needed.

Delivering the advice - To be effective a message has to be distributed through pathways that ensure it will reach and engage the target audience - in this instance, hapu members who gather kai. Furgal (1999) and Grondin and Carron (1999) in their work with northern hemisphere communities identified the need to consider both formal and informal pathways of delivery and information circulation. Data from the

Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by:

Formal networks: Health Protection Officers and Environmental Protection Officers.

Maori Health Workers.

Informal networks Whanau members.

While Maori have been active in developing relationships with resource management agencies, formalised relationships with the parties that can undertake the research necessary to understand contamination issues and deliver the messages may need to be developed.

> *Apart from the paper and the signs being out there, email is always a good communication tool, a text (Informant F).*

> *I suppose an exercise would good for our people, you know, to know what are the - which are the best weeds for the lake and which are the real pests so that we, yeah - a lot of our people don't know this. In some cases don't know the difference between the native weed and the pest weed (Informant F).Maori learn best by kanohi ki te kanohi, face to face discussion, and also being involved in the discussion. So not just simply saying "this is it, here it is", but saying "okay, this is it, here it is, what do you think the solutions are for you and your family". You know, so - and the other key is finding presenters that actually present in a medium that they take it on board, and that is the key (Informant J).*

Specificity - Vaughan (1995) and Slovic (2000) contend that personal experience, gender, age, socioeconomic status, and profession influence perceptions of risk. Understanding how Te Arawa see the issue is critical to ensure that the communication is best oriented towards their understandings and perspectives.

McGrath (2003) argues for a relationship based approach to exchanging knowledge on issues such as contaminants within and between communities. This will require scientists and communicators to understand the informal paths of information flow in communities so they can develop mechanisms that support and utilise these pathways to communicate information about contaminants.

> *One might argue that little true "communication" on the issues of contaminants, food, and health has taken place between scientists, health professionals, and Aboriginal residents in many northern communities; rather, a great deal of scientific information has simply been disseminated (Leiss, 1997).*

Understanding and developing ways to better communicate information on contaminants and their impacts on health is critical. Reports of contamination can undermine confidence of whanau in their environment and gathering of resources as a source of individual and collective well-being.

7.3 Implications for future management

The results of the Kai Consumption Survey show that the gathering and consumption of kai awa, kai roto and kai moana is highly complex. This is in terms of both the differences in availability of kai awa, kai roto and kai moana between hapu, the diversity of aquatic habitats, and the diversity within and between whanau. There is some indication that consumption levels are also related to the quality of kai awa, kai roto and kai moana that is available and the quality of aquatic ecosystems that they come into contact with when gathering. These results enable us to make a number of observations with respect to future management.

Sites from which kai is gathered - Where and when people gather kai is a function of the location of their work, the proximity of waterbodies, and other activities of a whanau. This is supported by Garaway (2005) who argues in relation to fishing that it is almost always combined with other activities. The Kai Consumption Survey confirmed that whanau are likely to go fishing in a nearby lake or stream thus reducing the time spent travelling between areas of work, home and collecting. For Te Arawa this means gathering from the lakes. Fortunately many in the community, aside from Te Arawa, are putting their hand up to protect the many waterbodies that support kai gathering.

Perceived changes in the abundance of species - If Maori are interacting with aquatic ecosystems on a regular basis they are ideally placed to observe changes – to sites and to species. Guidance is needed to ensure that their observations are part of a structured and robustly designed perception study so that they do not have their observations dismissed as being "anecdotal". However, the challenge will be that few agencies support perception based assessments – let alone prove that a species is at risk and in need of management intervention. The implementation of the Te Arawa Lakes Regulations (2006) includes development of species management plans by Te Arawa iwi members, through a Komiti Whakahaere. As part of these plans a

monitoring programme is likely to be initiated and will allow direct involvement of iwi members in reporting on changes in species abundance and distribution.

Kai gathering behaviours - There is a complex mosaic of uses and users of aquatic resources within a takiwa that collectively shape the livelihoods of whanau and hapu. Kai gathering cannot be classified as one activity. Instead, they are part of a complex combination of activities for a range of members in a household. As the survey shows whanau hunt, and tend fruit and vegetable gardens. The effort afforded to gather kai is not a homogenous activity – it is a flexible activity that is undertaken by different people, at different times, targeting different species from different waterbodies using a range of equipment. Collectively this confirms a complex relationship between humans and their environment. It is important that information continues to be collected to increase our understanding of these range of behaviours, including their aspirations.

Health and wellbeing of whanau members - Some informants explained that kaumatua represent valuable human and cultural capital: knowledgeable about kai gathering. While they may be disempowered by modern technologies they are well connected in the hapu and many continue to utilise their knowledge of mahinga kai.

7.4 Conclusion

This report has confirmed that the lakes and coast are integral to the cultural identity of the whanau of Te Arawa. It has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of both kai awa, kai roto and kai moana in the behaviours of whanau and hapu resident in the Rotorua Lakes Area.

The results from the Kaimoana Consumption Survey clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal that kai awa, kai roto and kai moana are vitally important to whanau and hapu in the Rotorua Lakes Area. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

Although the tendency with some contamination studies is to focus on the negative aspects whanau, despite witnessing degradation to valued taonga, articulated a positive vision for the future and we conclude this report with their words.

It would be wonderful to see the lakes come back to its pristine, clean quality (Informant E).

Nice clean, pristine – what I would like to see happen is my grandchildren or even their grandchildren dive in the lake and they can still see the same sparkle I did. And not put your foot on the bottom and then its dustier on the bottom of the lake than it is out of the lake. You know what I mean? (Informant M).

I think I'd like to see them cleaned up so that my kids don't have to go down every summer and read to see if there is a warning before they go swimming and that, you know. Be like when I was younger, used to just go down, you can swim, and an increase in the koura in our new clean lakes because I know they are getting scarcer and scarcer for those who do still go out and try catch them. I mean, I used to have fun using the scoop to catch them but I think the last time I went out it was a waste of time, didn't even get a pot full (Informant G).

But the amount of restorative work required cannot be overestimated –

That is what my wish is, to help the lakes. Because it is our food basket - treat it like that, and if you do, the quality – it's water, and water is sustainable - without water you can't do anything. You cannot even exist. My father said "take the sewage out of the lakes" and he fought through the Treaty of Waitangi to get the Rotorua District Council to take the sewage out. He proved the point, but when he died he said - it took him a lifetime. And it was so difficult because bureaucracy. He said – "You know, I've got mum to thank me. Mum was the one - she would help me. I would sit up late at night writing to the Crown. Nobody would listen to me". …So, that is my wish, that people will think twice about the environment and put more money into saving our lakes (Informant E).

The need for collaboration is recognised as an important strategy for realising the vision –

I see a positive future if all parties can work together and make sure that they are rowing the same boat and going on the same journey, and I mean, yes, if we get back to some of the fundamentals and, you know, and it can be something as little as starting to recycle properly so that those things aren't going into our lakes, simple stuff that if people within their homes start taking ownership for what is going on in their home and the things that they do as a

person and the impact on the environment, then if everybody started doing that, the benefits for Rotorua, we would see them in as short of a time as it has taken to pollute the lake (Informant J).

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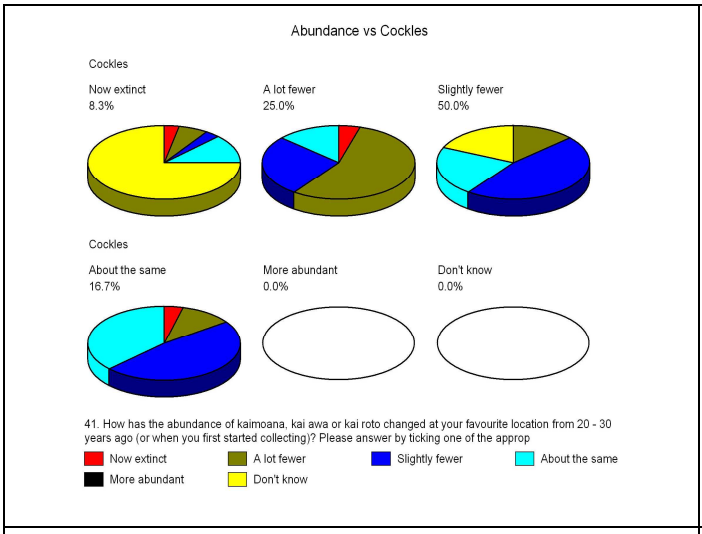
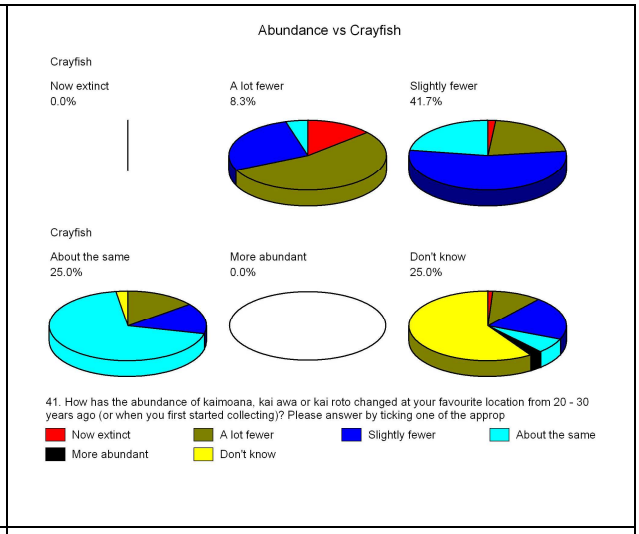
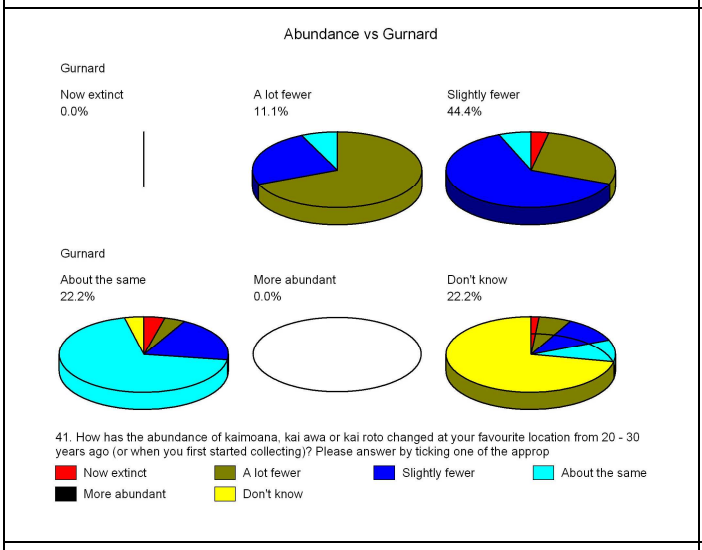
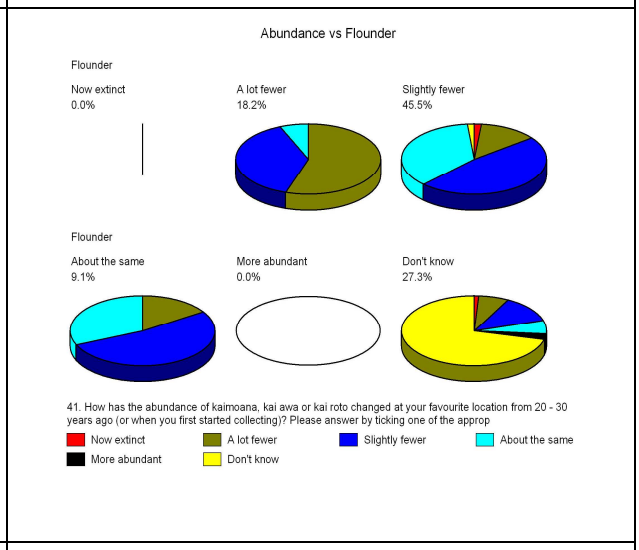
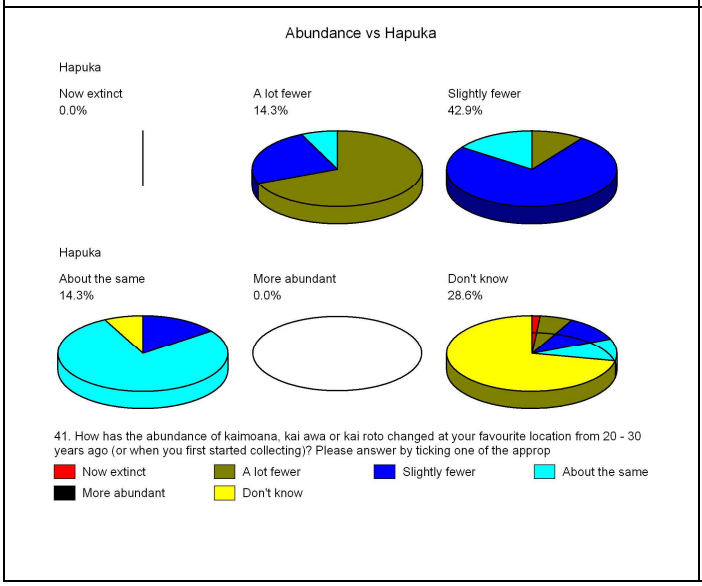
Appendix 1: Perception of changes in abundance of species

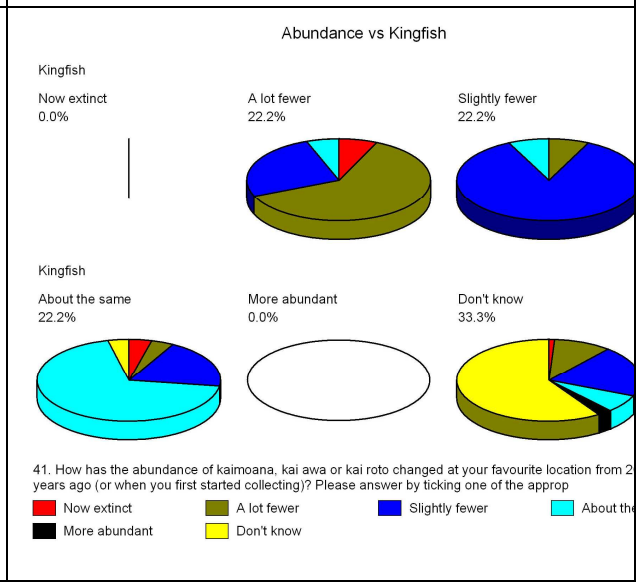


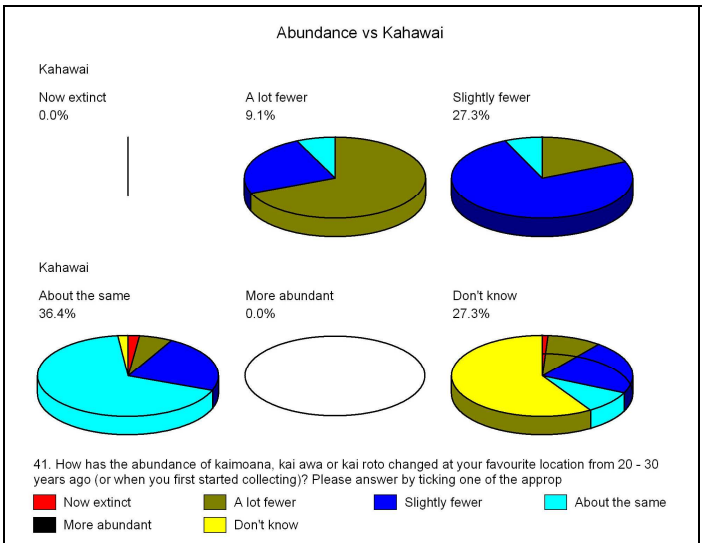


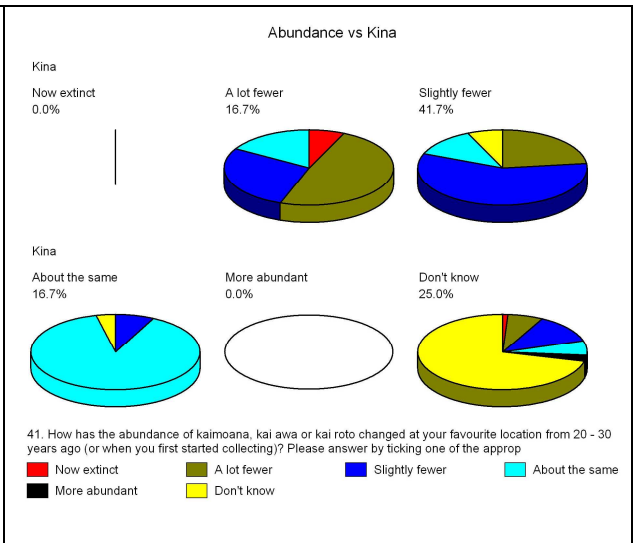


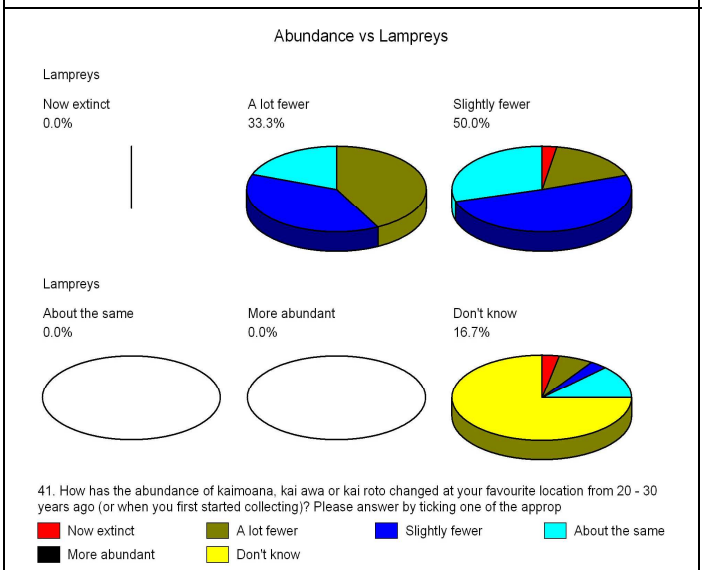


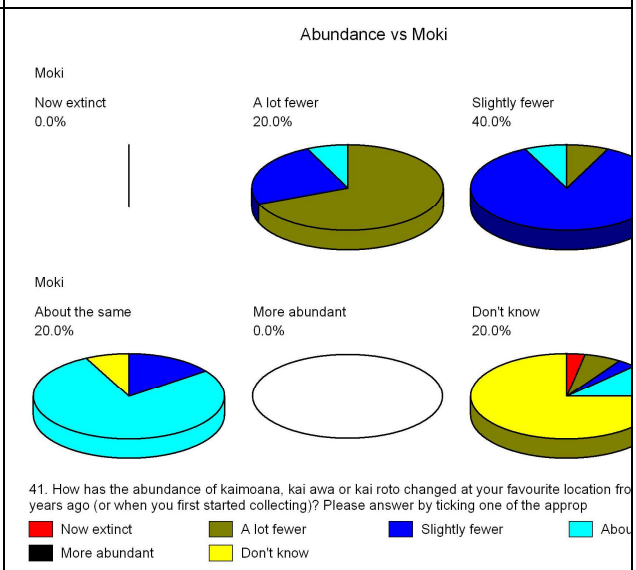


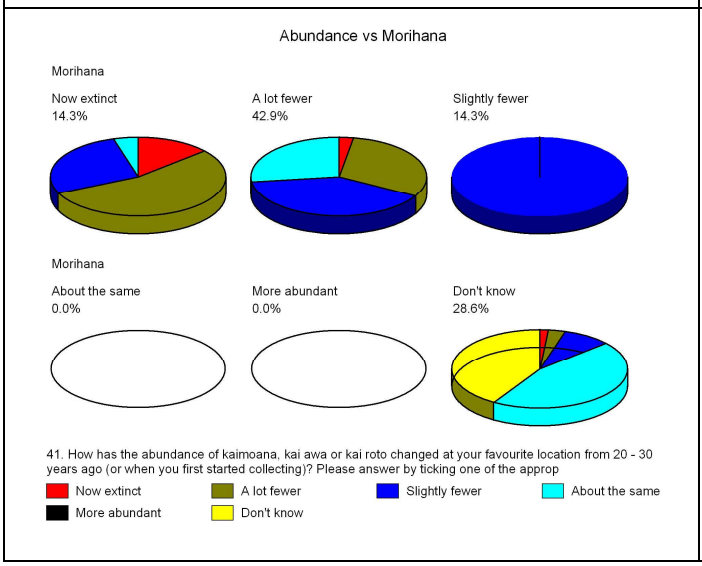


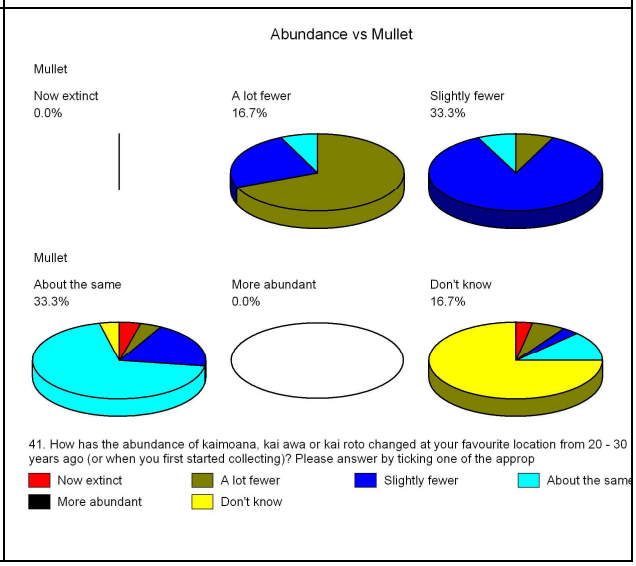

Abundance vs Kahawai
Kahawai
Now extinct
0.0%
A lot fewer
9.1%
Slightly fewer
27.3%
Kahawai
About the same
36.4%
More abundant
0.0%
Don't know
27.3%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

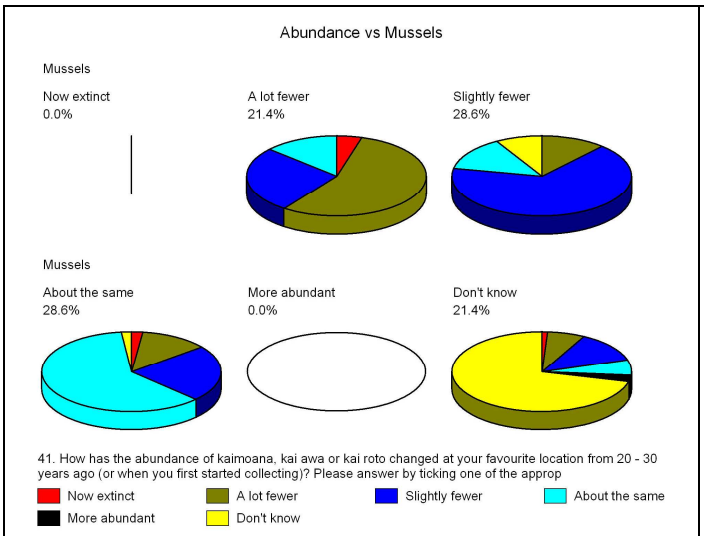

Abundance vs Kina
Kina
Now extinct
0.0%
A lot fewer
16.7%
Slightly fewer
41.7%
Kina
About the same
16.7%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

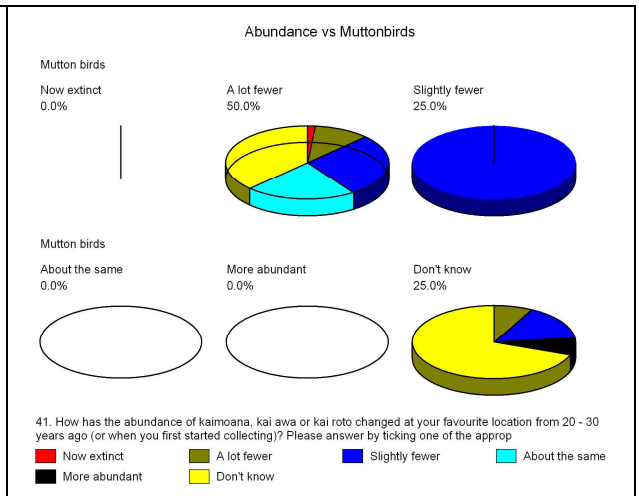

Abundance vs Lampreys
Lampreys
Now extinct
0.0%
A lot fewer
33.3%
Slightly fewer
50.0%
Lampreys
About the same
0.0%
More abundant
0.0%
Don't know
16.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

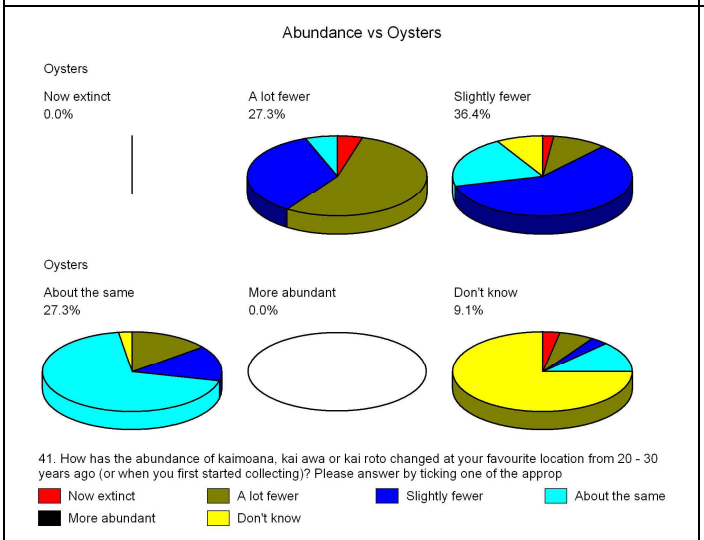

Abundance vs Moki
Moki
Now extinct
0.0%
A lot fewer
20.0%
Slightly fewer
40.0%
Moki
About the same
20.0%
More abundant
0.0%
Don't know
20.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location fro
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

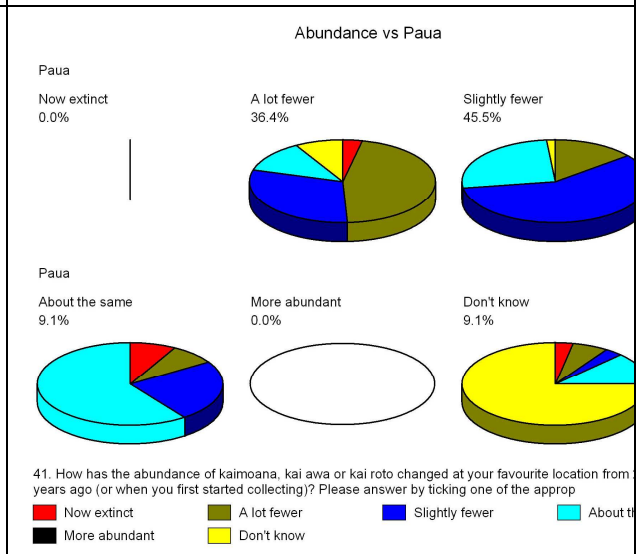

Abundance vs Morihana
Morihana
Now extinct
14.3%
A lot fewer
42.9%
Slightly fewer
14.3%
Morihana
About the same
0.0%
More abundant
0.0%
Don't know
28.6%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

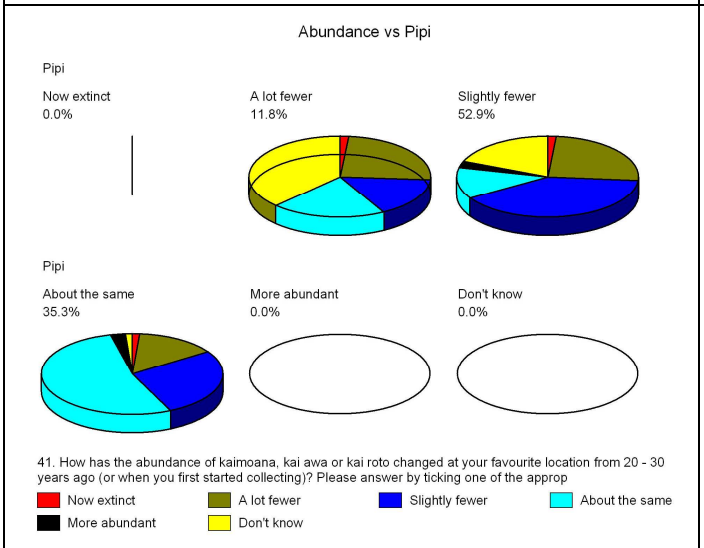

Abundance vs Mullet
Mullet
Now extinct
0.0%
A lot fewer
16.7%
Slightly fewer
33.3%
Mullet
About the same
33.3%
More abundant
0.0%
Don't know
16.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

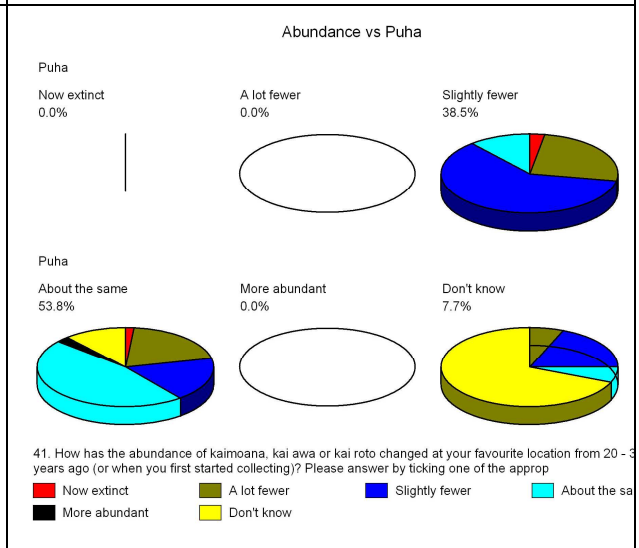

Abundance vs Mussels
Mussels
Now extinct
0.0%
A lot fewer
21.4%
Slightly fewer
28.6%
Mussels
About the same
28.6%
More abundant
0.0%
Don't know
21.4%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Muttonbirds
Mutton birds
Now extinct
0.0%
A lot fewer
50.0%
Slightly fewer
25.0%
Mutton birds
About the same
0.0%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

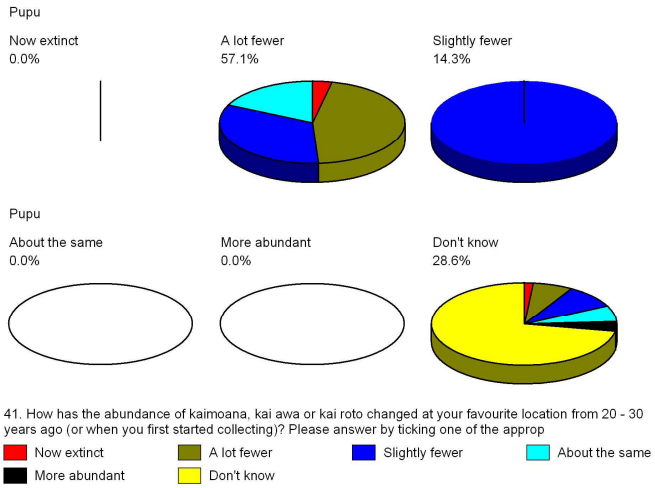

Abundance vs Oysters
Oysters
Now extinct
0.0%
A lot fewer
27.3%
Slightly fewer
36.4%
Oysters
About the same
27.3%
More abundant
0.0%
Don't know
9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Paua
Paua
Now extinct
0.0%
A lot fewer
36.4%
Slightly fewer
45.5%
Paua
About the same
9.1%
More abundant
0.0%
Don't know
9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know


Abundance vs Pipi
Pipi
Now extinct
0.0%
A lot fewer
11.8%
Slightly fewer
52.9%
Pipi
About the same
35.3%
More abundant
0.0%
Don't know
0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Puha
Puha
Now extinct
0.0%
A lot fewer
0.0%
Slightly fewer
38.5%
Puha
About the same
53.8%
More abundant
0.0%
Don't know
7.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 -
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

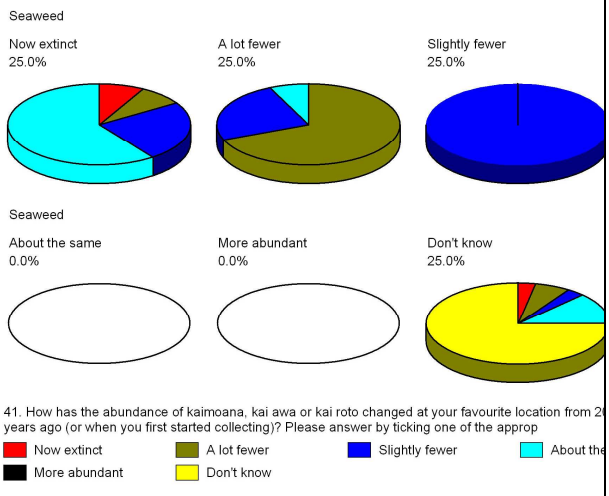
Abundance vs Pupu



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

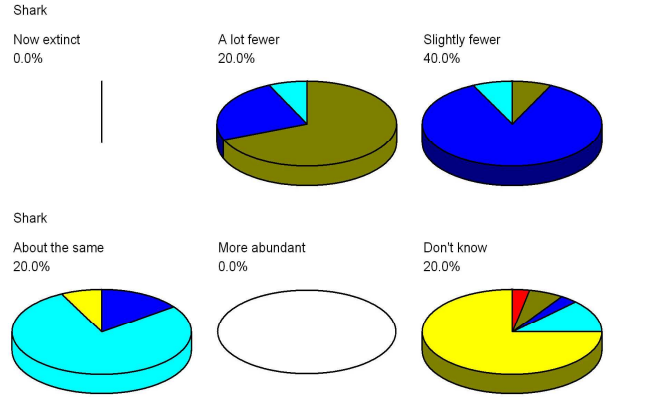
Abundance vs Seaweed



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 2
years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the
More abundant | Don't know

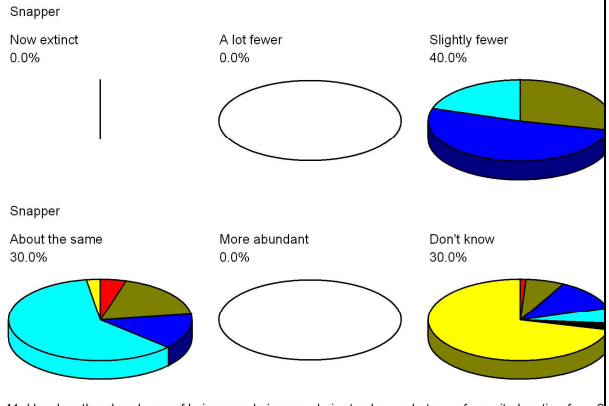
Abundance vs Shark



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

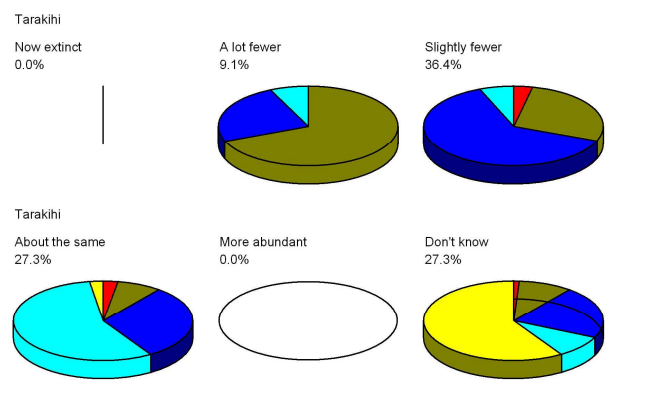
Abundance vs Snapper



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 2
years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About th
More abundant | Don't know

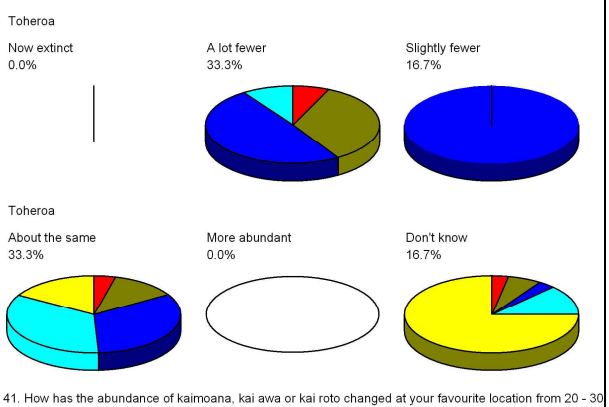
Abundance vs Tarakihi



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

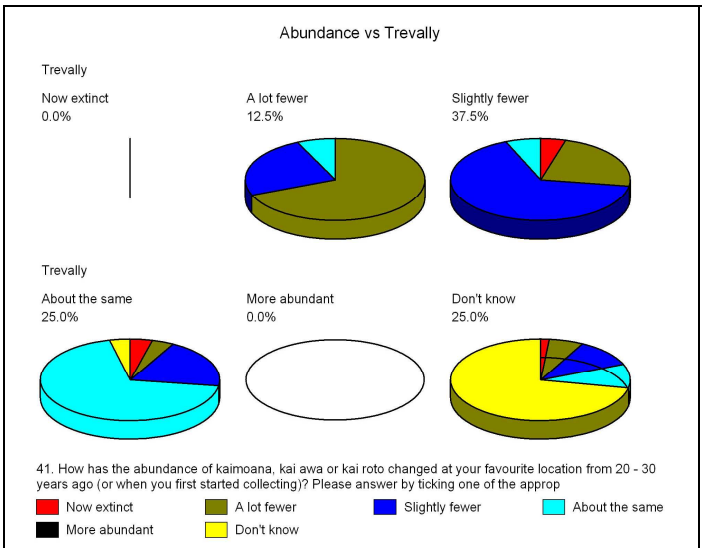
Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

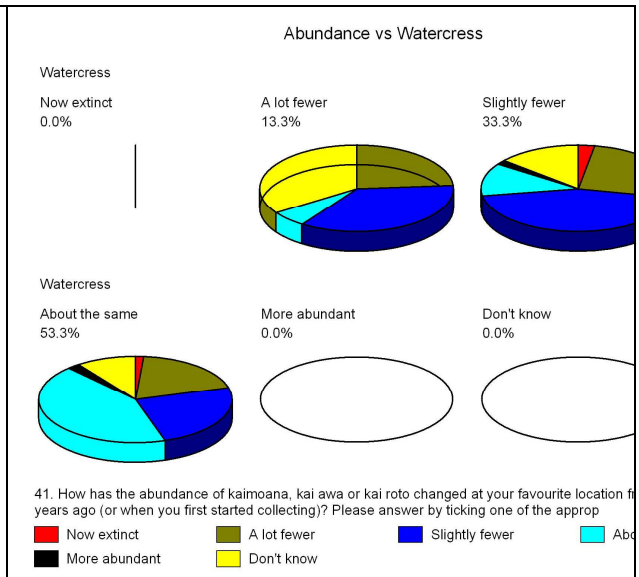
Abundance vs Toheroa

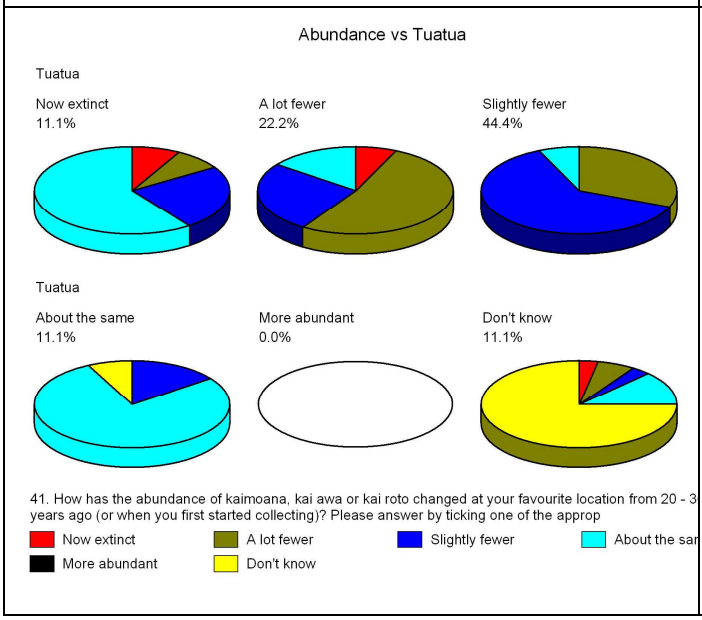


41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the sam
More abundant | Don't know


Abundance vs Trevally
Trevally
Now extinct
0.0%
A lot fewer
12.5%
Slightly fewer
37.5%
Trevally
About the same
25.0%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Watercress
Watercress
Now extinct
0.0%
A lot fewer
13.3%
Slightly fewer
33.3%
Watercress
About the same
53.3%
More abundant
0.0%
Don't know
0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location fr
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know


Abundance vs Tuatua
Tuatua
Now extinct
11.1%
A lot fewer
22.2%
Slightly fewer
44.4%
Tuatua
About the same
11.1%
More abundant
0.0%
Don't know
11.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 3
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

Appendix 2: Sites and species identified by iwi participants (number of respondents)

Kai	Rotorua	Rotoiti	Rotoma	Tarawera	Rotokakahi	Coast (incl Maketu)	Streams (incl Kaituna)	Ohau Channel	TOTAL
Trout	2	3		3	2	1	1	1	**13**
Koura	2	4	1	2				1	**10**
Pipi						7			**7**
Kakahi	1	3						1	**5**
Cockles						5			**5**
Tuatua						5			**5**
Inanga (Whitebait)		3				1	1		**5**
Eel		2				2	1		**5**
Kahawai						5			**5**
Kina						5			**5**
Paua						5			**5**
Mussels						5			**5**
Crayfish						5			**5**
Morihana (goldfish)		1	1	1	1				**4**
Watercress	1	3							**4**
Puha	2	2							**4**
Snapper						4			**4**
Flounder						4			**4**
Tarakihi						4			**4**
Pupu (mudsnail)						2	1		**3**
Kingfish						3			**3**
Moki						3			**3**
Shark						3			**3**
Oysters						3			**3**
Hapuka						2			**2**
Gurnard						2			**2**
Trevally						2			**2**
Seaweed						2			**2**
Lampreys						1			**1**
Mullet						1			**1**

Note: No gathering recorded from lakes Rotomahana, Rerewhakaaitu, Okareka, Okataina, Tikitapu or Rotoehu.

NIWA
Taihoro Nukurangi

A survey of wild kai consumption in the Te Arawa rohe

NIWA Client Report: HAM2010-096
August 2010

NIWA Project: HRC08201

A survey of wild kai consumption in the Te Arawa rohe

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Contents

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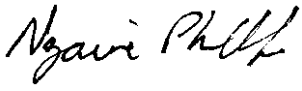

Dr Ngaire Phillips

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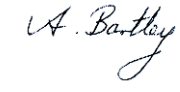


Executive Summary

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. Human health may be threatened either by the consumption of food (especially fish and shellfish) contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001). This research, funded by the New Zealand Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming. As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined, and pathways of potential contaminant uptake by tangata whenua investigated by analyzing relevant food-chain components.

Three Maori communities were involved in this research: Te Arawa: centred around the Te Arawa / Rotorua Lakes and Maketu coastal area; Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and Te Runanga o Arowhenua: centred on South Canterbury. The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts on the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

This report documents the results of the above research programme, specifically investigating the level of kai consumed by Te Arawa, whose whanau have resided in the Rotorua area for centuries. The lakes of the region were and remain taonga (treasures) for Te Arawa and are the foundation of their identity, cultural integrity, wairua, tikanga and kawa. For centuries the lakes have also been the mainstay of their economy as they and their margins were an important source of freshwater fish, waterfowl, and plants[1].

[1] For a detailed account of the traditional history of Te Arawa, see D M Stafford (1967) *A History of the Te Arawa People*, Auckland, Reed Books

On 18 December 2004, the Crown and Te Arawa signed a Deed of Settlement for Te Arawa Historical Claims and Remaining Annuity Issues over 14 lakes; Lakes Rotoehu, Rotomä, Rotoiti/Te Roto-Whaiti-i-kite-ai-a-Ihenga-i-Ariki- ai- a Kahumatamomoe, Rotorua / Rotorua-nui-a Kahumatamomoe , Ökataina / Te Moana i kataina a Te Rangitakaroro, Ökareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngähewa, Tutaeinanga, Ngäpouri/Opouri and Ökaro/Ngakaro.

With respect to the research design drawing on the earlier work of Bebbington (1999), importance of kai to whanau was examined using standard interview techniques according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

All of those interviewed for this research expressed a strong relationship with the lakes and the wider terrestrial and marine surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship. Two thirds of the participants spent their childhood in the middle of the North Island while 15.8% specifically identified Rotorua as the place where they spent their childhood.

A large variety of wild kai continues to be regularly collected, gifted, purchased and/or consumed. While whanau made use of many species, the centrality of koura and whitebait as a critical food source in the Rotorua Lakes is well known and is reflected in the initiatives to restore populations of taonga species. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in Rotorua Lakes region. Consistent with a kai gathering lifestyle:

- 42% grew their own vegetables;

- of the 42%, 21% of those who grew vegetables also grew fruit.

Having determined that all of respondents do consume different types of kai:

- 38% of respondents said they now only eat kai on special occasions; while

- 25.5% eat kai less than once a month; and

- 10% only eat kai 1-3 times per month.

In other words 73% eat kai 1-3 times per month or less. Of concern when reviewing the complete list of species and the frequency with which each was consumed, some respondents identified six species as being extinct (i.e., no longer present in the areas they gather kai from) – kakahi, cockles, koura, morihana, seaweed and tuatua.

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were then used as the basis for a sampling programme which examined contaminants in sediment and kai. Kai was gathered from 11 of the 14 waterbodies listed. The most highly used area was the coast as 52.4% said they gathered from Maketu followed by lakes Rotoiti (17.5%) and Tarawera (12%). There was no gathering by participants from lakes Rerewhakaaitu, Okareka, and Tikitapu.

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered. With respect to abundance, 56% felt that "fewer" stocks were available today, specifically, 22% of respondents believed that across all species gathered there were now a "lot fewer" available while another 33% believed that abundance was "slightly fewer".

There are little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation we assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats in the lakes, especially Rotorua. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, we can conclude that all respondents still consume kai awa, kai roto, or kai moana. In comparison to historic levels, the following conclusions can be drawn:

- The quantities available are substantially lower than historic levels and the levels desired by whanau who wish to engage in mahinga kai practices. The species that possibly approach

adequate abundance are mussels, which respondents confirmed were available and often sourced from the supermarket or takeaway.

> *You don't go out and get any watercress anymore, your river has become Pak'n Save (Informant M).*
>
> *I mean, we have got to the stage we are feeling directed to go to supermarkets and buy from there, it is more convenient (Informant E).*
>
> *We get our bulk food from the supermarket, whether that's vegetables, it's fish, seafood. Everything comes from the supermarkets. It is totally different today. We have no control over that. We aren't able to go out and get koura like how we did - it is a thing of the past (Informant E).*

- For almost every species, the majority of respondents believed that the abundance of populations was declining.

- The majority of kai species are now only consumed on special occasions.

- The quantities of kai consumed have steadily decreased:

    - from approximately 241g historically;

    - to about 94.1g in the mid twentieth century;

    - to approximately 36.2g today (which is similar to the average New Zealand consumption rate).

Part of the reduction in quantities consumed can be attributed to environmental degradation. A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining. In the 1930s, a number of factors were blamed for the decline in whitebait catches including: excessive take by whitebaiters; predation by sea birds, herrings, eels, trout; draining of swamps, backwaters, and creeks; or damage to estuarine spawning grounds by stock. By the 1990s a number of native fish species had disappeared from waterways or were in decline. A combination of factors was attributed to these losses including: afforestation, sedimentation and flooding, wetland drainage, river modifications, sewage, water abstraction (irrigation), and pollution arising from adjacent land uses. All of these changes directly and indirectly impact cultural practices, principles and tikanga associated with food gathering:

- Young people are growing up not learning the basic knowledge associated with kai species, fishing, boating and gathering.

- Whanau are "losing the taste" of kai.

From 30 down there wouldn't be a huge interest in it because it is not something that they have grown up with, but certainly from my age up, like, you know, if my grandmother was to - if you were to put a plate of koura in front of her, I think she would almost eat the shell from it. You know, that is the sort of level of delicacy it is for her, whereas if I were to put it in front of my son, he actually wouldn't be that impressed with it (Informant J).

- Kai generally was known to be good for health. There is a feeling that the younger generation don't know this, or if they do, they don't practice it.

- Fish and seafood is purchased more now, but often as fish and chips.

- Water quality is a concern for parents and therefore they are reluctant to let kids explore/play in aquatic environments unattended.

- Parents feel their children have missed something not growing up in an active hapū gathering environment.

- The context within which fundamental cultural practices such as whanaungatanga are learned has been impacted.

Finally, the result of these environmental perceptions is uncertainty as to whether or not kai is contaminated from within the urban environment.

Despite the level of environmental change and the potential for contamination, it also needs to be acknowledged that lifestyles today leave little time for fishing activities.

Changes to the health of the lakes and consequently the relationship of Te Arawa with the lakes have resulted in a range of health and wellbeing implications for Te Arawa whanui. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between the lakes and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

- 63.1% of respondents indicated they knew where to get advice about contamination issues.
- Only 26.4% (and two specific age groups – those in their 40s and 70s) did not know where to go to obtain information.

This study has confirmed that the lakes are integral to the cultural identity of the whanau of Te Arawa. It has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of kai awa, kai roto and kai moana in the behaviours of whanau and hapu resident in the Rotorua Lakes Area. The results clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal, that kai awa, kai roto and kai moana are vitally important to whanau and hapu in Rotorua Lakes. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

1. Introduction

1.1 Background

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. In the aquatic environment, contaminants transported by the air and in the water are highly likely to be deposited in sediments, where in turn, fish and shellfish are exposed. Contaminants are generally stored in the lipids of biota and can be biomagnified up the food-chain. Human health may be threatened either by the direct consumption of fish and shellfish contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001).

Concerns about the potential accumulation of contaminants in fish and other wildlife, which commonly form a component of indigenous peoples' diets, and their consequent potential effects on human health, has led to a worldwide proliferation of studies examining the effect of environmental contaminants on fish, wildlife and communities. For example, leading international indigenous contaminant research programmes, e.g., the Northern Contaminants Programme (NCP) and the Effects on Aboriginals from the Great Lakes Environment (EAGLE) Project were established in response to concerns regarding the exposure of humans to elevated levels of contaminants in the traditional subsistence diets of indigenous peoples. Research to date has shown that certain indigenous communities have elevated contaminant levels due to exposure through their traditional diet (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999; Van Oostdam et al., 2003). In addition, fish and wildlife are used as indicators of the health of the ecosystems.

The impact of environmental contamination on the resident "wild kai", and in turn, on Māori iwi/hapū consuming them, has not been investigated to date. A recent review of wild food in New Zealand identified gaps in knowledge of contaminants in non-commercial wild-caught foods, especially in terms of consumption levels (and hence exposure) (Turner et al., 2005). A resulting draft position paper identified a need for information and education on contaminants in kai (NZFSA 2005). In response, the National Institute for Water and Atmospheric Research (NIWA), in conjunction with Tipa & Associates and iwi research partners, Ngāti Hokopu ki Hokowhitu, Te Arawa Lakes Trust and Te Runanga o Arowhenua initiated a programme of research to investigate the contaminant levels and risk to Maori health associated with 'wild kai' – food gathered from the sea (kai moana), rivers (kai awa), and lakes (kai roto). This

research, funded by the Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

1.2 Research Rationale

Traditionally, Maori had their own knowledge systems of how the environment contributed to health and well-being. Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming.

As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined.

While it could be argued that contamination of wild kai has the potential to directly impact the physical health of Maori, the impacts of contamination and/or loss of an important cultural activity on wellbeing are also explored during the course of the project. Maori associate their well-being as individuals and as members of whanau, hapu and iwi, with maintaining the health of the natural environment (Durie 1994, 1998, Panelli and Tipa 2007, 2008). Maori strongly believe that the whenua and tangata are inextricably intertwined, and when one of these becomes unbalanced, the other equally suffers (Harmsworth and Warmenhoven 2002; Sims and Thompson-Fawcett 2002). Therefore, the sustainability of the natural environment and the long-term well-being of Maori are seen by some Maori as one and the same thing (Panelli and Tipa 2007). This is consistent with conceptualisation of wellbeing proposed by other indigenous communities (Adelson 2000, Greiner et al., 2005, McLennan 2003, McLennan and Khavarpour 2004, McGregor et al., 2003). Customary and recreationally gathered "wild kai" resources are therefore of significant cultural, recreational and economic importance in both traditional and contemporary Maori society (Waitangi Tribunal 1983, 1984, 1987, 1988, 1989, 1991, 1992, 1995, 1998)[2].

The majority of the international research in the area of contaminants in the traditional diets of indigenous peoples has primarily focused on the levels and health effects of exposure to heavy metals and organochlorine contaminants through the consumption of marine fish and mammals in peoples from the northern hemisphere, i.e., the Inuit

[2] The evidence submitted to the Tribunal by Iwi, and the summary reports from the Tribunal itself provide a graphic depiction of the significance of gathering kai for whanau, hapu and iwi.

people of northern Alaska, Canada and Greenland (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999). Research to date has shown that certain Inuit communities have elevated contaminant levels (e.g., mercury, lead and chlordane) due to exposure through their traditional diet (Van Oostdam et al., 2003).

It is unlikely that contemporary Maori communities have been exposed through their diet of "wild kai" to the levels of organochlorine contaminants as high as those observed in indigenous populations residing in the northern hemisphere (due to occurrence of large mammals in the customary diet of Inuit). However, the impact of environmental contamination on the resident "wild kai" and, in turn, on Māori iwi and hapu consuming them, has not been investigated to date. In addition, while existing consumptive advice is available for some species of relevance to Māori, this advice is based on average national consumptive patterns and doesn't account for potentially higher consumption rates of specific traditionally harvested foods by Māori, with its concomitant elevated exposure risk. Māori utilise kai from rivers, lakes and the oceans (as well as the land).

This research aims to identify and communicate the risks posed by the presence of environmental contaminants in the kai moana, kai roto and kai awa to the Maori communities that gather these resources. Major outcomes of the research will be development of a generically applicable risk assessment framework, and Maori-targeted risk communication strategies. It is envisaged that the research will be of interest to the wider Maori community, non-Maori, public health providers, as well as indigenous peoples worldwide for whom fish and shellfish constitute a major part of their diets.

1.3 Research aim

The overall aim of our research project is:

> *To determine to what extent locally available kai moana, kai roto, kai awa, and the associated aquatic environments pose a health risk to tangata whenua.*

Successful frameworks for undertaking research in a manner that is culturally acceptable, and which ensures the protection of intellectual property rights, were developed between NIWA and Ngāti Hokopu and Te Arawa during the HRC and FRST funded programmes 'The Revitalisation and Enhancement of Matauranga

Hauora of Aquatic Environments (C01X0226)' and 'Sustainability and Management Framework for Te Arawa Lakes' Customary Fisheries (CO1X0305)'.

Memoranda of Understanding between NIWA and Ngāti Hokopu ki Hokowhitu, Te Arawa and Te Runanga o Arowhenua have been established to formally record the expectations of conduct between NIWA and the respective parties with respect to the present research.

Three Maori communities were involved in the overall research:

- Te Arawa: centred around the Rotorua Lakes.
- Ngāti Hokopu ki Hokowhitu: centred around Whakatane.
- Te Runanga o Arowhenua: centred on South Canterbury.

These communities were selected on the basis of previous contact (and research projects underway) with key researchers. Permission was obtained and confirmed by a sub-contractual agreement.

The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

There are four main stages to the research project:

1. Objective 1: The first stage involves interviewing key informants and undertaking a survey to identify what kai moana species are harvested and eaten by iwi/hapu members from Ngāti Hokopu, Te Arawa and Te Runanga o Arowhenua, and the aquatic environments they are currently sourced from.

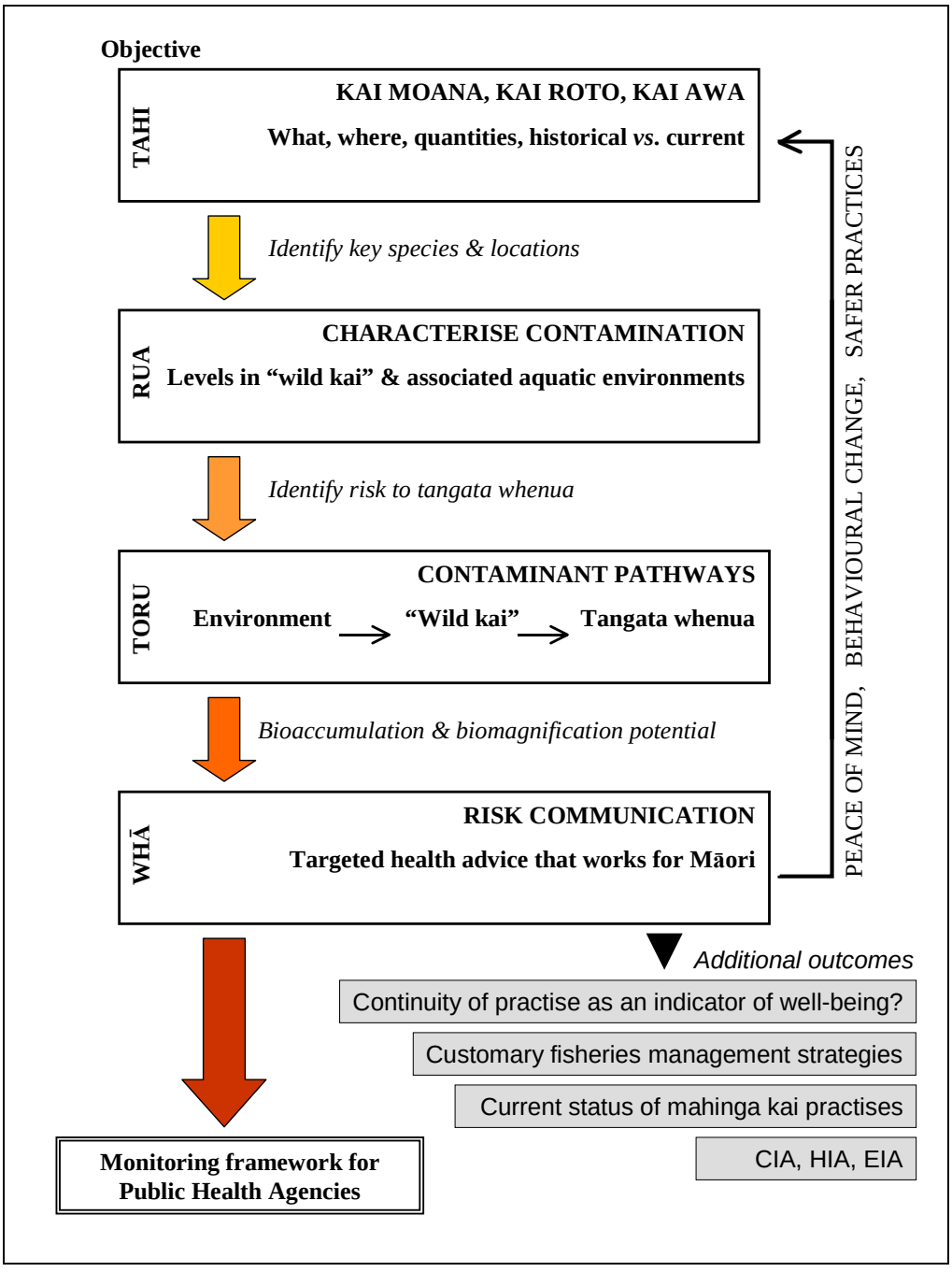
2. Objective 2: The second stage identifies the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori.

3. Objective 3: This stage establishes potential pathways of contaminant bioaccumulation via the food web utilising methyl mercury as an example of a bioaccumulative contaminant.

4. Objective 4: This stage identifies the potential health risks associated with the collection and consumption of contaminated “wild kai”, and develops risk consumption advice specifically targeted at Maori, that will take into consideration both the benefits and risks associated with eating kai moana, kai roto and kai awa.

Figure 1 provides a graphic representation of the identified research priorities, the objectives, and possible outputs.

Figure 1: Research priorities, the objectives, and possible outputs.



The first objective of the research (to provide a description of the kai moana, kai roto and kai awa collection, processing and consumption patterns of iwi/hapu members) is clearly a precursor to Objectives 2–4. This first stage identifies:

- What types of kai have been collected and/or eaten in the last 2–3 generations (e.g., species, life-stage, abundance)?
- Where were/are they harvested from and when (e.g., location, ecosystem, season, time of day, life-stage)?
- How is kai moana stored and processed for consumption?

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by whanau in and around the Rotorua Lakes and the potential effects of environmental contamination on their physical, spiritual and cultural well being.

To elicit the data needed we included methods that have been used previously with hapu around New Zealand. This consisted of focus groups and hui, followed by interviews. For this objective it was important to assemble a group of willing participants with knowledge and experience of kai gathering in the takiwa (area) and rohe.

1.4 Report Structure

This report has been divided into a number of sections:

Section 1: Sets out the background and the aims of this study.

Section 2: Describes the methodology that was used.

Section 3: Provides some information on Te Arawa and their rohe in the Central North Island, in particular around the Rotorua Lakes.

Section 4: Outlines international developments within which the research is situated, specifically:

4.1 indigenous communities and participatory approaches to management and research;

4.2 contemporary wellbeing research, and implications for this study;

4.3 international observations of the impact of changing diets;

4.4 effects of contaminants on health;

4.5 Maori conceptualisations of health and wellbeing.

Section 5: Introduces the empirical analysis by outlining the quantitative research results; specifically with respect to contemporary patterns of gathering. This chapter is informed by the Kaimoana Consumption Survey.

Section 6: Based on the results, develops a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It provides a brief comparative analysis by discussing the contemporary patterns alongside historic traditional patterns. It pulls together the qualitative and quantitative research results and identifies main themes that are then discussed in the context of international literature.

Section 7: Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

2. Methodology and Data Analysis

There is growing recognition of the significance of aquatic habitats and the resources found within them that sustain indigenous communities. Yet this recognition has not been accompanied by investigations to increase understanding of the specific contribution of aquatic habitats and resources to the health and wellbeing of communities depending on these resources.

Drawing on the earlier work of Bebbington (1999), importance to whanau was examined according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

This section of the report outlines the methodology employed, but starts with a description of the Maori community studied.

2.1 Study area

This report details the results of one case study: Te Arawa. Participants living in and around the Rotorua Lakes were recruited from Te Arawa whanui. Availability to take part in the research was the only exclusion criterion, although the preference was for key informants to be active kai gatherers. The study was undertaken under Ethics Approval MEC/07/07/088 and all participants gave written informed consent.

2.2 Methodology

The research team utilised two research methodologies to contrast the instrumental and hermeneutic role of aquatic resources as a source of kai awa, kai roto and kai moana. The first was a quantitative survey of wild kai consumption using a questionnaire, while the second incorporated participatory research techniques via a focus group and a series of qualitative interviews.

The survey followed once the interviews were complete. This was to ensure that the sites and species about which data was sought in the questionnaire were identified by the hapu, and not predetermined by researchers.

2.3 Quantitative survey - Kaimoana consumption survey

The Kaimoana Consumption Survey questionnaire was adapted from a range of other studies (including diet surveys, fish consumption surveys, traditional use surveys, surveys of the health of indigenous communities and perception/preference surveys). The survey questionnaire was approved as part of the Ethics Committee approval process, with minor modifications to reflect differences between the 2 iwi groups. The species and sites listed in the questionnaire were specific to the Rotorua Lakes area and are based on those identified during the interviews. The Te Arawa Lakes Trust reviewed and amended the survey to reflect the kai that is in their rohe.

2.3.1 Kaimoana consumption: quantifying importance of sites and species

We examined consumption using a food frequency questionnaire with frequency categories ranging from less than once per month to one or more times per day. Consumption is one of the principal means by which the importance of kai awa, kai roto and kai moana and the intimate and dependent relationship with aquatic environments from which they are sourced can be determined.

2.3.2 Existing estimates

Kaimoana consumption records in New Zealand are sparse. Estimates were derived using data from the questionnaire by calculating the amount consumed and the frequency of consumption.

2.3.3 Seasonal variation

Some species of kai awa, kai roto and kai moana are seasonal resources while others are open access. Seasonality is explained in historical literature recognising that tikanga and kawa was attuned and responsive to the life-cycle of the different species. Therefore, questions in the survey identified where possible seasonal patterns of contemporary gathering.

2.3.4 The impact of kai awa, kai roto and kai moana on whanau and hapu livelihoods

Arguably there is a need for a broader understanding of the importance of aquatic resources as a source of kai beyond the simplistic statements of mahinga kai that often

accompanies ecologically based descriptions of aquatic ecosystems. The questionnaire sought to address this need by analysing the complex relationship that whanau have with waterbodies found in their takiwa.

2.3.5 Other data

Other data gathered included:

1. demographic information, such as data on the prevalence of certain medical conditions, lifestyle factors including risk-related behaviours, and family history;

2. self-reported health status using generic, health-related quality of life questions;

3. kai gathering locations; and

4. perceptions held by whanau members about the importance of aquatic ecosystems and species, and their assessment of the health of these resources.

2.4 Qualitative methods

The qualitative methods used here address the first of the research objectives as stated in Section 1.3 above. Methods involved an introductory hui, a focus group session, follow-up interviews, informal discussions with many people and reviewing secondary data sources (documents).

2.4.1 Literature review

An examination of relevant literature was undertaken for four reasons

1. to provide a more comprehensive understanding of historical resource use and patterns of activity in the study community;

2. to gain an appreciation of the changes to the aquatic habitats over time, as perceived by Te Arawa participants;

3. to identify the changes over successive generations that have impacted on kai gathering behaviours; and

4. to address issues of concern with respect to waterbodies.

Qualitative data were collected from published and unpublished documents, from libraries, the Waitangi Tribunal (evidence to the Tribunal and reports from the Tribunal), statutory and iwi plans, and statutory planning documents. Internet searches also yielded further material.

2.4.2 Participatory methods

Before commencing working with Te Arawa whanui, an introductory presentation was given at a hui of Te Arawa at Te Papaiouru Marae and the participatory nature of the research was outlined. At the start of all interactions (focus group and interviews) the roles and obligations of participants and researchers were discussed.

Focus group - A focus group was convened in mid 2008 which was attended by approximately thirty participants. The participants were engaged in a guided discussion lasting 1–1.5 hours. The focus group followed the framework of questions presented in Box 1. This session focused on gaining a broad understanding of the spatial extent and description of aquatic resources from which kai awa, kai roto and kai moana were sourced, and the overall importance of each waterbody and species to whanau and hapu. Maps were used to record information about species, locations and other relevant information but given the numbers in attendance, map work was limited.

In depth semi-structured interviews - In the months following the focus group meetings, 13 follow-up interviews were conducted. The purpose of these interviews was to collect additional and more detailed data related to the location and types of kai collected and consumed, and factors that may have influenced gathering.

The questions used for the focus group were also used to guide the interviews that probed more deeply into the personal experiences, thoughts and feelings of the individuals. The intention was to identify and explore the diversity and complexity of relationships and gain a comprehensive understanding of the changes to aquatic environments and the emergent issues seen as potentially impacting health and wellbeing as perceived by different individuals. Interviews were carried out with 13 individual resident in and around the Rotorua Lakes. Each interviewee was identified by the Te Arawa Lakes Trust.

BOX 1: QUESTIONS AT THE FOCUS GROUP and INTERVIEWS

Species of kai

- What (species of kai) did you gather when you were young?
- What places can you remember visiting to gather kai when you were growing up?
- Did you collect year round or seasonally?
- Can you recall any places that you were told not to go to for kai?
- Were there any times / occasions that you were unable to gather kai?
- How long did it take to gather the kai that you needed?
- What (species of) kai do you gather today? What places do you use today?
- Do you gather kai year round or is it seasonal?
- What events / conditions etc. stop you from gathering kai?
- How often would you or someone in your whanau go out to gather kai?
- How long does it take to gather kai compared to when you were younger?
- What species / sites have you lost over the years? When and why did you stop using them?

Behaviours with kai

- Is kai shared? With whom? Has this changed over your lifetime?
- How was kai prepared? Has this changed?
- What methods are used to collect kai? Has this changed?

Condition of kai

- What quantities were taken when you were younger? What quantities are taken today?
- What was the condition of the kai when you are younger? How does this compare with what is taken today?

Observed and known changes

- What changes to the experience of gathering kai have you observed? How has this affected you and your whanau? How have you adapted to these changes?
- What changes to the habitats have you observed and how have these affected you?
- What sort of things would you like to see happen in the aquatic environment you associate with and why?
- Are you happy with your current level of access to kai that you value? What are the main barriers you face today?

Wider benefits of gathering kai

- What do you like about being able to go and gather kai?
- When you gather kai are you with other whanau or hapu members?
- What rules or beliefs do you follow with respect to gathering kai?
- Do you feel any special attachment to the places from which you gather your kai?

Health risks

- Do you know of any health risks associated with gathering kai?
- If you were told not to gather kai from an area because of the health risks would you still gather from there?
- What type of information would you need to help you decide whether to gather kai from an unsafe site?

There were four principal outputs: a map documenting the types, locations, and quantities of kai moana collected and consumed by those present; the transcripts from the interviews; a revised questionnaire for future use; and this report.

2.5 Qualitative data analysis

In summary, informants were interviewed and interacted with in different fora, and their written documents (both historic and contemporary) and submissions provided further context for interpreting their values, practices, activities and concerns. Accessing multiple sources of data was one of the methodological tools employed to ensure the validity of data collected.

Lincoln and Guba (1985, 224-225) contend that the role of data analysis is "to 'make sense' of the data in ways that will, firstly, facilitate the continuing unfolding of the research, and secondly, lead to a maximal understanding of the phenomenon being studied in its context. There were two aspects to the data analysis:

1. firstly to identify sites and resources to be sampled for analysis of contaminant levels; and

2. secondly, the analysis involved identifying, sorting and grouping data from very detailed individual transcripts to identify key themes. The methods of data collection resulted in a considerable quantity of raw data being gathered, and data from a variety of sources had to be systematically analysed.

Data were coded and categorised to enable similar themes to be distilled. Some of the themes had been established *a priori* based on key issues that had emerged while reading related literature and undertaking preliminary discussions when scoping the research topic and negotiating entry to the three communities. Principal categories that were identified represent the headings under which the research findings are presented in sections 5 and 6.

2.6 Quantitative data analysis

The questionnaire was constructed on Survey Pro 5 (Apian Software Inc) and all data were entered into this programme. The results that are reported in section 5 and discussed in section 6 have been produced using the Survey Pro reporting functions. Microsoft Excel was used to construct two of the graphs.

2.7 Summary of methods applied

The methods applied to enable us to understand kai gathering behaviours over different time periods are set out in Table 1.

Table 1: Methods used during the course of the research.

Pre-European	19th Century post	20th Century up to	Present day
Manuscripts		Interviews	Interviews
Cultural maps	Cultural maps		Review of literature
Historical texts	Historical texts	Evidence to the	Kai Consumption
	Evidence to the Waitangi	Photographs	Maps
Evidence to the	Paintings		Photographs

3. Study Group: Te Arawa

> *If you look at Rotorua – the name of Rotorua – if you follow that trail that is actually the history of the Te Arawa waka, eh. You see, when they came up and got to Rotoiti… and that is where Ihenga saw the lake and then called it the long narrow lake…. Then he came across here and he saw this big huge lake, Te Rotorua, the second lake, and he named it after his Uncle Kahu Mata Moemoe, who was Tamata Kapua's son, who was the kaihautu on the waka Te Arawa when it came across. So what you have there – and if you listen …Then you go down here and you go to the cockabullies of Okere, then you go to the Te Heke Heke of the Kaituna, to the rapids of the Kaituna…. at Maketu …where the waka of Te Arawa landed, eh. .. It's a journey of history… So you are taking the journey from here, all the way around there. And there is a lot. That is only one of many.. ... And they are memories that are buried now by sediment (Informant M).*

Te Arawa arrived at Maketu around 1350 (Stafford, 1967). Te Arawa is a confederation of iwi which are descended from the crew of the Arawa canoe. From Maketu the voyagers and their succeeding generations moved inland occupying the central part of the North Island. This means Te Arawa have resided in the Rotorua area for centuries and the lakes of the region were and remain taonga (treasures) for Te Arawa. They are the foundation of their identity, cultural integrity, wairua, tikanga and kawa. The numerous lakes of the Rotorua district as shown in Figure 2 are found in hill country approximately 80 kilometres south of Tauranga, and 50 kilometres west of Whakatane[3]. The lakes of the Rotorua district remain the centre of Te Arawa settlement. For centuries the lakes have also been the mainstay of their economy as the lakes and their margins were an important source of freshwater fish, waterfowl, and plants[4].

The Te Arawa Maori Trust Board was established in 1924, pursuant to Section 27 of the Native Land Amendment Act and the Native Land Claims Adjustment Act 1922, and operated under the Maori Trust Board's Act 1955. Fifteen hapu were represented on the Board as well as one seat allocated for Tumataunenga which acknowledged the returned serviceman of Te Arawa who served in the First or Second World Wars, totalling 19 representatives. Initial membership of the Board was based on ownership

[3] Historically attention has focused primarily upon the three largest lakes of the area; Rotorua, Rotoiti, and Tarawera. During the 1918 Native Land Court investigation of title to the Rotorua lakes, counsel for the applicants informed the court that he had only prepared the applications for Rotoiti and Rotorua, but that he would attend to the others in due time. However, the Court's inquiry was abandoned, and a settlement was negotiated that applied to Rotorua, Rotoiti, Tarawera, Rotoehu, Rotoma, Okataina, Okareka, Rerewhakaitu, Rotomahana, Tikitapu, Ngahewa, Tutaeinanga, Opouri, and Ngakaro. 'Minutes of the Rotorua Lakes Case: Application for Investigation of Title to the Bed of Rotorua Lake', 16 October 1918, p 137, cl 174, NA Wellington.

[4] For a detailed account of the traditional history of Te Arawa, see Stafford (1967).

of the 14 Te Arawa lakes, which surround the Rotorua district, and this remained the structure of the Board.

On 18 December 2004, the Crown and Te Arawa signed a Deed of Settlement for Te Arawa Historical Claims and Remaining Annuity Issues over 14 lakes; Lakes Rotoehu, Rotomä, Rotoiti/Te Roto- Whaiti-i-kite-ai-a-Ihenga-i-Ariki- ai- a Kahumatamomoe, Rotorua / Rotorua-nui-a Kahumatamomoe , Ökataina / Te Moana i kataina a Te Rangitakaroro, Ökareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngähewa, Tutaeinanga, Ngäpouri/Opouri and Ökaro/Ngakaro.

The settlement was made up of 4 components of a "redress package", one of which was the Cultural Redress recognizing Te Arawa traditional, historical, cultural and spiritual association with the lakes covered in the settlement, including the transfer of 13 lakebeds.

Te Arawa Lakes Trust (formerly Te Arawa Maori Trust Board) is the new governance entity to receive and manage the redress on behalf of Te Arawa, to ensure that the benefits of the settlement will be available to all registered members of Te Arawa, wherever they live.

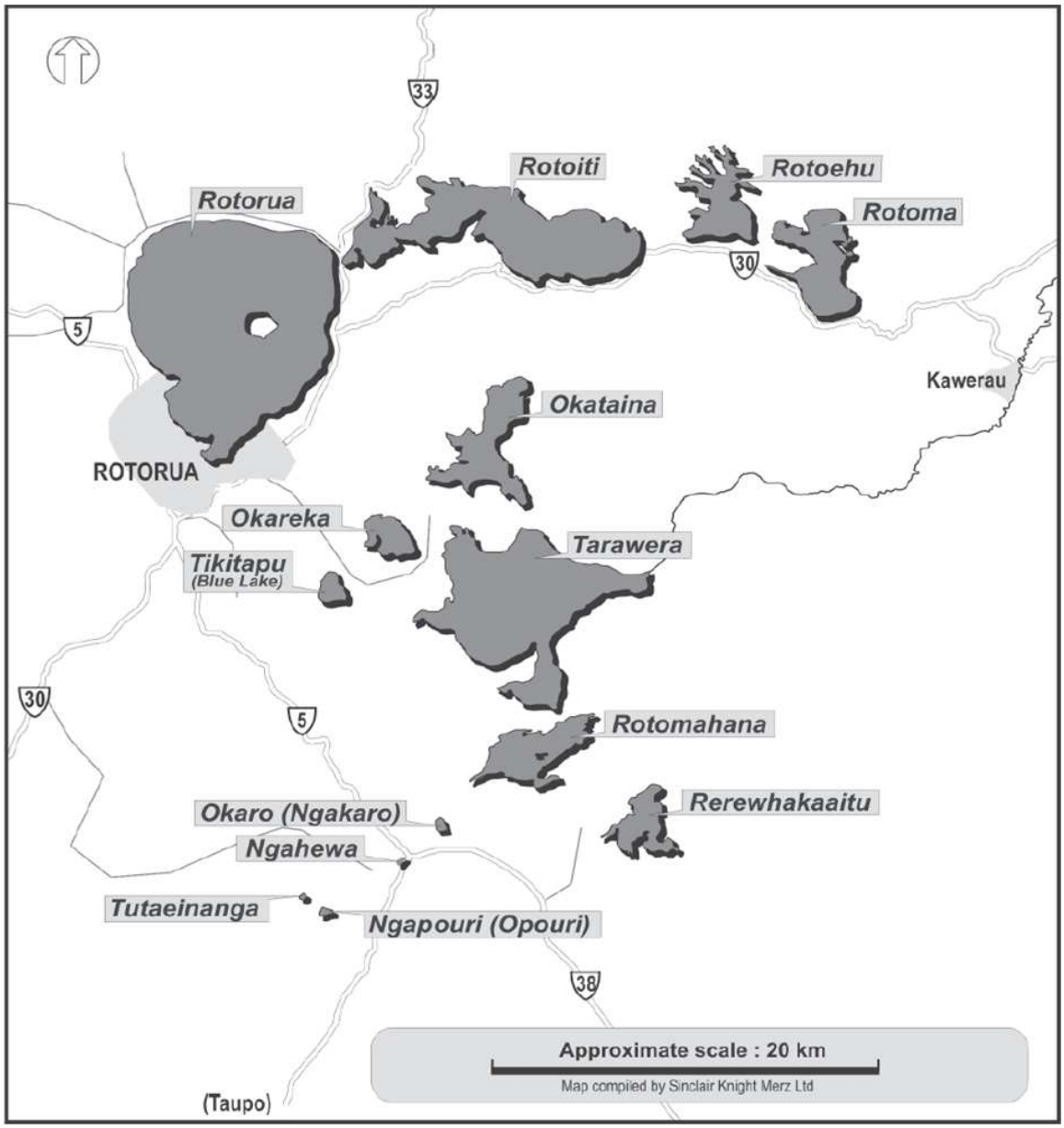


Figure 2: Map of the Te Arawa lakes.

Implementation of this project saw NIWA and its subcontractors working with representatives of Te Arawa Lakes Trust. The Trust had two champions - individuals who helped facilitate the focus groups and the interviews.

> *All these lakes are historical to this country. The history of these lakes is actually the history of this country (Informant M).*

4. International developments relevant to the research

Consistent with the need for the present research to be examined in a context of international literature and academic thought, this section seeks to position the research design and data analyses within contemporary writings from four related areas:

- indigenous communities and participatory approaches to management;
- contemporary wellbeing research, and implications for this study;
- international observations of the impact of changing diets and effects of contaminants on health; and
- Maori conceptualisations of health and wellbeing.

4.1 Indigenous communities and their participation in management

This research sought to utilise participatory research methods. Participation is seen as a means of affording affected parties the opportunity to articulate their interests, enhancing the quality of information available to decision makers; enhancing the potential for support of decisions by enabling early and meaningful involvement; and affecting one's destiny as the opportunity to participate in decisions is a key element of self-empowerment and self-actualisation (Fenge, 1994). In the context of this research project, in addition to collecting environmental contamination data, the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana are examined, and empirical data collected for use by whanau and hapu.

Participatory approaches to environmental management received emphasis initially in the Brundtland report (WCED 1987) and in Agenda 21, at the 1992 ‘Earth Summit’. Perhaps the greatest significance of these fora lay in the acknowledgement that sustainable development would require new approaches to environmental management, and that effective environmental management would need to be differentially negotiated within individual states, even within individual communities. In effect, this research will also result in a range of cultural values and perspectives of particular aquatic locations being documented and available to each Maori community to inform local processes of management should they so choose.

Pimbert and Pretty (1997) contend that new partnerships and connectedness between different interests is required in environmental management and argue that

participatory processes must be locally grounded which will likely require different solutions for different places. This research will facilitate new participatory processes between environmental managers, public health managers, science agencies and Maori. Despite the increase in participatory initiatives, Pimbert and Pretty (1997) also warn that the call for peoples' participation risks becoming a catch-cry and part of the conventional rhetoric without delivering meaningful outcomes for participants. This warning reinforced the desire of the researchers to deliver a meaningful and effective process for application by Maori and outputs such as those listed in Figure 1 for use by Maori and resource managers.

The drive for greater participation has been paralleled by a concerted drive by indigenous communities to reassert their customary and Treaty rights to access and use land and water resources and greater recognition of the knowledge held within communities including indigenous communities (Western et al, 1994, Pinkerton 1989, 1992, Notzke 1994, Berkes and Folke 1998). Although a range of terms are used, often interchangeably, Berkes (1999) defines indigenous knowledge as that knowledge held by indigenous peoples and traditional ecological knowledge as a subset of that – a practical knowledge of species and beliefs regarding human interaction with the ecosystem. Menzies and Butler (2008) list the attributes of traditional ecological knowledge as cumulative (from long term intergenerational interaction), dynamic (informed by a customary lifestyle but not unchanging), providing a historical understanding of change, local, holistic (viewing all elements as interconnected), embedded (in a unique matrix of local, cultural, historical and traditional elements), moral and spiritual. In order to understand the changes to the diets of successive generations of Maori, the research team was dependent on key informants being experienced and knowledgeable (with indigenous knowledge and/or traditional ecological knowledge) about kai gathering.

Sadly, Maori, like other indigenous communities have witnessed the destruction of valued environments and their alienation from the resource bases upon which their cultures and identities are constructed (Berkes 1991, 1994, 1999). Documenting the changes that have been experienced in the Rotorua Lakes region and the impacts on whanau and hapu, including a profound sense of loss, was therefore vital.

The growth of interest in the knowledge held by indigenous communities is related to the wider shift within resource management to an ecosystem based management approach (Menzies and Butler, 2003) and recognises that indigenous communities understand the way species interrelate and how ecosystems work as a whole. It recognises that indigenous communities have a well developed understanding of the local environment and their own impacts on local ecosystems. The data collected via the interviews and questionnaire confirmed the proposition of Berkes (1999, page 33)

that the "use of traditional knowledge may benefit development by providing more realistic evaluations of local need, environmental constraints and natural resource production systems".

Initiatives involving the incorporation and/or application of indigenous knowledge are emerging around the world as resource managers seek to engage with indigenous communities. New Zealand has also experienced the drive for greater participation, including greater recognition of the beliefs, values and practices of Maori. In 1991, the Resource Management Act 1991 became the governing legislation for resource use in New Zealand (Davis and Threfall 2006). Two sections are of particular relevance.

Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including "the relationship of Maori and their cultures and traditions with their ancestral lands, water, sites, *wahi tapu* and other *taonga*" (section 6(e)). Gathering from tribal lands and waters, species that are often accorded the status of "taonga", clearly falls within the gambit of section 6(e) and is thus a matter of national importance.

Pursuant to section 7(a) decision-makers are required to have particular regard to *kaitiakitanga*. The Act presently defines kaitiakitanga as:

> *The exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

The responsibilities of Tangata Kaitiaki are to protect the integrity of resources (including the kai species identified by informants). This requires Maori to focus on long term environmental results, which are likely to include healthy ecosystems with abundant populations of valued kai species that are able to sustain cultural uses well into the future. Despite these encouraging and potentially enabling provisions, often there is little guidance given to managers and regional bodies seeking to meet the obligations to indigenous communities (a challenge Maori confront in New Zealand). This research seeks to produce outputs that will guide both Maori and non-Maori resource managers.

4.2 Contemporary wellbeing research: implications for this study

For indigenous communities food is not just a resource for sustenance as many might understand it in western contexts (Slocum 2007). Rather, Panelli and Tipa (2007,

2008) argue, that food needs to be understood in a wider cultural context that interweaves complex indigenous cultural and environmental relations.

Panelli and Tipa (2007, 2008) contend that to identify these relationships primarily by a particular bio-physical character (e.g., forests, coasts and waterways) misses the range of spiritual, physical, social, material, cultural, economic and political relationships that might be involved in any one case. The complexity of these relationships must be appreciated before the significance of an 'individual' phenomenon or activity (such as food or food gathering) might even begin to be approached (let alone the cultural or health implications of such things). They further contend that to consider kai gathering without this contextual understanding would diminish its cultural value and the rich dimensions that underpin whanau and hapu experiences of identity and well-being. The results of the Kai Consumption Survey reported in subsequent sections of this report support the proposition that individual experiences of interviewees vary as lives are influenced by a complex combination of: cultural beliefs, values and uses; a history of colonization, loss of lands, alienation from their lands, waters and resources; and contemporary interactions with a dominant non-Maori world that is based primarily on capitalist, western values (Panelli and Tipa, 2008). The range of perceptions, preferences and the experiences of members of Te Arawa that emerged from the analysis of data collected for the present research are set out in sections 5 – 7 of this report.

Indigenous communities have traditionally been resource users and developers (O'Regan 1984, Notzke 1994). They used natural and physical resources for subsistence (physical survival) and sustenance (spiritual survival). Internationally there are calls to recognize and protect cultural knowledge and practices that are 'fundamental for food security and well being' (FAO 2007). Gombay (2005: 418) explains the significance of this stance, and when describing the Inuit argues that when they:

> *hunt, fish, or gather food the material and immaterial worlds blend together, with layer upon layer of meaning and understanding. The getting of country foods is about understanding the land in which one lives. It is about building an awareness and knowledge of one's place in the natural world ….*

The gathering, exchange and consumption of kai are also significant cultural activities for Maori. Complex associations with the environment and mahinga kai have developed over centuries and include social, economic, psychological, spiritual and physical dimensions that are an intrinsic part of health and well-being of whanau members. Diversity is wide (as evidenced by the individual variation from the survey results) but this is considered acceptable within whanau and hapu. The data collected

helps explain how sourcing kai from lands and waters reaffirms firstly, connectedness with the lands and waters to which one has whakapapa, and secondly ensures continuity of practices initiated and valued by tupuna. In the Maori context, kai gathering practices also enable social and environmental responsibilities to be fulfilled. To be denied the opportunity to manaaki visitors to one's home and marae would have consequential adverse effects on the health and well-being of Maori – a point that may be experienced beyond the individual and whanau level.

4.3 Maori conceptualisations of health and wellbeing

Durie (1994) introduced *Te Whare Tapa Whā* - a four sided house - or the four cornerstones of health; these being: *hinengaro* (mental well-being), *wairua* (spiritual well-being), *whanau* (family well-being) and *tinana* (physical well-being) which was subsequently adopted by the Ministry of Health (2006). Durie (2004) then proposed a second conceptualisation, *Te Pae Mahutonga*, which he contends represents the fundamental components of health promotion - *Mauriora*, *Waiora*, *Toiora* and *Te Oranga*. He explains that: *Mauriora* is dependent on a secure cultural identity; *Waiora* refers to healthy air, land and water environments which requires a balance between use and development and protection; *Toiora* focuses on personal behaviours and responsiblities; and *Te Oranga* recognises that health promotion (in particular increasing well-being) requires increased participation by Maori in societal affairs.

Another conceptualsation, by Pere (1997) emphasises reciprocity and interconnection between individual selves and wider social interests. In this sense, each experience of well-being would vary from place to place reflecting *whenua* (earth), *turangawaewae* (standplace), *whanaungatanga* (kinship), *whanau* (family), *wairua* (spirit), *hinengaro* (mind, heart), *whatumanawa* (feelings) and *tinana* (body). This conceptualisation by Pere helps explain connections between specific understandings of *whenua* and the social and cultural relations developed in particular places.

Panelli and Tipa (2008) explain how many Maori express a strong affinity for the earth and adhere to basic principles regarding their relationship with other aspects of creation and quote Crengle (2002) who explains all parts of the environment are related to one another and exist within a mutually inter-dependent whole. Deriving economic or social benefit from resource utilisation (recognised as contributors to wellbeing), must be carefully balanced.

Initiation of the current research programme and exploring the contribution of kai gathering to health and wellbeing is predicated on the belief that understandings of health and well-being can be enhanced by explicit conceptualisations that align spiritual, social and cultural elements in connection with bio- physical bases.

4.4 Effects of contaminants on health

While some agencies and researchers contend that people everywhere are exposed to chemical contaminants in the environment, international studies confirm that the majority of exposure to contaminants comes from food, with the consumption of contaminated fish identified as the largest single source of exposure in Canada (Health Canada 1997). Of concern, fish constitutes a significant dietary source of protein for many populations worldwide, especially indigenous communities.

Traditionally, the diet of many indigenous communities (including Maori) consisted of fish, game, waterfowl, and plants sourced from local lands, waters and coasts. Contemporary diets, in contrast, are likely to be a combination of traditional food items and more easily accessed commodity or convenience foods. Despite the change to convenience foods, traditional foods continue to underpin cultural identity for many indigenous communities. Delormier and Kuhnlein (1999) explain how changes experienced by Eastern James Bay Cree have affected diet, traditional food use, and nutrition. They contend that the reduced use of traditional food by younger generations, changes in fish consumption as a result of contamination, and increased incidence of obesity, diabetes, and cardiovascular disease within communities, represent particular socio-cultural concerns. Exploration of these issues and the longer term impacts has necessitated examination of the current diet and food consumption patterns of the Cree. The nature and extent of the risk that Maori confront in New Zealand is unknown but this research attempts to assess the risk.

If food is a major route of human exposure to many persistent toxic environmental contaminants the present research hypothesised that the consumption rates of aquatic species by Maori could represent a significant risk of exposure given their potential higher rates of consumption of these foods. The information gathered through the interviews and the questionnaire therefore had to enable the research team to establish whether there were any correlations between the contaminant levels measured in the participants' tissues (hair) (a separate component) and the fish or shellfish species they consumed in the past year. While such a relationship could not be considered as defining a direct cause:effect relationship, it would increase our understanding of the possible exposure risk to tangata whenua. We have also developed a model of potential contaminant accumulation pathways between participants and the kai they consume and calculation of relative risk, based on measured contaminant levels in kai species, their associated environments and consumers. Furthermore, the data had to enable the research team to assess the levels of contaminants in the respective fish and shellfish species consumed, by identifying important species and harvesting locations. These data were subsequently used to develop a sampling plan for kai species and associated environmental parameters. The results of these strands of research are to be presented elsewhere.

In risk management, the focus is on ensuring that mitigation strategies are culturally appropriate yet rarely are Maori perspectives or knowledge explicitly included in determining the hazards or health outcomes to be considered in the risk assessment. In the absence of explicit procedures to apply health risk assessment in Maori communities, the data derived from the questionnaires and interviews will contribute to the development of a health risk assessment model. Again using data gathered from this stage, we will develop Maori-focused guidelines with respect to the consumption of wild sourced kai and will also explore the appropriateness of existing information dissemination tools for effectively communicating risk.

5. Research results

In this section of the report we start by providing a description of the contemporary mahinga kai practices of whanau and hapu across the Rotorua Lakes region that has been extracted from secondary data sources, interviews with whanau members and the Kai Consumption Survey.

5.1 Background of participants

All respondents to the Kai Consumption Survey were Maori residing in the Rotorua Lakes region. All of those interviewed for this research expressed a strong relationship with the lakes and the wider terrestrial and aquatic surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship.

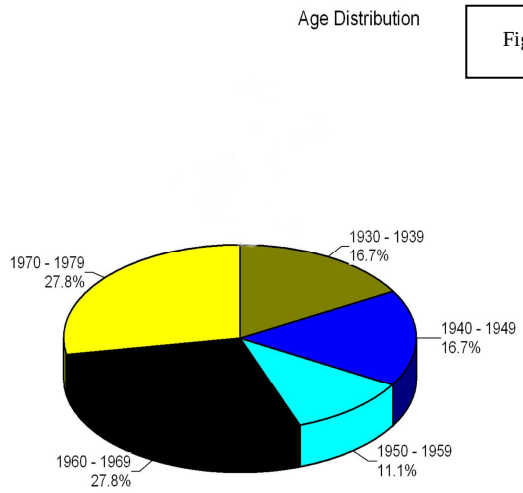


Figure 3

Only a limited number of participants have completed the survey to date (Figure 3):

- 5 are aged 20-29 years
- 5 are aged 40-49 years
- 2 are aged 50-59 years
- 3 was aged 70-79 years
- 3 was aged 80-89 years

Of the 18 participants 8 were female and 10 were male, and 1 did not answer the question.

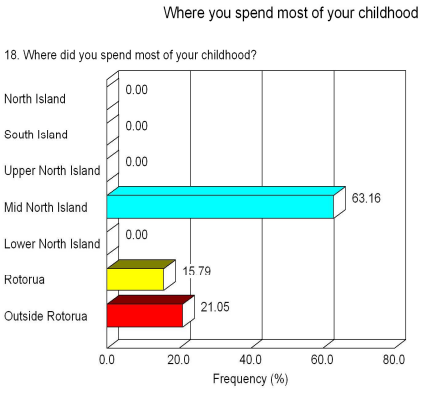


Figure 4

Two thirds of the participants spent their childhood in the middle of the North Island while 15.8% identified Rotorua as the place where they spent their childhood Figure 4).

The most explicit strands of the relationship with the lakes, are whakapapa, birthplace/wāhi whenua, childhood experiences, livelihood, recreation and kai gathering. Cultural values, principles, and tikanga such as kaitiakitanga, manaakitanga, mana and tino rangatiratanga help describe the importance of kai gathering for individuals and provide common bonds and experiences that provide a sense of common identity that connects them physically and spiritually to the lakes region.

5.2 Patterns of kai consumption

5.2.1 Introduction

A large variety of kai continues to be regularly collected, gifted, purchased and/or consumed. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in Rotorua Lakes region. The range of species that are consumed are listed in Table 2.

Table 2: A list of foods that are still consumed today by Te Arawa living in the Rotorua Lakes region.

Toheroa	Morihana	Gurnard	Lampreys	Crayfish	Whitebait
Tuatua	Pipi	Snapper	Mutton birds	Oysters	Trout
Watercress	Cockles	Moki	Eel	Pupu	Kina
Puha		Shark	Flounder	Seaweed	Paua
		Tarakihi	Hapuka	Freshwater crayfish	Mussels
			Mullet	Trevally	Butterfish
			Kahawai		Freshwater mussels
			Kingfish		

We would also have rotten corn, and that was after harvesting, and we used to put the rotten corn into bags .. so that the rats would not get into the bag and make a hole, otherwise we'd lose all our rotten corn. And the rotten corn would be hanging off a huge willow tree which was sort of flowing over the Ohau Channel, and we would be getting rotten corn at a different time of the year (Informant E).

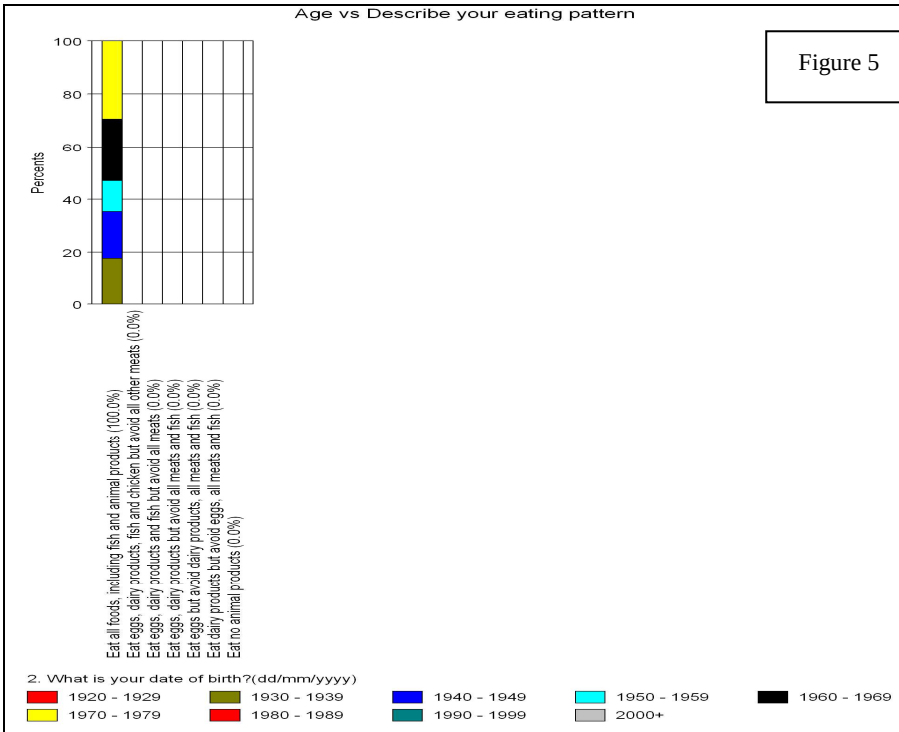


Figure 5

All participants eat all foods, including fish, meat and all dairy products (Figure 5).

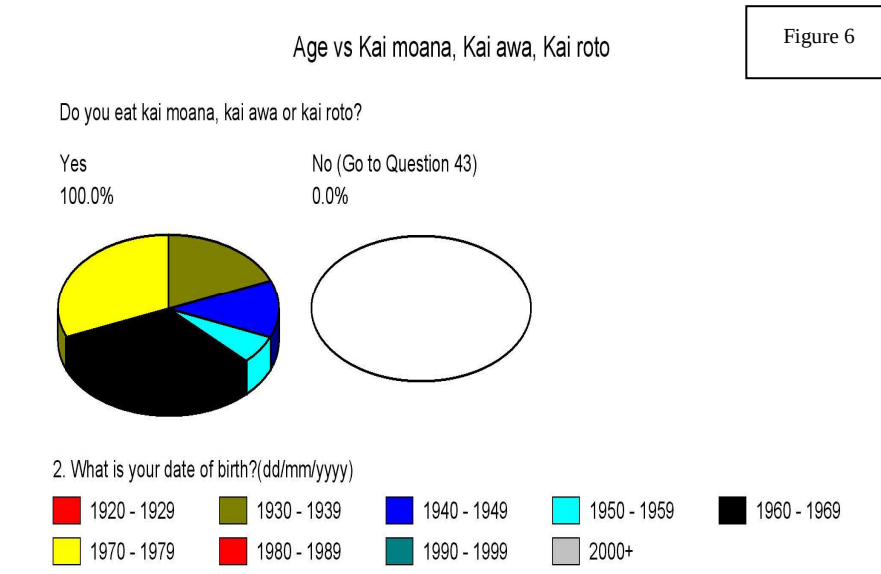


Figure 6

All participants eat kai moana, kai awa or kai roto (Figure 6).

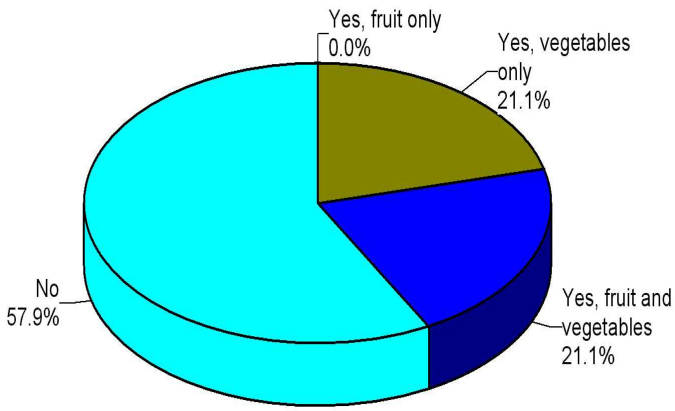


Figure 7

Consistent with a kai gathering lifestyle:

- 42% grew their own vegetables.
- Of the 42%, 21% of those who grew vegetables also grew fruit (Figures 7).

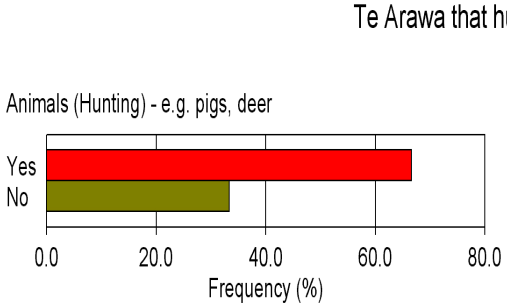


Figure 8

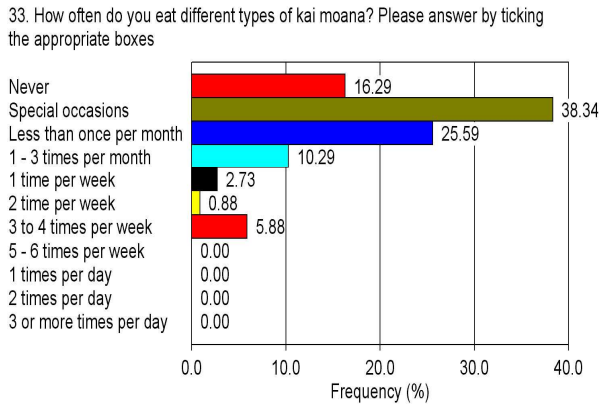
Approximately 66% of respondents hunted.

Yeah, we hunted a lot. Yeah, we hunted a lot but it was mostly at Tarawera, all those sort of things we hunted there. But the lakes were pretty good - those lakes were always pretty clean. The Rotokakahi was always clean – it's still clean but it's starting to – the weed is starting to blanket it now…especially Tarawera where we used to go hunting. You could go in there – we used to go in there and get some watercress for our tea, you know, to cook up with our tucker, you know. Not any more. I don't know why. But I think DOC, I think, poisoned a lot of them. The streams – we used to get a lot of it and it was beautiful watercress from Tarawera (Informant C).

I mean, even our parents - we owned gardens, we grew our own vegetables, our own fruit. We had sections - three acre sections, two acre sections, one acre sections - huge sections. We would have our chooks, we would have everything. Our parents - I know my father was disgusted when he first saw baked beans and spaghetti and everyone was eating that, and he's saying "what's the matter with people, don't they know how to use a spade anymore?" You know, and that is what they were so used to - using their hands to create work and then producing food (Informant E).

How often do you eat different types of kai moana

Figure 9



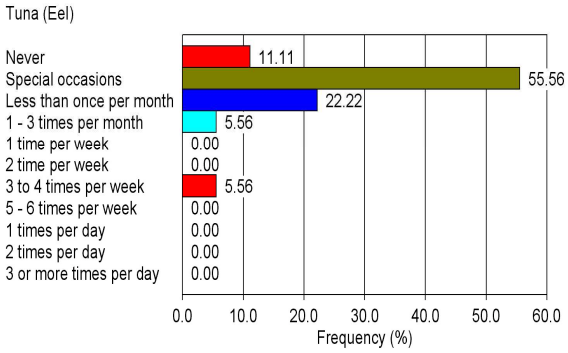
Having determined that all of respondents do consume different types of kai:

- 38% of respondents said they now only eat kai on special occasions; while
- 25.5% eat kai less than once a month; and
- 10% only eat kai 1-3 times per month (Figure 9).

In other words 73% eat kai 1-3 times per month or less.

Amount of Eel consumed

Figure 10

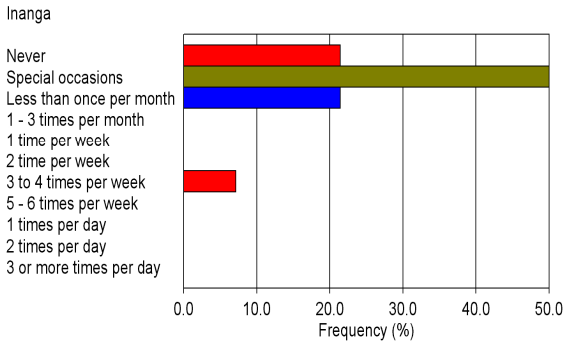


Figures 10 - 15 illustrate how often the various species are consumed:

- Only 5% of those eating eel have this food 1-3 times per month in contrast to 56% who eat eel on special occasions.
- It was of concern therefore that 57% of the respondents believed that there were now "fewer" eels present.

Amount of whitebait consumed

Figure 11



For whitebait, 50% of the respondents indicated they consumed these species at special occasions while another 20% have it less than once per month and another 20% **never** consume whitebait.

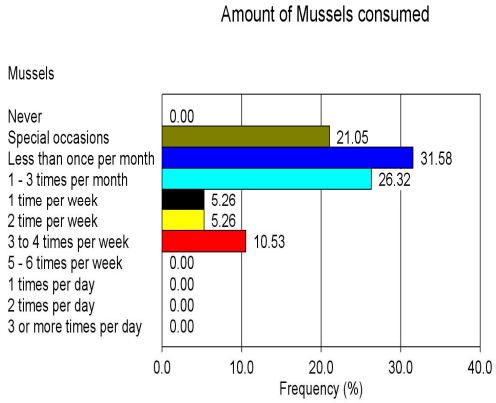


Figure 12

Marine mussels are consumed weekly – specifically once or twice per week by 10.5% and 3-4 times per week by another 10.5%.

Respondents observed that mussels can now be easily accessed from supermarkets.

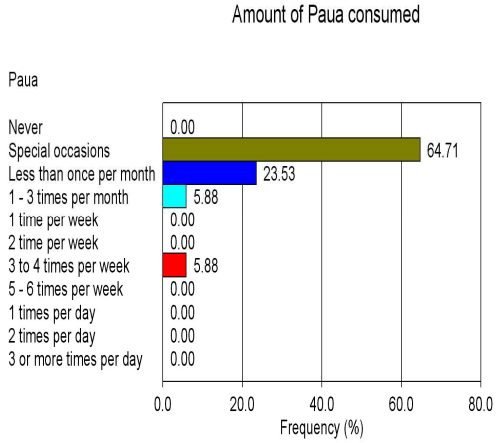


Figure 13

64.7% of respondents only eat paua on special occasions and other 23% less than once per month.

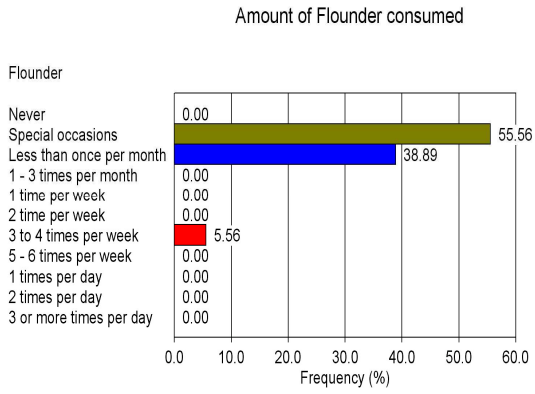


Figure 14

As with the other species flounder (55.5%) was consumed mainly on special occasions.

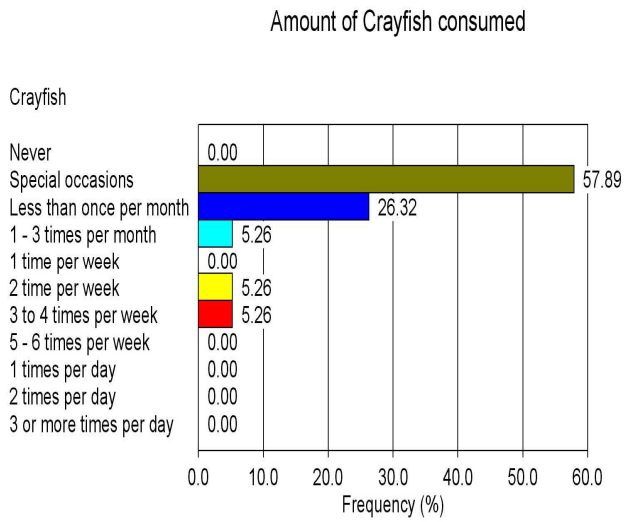


Figure 15

Similarly crayfish was mainly consumed on special occasions by 57.9%.

As whanau explained -

> *We took kai from the river in the way of eels and kakahi and trout. Of course, trout being an introduced species, we made full use of their being available (Informant A).*

Of concern when reviewing the complete list of species and the frequency with what each was consumed, some respondents identified six species as being extinct (i.e., no longer present in the areas they gather from) – kakahi, cockles, koura, morihana, seaweed and tuatua.

How respondents prepare their kai also has health implications. It was accepted that although many would prepare their own kai, others would purchase fish at take-aways, and supermarkets (as either fresh or tinned fish). Figures 16-20 illustrate the difference between age groups.

Figure 16

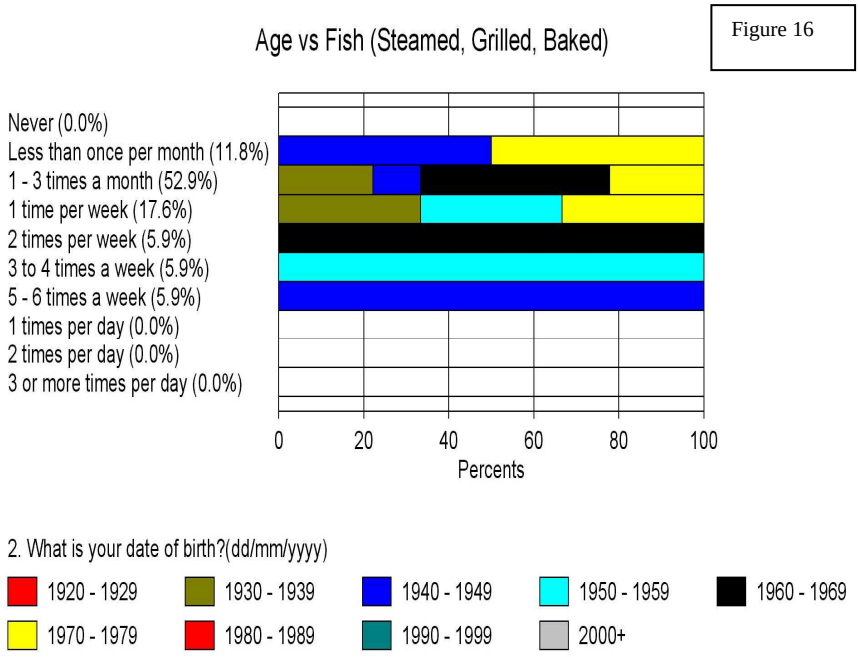
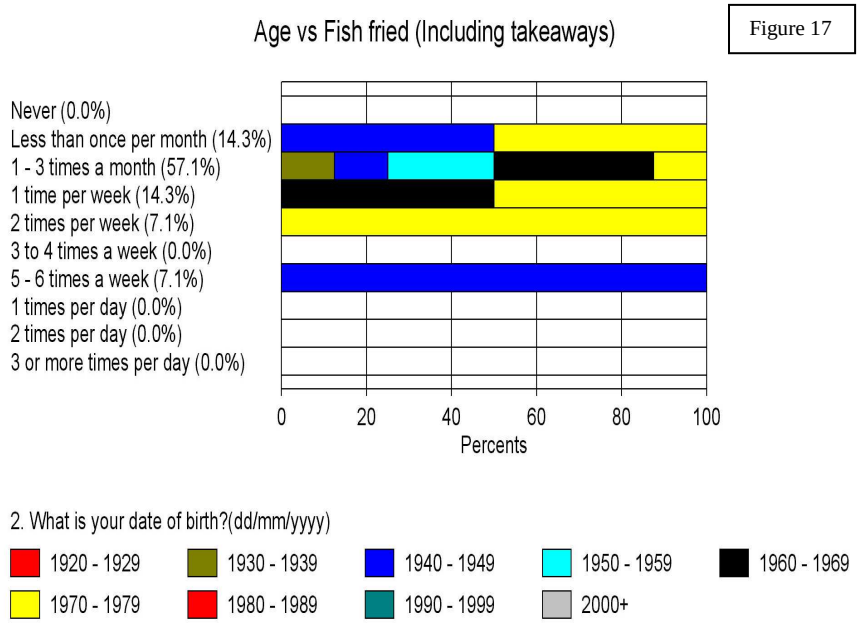


Figure 17



52.9% of respondents consumed steamed, grilled or baked fish 1-3 times per month while another 17.6% recorded consuming at least once per week. Another 17.7% eat fish more than once per week.

Those who eat fish 5-6 times per week were all in their 60s while those eating it 3-4 times per week were all in their 50s.

Today convenience foods can be purchased from a variety of sources and is available:

- as tinned fish;
- as fresh fish available in the deli of a supermarket; and
- as fish and chips at a takeaway store.

The graphs at left confirm that:

- Fried fish is consumed frequently and by 28% of respondents at least once per day.

- 57% eat fried fish at least 1-3 times per month.

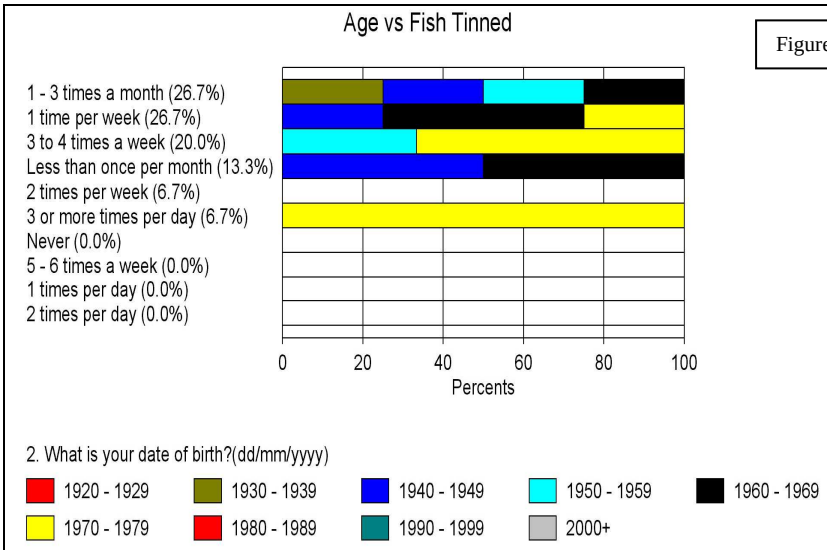


Figure 18

Interestingly Kaumatua consume fried fish and tinned fish 1-3 times per month. In contrast those aged in their 30s were all weekly consumers of tinned fish.

We wanted to determine how dependent whanau were on kai. A question therefore asked if kai moana was the main source of food for the whanau.

37% of informants agreed with this statement (21% agreeing strongly). Those who agreed were aged 40 years and older. In contrast those aged in their thirties were either neutral or disagreed.

In fact 36.8% spread across four age groups disagreed or strongly disagreed – in other words, despite the historic dependency of the lakes for sustenance, kai was not the main source of food for their family.

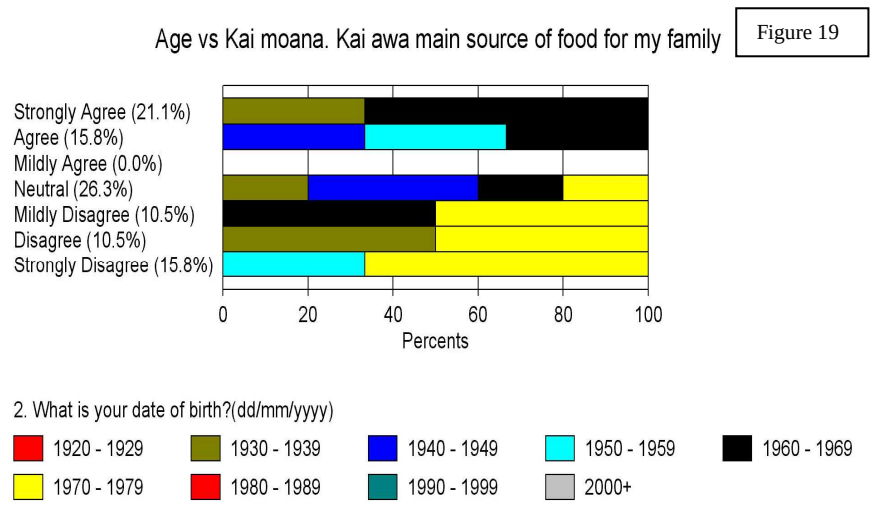


Figure 19

Questions sought to identify changes from a traditional kai dominated diet to a western style diet (Figure 20). It was of concern that 30.8% of respondents eat meat pies, pasties, quiche or savouries at least weekly, and all are aged in their 30s and 40s.

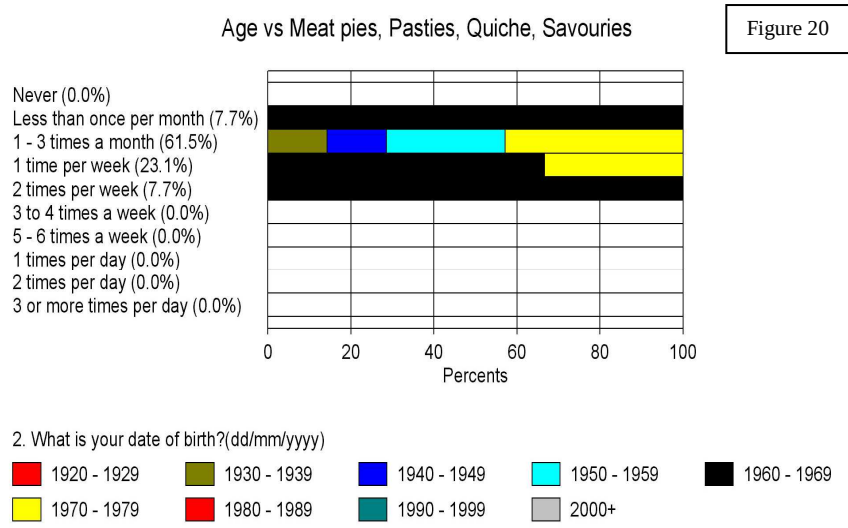


Figure 20

5.2.2 Estimates of the quantity of kai consumed

This research investigates the risk of contamination from eating wild sourced kai. A key consideration is the amount of kai that they are actually consuming, along with the levels of contaminant present. We calculated consumption rates by examining:

- the frequency or number of times they consume kai; and
- the quantity per sitting.

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week. From the data collected we also know that they consumed approximately 219g of fish per sitting[5].

5.2.3 Sites at which kai gathering and other activities are undertaken

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were used as the basis for a sampling programme which examined contaminants in sediment and kai species. Figures 21 and 22 below confirm kai was gathered from 11 of the 14 waterbodies listed. The most highly used area was the coast as 65.05% said they gathered from Maketu followed by lakes Rotoiti (21.04%) and Tarawera (14.39%). There was no gathering by participants from lakes Rerewhakaaitu, Okareka, and Tikitapu.

[5] This is discussed more fully in section 6.3.1

Figure 21

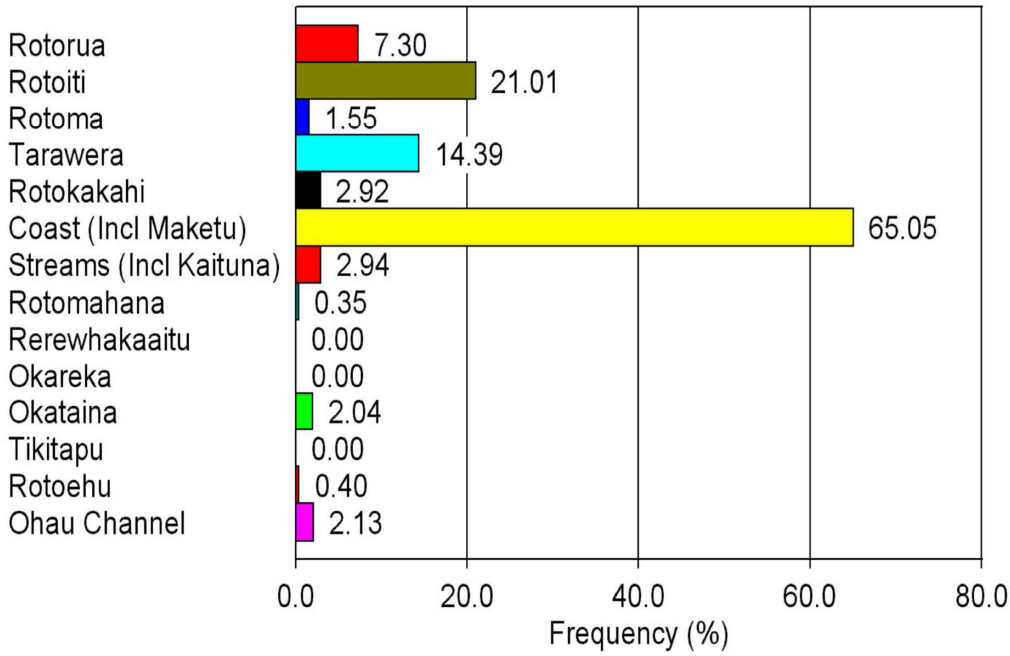
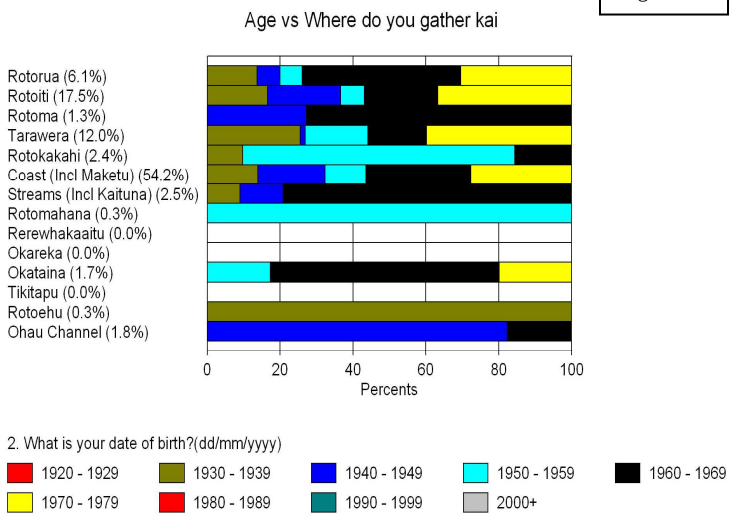


Figure 22



Of the sites listed in the Figures at left (Figure 22):

With respect to ages:

- those that gathered from Rotoehu were in their 70s.
- those that gathered from Rotomahana were in their 50s.
- all age groups were represented amongst the gatherers in Lakes Rotorua, Rotoiti, Tarawera, and the coast.

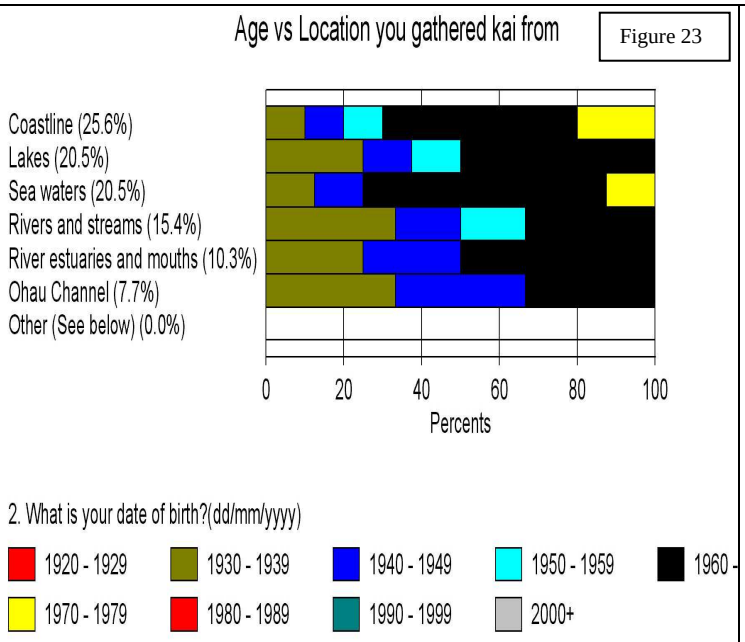


Figure 23 suggests that those in their 30s prefer kaimoana or marine species as gathering occurs at the coast or at sea. This result could also be a reflection of their mobility and possibly access to boats.

In contrast kaumatua gather from all habitat types.

In Figure 24 we show where each of the species are gathered. Most freshwater species are gathered from a range of sites (other than kakahi). Many more coastal species are gathered than freshwater species, although some species (inanga, eels) are gathered in both areas. Figure 25 shows the proportion of individuals that gather each species. Trout, koura, pipi, mussels, kahawai, cockles, snapper and kina are gathered by at least 70% of participants.

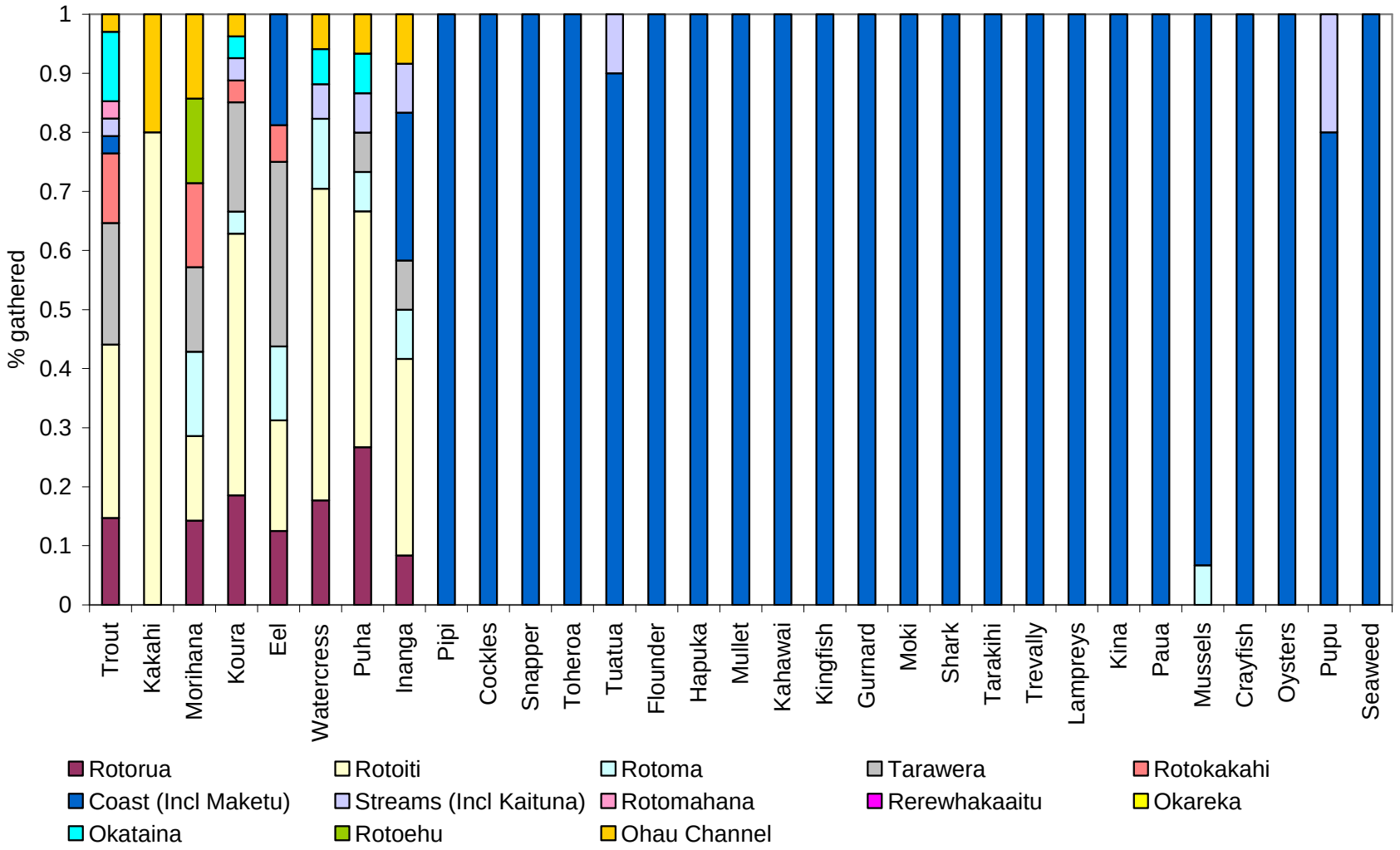


Figure 24: Relative proportions of sites from which the different species of kai were gathered.

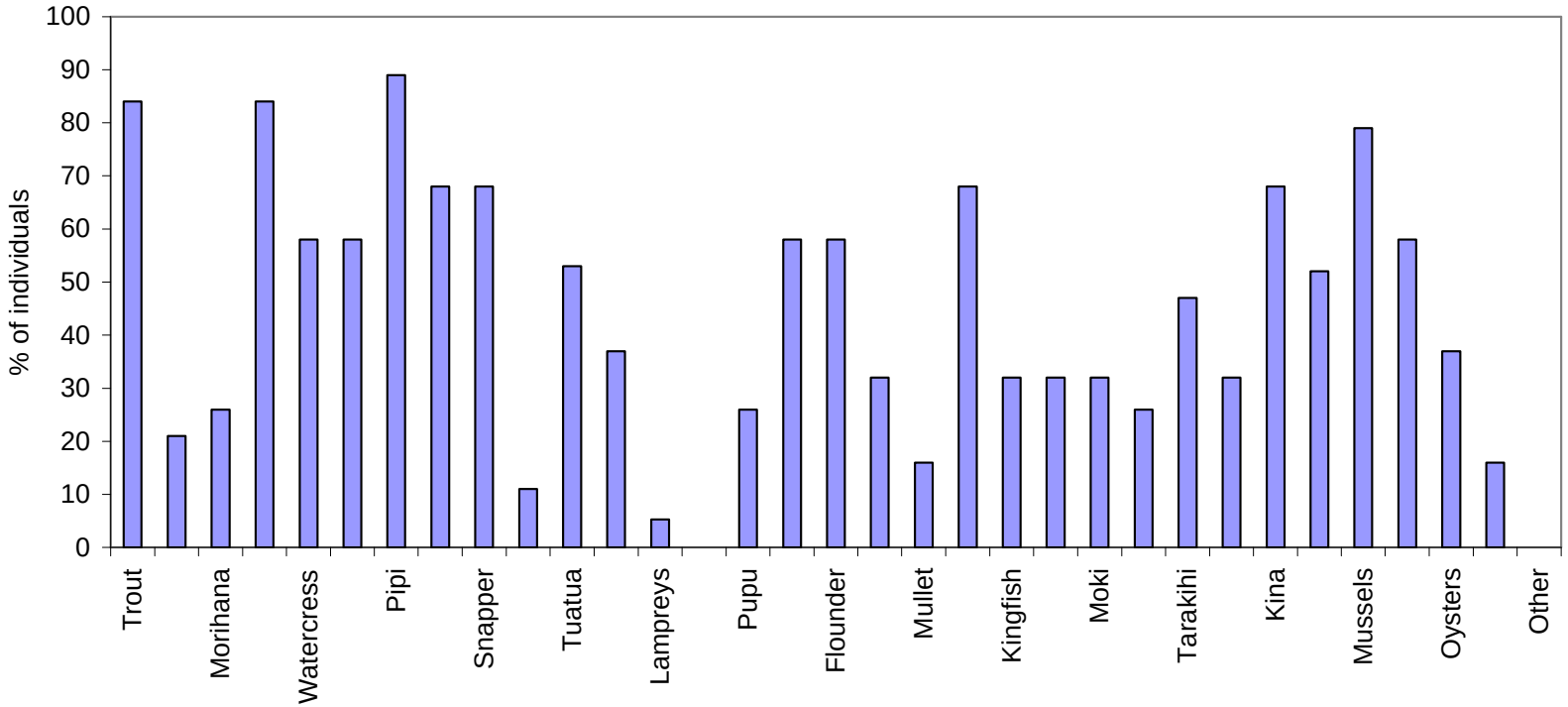


Figure 25: Percentage of individuals who gather each species.

5.2.4 Other sources of kai

This project is about the risk of exposure to contaminants as a result of kai gathering. If there are concerns about the safety of kai consumed, and people are consuming kai that has been gifted, it is important for them to know where the kai comes from.

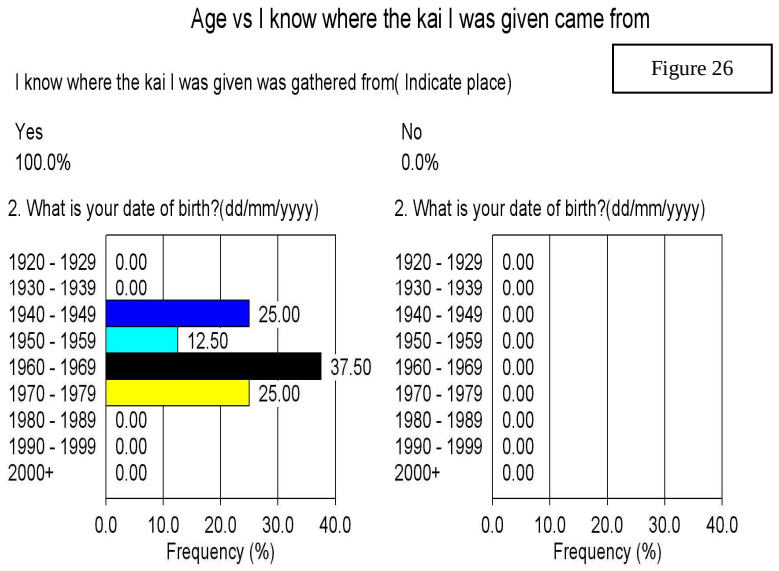


Figure 26

All respondents indicated that they did know the source of the kai they were gifted (Figure 26).

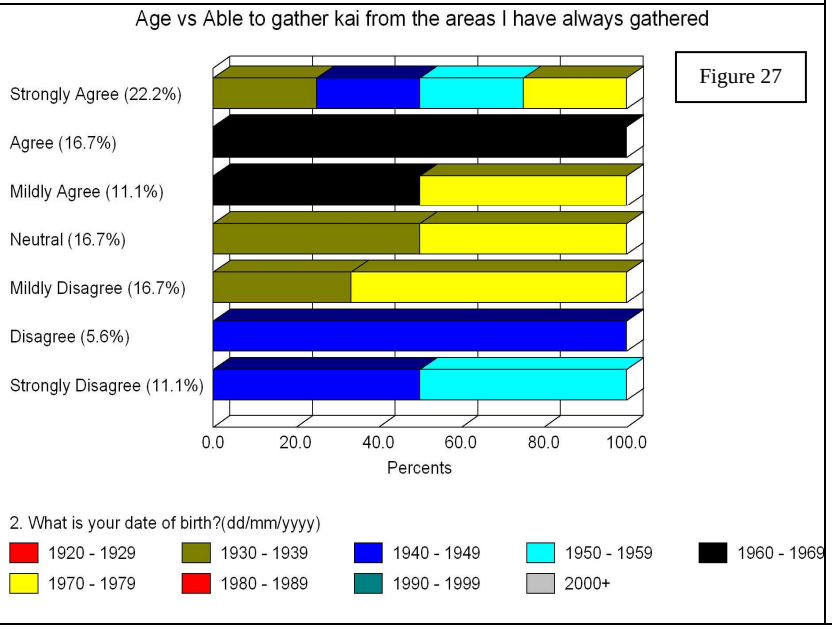


Figure 27

Assuming the sites whanau gather from would change if the condition of the site was degraded; respondents were asked if they were able to gather from the sites that they have always gathered from (Figure 27).

- 50% agree that they can.
- 33% say that they cannot.

No trends can be detected when looking at the respective age groups, although those aged in their 40s all agreed with the statement.

Tangata whenua have witnessed and experienced a range of changes to the local waterbodies and their relationship with them in the last few decades. One of the changes witnessed concerns the abundance of kai available. This is considered in the next section.

5.2.5 Perceived changes in the abundance of species that are gathered

If kai are to be promoted as a beneficial source of food, sufficient quantities of healthy stocks need to be available in order to sustain gathering. The Consumption Survey asked whanau to provide an assessment of the stocks of various species gathered and whether or no abundance had changed. Table 3 presents a summary of these results.

Table 3: Changes in the abundance of species (as a percentage of respondents)[6].

Species	A lot fewer	Slightly fewer	About the same	More abundant
Kakahi	22.2	44.4	-	11
Morihana	42.9	14.3	-	-
Cockles	25.5	50	16.7	8.3
Pipi	11.8	52.9	35.3	-
Toheroa	23.3	16.7	33.3	-
Tuatua	22.2	44.4	11	-
Lamprey	33	50.5	-	-
Mutton birds	50	25	-	-
Pupu	57.1	14.3	-	-
Eel	28.6	28.6	21	-
Flounder	18.2	45.5	0.1	-
Paua	36.4	45.5	9.1	-
Mussels	21.4	28.6	28.6	-
Crayfish	8.3	41.7	25	-
Oysters	27.3	36.4	27.3	-
Seaweed	25	25	-	-
Koura	7.1	35.7	25	-
Watercress	13	33.3	28.6	-
Puha	0	38.5	53.3	-
Hapuka	14.3	42.9	14.3	-
Mullet	16.7	33.5	33.3	-
Kahawai	9.1	27.3	36.4	-
Kingfish	22.2	22.2	22.2	-
Gurnard	11	44	22	-
Snapper	0	40	3	-
Moki	20	40	20	-
Shark	20	40	20	-
Tarakihi	9.1	36.4	27.3	-
Trevally	12.5	37.5	25	-
Whitebait	14.3	42.9	28.6	-
Trout	25	16.7	50	8.3
Kina	16.7	41.7	16.7	-

[6] Perceptions with respect to individual species are summarised in Table 8 with graphs included as **Appendix 1**

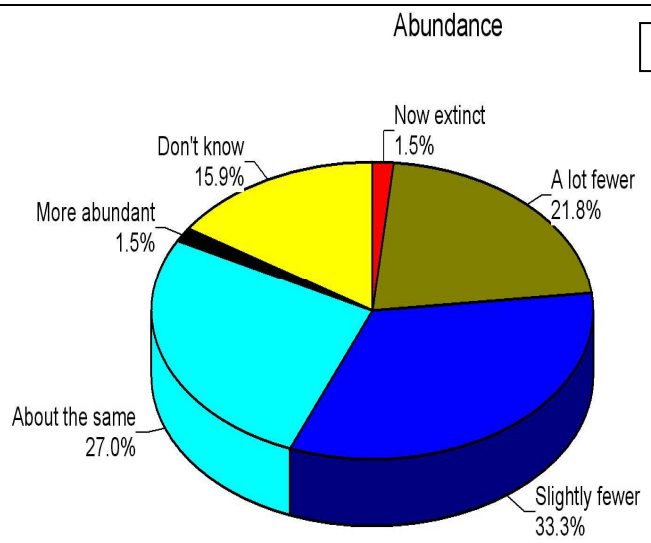


Figure 28

With respect to abundance, 56% felt that "fewer" stocks were available today, specifically, 22% of respondents believed that across all species gathered there were now a "lot fewer" available while another 33% believed that abundance was "slightly fewer"(Figure 28).

As stated earlier 1.5% believed that a number of species – including morihana and koaro were extinct (i.e., no longer present at those places previously gathered from).

5.2.6 Kai gathering behaviours

It cannot be assumed that all kai consumed is gathered by the respondents. Questions in the survey therefore asked about purchasing kai and sought to understand if it was shared within the whanau and wider community.

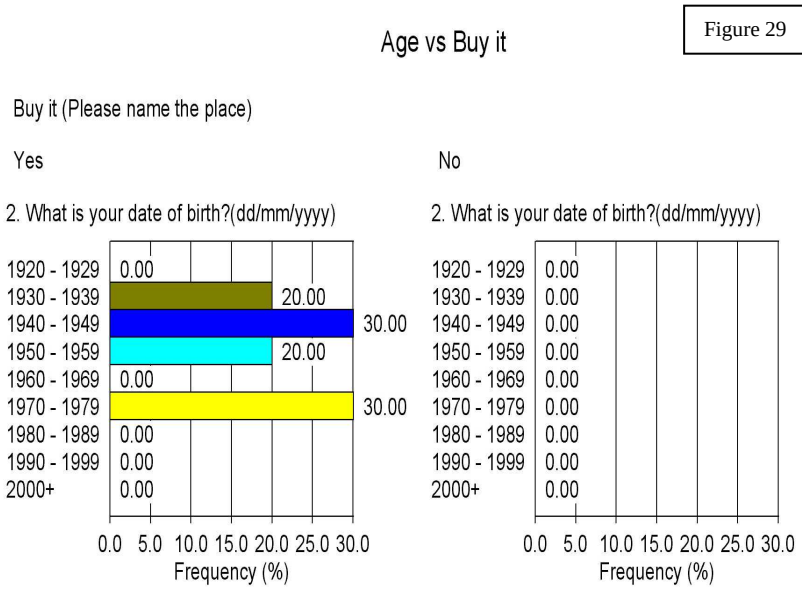


Figure 29

All respondents buy some of their kai (Figure 29).

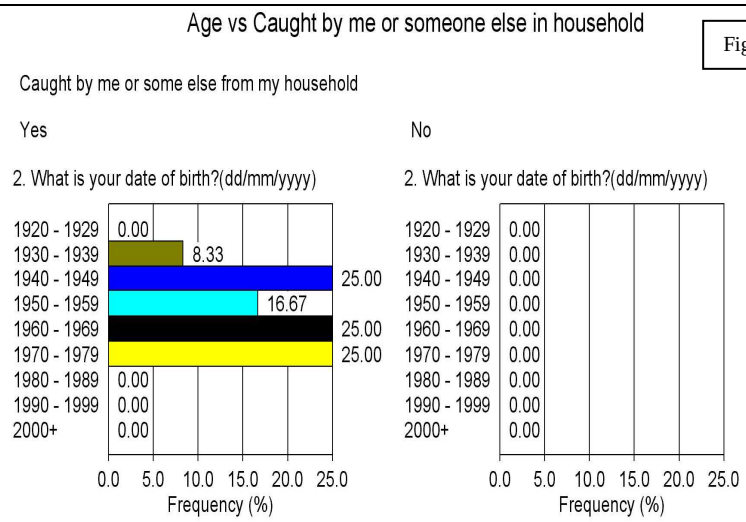


Figure 30

All respondents confirmed that they or someone in their household caught their own kai (Figure 30).

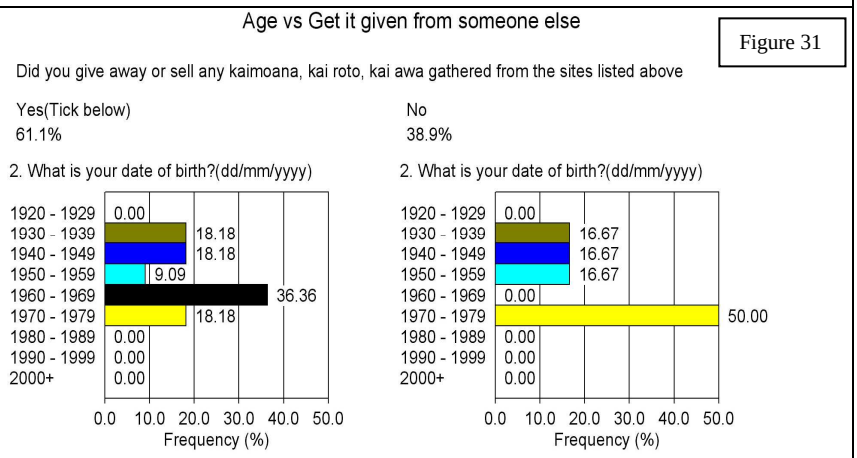


Figure 31

61% of participants said that they also were also given kai (Figure 31).

Aside from knowing how to gather kai, whanau need to know how to prepare the respective species.

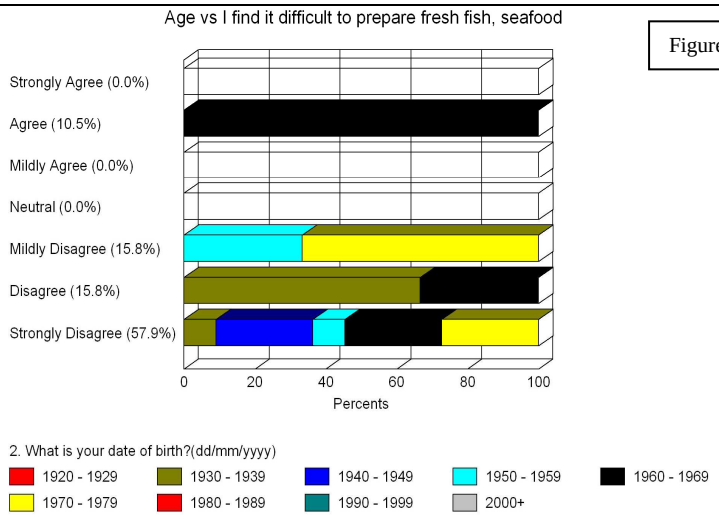


Figure 32

90% of respondents disagreed with the statement (58% strongly disagreeing) that it was difficult to prepare fresh fish and seafood. In other words 90% knew how to prepare their kai (Figure 32).

Of note however was the difference between generations, those that agreed with the statement – i.e., they find kai difficult to prepare - were all aged in their 40s.

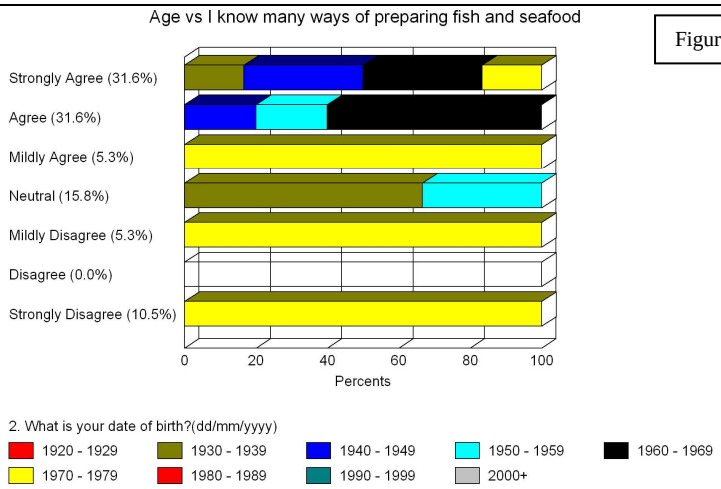


Figure 33

68.7% of respondents know many ways of preparing kai (Figure 33). In contrast, those aged in their 30s replied that they definitely did not know multiple ways of preparing kai.

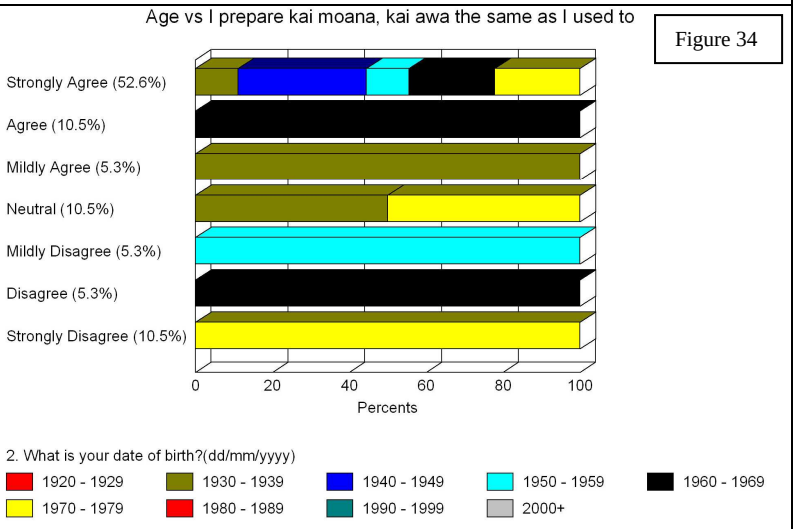


Figure 34

52.6% (across all age groups) strongly agree they prepare kai the same way that they have always done (Figure 34). In fact, 68% of respondents indicated they prepared their kai the same way as they have always done.

5.2.7 Perception of the environment

Yeah, about 60 years ago, beautiful, high and wide and I guess you got the incoming tide from the ocean and the outflow and that, you know. Well, look, it's just quite natural, eh, how you got the Kaituna coming down, you know, and pushing up and you got the foreshore, both doing justice to the estuary and that's how it used to be (Informant K).

The lake was our playground that is all we had. Along Kotu during the summer and we never went anywhere else. We walked it, we swam it, we sailed it, we played in it (Informant M).

Maori experience environments and central to their continued interaction and utilisation of environments will be their perception of the good health of such areas. A number of questions in the survey asked for them to give an assessment of the condition of the sites from which they gather kai.

Figure 35

Responses were mixed when asked about the condition of sites (Figure 35), with:

- 52.7% believing sites to be in good condition while
- another 31% did not provide an assessment.
- Only 16% appeared to believe that sites from which they gather are not in a good condition.

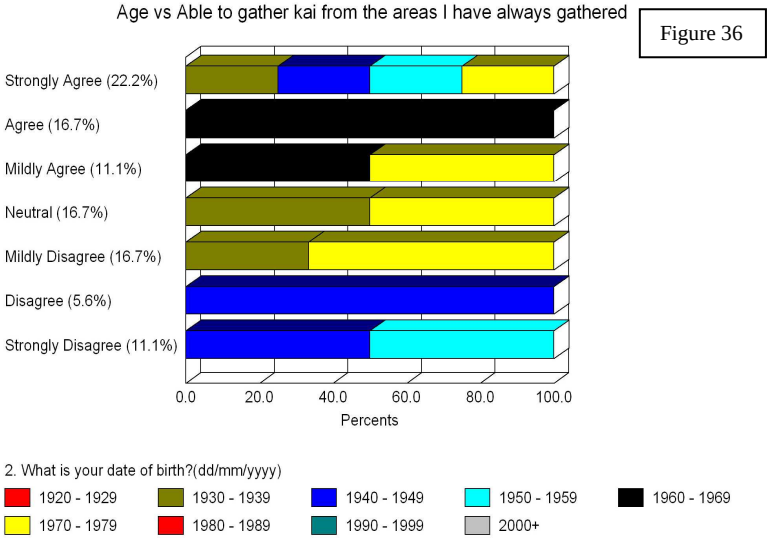


Figure 36

This is supported by the assessment by 50% of respondents who believe that kai could be gathered from the same sites that have always been accessed (Figure 36).

With respect to age differences those who believed they could no longer gather from the sites they have previously been able to were aged in their 50s and 60s.

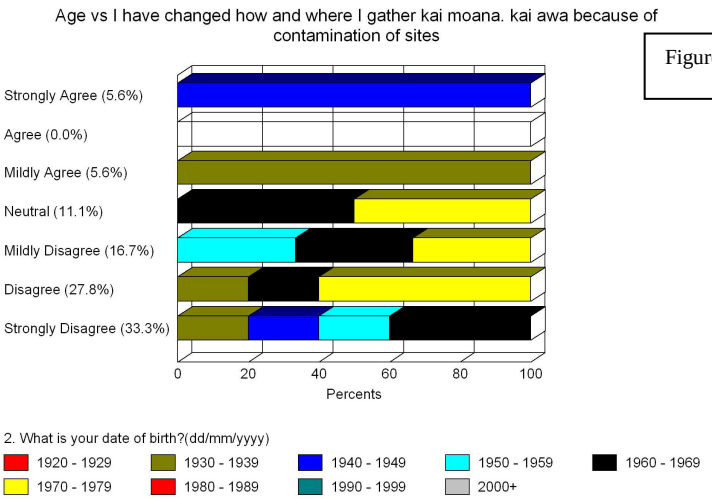


Figure 37

Responses were also mixed when asked about changing the sites they gather from as a result of perceived contamination at the sites (Figure 37):

- Only 11% agreed that they had changed their gathering behaviour.
- In contrast 77.8% across all age groups disagreed.

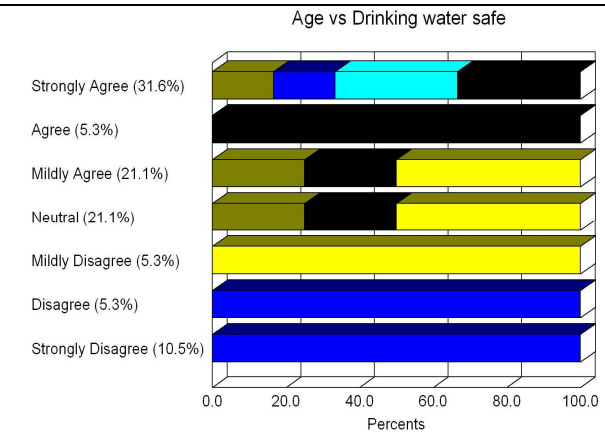


Figure 38

The majority of participants (58%) believed that their drinking water was safe (Figure 38). However, 21% did not comment.

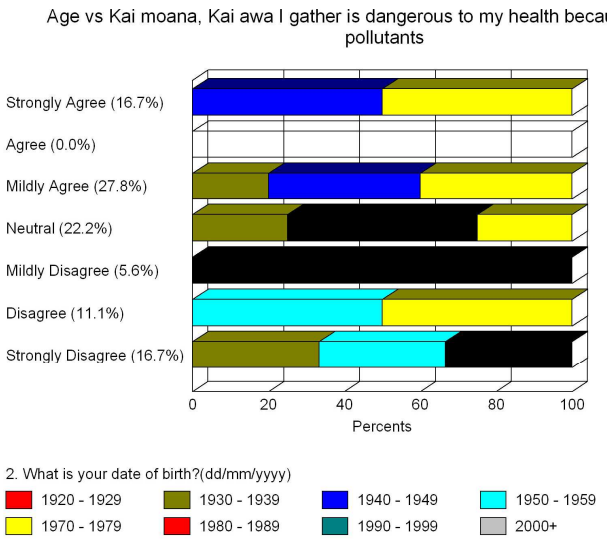


Figure 39

In relation to pollutants (Figure 39):

- 44.5% strongly disagreed with the statement that the kai gathered was dangerous to human health because of pollutants with (16.7 strongly disagreeing)
- However 22% did not provide an assessment.

With respect to age differences all respondents in their 60s agreed with the statement – that kai is dangerous because of pollutants.

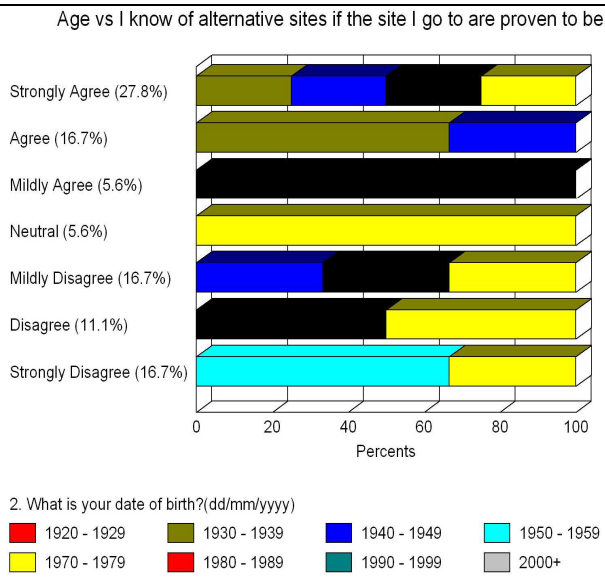


Figure 40

No clear trends emerged when asked if kai gathering was dangerous to the health of respondents because of pollutants or toxins.

However, if a site is contaminated then the expectation would be that alternative sites would be used.

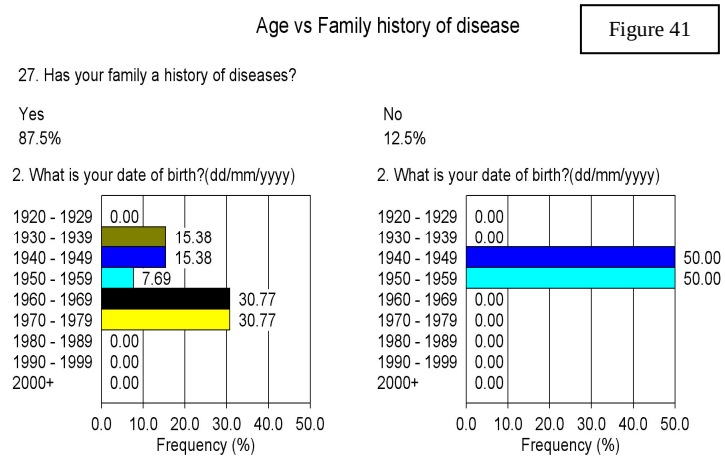
However only 50% knew of alternative sites that they could use (Figure 40). 27.8% strongly agreed with the statement that they would use alternative sites.

All respondents aged in their 70s knew of alternate sites.

5.2.8 Health of whanau members – Self Reported Rates of Diseases

Participants were asked to self report diseases prevalent in the family (Figures 41 and 42).

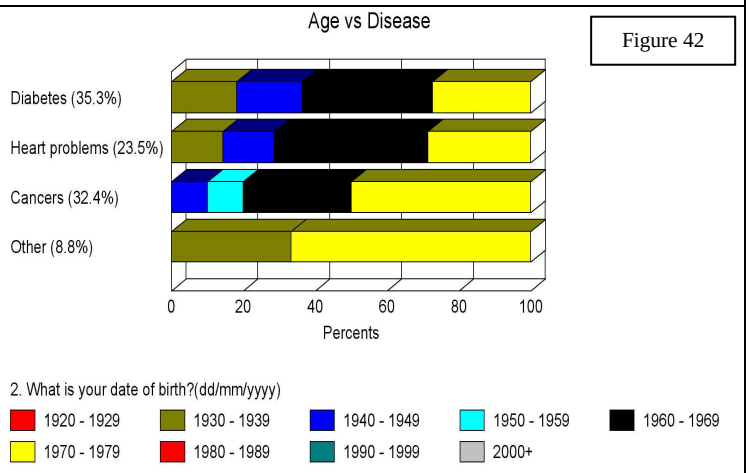
Figure 41



The lowest reported incidence of disease was among those in their 50s (at 7.69%) while those aged in their 60s and 70s each scored 15.38% which contrasts with a rate of 31% for those aged in their 30s and 40s.

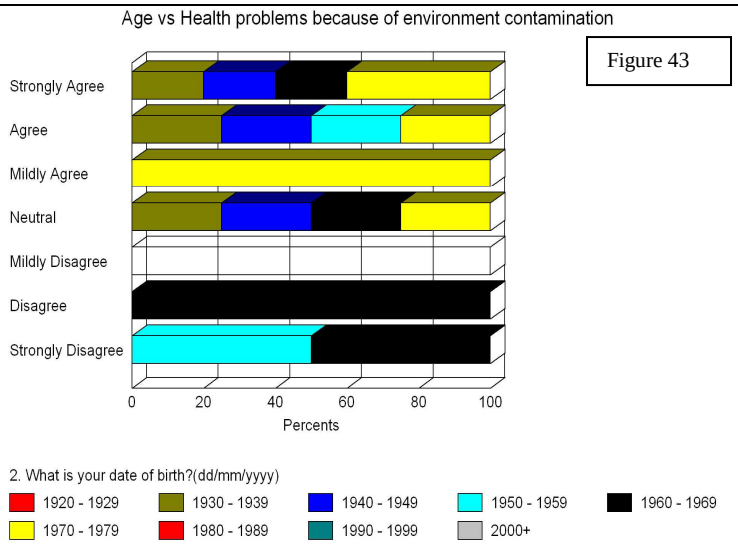
- 87.5% reported that there was a history of disease in their family.
- 35.3% of participants, across four age groups, reported a history of diabetes within their whanau.
- 32.4% of participants, across four age groups, reported a history of cancers within their family.
- 23.5% of respondents, reported heart problems (Figure 42).

Figure 42



Despite the prevalence of illness in their whanau (at above average rates) 84.2% of the individuals participating rated their health as good, very good or excellent (Figure 43). No one rated their health as poor.

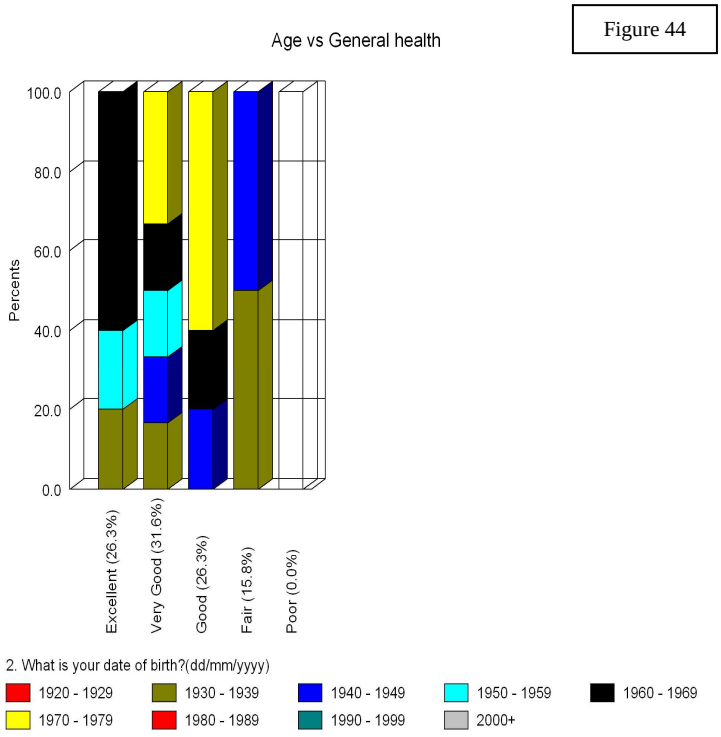
Figure 43



Two questions in the survey asked if respondents believed their health problems could be attributed to environmental contamination or more specifically water contamination (Figure 43).

With respect to environmental contamination, 61% of participants across most age groups agreed with the statement that health problems can be attributed to contamination.

Figure 44

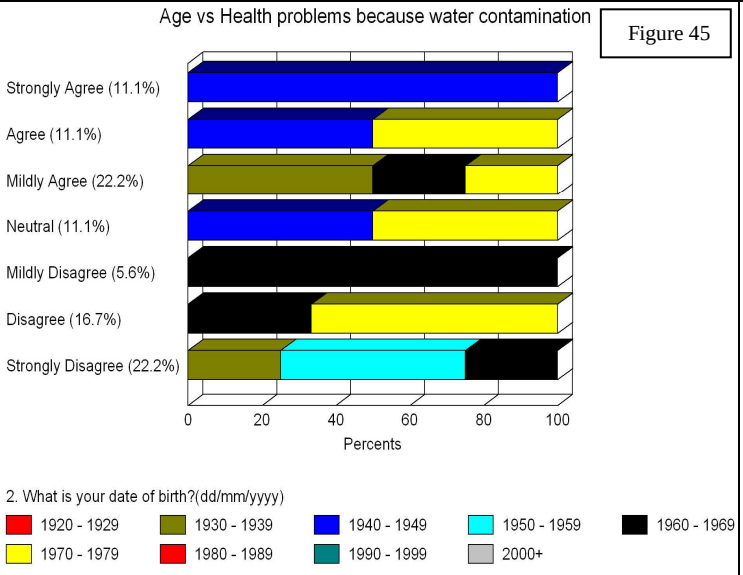


Other age group observations (Figure 44):

- The eldest participant considered their health as excellent.
- Those aged in the 70s and 60s were the only ones to rate their health as fair.
- The greatest variation was in the 70+ years age group with participants rating their health fair, very good or excellent.

As expected, the youngest participants (aged in their 30s and 40s) considered their health very good or good.

Figure 45



Interestingly 44.5% of participants disagreed with contaminated water being the source of their health problems while an equal number agreed.

The "casting vote" lies with the 11.1% who provided no comment (Figure 45).

5.2.9 Disseminating advice about contamination issues

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

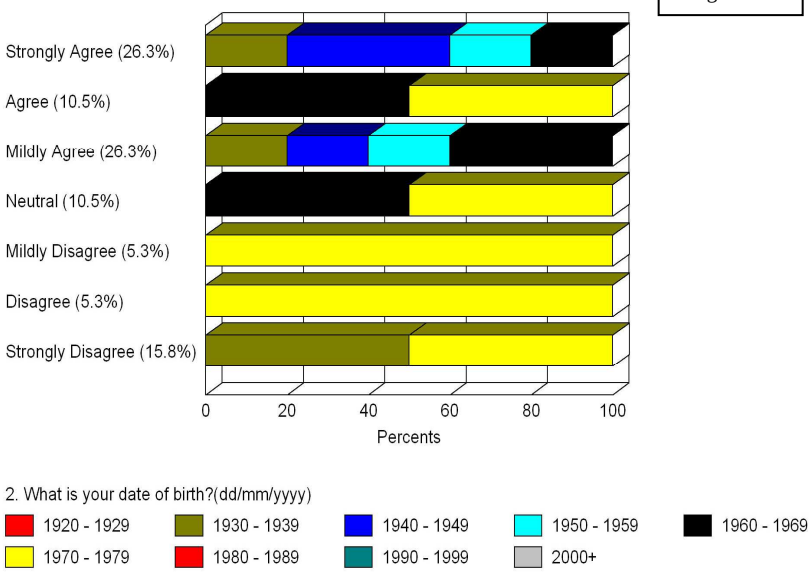


Figure 46

63.1% of respondents indicated they knew where to get advice about contamination issues (Figure 46).

Only 26.4% (and two specific age groups – those in their 40s and 70s) did not know where to go to obtain information.

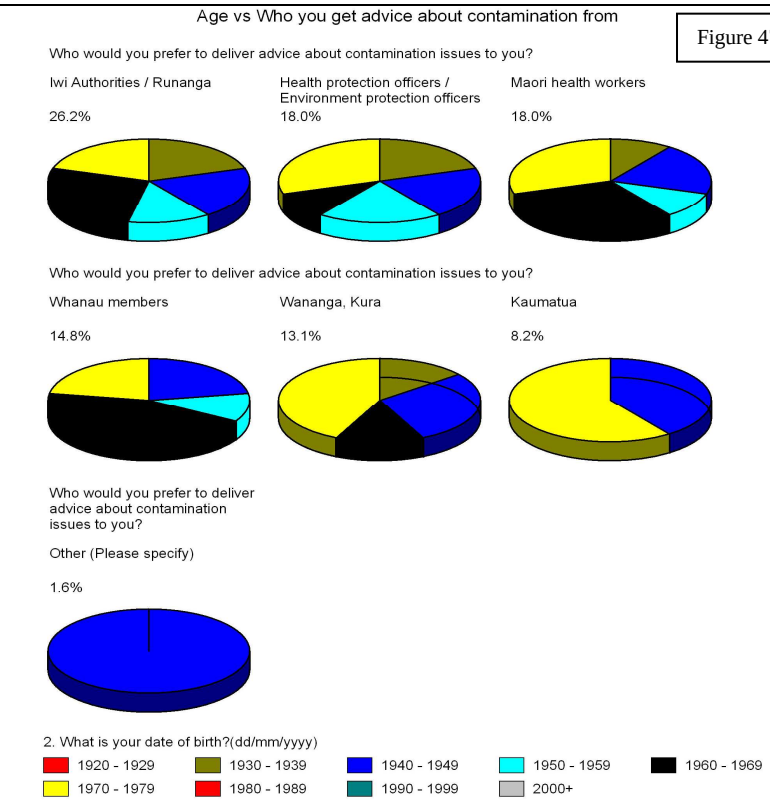


Figure 47

There is a slightly higher preference for iwi authorities/runanga to deliver the information (26.2%), although HPOs/EPOS, Maori health workers, whanau members and whananga were also considered important (Figure 47).

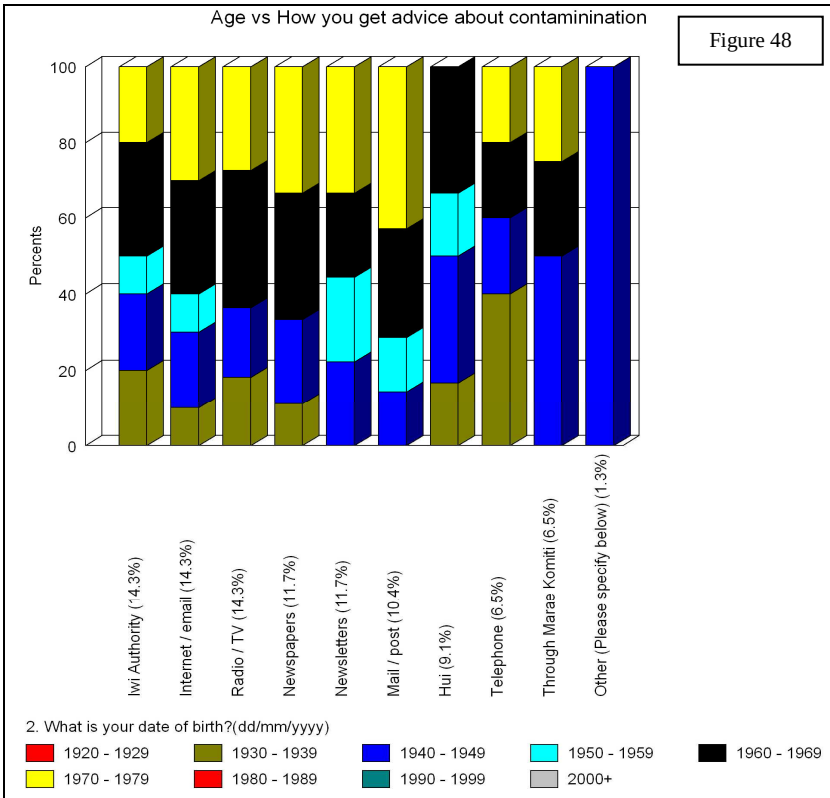


Figure 48

Similarly there was no clear preference with respect to the means of communicating contaminant information, which in fact suggests that a range of media should be used. About 9 different media were supported evenly (Figure 48).

However, when reviewing the means of communicating we need to be cognisant of the equipment needed by whanau.

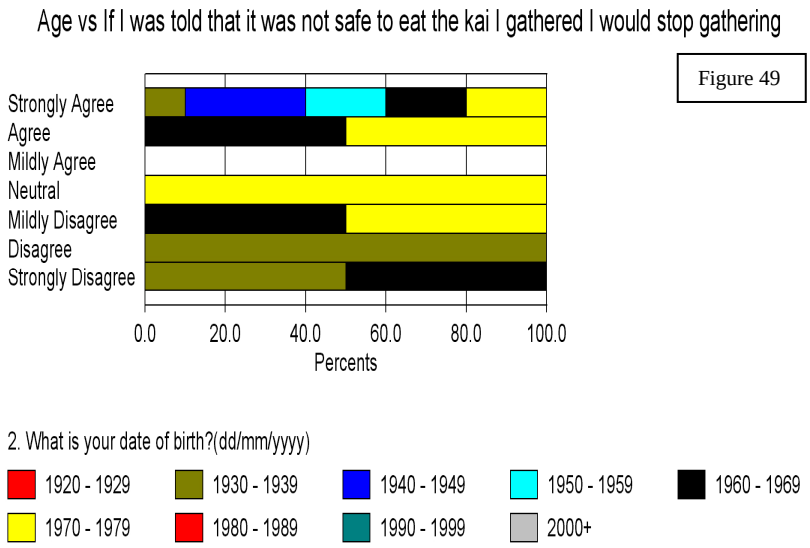


Figure 49

The final result (Figure 49) concerns the long-term outcome of this programme and the need to communicate health risk. Importantly, 63.6% of respondents (across all age groups) indicated they would stop gathering kai if advised that kai was not safe.

In the section that follows we discuss the implications for Te Arawa of the results presented in this chapter.

6. Discussion - understanding the socio-economic-cultural importance of kai to whanau and hapu

> *Indigenous relationships to the land are based in cultural practices. Harvesting of traditional foods is a central, material part of this relationship. A key problem for indigenous peoples occurs when, because of the practices of competing world views such as those often held by colonial states, practising these material connections becomes difficult. Problems ensue. These problems include issues related to health and well-being, and a disruption of well-established life-ways. (Fediuk and Thom, 2003, p 1)*

The discussion in this chapter compares traditional and contemporary consumption patterns of kai gathering, processing and consumption, the health of significant sites, and summarises environmental change over the last 160 years to identify drivers of the transitions from a traditional kai based diet to a western diet. Insights, firstly, concerning the impact of dietary changes and secondly, the ongoing risk of exposure to contaminants and the impacts of this risk on the health and wellbeing of whanau are discussed in the wider political / social / cultural context in order to give a more complete reporting of cultural-environment relations.

From the histories of Te Arawa and written manuscripts, descriptions of lifestyle heavily dependent of kai gathering emerges. The resources available from these lakes were crucial for sustaining the livelihoods of Te Arawa whanui prior to European settlement. Kai gathering was the basis of an economy and culture before contact with Europeans. In this chapter we distinguish kai gathering in three time periods:

- pre European settlement through until late nineteenth century using mostly information sourced from secondary sources;
- twentieth century up until the 1970s and 1980s – using information sourced from interviews with members of Te Arawa whanui; and
- the present - using information obtained from:
    - the interviews with members of Te Arawa whanui;
    - the kai consumption survey; and
    - monitoring reports of EBoP, research reports and statutory plans.

6.1 Structure of this chapter

Te Arawa have continually asserted their right to have their mahinga kai and cultural practices protected. However, many whanau in Rotorua Lakes have witnessed the degradation of valued habitats and experienced significant barriers to gathering kai. They continue to express their concerns in a variety of forums. This chapter follows the format of Chapter 5 and discusses:

- patterns of kai consumption;
- estimates of the quantity of kai consumed;
- sites from which kai is gathered;
- perceived changes in the abundance of species;
- kai gathering behaviours;
- perception of the environment;
- health and wellbeing of whanau members; and
- disseminating advice about contamination issues.

6.2 Traditional patterns of gathering

> *At 1840, Lakes Rotoehu, Rotomā, Rotoiti, Rotorua, Ōkataina, Ōkareka, Rerewhakaaitu, Tarawera, Rotomahana, Tikitapu, Ngāhewa, Tutaeinanga, Ngāpouri, and Ōkaro were rich in resources. These included extensive indigenous fauna and flora that provided food, shelter, and economic resources for Te Arawa as well as the means to provide for manuhiri (visitors) and others in the district. The lakes were also primary transport routes for the area. To Te Arawa, the lakes were taonga, and their relationship to the lakes and environs was and continues to be the foundation of their identity, cultural integrity, wairua, tikanga and kawa.*

The evidence of Captain Gilbert Mair, before the Native Land Court during its 1918 inquiry, explained the significance of aquatic resources, (as apart from birds and rats), that the Rotorua district was seen to be unsuitable for cropping. This resulted in fishing assuming greater importance to Te Arawa. Mair listed the various species of

fish caught in the Rotorua lakes including: kakahi (a kind of freshwater mussel), kokopu, koaro (fish similar to small trout), koura (freshwater crayfish), and inanga (whitebait)[7].

Rights to water fowl were held by particular hapu, and were sustainably managed. Kawa (shags) and seagulls, which nested on the lakes' margins, were also managed as were plants such patches of raupo growing along the lake shore[8]. Overall, the list of food items, materials, and other resources relied on by Central North Island Māori including Te Arawa to sustain themselves is substantial. Listed below are some that have been referred to in written text and statements –

Fish and crustacea including:

> eels of different kinds, koura (freshwater crayfish), inanga or whitebait, kōaro, kokopu, kakahi (freshwater mussel), karehe (freshwater pipi), toitoi (common bully), ngorungoru, pahore, mataitai (foodstuff from the sea, generally).

Birds including:

> ducks, kaka, kiwi, kakapo, kukupa and kereru (pigeons), tui, taiko (petrels), mutton birds, matuku (bitterns), kahu, weak.

Other fauna including:

> kerewai (a green beetle, found in manuka scrub), kiore (rats), and [as a later introduction] pigs.

Plant products including:

> flax, kakaho, raupo, paopao (another type of reed), kiekie, toetoe, aruhe (fern root), putere (raupo root), mānuka [used for medicine and also for constructing koneke and shelters], tahara, mingimingi, kaponga bark [for medicine], tutu and koromiko [for medicine], makaikai/maikaika tubers (a kind of potato), kohekohe, pukeatea, rewarewa, mangeao, puriri, wharangi, kotukutuku, makomako, kaponga-mamuka, tawhero, mawa, kawakawa, piripiri [these last 13 all having medicinal uses], ti kouka shoots, berries (tawa, hinau, titoki, makomako, kotukutuku, rohutu, poporo, karaka, miro, tutu), young fern fronds (moku, paretao and pikopiko), rarauhe (bracken),

[7] Evidence of Gilbert Mair, ibid, pp 191–196
[8] Evidence of Wiremu Maihi Ereatara, ibid, p 306

tāwhara fruit and flowers [both used for food], huahua, tupakihi, tawhara, puha, watercress, and [cultivated] kumara, hue (gourds), and taro.

Timber including:

totara, puriri, tanekaha, pohutukawa, white pine.

Other materials such as:

paru [for dyeing fibre], kokowai (red ochre), sulphur [used for medicinal purposes].

Other natural resources:

water, geothermal resource [both with multiple uses including spiritual].

Another comprehensive description of the species sourced from the Rotorua Lakes area is provided by Makereti in “Old Time Maori” (originally published in 1938).

Table 4: Species traditionally gathered from across the Rotorua Lakes region sourced from the writings of Makereti (1938).

SPECIES				
Koeaea (whitebait)	Kokopu (*Galaxias*)	Upokororo (grayling)	Eel	Koura (crayfish)
Inanga/smelt (*Retropinna retropinna*)	Tamure (schnapper)	Trevally	Kahawai	Kumukumu (gurnard)
Kingfish	Mangopare	Pepeke	Kapeta	Parore
Mangotara	Koheriri (horse mackeral)	Kutorotoro (sandfish)	Tutahuna	Tarakihi
Mango (shark)	Hapuka (groper)	Kanae (mullet)	Warehou (sea bream)	Moki
Manga (barracuda)	Tuangi (cockles)	Kuku (mussels)	Karengo (*Laminaria*)	Rimurehia / rehia – edible seaweed
Paua (*Haliotis*)	Kina (*Echinus*)	Tio (oysters)	Pipi	Kotukutuku (*Fuchsia excorticata*)
Aruhe (bracken fern)	Poporo berries (*Solanum aviculare*)	Hakeke (*Polyporus*) – an edible fungus	Kakahi (freshwater mussel, *Echyridella menziesi*i)	Toitoi (*Gobiomorphus gobioides*)
Kumara	Tutu – the berries of the puho (*Coraria ruscifolia*)	Harore (*Agaricus adiposus*)	Kiore – rat (*mus esculens*)	Pig
Para twahti, para reka or para (*Marratia fraxinea*)	Berries of the karaka tree (*Corynocarpus laevigata*)	Pungapunga – pollen of raupo (*Typha sp.*) koreirei – roots of the raupo	Many different bird species	Potato
Tawa berries (*Beilschmiedia tawa*)	Ti kouka or whanaka (*Cordyline australis*)	Puwha (*Sonchus oleraceus*)	Tawhara – part of the kiekie (*Freycinetia banksii*)	Fruit of the Hinau tree (*Elaeocarpus dentatus*)
Taro	Fruit of tumingi (*Cyathodes acerosa*)	Roots of pohue (*Convolvulus sepium*)	Te korito – heart of Nikau palm (*Areca sapida*)	Fruit of the Makomako (*Aristotelia racemosa*)
Young fronds of the fern Moku (*Asplenium bulbiferum*)				

Makereti (1938) also describes how the respective species were gathered.

Shellfish

Shellfish was an important food, and many species were found in the sand of the beach when the tide was out. The varieties are too numerous to mention. All shellfish were collected by women and not by men.

Kuku, mussels, were taken from the rocks by hand and collected in baskets.

Paua (Haliotis)… is taken from the rocks by hand, and the inside is taken out and beaten to soften it before it is cooked on hot coals or in a hangi.

Kina (Echinus)... is generally eaten raw. It is usually collected at the same time as the paua.

Tio, oysters of two kinds, were found on the coast. One kind is rather small and has a rough and crinkled shell, and is found on rocks. The other is much larger, and has a comparatively smooth shell, and lives in mud. The Maori did not care a great deal for oysters, as he did for other shell-fish.

Pipi grows all over New Zealand, generally in sand banks or in sandy mud, and was a favourite food.

Freshwater fish

Koura …..They used the paepae, a dredge net, and also whakaweku, bunches of fronds of raurahe (bracken) sunk to the bottom of the lake, or tau, bunches of fern tied to a post.….Our people also ruku koura, that is, dived for crayfish, going to the bottom of the lake and bringing them up between both hands.

Inanga (Retropinna retropinna) was taken in great quantities in most of our lakes with the kupenga, or seine net. They were also taken in an oval hoop net with a long wooden handle which went right across the net, and also in a small conical scoop net. The fishers who used these small nets waded near the shore. But the big net was generally used in the old days in Lake Taupo and Lake Rotorua, Lake Rotokakahi, and other lakes...

Toitoi (Gobiomorphus gobioides) is a small fish caught in the lakes, and like inanga was taken in nets…. Toitoi was also called titarakura and other names.

Pahore was another small fish found in the lakes like the toitoi.

Koeaea or whitebait was much thought of, and it is one of the nicest of all small fish….

Kokopu (Galaxias) was an important food among the people who lived inland..… The kokopu was generally taken on dark nights in summer and autumn….. Its flavour was not unlike whiting, and there were about six varieties.

The upokororo or grayling, of which there were the tirango, kutikuti, and rehe, were caught in traps when they were going up rivers after a flood while the water was still dirty. The upokororo was also taken in nets and by other means.

The Maori sometimes caught the patiki or flounder with a spear. The spear was made with a point at the end which was barbed. It was not unlike the spear used for catching birds.

Kakahi, the fresh-water mussel.

Eels were taken in a hinaki, eel trap, set at a pa tuna (eel weir), and with a bob, spear, or even with the hand..…

Marine species

The mango (shark) was taken, not only to eat, but for the teeth. The teeth of the mako shark, or some of its species, were used as ornaments and as cutting implements.

There were also hapuku (groper), tamure (schnapper), kanae (mullet), warehou (sea bream), moki, kahawai, kumukumu (gurnard), and other fish.

Sea crayfish were also taken by diving. Men and women were clever at the work of ruku koura, that is diving for crayfish among the rocks of the sea.

Kahawai (Arripis salar) was caught by trawling.

Hapuku (groper), another favourite fish, was also caught by trawling.

Kanae (mullet) was another favourite, which to me tasted like the mackerel I have eaten in England.

Whai or sting-ray was taken with a wooden spear.

Wheke or octopus if small were taken by hand from among the rocks. Should the wheke twine its many legs round the arm of the catcher, he puts his other hand underneath the body.

Seaweed

Karengo (Laminaria sp.) was a seaweed which grew on flat clayey tidal rocks. It grew in plenty on the east coast of New Zealand.

Rimurehia or rehia was an edible seaweed, gathered in the sea close to the shore, or on the beach, and cooked in a hangi and eaten.

Rimiparo was another seaweed gathered and cooked and eaten in the same way. In the summer it was sometimes eaten cold.

Plant species

The pungapunga, the yellow pua, or pollen of the raupo (Typha angustifolia) was mixed into cakes with water and baked. The pungapunga was gathered in summer when the plant was in full flower, and was obtained by shaking the dense flowering spikes gently. Raupo grows in swamps by the edge of streams and rivers and lakes. It has a sweetish taste. The middle part of the white succulent roots of the raupo, called koreirei, was also favoured as a food. It was generally eaten raw during the summer season.

The roots of the pohue (Convolvulus sepium) were dug up out of the ground, cooked in a hangi and eaten. The root was long and tough, and got after much trouble. It was quite good to eat.

6.3 Contemporary species

Many of valued species gathered historically that were of high nutritional value are no longer available in quantities sufficient to enable them to be a primary food source. The species identified during the interviews include:

Kakahi	Morihana	Cockles	Pipi
Toheroa	Tuatua	Lamprey	Mutton birds
Pupu	Eel	Flounder	Paua
Mussels	Crayfish	Oysters	Seaweed
Koura	Watercress	Puha	Hapuka
Mullet	Kahawai	Kingfish	Gurnard
Snapper	Moki	Shark	Tarakihi
Trevally	Whitebait	Trout	Kina

As Table 3 confirmed most species are perceived to be "fewer" in abundance and many iconic species are now only consumed on special occasions. The decline of the freshwater resources is of particular concern to Te Arawa. In addition to the reduced numbers, the condition of the kai may be compromised as well. Most distressing and representing a significant cultural loss, is the possible loss of entire species e.g., koaro, and morihana from some streams and lakes.

While whanau made use of many species, the centrality of koura and whitebait as a critical food source in the Rotorua Lakes is well known and is reflected in the initiatives to restore populations of taonga species. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round.

Food security implies adequate access to affordable, high quality foods that are culturally acceptable. However, introduced aquatic species were not seen by Te Arawa as substitutes of equivalent cultural, spiritual or nutritional value. This is supported by the fact that trout is not eaten by 11% of respondents. However if trout is the abundant species and requires less catch effort than the declining indigenous species gathered historically, it is inevitable that some substitution occurs. It is clear from our research that whanau currently gather kai at quantities less than they did historically and at quantities less that they desire. This is discussed in the next section.

6.3.1 Estimates of the quantity of kai consumed

There is little data available to enable calculation of pre-European (historic) contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. From Makereti (1938) we know:

Two meals were taken each day, the first about 9 a.m., and the other about 4 p.m..…

For the calculation set out below in Table 5 we have assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats in the lakes, especially Rotorua. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

It started to change - in the 70s. Okawa Bay was established in 1971 and it became a subdivision and when you look there, it is all a mixture of all nationalities, whereas Mourea is the old hapu (Informant E).

In the late 1970s, early 1980s when the seaweed and the little maggots, eh, in the lakes start to stink. And that, you know, gradually got worse and as the seaweed went away the stink remained, (Informant M).

The Kai Consumption Survey asked respondents to identify quantities of various types of kai consumed. For taonga species, the following calculations for the quantities for the respective species are considerably less:

	Contemporary consumption of whitebait	**Equals 5.7g per person per day**
	Contemporary consumption of mussels	**Equals 16.9g per person per day**
	Contemporary consumption of kakahi	**Equals 0.3g per person per day**
	Contemporary consumption of koura	**Equals 2.5 per person per day**
	Contemporary consumption of trout	**Equals 10.9g per person per day**

With respect to contemporary consumption, from the Kai Consumption Survey, all respondents still consume kai awa, kai roto, or kai moana. For the comparative analysis in Table 5 we have extracted the quantities of fish consumed from the Kai Consumption Survey data as well as the frequency data.

Table 5: Estimates of the quantity of kai consumed.

Kai consumption historically	Kai consumption up in twentieth century 1970s, 1980s	Contemporary kai consumption
Assumptions The data for estimating the quantity per sitting is that relating to "fish streamed or grilled[9]". At least one meal of "kai gathered" per day per person. Because of the abundance compared to the present, at least 10% more per setting would be consumed compared to today's per sitting estimates. 219.44g per sitting per day. Plus 10%.	Assumptions The data for estimating the quantity per sitting is that relating to "fish steamed or grilled". At least 3 meals of "kai" per week per person. The quantity per sitting would be the same as today's per sitting estimates of 219.44g.	Assumptions The data for estimating the quantity per sitting is that relating to "fish steamed or grilled". The quantity per sitting would be the same as today's per sitting estimates of 219.44g. Special occasions are estimated to be 6 per year. Less than once a month is estimated at 9 per year (which accounts for 11.8% of respondents). 52.9% eat kai 1-3 times per month. 17.6% eat kai once a week per month. 5.9% eat kai twice per week. 5.9% eat kai 3-4 per week. 5.9% eat kai 5-6 per week.
Equals 241.38g per person per day	**Equals 94.05g per person per day**	**Equals 36.20g per person per day. This is similar to the average New Zealand consumption of 32.87g per person per day (Kim and Smith, 2006).**

For the taonga species, the following observations can be made

The quantities available fall far short of historic levels and the levels desired by whanau who wish to engage in mahinga kai practices. The species that possibly approach adequate abundance are mussels which respondents confirmed were available and often sourced from the supermarket or takeaway.

You don't go out and get any watercress anymore, your river has become Pak'n Save (Informant M).

[9] It is assumed that the "fish fillets" estimate would apply for butterfish, greenbone, kanakana, eels, founder, hapuka, mullet, kahawai, kingfish, gurnard, snapper, moki, shark, trevally and trout.

I mean, we have got to the stage we are feeling directed to go to supermarkets and buy from there, it is more convenient (Informant E).

We get our bulk food from the supermarket, whether that's vegetables, it's fish, seafood. Everything comes from the supermarkets. It is totally different today. We have no control over that. We aren't able to go out and get koura like how we did - it is a thing of the past (Informant E).

- For almost every species, the majority of respondents believed that the abundance of populations was declining.
- The majority of kai species are now only consumed on special occasions.
- The quantities of kai consumed have steadily decreased:
    - from approximately 241g historically;
    - to about 94g in the mid twentieth century;
    - to approximately 36g today.

These observations are supported by the statements of whanau -

Last time I had a feed of koura…. was six years ago (Informant B).

I haven't had one [koura] this year. I haven't had one this year. You see, like now what has – you know, you have got the sediment, you have got all the paru in the lake. The other thing you also got is the bottles, eh? And so guys are using those for koura, eh. Used to, but now the hapu have stopped all that – told those guys, eh? You know, and the only place you can get real good eating koura is here and here (Informant M).

Yet for some whanau consuming kai remains a treat and one kaumatua described the behaviours of his mokopuna:

Man, you ought to see them with bloody kinas. They eat kinas…Kinas, mussels, anything like that; they'll get into them (Informant C).

6.3.2 Sites at which kai gathering and other activities are undertaken

Historically different parts of the region were renowned for supplying prized resources. Often sites from which specific resources were gathered would be given a name e.g., it is recorded that in Lake Okataina each of the best mussel beds had its own name.

In the paragraphs that follow we summarise the features of some the lakes, plus the Kaituna River and Maketu that appear in historic references. Makereti (1938) explains:

> *Fishing grounds belonged to the hapu which owned the land going down to a lake or along a river, and were marked by posts as described in the account of sea fishing. In Lake Rotorua about half-way between Owhata on the mainland and Mokoia Island was such a post, called Hinewhata. My ancestors Wahiao and his father Umukaria who lived at Owhata used this post for tying their fishing nets on when they were getting inanga, and they also tied on bunches of fern for catching koura, or crayfish.*
>
> *In the old days inanga was taken by the hapu of Tuhourangi from Otamakari on the north of Tarawera Lake, Owhaia and Te Puna north of Tarawera, Te Manuka at the same place, Waitangi to the north-west, Parahamutu, Rahuiroa, Terapatiki, Matakana, all near by, from Kariri and Punaromia, from Waitoharuru (Wairoa Falls), and Karikaria close by, from Hawaiki on the south-west of Tarawera Lake, from Taneroa, from Whangaruru on the peninsula, from Te Ariki, from Tutaiinanga on Paeroa block, from Motutawa, and from all round Rotokakahi Lake at Okareka, on the west side of Otaku. All these were ancient fishing grounds.*
>
> *My people in the Lakes district, at Rotorua, Rotoiti, Okataiua, Tarawera, Rotokakahi, and other lakes, took the koura in many ways.*

In recent decades concern has been expressed at the deteriorating condition of the lakes, in particular Lake Rotorua where weed growths, scum, algae blooms, sedimentation and mud build up on the lake-bed, and poor water clarity have been experiences. During the 1970s it was recognised that water quality was deteriorating in Lake Rotorua because of increased nutrient loads - notably from treated sewage, streams draining pasture, and aerial top-dressing (Hamilton, 2003).

During the 1980s lake water quality targets for Lake Rotorua were adopted by the regional council, the decision was made to stop directly discharging treated sewage to

the lake, and nutrient load targets were set for sewage-derived nutrients. These initiatives saw improvements in lake water clarity, nutrient and chlorophyll concentrations from the early 1990s, but since then lake water quality has again deteriorated. Most of the decline is attributed to increasing nitrate in streams that drain agricultural land and the amount of nitrates that are locked up in the lake bed sediments.

This impacts a range of uses, including kai gathering. The outflow of Lake Rotorua is through the Ohau Channel which leads into Lake Rotoiti which in turn flows out and down the Kaituna River that flows about 50 km to enter the sea near Maketu. Degradation in one waterbody inevitably degrades others connected to it. Dr Edward White[10] explained that Lake Rotoiti shows significant “deterioration for a lake as large as Rotoiti. I see no prospect of either arresting this deterioration or of restoring the lake, without reducing the quantity of nutrients entering Lake Rotorua".

Ohau Channel

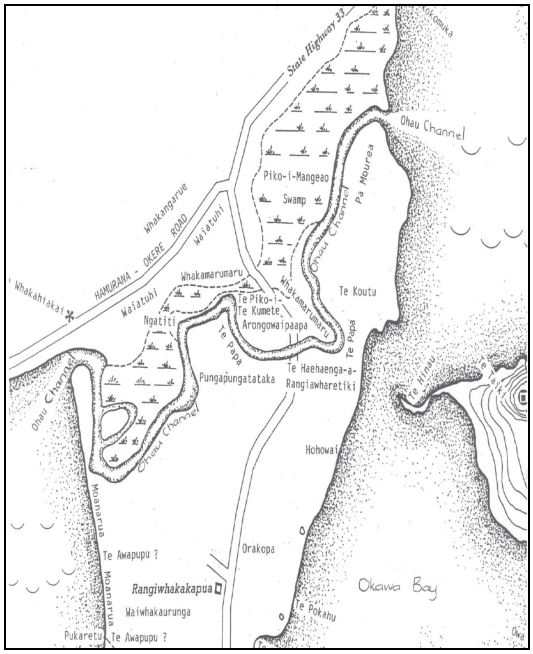
Whitebait were a commercial resource, being sold and traded. Mair reported that from around 1860 to 1919 he had seen Ngati Pikiao netting koaro in the Ohau channel Figure 48), sun-drying them, storing them for winter use, and bartering them profitably with West Coast tribes.

A resource kete from Environment Bay of Plenty (EBOP, 2010a, b) provides statements from a kaumatua who recalls her early childhood days living beside the Ohau Channel.

[10] Dr White was leader of the Freshwater Section of the Dept. of Scientific and Industrial Research who gave evidence to the Waitangi Tribunal on the health of Lake Rotoiti.

A crystal, clear, swift flowing river fringed with raupo, manuka scrub, grassy banks and paddocks, overhanging willows and dotted here and there with the odd domestic wharf, boatshed and kainga. It was a haven for wildlife, a rich food basket, a natural environment of wetlands and a place of historical and spiritual significance. It was a 'paradise' especially in the warmer months. Children would spend all their time swimming against the strong current, diving off banks, catching cockabullies in the shallows, hunting for frogs and tadpoles in the swamps, paddling the old Māori river canoes up and down and hunting for the best jackstones on the beds of shingle. Even then there were signs of human activity and land use upstream and downstream that would soon impact on this idyllic waterway. From the mouth at Lake Rotorua to the outlet at Lake Rotoiti, the river twisted and turned carrying a strong current of crystal clear waters, which provided a host of water activities including trout-fishing, boating and swimming in contrast to the traditional methods of fishing for inanga and koura and the gathering of kakahi.

Figure 50: The area around the Ohau Channel.



Swamps teemed with frogs and tadpoles while kotare above waited patiently to swoop down on unsuspecting prey. Noisy pukeko made untidy nests in the dense raupo, and fantails flitted among the manuka while the shy matuku stood still and erect perfectly camouflaged against a background of rushes and sedges. Pied stilts picked their way along the muddy flats while water rats hid among the debris and undergrowth.

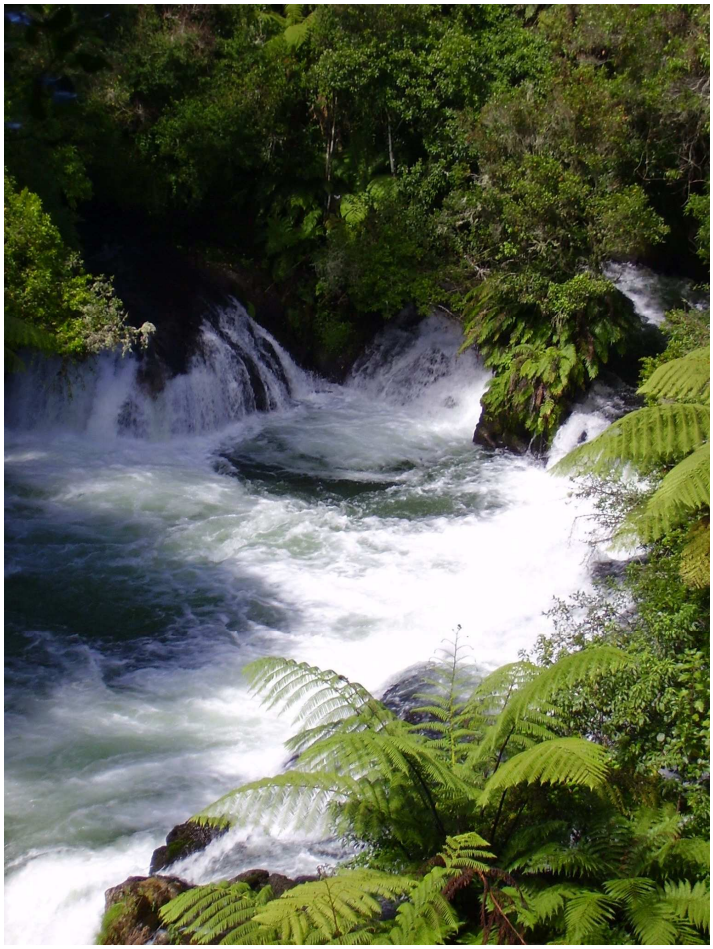
The old red, painted, wooden bridge that spanned the main road from Rotorua to Tauranga was a popular 'hangout' for the local swimming and diving champions. Many households drew water from the channel for domestic use and the washing of clothes in the river was a normal activity. Food scraps and other rubbish were often thrown unwittingly into the river.

Night hunting for koura or 'hi koura' was popular with the kids, who used long manuka sticks baited with threaded worms to entice the koura out of their holes in the banks. As soon as a koura attached itself to the bait the stick would be slowly drawn up to the surface and grabbed with bare hands or netted.

It's getting worse. 70s, 80s – it's getting worse. It got to the stage where my mother and father said "I don't want you going swimming because it's polluted" (Informant E).

Kaituna

The Kaituna River is famous for the pools in its upper reaches, the Okere falls not far from Lake Rotoiti and for the rapids and waterfalls. It discharges to the Maketu Estuary on the coast of the Bay of Plenty. Historically the river was valued for aquatic recreation, for gathering duck, and plants of many kinds (many of special value and importance, some species being rare) that grew along its banks. These were used for medicinal purposes, weaving, dyeing.



The place called Te Wai-i-rangi, (a lovely clear pool from which the river flows on into a green tunnel of vegetation), was, the place where those returning from battle would go to bathe and remove the tapu. Burial caves line the river in the steep gorge reaches.

Maketu

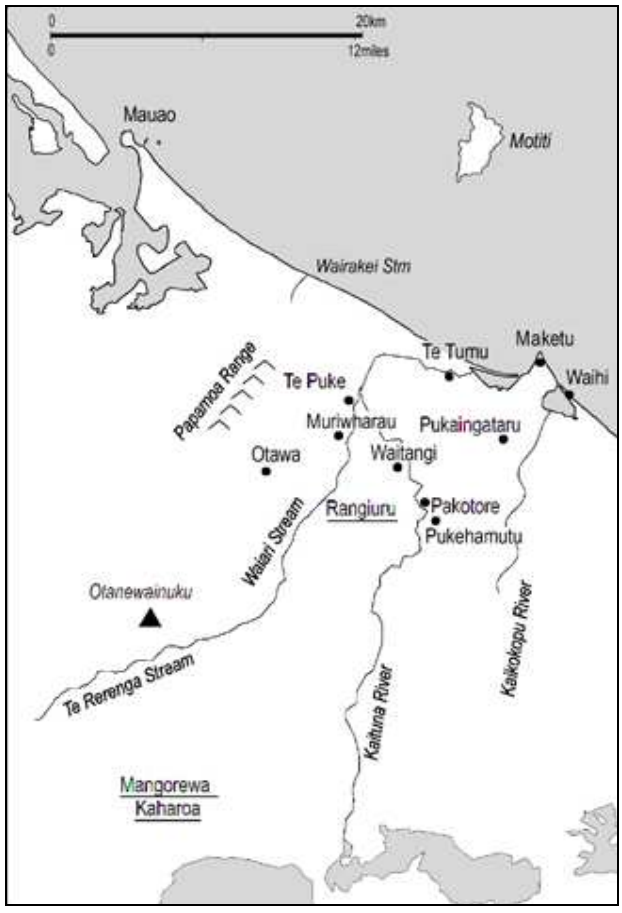
> *The tribes or hapu who owned land down to the sea would own the fishing rights for some distance out to sea. A stake would be put in at each end to mark the boundary line on each side, and these might be a few miles, or many miles apart. The stakes prevented any outsider from fishing in the waters. Only the members of the hapu, or of the several sub-hapu, who owned the land would have any right here. The Maori had names for each fishing rock, ground, or bank which belonged to a hapu, and called them all by name. Some of them were eight or ten miles out in the deep water. The Maori knew all the signs of a good fishing ground.*
>
> *Their fishing grounds were sometimes five, eight, or more miles away.*

Maketu remains important as a place where tupuna walked.[11] It was identified as the site of Tokaparore/Takaparore, the rock (or possibly anchor stone) to which the Te Arawa waka was tied when it first arrived. The Maketu Estuary has always been significant for Te Arawa. The stern anchor of the waka is said to have been placed at Te Awahou, roughly where the Kaituna River flows out to sea today following the diversion cut that was made in 1957. The bow anchor was set down at about the place where the Kaituna River used to flow out to sea at Maketu. The importance of Maketu to Te Arawa therefore can be traced back to their arrival in New Zealand.

The Kaituna River and the estuary at Maketu, were rich in kai awa and kaimoana respectively, providing fish, shellfish, eels, fresh-water crayfish (koura) and many other kinds of food.

Dr Ballara's evidence (Ballara, 2004) to the Waitangi Tribunal noted the range of natural resources in the Maketu area and its strategic importance as a point where communications routes converged. Figure 52 shows the area in the vicinity of Maketu.

Figure 51: The Maketu area.



[11] Don Stafford and Raewyn Bennett evidence to Waitangi Tribunal.

After the Kaituna River diversion cut was made the main flow of the river no longer ran through the estuary, and the resultant deterioration is of concern to Te Arawa. In the context of the present research this is significant given there is a perception that shellfish there may not be fit for human consumption because of contamination issues arising from the lack of flushing.

The health of aquatic resources has impacted kai gathering. Although the alienation of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and believed that the most damaging changes have occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change. Yet, as the interviews and Kai Consumption Survey show, many Te Arawa continue to gather and consume kai awa, kai roto and kai moana. But as the following tables show patterns of usage have changed.

Table 6: Numbers of lakes from which different species gathered[12].

Species	Historical	Today
Trout	12	9
Mussels	6	2
Morihana	-	-
Koura	10	8
Watercress	5	6
Puha	-	-
Inanga	3	7
Lamprey	2	1
Eel	5	6

While Table 6 suggests that the distribution of all species has changed, this information needs to be considered alongside Table 7 which provides greater clarification as to how the different lakes have been impacted by changes in gathering patterns. The increased fishing pressure on Lake Rotoiti is evident as the number gathering at Rotoiti have increased across all species. The other obvious changes are the decreased levels of gathering across all species in Rerewhakaaitu and from the streams in the area.

[12] These numbers are based on the results of the Kai Consumption Survey and refer specifically to the sites of gathering, not from species distribution surveys that tell us the sites where these species are known to be.

Table 7: Trends in the number of respondents gathering different species at each of the lakes.

Lake	Watercress	Trout	Kakahi	Inanga	Koura	Eel
Rotoiti	↑	↑	↑	↑	-	↑
Tarawera	-	↑	↓	↑	↓	↑
Rotorua	↑	↓	↓	↑	↓	↑
Rotokakahi	-	↓	-	-	↓	↑
Okataina	↑	↑	-	-	↓	-
Rotomahana	-	↓	-	-	↓	-
Rotoma	↑	↓	-	↑	↓	-
Rerewhakaaitu	↓	↓	↓	-	↓	-
Okareka	-	-	-	-	-	-
Rotoehu	-	-	-	-	-	↓
Ohau Channel	↑	↑	↑	↑	↓	-
Streams	↓	↓	↓	↓	↓	↓
Coast	-	↓	↓	↓	-	↑
Tikitapu	-	↓	-	-	-	-

Table 8 that follows focuses on 3 of the lakes – Rotorua, Rotoiti and Tarawera and shows the magnitude of the changes. Although those gathering inanga from the lakes shows an increase we are unsure whether they mean whitebait or the adult stage.

Table 8: Changes (shown as a %) in the number of respondents gathering different species at each of the lakes.

	Rotorua	Rotoiti	Tarawera
Trout	↓ 18.7	↑ 5.40	↑ 8.10
Mussels	↓ 33.3	↑ 33.3	↓16.70
Morihana	-	-	-
Koura	↓ 10.4	same	↓ 10.40
Watercress	↑ 42.0	↑ 20.3	-
Puha	↓ 9.80	↑ 8.30	↓ 7.70
Inanga	↑ 14.3	↑ 23.8	↑ 14.3
Lamprey	-	-	-
Eel	↑ 18.20	↑ 16.2	↑

In the tables that follow, we present information for each of the lakes and provide a relative ranking (present and past (in brackets) of the importance of gathering activities for each species across all lakes.

Figure 52: An aerial photograph showing the location of the respective lakes.

An aerial view of Lake Rotorua

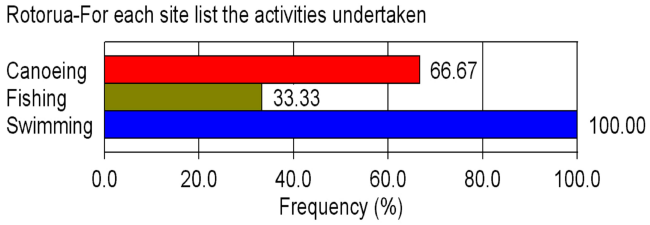
Table 9: Summary of Lake Rotorua.

Trends in gathering activity		**Present day rankings**	
Trout	↓ 18.7	Trout	3rd (2nd)
Kakahi	↓ 33.3	Kakahi	- (2nd)
Koura	↓ 10.4	Koura	2nd (2nd)
Watercress	↑ 42.0	Watercress	2nd (2nd)
Puha	↓ 9.80	Puha	2nd (1st)
Inanga	↑ 14.3	Inanga	3rd (-)
Eel	↑ 18.20	Eel	4th (-)

I wouldn't touch watercress in the Lake Rotorua, …, I just think it is too suspect …I don't know that there is a lot of watercress around - like I think there is where the natural springs are, I think there is watercress there, but as you are coming around Lake Rotorua, I shouldn't imagine that there would be that many spots left to actually pick watercress from anymore (Informant J).

They used to catch inanga around the edge of the lake….But now you don't see that, I mean not only that, the water is so murky you can't see them, but yes, we used to catch a lot of inanga, I tell you (Informant B).

Other activities: 33% of those who go to the lake fish. In contrast everyone who goes to the lake swims.



Rotorua now, we haven't swum there for ages (Informant A).

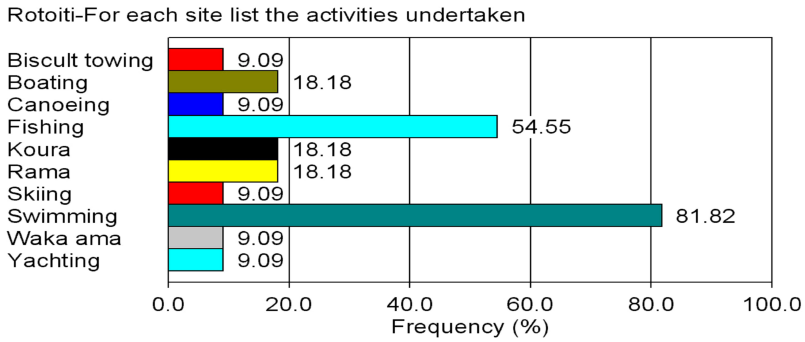
I wouldn't swim in it. I had EBOP down there just over the winter. They actually took photos of the amount of junk that came out of that lake onto our back lawn. So I wouldn't – I get a lot of tourists coming down to our village and they ask can they go for a swim. I just say, "No, don't bother" (Informant D).

Photos of Lake Rotoiti

Table 10: Summary of Lake Rotoiti.

Trends in gathering activity		Present day rankings	
Trout	↑ 5.40	Trout	1st (1st)
Kakahi	↑ 33.3	Kakahi	1st (1st)
Koura	same	Koura	1st (1st)
Watercress	↑ 20.3	Watercress	1st (1st)
Puha	↑ 8.30	Puha	1st (2nd)
Inanga	↑ 23.8	Inanga	1st (2nd)
Lamprey	-	Lamprey	-
Eel	↑ 16.2	Eel	2nd (3rd)

Other activities: Clearly a range of activities are undertaken, including a range of recreational activities. Fishing and gathering koura, including rama koura, feature strongly**.**



Setting a 'tau' in the lake was the most popular method of gathering this delicacy [koura]. *During the summer months bundles of raurauhe were cut, tied together and left to dry. These were then tied to a long main line and dropped into the lake bottom at about six metre intervals. Marker poles stood in the lake to identify the place of each family's tau. After a few weeks the ferns would be carefully drawn up out of the lake and shaken onto a korapa. In no time a large quantity would be caught and taken home for the 'weekend lunch or dinner'.* (Makereti, 1938)

Rotoiti, we have been known to swim … even in recent years, we come back and my kids jump out of the car, dive into it. We know full well that the lake is not well and it is so hot they just duck into the lake there and have a jump around and duck back in (Informant A).

Then you had puha …. We used to just go around the hills, all over the place collecting puha. And then there was watercress, all the creeks running into Lake Rotoiti were full of watercress. (Informant E)

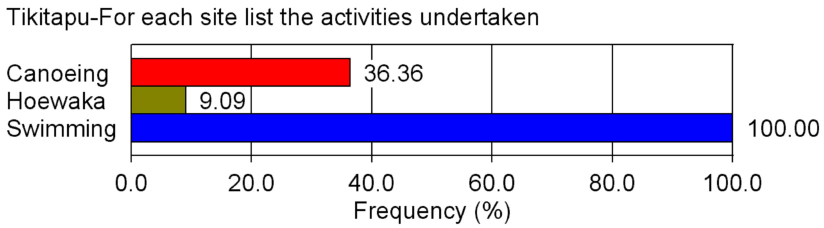
Photos of Lake Tikitapu

Lakes Tikitapu (foreground), Tarawera (left background), and Rotomahana(centre background) are all visible in this eastward-looking view.

Table 11: Summary of Lake Tikitapu.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	-	Kakahi	-
Morihana	-	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities: Everyone who goes to the lake swims. Canoeing is another popular activity.



Tikitapu, the Little Blue Lake …is the most picturesque lake in the district and owes much of its attractiveness to the magnificent forest which clothes the hills on its northern and western sides.
Raupo (Typha sp.) occurs in small quantity at the north end of the lake; it is so extremely rare in the district, that the whare are usually constructed of sedges and grasses.
We were mostly at Lake Tarewera and Lake Tikitapu…In summer time we'd probably be out at Tikitapu probably once, at least once a week (Informant F).

Photos of Maketu

Table 12: Summary for Maketu.

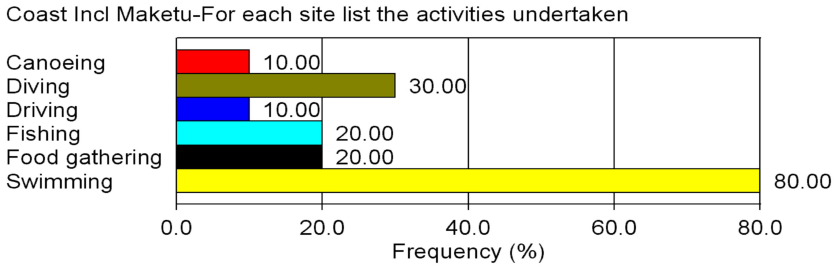
The kina and paua, crayfish and we go fishing and the main species are kahawai, snapper and gurnard fish…. Usually every long weekend we'd head to the coast for that. But since the fuel increases and so and so it's not as often… (Informant F).

Because when the whole river was coming through here, I remember I've been coming here since the 50s, as a kid, and all the fishing boats used to come in here …But all the fish used to come in here…..There stingrays, there were sharks, there were – everything was coming through here, kahawai and everyone just fishing here at the outlet. And now they're all fishing up at the cut .. Well, there's only pipi at the moment because all our tuangi have gone and pupus that we used to have in abundance have all disappeared (Informant K).

Trends in gathering		Present day rankings	
Trout	↓	Trout	6th
Kakahi	↓	Kakahi	- (4th)
Morihana	↓	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	↓	Puha	- (3rd)
Inanga	↓	Inanga	2nd (1st)
Lamprey	↓	Lamprey	1st (1st)
Eel	↑	Eel	3rd

It was in abundance, it was growing so fast that even our people couldn't keep up with it (Informant K).

Other activities Maketu is a popular swimming site.



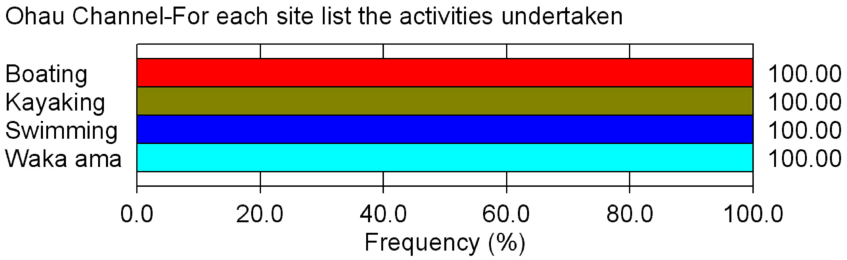
… the return of the estuary is vitally important and it's only because of the food bowl … It'll be entirely different. The outflow would be different and therefore it would – it'll only create a channel in certain areas. A channel will be created, so it wouldn't be the pristine that you'd want once upon a time. So that's the – which is very sad that it cannot be brought back the way that we wanted to ….But there's not enough volume of water actually coming through the system, actually it's only a trickle, and very disappointing really – very disappointing that way (Informant K).

Another area we used to frequent was the Maketu… especially in the summer you would want to go over there and collect pipi and mussels, and also we got family at Motiti Island, so it would give us any reason to go to the beach because it was a good - Newdicks was quite a popular place back then… I hardly see cockles now…Maybe even like try to increase the flow a little bit so that it is – well, you know, I do not know whether to narrow it or add some rock or that sort of - - -(Informant H).

Trout fishing in the Ohau Channel

The Ohau Channel today

Table 13: Summary for Ohau Channel.

<table>
<tr><td rowspan="10">My mother used to go out and she would get into her garden and she'd get all these worms, and she would bundle these worms up using a needle and thread. She would thread through the worm and create a bundle, and that is what we would use for our bait to catch the koura in the Channel - at the end of a willow stick. Oh, we used to love it because we would just quietly watch the koura grab the worm and then we would put the stick up and then catch it with a fish and chip container (Informant E).</td><td colspan="2">Trends in gathering activity</td><td colspan="2">Present day rankings</td></tr>
<tr><td>Trout</td><td>↑</td><td>Trout</td><td>-</td></tr>
<tr><td>Kakahi</td><td>↑</td><td>Kakahi</td><td>2nd</td></tr>
<tr><td>Morihana</td><td>-</td><td>Morihana</td><td>-</td></tr>
<tr><td>Koura</td><td>↓</td><td>Koura</td><td>8th (8th)</td></tr>
<tr><td>Watercress</td><td>↑</td><td>Watercress</td><td>6th</td></tr>
<tr><td>Puha</td><td>↑</td><td>Puha</td><td>6th</td></tr>
<tr><td>Inanga</td><td>↑</td><td>Inanga</td><td>8th</td></tr>
<tr><td>Lamprey</td><td>-</td><td>Lamprey</td><td>-</td></tr>
<tr><td>Eel</td><td>↓</td><td>Eel</td><td>-</td></tr>
<tr><td colspan="5">Other activities - The channel is still used for a range of recreational activities.
 
</td></tr>
<tr><td colspan="5">The Ohau Channel. I always felt that was my birth place, and my bedroom was right against the Channel and it was paradise. We saw a lot of things that other people just talk about, but we experienced everything on the Channel, and that was our food basket as well as Lake Rotoiti and Lake Rotorua ….We have lost that current - it was a very swift current flowing through the Ohau Channel and the children - we used to challenge that flow of water when we were swimming because half the year we would be in the Ohau Channel swimming. We spent a lot of time swimming, back and forwards from Lake Rotorua, down to Lake Rotoiti. We were the best swimmers … I put it back to we were born on the Ohau Channel - we were natural swimmers (Informant E).

Ducks and birds - when I was living on the Ohau Channel we had the Mataku, beautiful. We had the Shag and they would sit in the trees just watching down on the Ohau. When everything started happening, like the inanga would run, well, you would just see them darting down onto the water.. And the crying, it was something I missed when I went away from home - the call of the birds and the cry - it is something totally different. You could hear the water flowing past your home. My bedroom was right against the Ohau Channel, and that was a sincere sound, it is a sound you don't often hear (Informant E).</td></tr>
<tr><td colspan="5">Other kai consumption survey results: All those who gather at the Ohau Channel have changed how they gather kai because of contamination of sites they used to gather from.</td></tr>
</table>

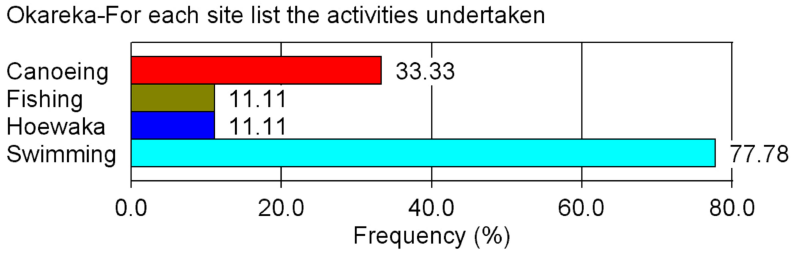
Photos of Lake Okareka

Table 14: Summary of Lake Okareka.

There is no gathering at the lake as it is wai tapu.

Trends in gathering activity		Present day rankings	
Trout	-	Trout	-
Kakahi	-	Kakahi	--
Morihana	-	Morihana	-
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - As with the other lakes Okareka is popular for swimming.



The biggest ones [koura] *I have struck here in the Rotorua Lakes, when I used to dive the lakes, was Lake Okareka … Water skiing "Blue Lake….. Okareka, Rotoiti and Tarawera" (Informant D).*

And also the Green Lake, even though you are not supposed to fish in the Green Lake because of our links to that area, you can get access to those areas (Informant H)..

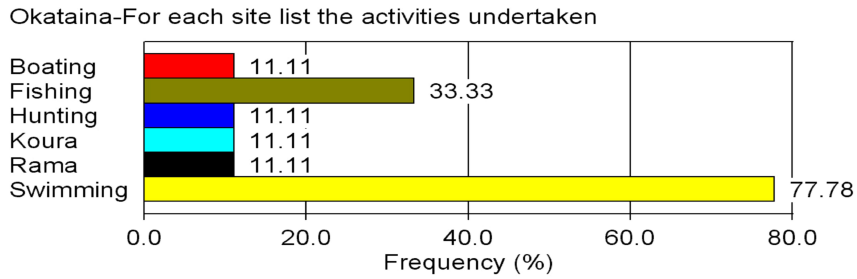
There are those beautiful picturesque moments that - like, I love going down to Lake Okataina and Lake Okareka, in summer they are the places that are a little bit hard to reach, I think, are probably a little bit more worth the effort to get there (Informant J).

Photos of Lake Okataina

Table 15: Summary of Lake Okataina.

Trends in gathering activity		Present day rankings	
Trout	↑	Trout	5th (6th)
Kakahi	↑	Kakahi	--
Koura	↓	Koura	7th (7th)
Watercress	-	Watercress	5th
Puha	-	Puha	5th
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - are very similar to the results for Rotoiti.



So, yes, so generally there are a lot of us and, like, when we went out here to Okataina there was a whole heap of us, so it is just something that we do as a family. Yes, so I suppose that is the beauty of your water is it always connects you in one way or another, and so, yes, that is why we tend to do things in droves, and also it is always more fun when there are heaps of you when you are going out swimming. You know, my children aren't fighting with each other and I have got all these other people to help (Informant J).

Other kai consumption survey results: All those who gather at the lake have not changed how they gather kai because of contamination of sites they used to gather from. All those who gather believe the kai gathered is not dangerous because of pollutants.

Photos of Lake Rotokakahi

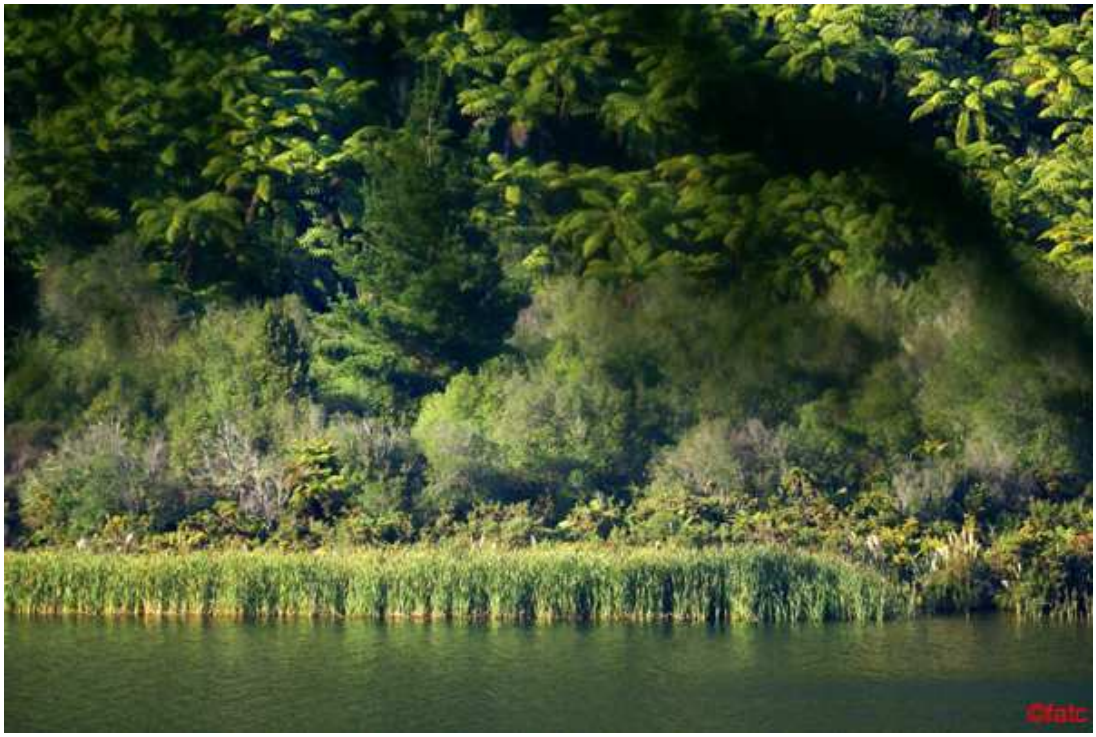
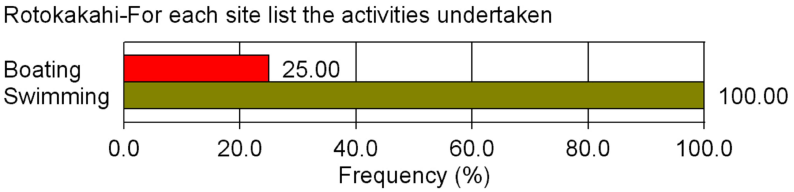


Table 16: Summary of Lake Rotokakahi.

Trends in gathering activity		Present day rankings	
Trout	↑	Trout	4th (4th)
Kakahi	-	Kakahi	-
Morihana	-	Morihana	- (2nd)
Koura	↓	Koura	5th (5th)
Watercress	-	Watercress	
Puha	-	Puha	
Inanga	-	Inanga	
Lamprey	-	Lamprey	
Eel	↑	Eel	6th

Other activities - All those that go to the lake swim there while a quarter of them go there for boating.



Other kai consumption survey results:

All those who gather at the lake have not changed how they gather kai because of contamination of sites they used to gather from.

Photos of Lake Rotomahana

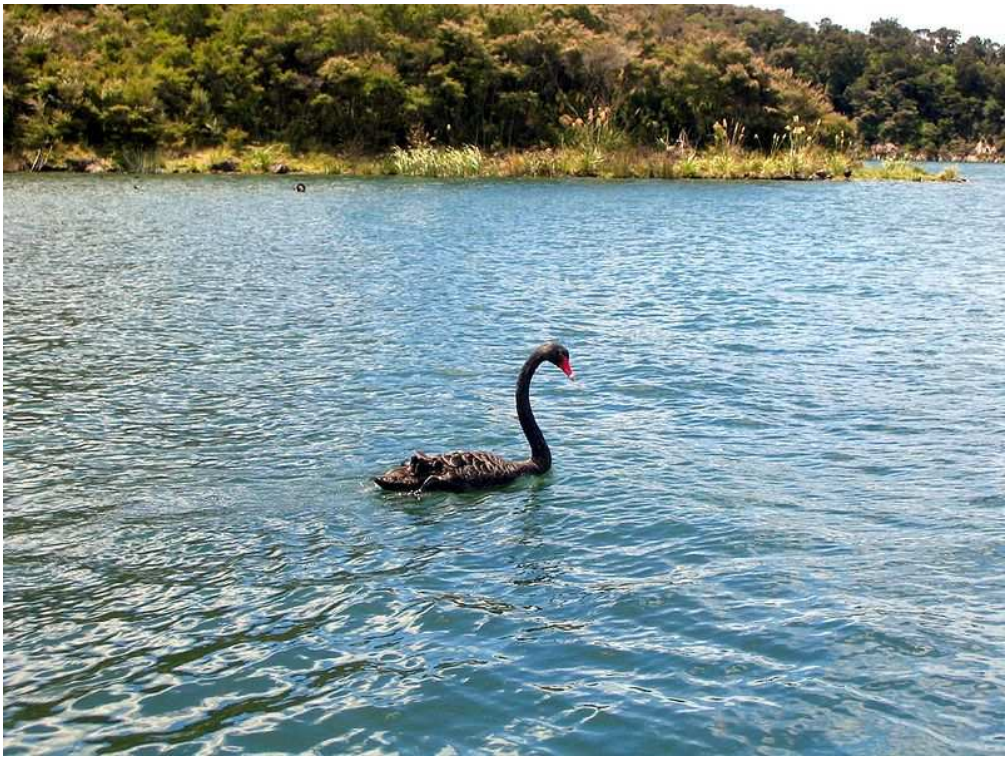
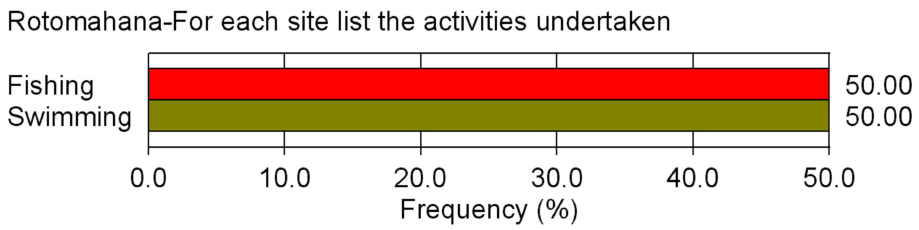


Table 17: Summary of Lake Rotomahana.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	- (5th)
Kakahi	-	Kakahi	-
Morihana		Morihana	-
Koura	↓	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	- (3rd)
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - Swimming and fishing are the two activities at Rotomahana.



Rotomahana is a funny lake, it is coloured all the time. Some places it is green. But I think Rotomahana you may have to be careful of (Informant A).

Rotomahana, they swim there (Informant A).

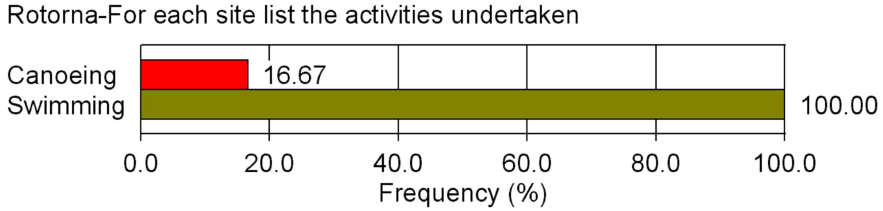
Rotomahana is of small size, its greatest diameter being less than a mile. From the numerous swamps which surround it the absence of wood, the dirty green colour of the water and the stunted aquatic vegetation which certainly exists under unfavourable circumstances the first view of this remarkable lake is strangely disappointing (Kirk 1872).

Photos of Lake Rotoma

Table 18: Summary of Lake Rotoma.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	-	Kakahi	-
Morihana		Morihana	- (2nd)
Koura	↓	Koura	4t (4th)
Watercress	↑	Watercress	3rd (4th)
Puha	↑	Puha	3rd (3rd)
Inanga	↑	Inanga	4th
Lamprey	-	Lamprey	-
Eel	-	Eel	-

Other activities - All those who go to Rotoma go swimming.



I suppose the ones where there has been minimal development has always been - the lakes are still in a very similar quality, like Lake Rotoma, when I go out there I have swam and I have jumped off the rock or the cliff out there. It is still really similar to how I remember it as a child. The water quality, you know, it is beautiful, but as you are getting into more densely populated areas you really notice the poor quality of the lakes and the effect that that population has had on them (Informant J).

Because that is where all the morihana used to be in that lake, mind you they were in all the lakes but the Rotoma was known for that (Informant F).

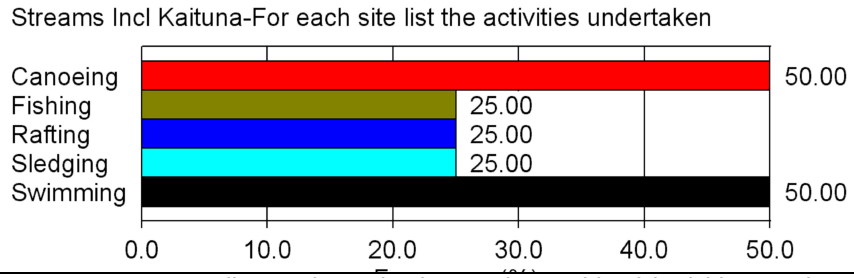
It was certainly Lake Rotorua and going down the Utuhina Stream…. and every now and then we would go out to - more often than not - Lake Rotoma to swim at the point and my grandfather was a keen fisherman, so there was a fishing club out at Lake Rotomahana that I used to go to as a child as well… (Informant J).

Fishing for whitebait on the Kaituna River (1931)

Table 19: Summary for streams.

Species gathered today	**Trends in gathering activity**		**Present day rankings**	
	Trout	↓	Trout	7th (7th)
	Kakahi	↓	Kakahi	-
	Morihana	-	Morihana	-
	Koura	↓	Koura	6th (6th)
	Watercress	↓	Watercress	4th (3rd)
	Puha	↓	Puha	4th
	Inanga	↓	Inanga	7th (3rd)
	Lamprey	↓	Lamprey	- (2nd)
	Eel	↓	Eel	5th (2nd)

Other activities



That Purenga stream… was yellow …down the bottom has a bit of bad history where council was allowing the raw sewerage to go out into the lake; years of it built up (Informant A).

Hamurana is crystal clear and it is full of phosphorous and, of course, the lake programme has to do something about that, (Informant A).

Utuhina - *even the flow of the river is quite different, so it would be good to have testing from the river because, I think, as you are coming further downstream and into the Lake, just the whole vegetation, … when I put my feet into the ground of the river on the Utuhina River, it is revolting. It is not like a clay, it is not even a mud. I can't even describe it. But it has that type of feeling to it (Informant J).*

I wouldn't let my children swim in there. The quality of the water is disgusting and it is unsafe. …. I can remember swimming in the Utuhina Stream as a child and it was lovely and clean and fresh, now to hop in it you can feel all the clay and all the silt that sits on the bottom and it is not very nice (Informant J).,
I think to go out in the areas I used to as a child where we used to gather - and I am talking about Rotorua predominantly - to gather koura, I don't believe there is any. So having gone down just to probably, I don't know, about five years ago, having gone down to take the children through the experience, there weren't actually any koura in places that we used to go to as children. So the rama koura did … I think even if we had have come across koura, I wouldn't have let the children eat them anyway (Informant J).

The Utuhina River between the Utuhina Bridge … when I was growing up it was a pristine river at that time….The river flow was excellent, clarity was excellent. We could even drink out of it …I learnt how to swim in the river, and I did all right, too, as a swimmer. Did no formal training. Because it had a good current, it had a good flow and you could actually just swim at a constant pace and stay in the same area. And we had a swing across the trees, because the trees used to – oh, we had willow trees but they sort of intertwined and you could – we had a swing.. but it was mainly our playground there ….And there was like little hotspots in the river, too. Like there was a lot of thermal underneath and it was in that whole area, so you had to sort of know where to put your foot and all the rest of it, and you were warned of areas where you shouldn't go and swim. But it was great (Informant H).

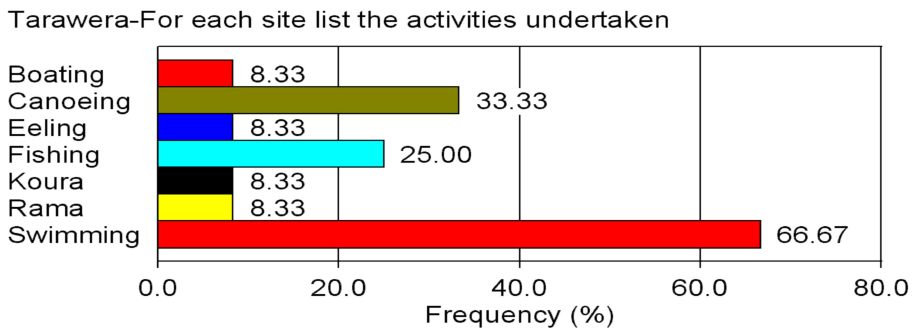
That silt build-up .. It would stick to your feet and then it was sort of like, "Oh, I want to go to the Aquatic now". Probably to Hamurana and Hamurana Springs there. That is still a nice river to swim in. Even now we still take our kids out there, because it is a nice spring and we went to the origin of that spring, as well, you know, just to show the kids, you know? (Informant H).

Photos of Lake Tarawera

Table 20: Summary for Lake Tarawera.

Trends in gathering activity		Present day rankings	
Trout	↑ 8.10	Trout	7th (3rd)
Kakahi	↓ 16.70	Kakahi	- (3rd)
Morihana	-	Morihana	- (2nd)
Koura	↓ 10.40	Koura	6th (3rd)
Watercress	-	Watercress	4th
Puha	-	Puha	4th (3rd)
Inanga	↑ 14.3	Inanga	7th
Lamprey	-	Lamprey	-
Eel	↑	Eel	1st (3rd)

Other activities - Eeling is specifically identified as an activity. Swimming and recreational activities are popular.



Tarawera, although the lake appears to be clear it still has its problems. We still have algae bloom over there …Tarawera, yes, but I would be very cautious in the summer time when the weather is hot and the algae starts to come up to the surface. We have that problem in Tarawera, although we are not treated as high a risk of other lakes, but I think the council is on to it (Informant A).

We would go to Tarawera where generally most of the swimming .. So, you know, I don't allow my children to wet their hair in the water in Lake Rotorua, I don't know, it is just certainly not the same sort of quality that I remember as a child and I wouldn't - Lake Tarawera is not so bad, but the inlet where we used to go to as a child to collect koura, there is a whole oil - I suppose because there's the big boats that sort of launch there, I think that it has had an impact. So where we used to previously go to get koura at that inlet, from last having had a look, and my husband went down and he had the goggles and the snorkels and had a really good look around, we couldn't find any, and that is just in the inlet area, but we haven't gone any further to have a look at that to see the impact on it. But, just in the areas we used to go immediately to because it was easy access, we haven't been able to find any of that - particularly koura - in those areas (Informant J).

Table 21: Summary of Lake Rotoehu.

Trends in gathering		Present day rankings	
Trout	-	Trout	-
Kakahi	-	Kakahi	-
Morihana	-	Morihana	- (2nd)
Koura	-	Koura	-
Watercress	-	Watercress	-
Puha	-	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	↓	Eel	- (4th)

Other kai consumption survey results
All those who gather from the lake have changed how they gather kai because of contamination of sites they used to gather from.

Table 22: Summary of Lake Rerewhakaaitu.

Trends in gathering activity		Present day rankings	
Trout	↓	Trout	-
Kakahi	↓	Kakahi	- (5th)
Morihana	-	Morihana	-
Koura	↓	Koura	-
Watercress	↓	Watercress	- (5th)
Puha	↓	Puha	-
Inanga	-	Inanga	-
Lamprey	-	Lamprey	-
Eel	-	Eel	-

When recounting their early lives interviewees described how interaction with the lakes occurred on a daily basis. Most days, interaction involved gathering kai for personal consumption or sharing. This was a commonplace group/whānau activity that permeated households and the community.

Table 23: Present day ratings of lakes on the basis of number of respondents gathering species from the lakes (1 = highest number of gatherers, 8 = lowest number of gatherers).

	Ratings							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Trout	Rotoiti	Tarawera	Rotorua	Rotokakahi	Okataina	Coast	Streams	Maketu
Kakahi	Rotoiti	Ohau	-	-	-	-	-	-
Morihana	-	-	-	-	-	-	-	-
Koura	Rotoiti	Rotorua	Tarawera	Rotoma	Rotokakahi	Streams	Okataina	Ohau
Watercress	Rotoiti	Rotorua	Rotoma	Streams	Okataina	Ohau	-	-
Puha	Rotoiti	Rotorua	Rotoma	Streams	Okataina	Ohau	-	-
Inanga	Rotoiti	Coast	Rotorua	Rotoma	Tarawera	Tarawera	Streams	Ohau
Lamprey	Coast	-	-	-	-	-	-	-
Eel	Tarawera	Rotoiti	Coast	Rotorua	Streams	Rotokakahi	-	-

Across all species we can obtain an average rating for the present day usage of the lakes. The results confirm the significance of Lakes Rotoiti, Rotorua and Tarawera. The average ratings for present day gathering are:

Rotoiti 1.14

Rotorua 2.67

Tarawera 3.40

Rotoma 3.50

Coast 4.00

Rotokakahi 5.00

Streams 5.50

Okataina 5.50

Ohau Channel 6.00

Rotomahana, Rerewhakaaitu, Rotoehu –
not gathered

We are also able to prepare rankings based on historic use. These are shown in Table 24.

Table 24: Historic ratings of lakes on the basis of numbers gathering species**.**

	Ratings							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Trout	Rotoiti	Rotorua	Tarawera	Rotokakahi	Rotomahana	Okataina	Streams	
Kakahi	Rotoiti	Rotorua	Tarawera	Coast	Rerewhakaaitu	Ohau	-	-
Morihana	Rotoiti	Rotorua	-	-	-	-	-	-
Koura	Rotoiti	Rotorua	Tarawera	Rotoma	Rotokakahi	Streams	Okataina	Ohau
Watercress	Rotoiti	Rotorua	Streams	Rotoma	Rerewhakaaitu	-	-	-
Puha	Rotorua	Rotoiti	Rotoma	-	-	-	-	-
Inanga	Coast	Rotoiti	Streams					
Lamprey	Coast	Streams	-	-	-	-	-	-
Eel	Tarawera	Streams	Rotoiti	Rotoehu	-	-	-	-

The average rankings for past gathering are as follows:

Rotoiti 1.57

Rotorua 1.83

Rotoehu 2.00

Tarawera 2.50

Coast 2.67

Rotomahana 3.00

Rotoma 3.25

Rotokakahi 3.67

Streams 4.50

Rerewhakaaitu 5.00

Okataina 6.50

Ohau Channel 7.00

The present day ranking confirms the importance of the coast and the higher ranking accorded Rotoma. In contrast, Rotoehu, Rotomahana, Rotokakahi, Rerewhakaaitu and the streams appear to have slipped in the numbers of gatherers using them.

6.3.3 Mahinga kai and taonga species

The main species harvested by Maori in the lakes prior to European settlement included:

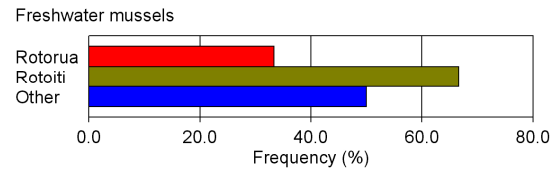
- The juvenile (inanga) and adult (kokopu) stages of the koaro.
- Adult common bully (toitoi).
- Eels (in Lake Tarawera).
- Koura and kakahi.

Fishing grounds for inanga, kokopu and toitoi were clearly marked, and actively managed (Phillips et al., 2007a). Informants also confirmed the importance of the respective kai species.

> *But it was sustainable, you know, it filled us up and fed us, and of course Inanga. Which was one of the staple diets during those days too, because they used to dry them as well eat them fresh. So, no, it was - I think everybody in Rotorua used to live on crayfish, especially the Maori families - crayfish and kakahi, way back in those days. But Lake Rotorua was clear when I was going out - clear as crystal and you could see - when we used to go and get morihana, you could see the schools and they were huge schools of morihana swimming all around the lake, all around the lakefront and they used to breed in the raupo (Informant B).*

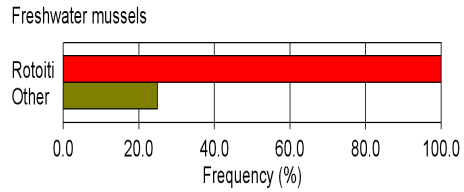
A management framework for customary fisheries in the Rotorua lakes has been developed through a joint project between NIWA and the Te Arawa Lakes Trust (Phillips et al., 2007a; see also http://www.niwa.co.nz/our-science/freshwater/our-services/freshwater-species-and-habitat-management/te_arawa_lakes). The outputs from that programme include tools, monitoring methods, and guidelines for managing culturally significant mahinga kai and taonga species. Data collected from our study will be useful in augmenting existing knowledge and is detailed below.

Table 25: Kakahi.

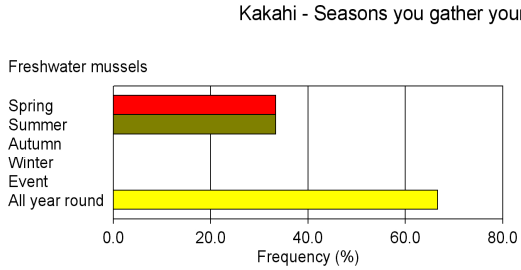


* Note: Multiple answer percentage-count totals not meaningful.

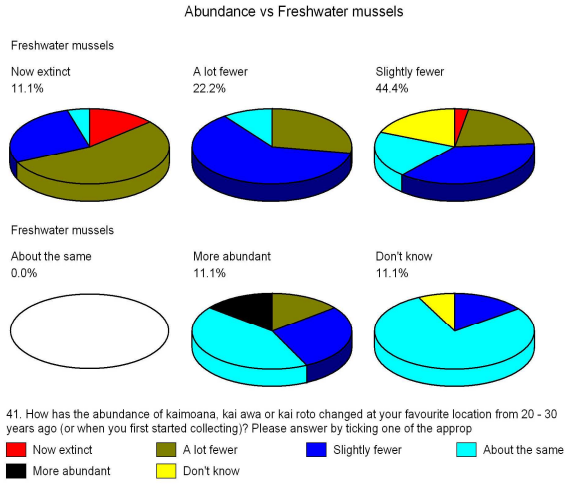
Also recorded in Rerewhakaaitu, Rotoehu, Rotokakahi, Rotoma, Tarawera (Phillips et al., 2007b)

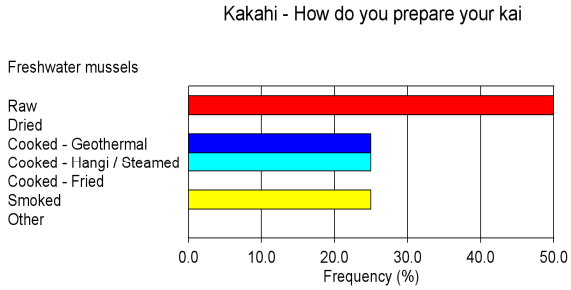


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

Kakahi are still gathered and consumed today, mostly from Lake Rotoiti. They are eaten raw or cooked in various ways. 77% of the participants believe kakahi have reduced in abundance.

Kakahi …is the most important on story, song and proverb. For instance there is an old saying tane moe whare, kurua te takataka; tane rou kakahi, aitia te ure (Man drowsing in the house smack his head, man skilled in dredging kakahi, marry him) – Hiroa, 1921

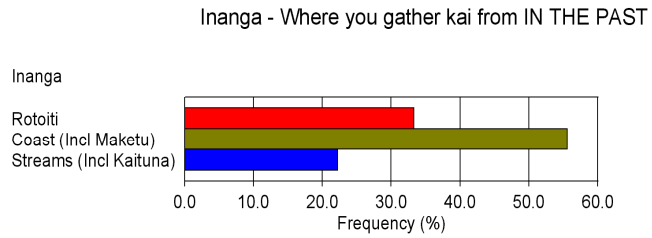
The kakahi is very tasteless and insipid (Hiroa, 1921).

It was cooked and fed to infants – it could be sucked like milk (Hiroa, 1921)

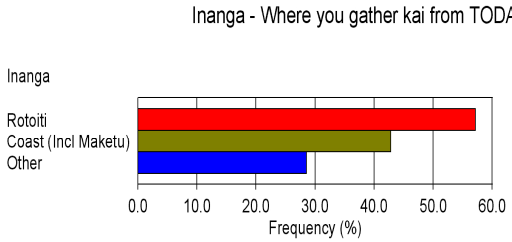
The only concern that my mum had, of course, when I brought kakahi back. She was really conscious of kakahi having a poisonous element, depending where you got it from.… kakahi was the main culprit perhaps in being certain that you did not get it from a place that is polluted from a swamp or anything else. So getting it from the river was good. The same thing happens here. The clearer the water and the lakes, the safer you are from getting kakahi (Informant A).

We used to live on kakahi. My mother used to cook a lot of kakahi, with bacon and something else - it would give them a bit of taste, it was just like eating cold water (Informant B).

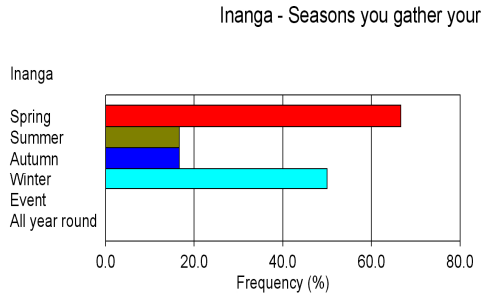
Table 26: Inanga.



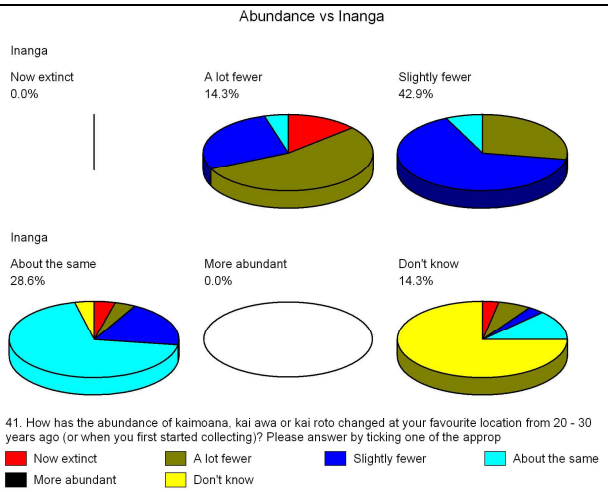
* Note: Multiple answer percentage-count totals not meaningful.

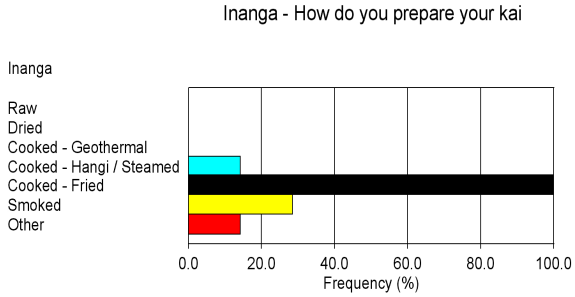


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

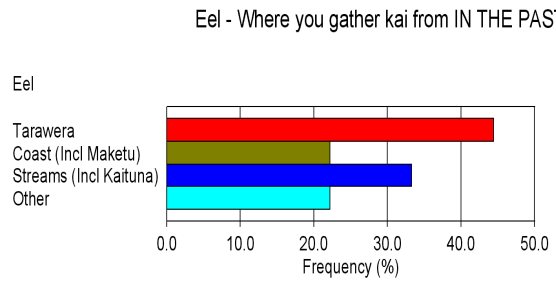
- 57% believe that inanga are fewer in number
- There are limited waterbodies from which inanga are gathered.
- It is always cooked.

Well, ever since I was a child my family went out using the old methods of catching inanga, koura, collecting kakahi, morihana, all the natural species from out of the lakes. And we just lived on that for breakfast, lunch and tea … And we never, ever came home without anything …If you want a feed of whitebait today you can sit around all day, which I have done, and it will take about a whole day just to catch a cupful (Informant E).

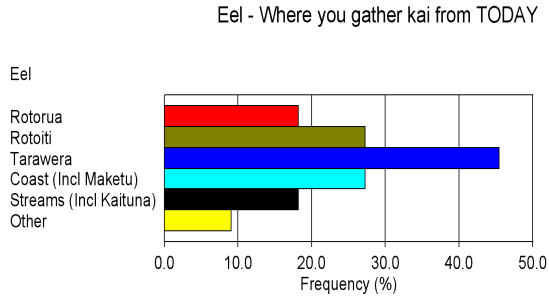
I mean, us as children, it was an enjoyment as well, but at that stage when you are very young you don't sort of realise you are providing for your family - food, so that was bringing in food, and my mother was very strict. She would come down and she would check us, and if any of the inanga would – well, they used to froth in the tub and sometimes they used to jump out. My mother would pick every one up. She would tell us - you are not to let one go into the grass. We had to make sure that nothing was being wasted (Informant E).

They used to get a lot of whitebait ... it is slim pickings these days. I, myself, never sort of experienced the sort of abundance that my parents sort of (Informant H).

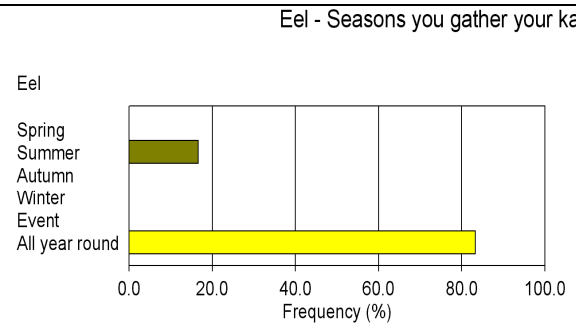
Table 27: Eel.



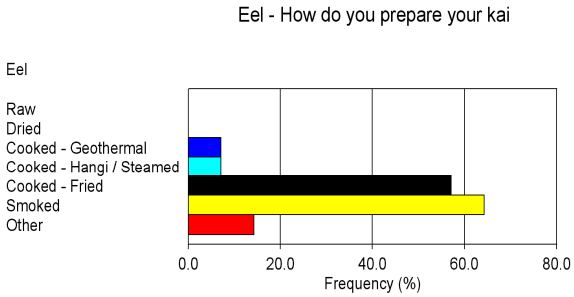
* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.

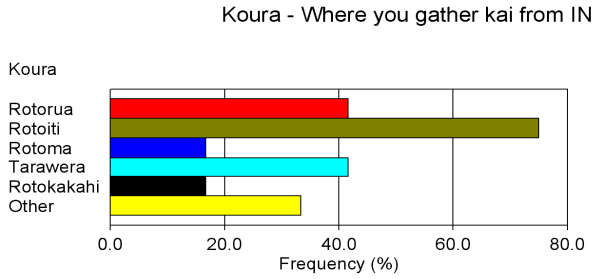
Eel is still gathered, predominantly from lake Tarawera, all year round. It is mostly fried or smoked. Eels are thought o have been stocked in the Te Arawa Lakes (Martin et al, 2007).

Each family that I knew … had a holding box for where we stocked our eels and so that we will have eels right throughout the winter. While the eels were in that box they fed themselves from the insects and whatever that came in through the box feeding, they never made fat but they were clear of anything in their insides, in their stomachs. So as far as eels were concerned, we had a lot of eels and we lived on the river (Informant A).

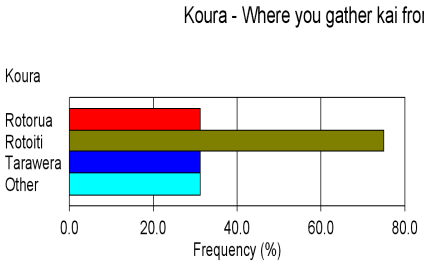
The only difference I know, … is the eels from Murupara …. Murupara are very thin skinned eels. Tarawera are very thin skinned but big and fat. But I guess you can tell the difference in kai from different places, you can identify them (Informant A).

Yes, eels. We used to get a lot of eels in Rotorua … and I used to go down the Kaituna River …I would go down the Kaituna with my uncles, and they taught me - showed me the holes and everything down there. Of course the weir that they built down at Okere Falls changed all that as well - it changed the places where the eels used to rest, because now it's a raging torrent nearly all the way down. Before it was a torrent with backwash in it and then that is where all the eels used to lie… Used to catch eels at Tarawera as well - in the lake as well as in the stream coming down from the tea rooms, the same way - would feel for them there. They were big eels….Yes, the eels are very, very big, yes, they are a good size. There is about 28 pound, the average size….Yes, well Tarawera - yes, they average 28. And so does Rerewhakaaitu - they are huge, because nobody fishes for them. And the same down the Kaituna River, you know, the eels I used to catch there with my hands were all in their 20 pounds - you know 20 pounders - big eels. Three eels and you had a load to bring home…I have caught eels in Rotoiti (Informant B).

Table 28: Koura.

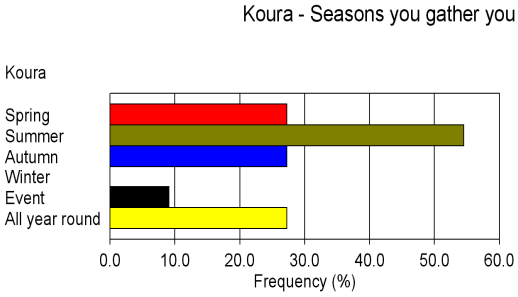


* Note: Multiple answer percentage-count totals not meaningful.

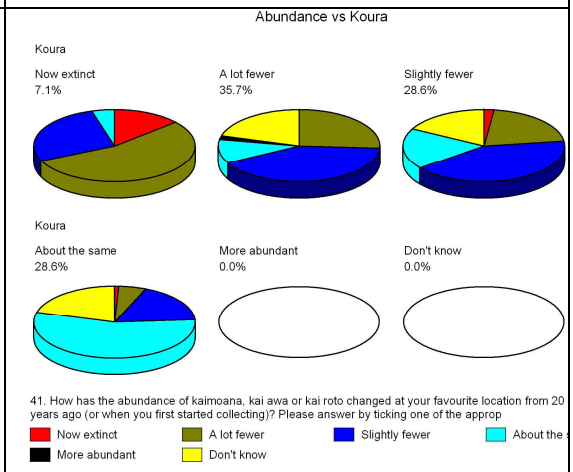


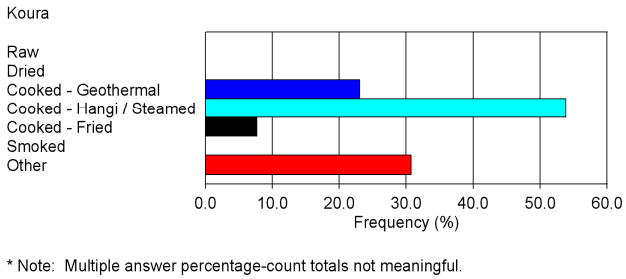
* Note: Multiple answer percentage-count totals not meaningful.

They have also been recorded in lakes Okareka, Okataina, Rerewhakaaitu, Rotoehu, Rotoma, Tikitapu (Parkyn and Kusabs, 2007)



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

Maori Land Records show 152 individual ancestral fishing grounds in Lake Rotorua, 40 in Rotoiti, 19 in Lake Rotoehu, and 11 in Lake Rotoma (Stafford, 1994, 1996)

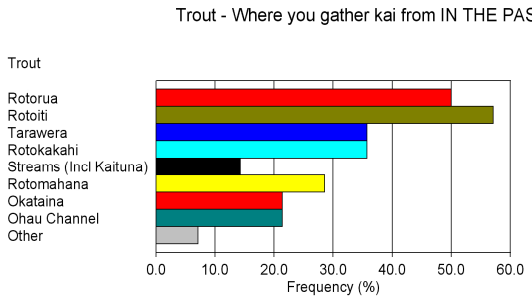
Mair (1923) knew of 700 fishing grounds in Lake Rotorua.

Koura are predominantly harvested from Lake Rotoiti, mostly in summer. 69% of participants believe there are fewer koura than there used to be.

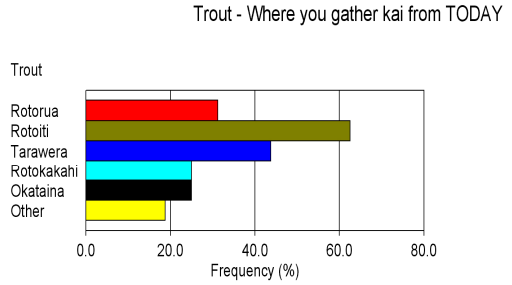
Everybody ate bloody kouras. They wouldn't eat the ones from the sea though. Less there than in there were in the old days; there's less … We used to go out at night - rama koura and we used to catch them. You can't even see anything now because of the dirtiness of the water….Or either they're out in the deep and they can't come in because the weed is stopping them from coming in, maybe? …Nobody's been diving for them for years and years because nobody wants to swim in that dirty lake (Informant C).

Last time I had koura was at a tangi and that was this year, and the discussion that went on at the tangi table, at the hakere table, was great because we hardly ever see koura on the table, whereas previously it was quite common practice to have koura on there, now - I think it is the first tangi that I have been to in over 10 years where there was actually koura on the table at Ohinemutu ….Because, I suppose they're a delicacy in their own right, nothing was ever added to it to provide flavour because the flavour was already there in the koura (Informant J).

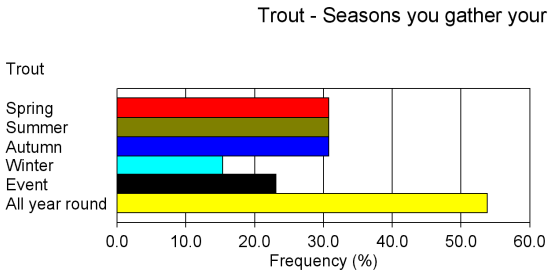
Table 29: Trout.



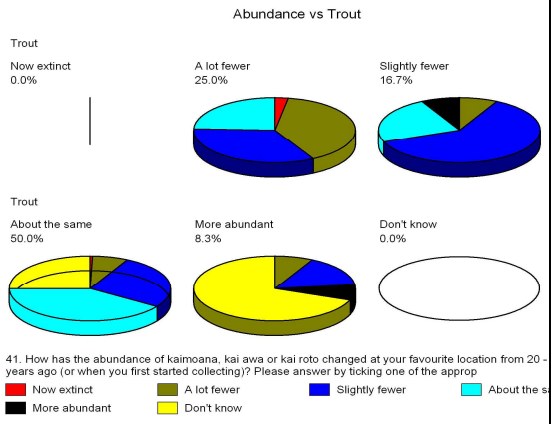
* Note: Multiple answer percentage-count totals not meaningful.

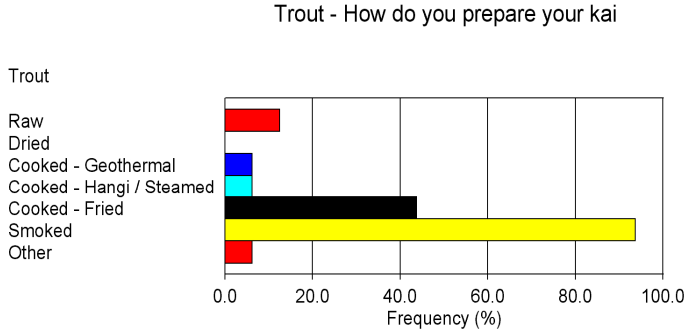


* Note: Multiple answer percentage-count totals not meaningful.



* Note: Multiple answer percentage-count totals not meaningful.





* Note: Multiple answer percentage-count totals not meaningful.

Trout are widely fished, although the number of lakes were they are gathered from has reduced. They are collected all year round and mostly smoked. Most participants believe trout numbers are similar or have even increased in comparison to historic records.

We would go down and my grandfather was a keen fisherman, so we were always out and my grandfather was fishing every weekend, and he always came home with good trout and they were always lovely and fleshy and yes. So, and that was every weekend, my grandfather would come home with at least three or four trout and he wouldn't even be out on there that long when he would be fishing during the fishing season (Informant J).

6.3.4 Perceived changes in the abundance of species that are gathered

A number of questions on the Kai Consumption Survey sought to determine the reasons for the dietary changes. The quantitative data summarised in Table 3 suggest the declining abundance of aquatic species is likely to be one of the main causes of diet change. However interviewees also reported degradation of aquatic environments, societal change (more specifically working longer hours) and the introduction of licensing of fisheries as barriers to their engagement in mahinga kai activities. With respect to the quantities gathered Pakeha settlers described the abundance of kai as 'shoals of inanga". Also during the 1860s, Captain Gilbert Mair described Maori trapping of adult koaro in the Hamurana Stream (Rotorua) at night.

> *Two hours after the net was lowered 'several hundredweight of the fat little fish were emptied into the canoe….This process was repeated during the night till quite a ton weight had been obtained . . . Of course the introduction of trout was the death knell of the koaro'*[13]

> *An example of this productivity was at the opening of Tamatekapua at Ohinemutu in 1873 where a reputed 500 rohe (a rohe was roughly the equivalent of a modern sack) of dried koura and inanga were consumed (Hiroa, 1921)*

Other descriptions are found in historical text -

> *The people who lived inland had an enormous supply ….. until the Europeans introduced the trout and other fish. Now our fresh-water fish have almost entirely disappeared.*

> *Koura (crayfish) were found in great quantities in the lakes and rivers...…*

> *The whitebait went up the river like a company of soldiers in great numbers, keeping a column two or three feet wide.*

McDowall provided further descriptions of the losses that were experienced in the 1940s:

> *My grandfather, who farmed the banks of the Ohau from the early 1900s, took substantial [whitebait] catches – 20kg or more – from this river. When he took us whitebaiting in the 1940s, catches of 5 kg could be expected during good*

[13] McDowall (1984), p 91

> *runs. By then the Ohau River ran through fully developed pastoral country. He had in the early 1900s cleared his property of dense tawa forest. The streams had probably once supported banded kokopu and giant kokopu and masses of inanga when there was still forest. By the time I was there we only saw a few inanga and the odd banded kokopu in the tiny patch of remaining bush*[14].

A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining. In the 1930s, a number of factors were blamed for the decline in whitebait catches including: excessive take by whitebaiters; predation by sea birds, herrings, eels, trout; draining of swamps, backwaters, and creeks; or damage to estuarine spawning grounds by stock. By the 1990s a number of native fish species had disappeared from waterways or were in decline. A combination of factors was attributed to these losses including: afforestation, sedimentation and flooding, wetland drainage, river modifications, sewage, water abstraction (irrigation), and pollution arising from adjacent land uses.

6.3.5 Seasonality of kai gathering

Differences in seasonality also existed from place to place, for example, in Taupo inanga fishing began in September, while in Rotorua it was from December onwards.

> *The koura came in October and lasted from November to March. They ceased being fat in April. Inanga and kokopu were in season from December to February and perhaps to March; toitoi from May to September. Kakahi were obtained throughout the year but were best in winter (Hiroa, 1921).*

Although some whanau adhere to seasonal regimes, the technology (in particular the gear) available to fishers today means that resources can be gathered all year round. While all year availability provides a secure food supply for whanau, it will affect the abundance of species. The following Table has been compiled with the data from the Kai Consumption Survey and identifies the seasons when species are gathered today.

[14] McDowall (1984), p 79

Table 30: Seasonal kai gathering patterns today.

SPECIES	SUMMER	AUTUMN	WINTER	SPRING	MOST
Kakahi					66.7%all year
Morihana					66.7% winter
Cockles					45.5% all year
Pipi					53.8% summer
Toheroa					100% summer
Tuatua					50% all year
Lamprey					50% all year
Mutton birds					75% autumn
Pupu					66.7% summer
Eel					83.3% eel
Flounder					66.7% flounder
Paua					62.5% summer
Mussels					50% summer
Crayfish					55.6% summer
Oysters					57.1% summer
Seaweed					100% summer
Koura					54.5% summer
Watercress					50% spring
Puha					45.5% spring
Hapuka					100% all year
Mullet					75% all year
Kahawai					66.7 all year
Kingfish					57.1% summer
Gurnard					83.3% all year
Snapper					55.4% all year
Moki					75% all year
Shark					66.7% summer
Tarakihi					50% all year
Trevally					50% all year
Whitebait					66.7% spring
Trout					58% all year
Kina					63.6% summer

Key:

	All the seasons when gathering occurs		When the greatest concentration of gathering occurs

Although this research focuses on aquatic ecosystems, gathering birds was also regulated

> *But it was totally controlled - you never went out until somebody went up to check to see if they had enough to shoot, and they'd come back and say – "right, the season is open, you can go up", and then you were allowed about probably a month and a half, maybe two months, because that was the feeding period for the miro (Informant B).*

Informants also spoke of the seasonality of gathering -

> *We would go from August catching inanga and that would go for two-three months. I mean, the seasons have changed today, warmer climate change. But when the inanga ran it was just a mass of black running along the banks of the Ohau Channel, and we were just collecting tubs full, it was just continuous (Informant E).*

> *Then koura sort of came over the summer period - December, January, February and we caught rama koura - that was catching it along the shoreline, just with a fish and chip basket and using candles inside a huge fruit tin. So we were saving energy, you know, that was our light. And we always chose a full moon. Our parents knew - they sort of had this Maori calendar as to when was the best time to go out and they would tell us to go out and they would prepare everything for us and make sure we were safe, and they would tell us when to come home and when to go out (Informant E).*

> *During the summertime, we like to go out probably once a fortnight (Informant D).*

> *It was on a regular basis……we did the gathering of the koura at night…we would do rama koura and we would have a spotlight… and I would say in a summer we would probably have koura about, I suppose, four times in that summer period, and we would be looking at - say there would be enough to feed a family, so there was five of us and there was normally enough for two meals, so we are probably looking at, on average, I would say between - I would say probably about 60 koura at any one time (Informant J).*

It is important to realise the even today seasonality is a management technique that respects the life stages of kai species.

Yes, it was the summer months and it wasn't only simply because the water was warm, it was also a matter that you allowed the stocks to replenish themselves so that there was a period that they could - where I suppose the stocks could refill again, otherwise they would be greatly depleted (Informant J).

6.3.6 Processing of preferred species

The processing of kai species needs to be understood if all possible pathways of contaminants are to be identified.

Historically[15]

Koura *(crayfish) would be … dropped into the boiling water for a few seconds, then taken straight out and eaten, or the crayfish might be put into the steam hole for two or three minutes. Koura cooked in this way were beautiful.*

Fish *was generally steamed in a hangi, either in a tukohu or in a vessel, and meat or birds were also cooked in these steam holes.*

All the fish were steamed in a hangi, though some were dried and put away in a whata for future use.

Koeaea (whitebait), *like koura, needed very little cooking, and might be put for a minute or two in the boiling water, or steamed. In the old days the koeaea was only eaten fresh. It was caught in July, August, and early September.*

Inanga (Retropinna), *a small fish, was a favourite food of the Maori, and was eaten either fresh or dried. It was the relish eaten with the fern root.*

Shellfish *were eaten raw, or cooked for a very short time on hot coals. They might be placed in a heap, and a fire built round them. Or they might be dried and threaded on takiaho, a string of prepared fibre.*

Kuku *either cooked or eaten raw.*

[15] These descriptions were taken from Makereti (1938). We note that none of the interviewees used the term "koeaea".

The pipi *was eaten raw, dried, or cooked either on hot coals, or by steaming for a very short time.*

The eel *was generally cooked in a hangi… either cut into pieces, or cooked whole, encased in the leaves of the puwha (Sonchus oleraceus, var.), or sometimes bound spirally in the leaves of the harakeke (Phormium sp), and then placed on the hot stones of a hangi. Tuna cooked in this way was lovely, the outside skin getting quite pakawera, i.e., well browned and crackly. Tuna was considered a great delicacy.…Many are dried and put away for future use, or for taking to relatives for some special gathering. The people prepare teahi rara tuna, the fire for drying eels. The eels are laid on a frame made of green rods over the fire. If small, they are put on just as they are, but if large, they are opened out and kept open with small pieces of wood before they are laid on the fire (ka pawhara tia).*

The flesh of the dried ***shark*** *was considered a great delicacy. It had a very strong smell.*

From the Kai Consumption Survey we know that whanau today use a number of different methods to process the kai they gather.

Table 31: Number of respondents (as a %) that use different methods to process the kai they gather.

SPECIES	SMOKED	COOKED –	RAW	COOKED	COOKED	DRIED	OTHER
Kakahi	25	-	50	25	25	-	-
Morihana	33.3	33.3	-	33.3	66.7	-	-
Cockles	-	-	23.1	23.1	61.5	-	30.8
Pipi	-	7.7	23.1	15.4	46.2	-	38.5
Toheroa	-	-	33.3	66.7	66.7	-	-
Tuatua	-	-	33.3	33.3	66.7	-	-
Lamprey	-	-	-	-	-	-	-
Mutton birds	14.3	28.6	-	14.3	-	-	71.4
Pupu	-	-	-	-	75	-	25
Eel	64.3	57.1	-	7.1	7.1	-	14.3
Flounder	20	100	-	-	-	-	13.3
Paua	6.7	53.3	46.7	-	20	-	26.7
Mussels	17.6	47.1	76.5	5.9	11.8	-	29.4
Crayfish	6.7	33.3	26.7	20	46.7	-	20
Oysters	6.7	6.7	93.3	-	6.7	-	6.7
Seaweed	-		40	-	20	20	20
Koura	-	7.7	-	23.1	53.8	-	-
Watercress	-	7.7	15.4	30.8	53.8	-	38.5
Puha	-	15.4	-	23.1	38.5	-	38.5
Hapuka	45.5	81.8	-	-	-	-	18.2
Mullet	85.7	42.9	-	-	-	-	-
Kahawai	85.7	50	14.3	-	7.1	-	14.3
Kingfish	60	80	10	-	10	-	-
Gurnard	55.6	77.8	11.1	-	22.2	-	11.1
Snapper	81.3	75	31.3	-	12.5	-	12.5
Moki	57.1	71.4	-	-	-	-	28.6
Shark	28.6	71.4	-	-	-	14.3	14.3
Tarakihi	50	71.4	35.7	-	21.4	-	21.4
Trevally	37.5	62.5	12.5	-	25	-	37.5
Whitebait	28.6	100	-	-	14.3	-	14.3
Trout	93.8	43.8	12.5	6.3	6.3	6.3	-
kina	6.3	6.3	93.8	-	-	-	6.3

Observations

- Koura - the majority are steamed although a small percentage are now fried.

- Fish – a significant number of species are now smoked e.g., trout (93%), snapper (81.3%), mullet and kahawai (each 85.7%) and eel (64.3%). Frying fish seems to be the next most common means of processing although being steamed in a hangi, or boiled is still a common practice.

- Koeaea (whitebait) – is mainly fried although 28.6 % claim they smoke it.

- Shell-fish such as kina are still eaten raw (93.8%) Kuku were eaten raw by 76.5% of respondents while oysters are eaten raw by 93%. Many are still steamed but in contrast to the past practice, none of the respondents said they dried kaimoana. Only seaweed, shark and trout were dried by a minority of the respondents.

- The pipi are eaten raw, or cooked by steaming (geothermally or in a hangi). Respondents did not say they dried pipi.

- In contrast to the traditional way of processing eel (in a hangi) the majority of respondents smoke it or fry it. No one reported that they dried it.

  The pigeon – these were probably preserved in their own fat, because we don't get the same fat pigeon today as we did then. I remember shooting pigeon, it was just a ball of fat and inside would be a whole heap of fat inside the stomach itself…No, it was interesting growing up with the old people and how they regarded food - any food that you gathered.

6.3.7 Kai gathering – its contribution to wellbeing

The concept of mahinga kai extends beyond the nutritional value of species and its physical health benefits to encompass a range of cultural values. It describes species available locally and encompasses the cultural values attributed by whanau and hapu to these species as each is gathered, processed and distributed according to tikanga and kawa. Some of these values are discussed, albeit briefly, in the paragraphs below.

Whakapapa - Whakapapa is an important conceptualisation for Maori. Whakapapa connections to the lakes are evident in at least two ways:

1) collective ownership of lands and/or customary rights to fishing grounds and natural resources; and

2) the names of tūpuna/whanaunga or important iwi/hapū or events that have been given to geographical locations, landmarks, other such things.

The old time Maori …soon ascertained the parts of the lake where the various foods were most plentiful and most easily procured. These spots became the fishing grounds carefully marked and jealousy guarded by the various subtribes and families. They were given names and the most famous alluded to in song and story (Hiroa, 1921)

Whakapapa is also central to kai gathering, which like many other cultural activities, is built around collective action (Ireson 1992, 1996). This is highlighted in Rotorua Lakes where rights of manawhenua determine access to reserves and fishing grounds.

Our iwi and our hapu locally were very respectful people. We honoured everybody's rights when it came to hapu collecting from certain areas (Informant E).

We stayed within our boundaries. We were respectful and even the way we fished there was a lot of respect… No, that is gone. People are fishing over other boundaries. They have got this thing about the more they can catch, it is a money making proposition. The traditional values are going out the window, and it is sad to see (Informant E).

The current generations aspire to continue ahi kā, to perpetuate Te Arawa culture and identity which has always included the right to utilise specific resources (e.g., koura, kakahi) and practice certain activities primarily associated with the kai gathering. A few whānau in Lake Rotoiti epitomise this, by retaining the traditional way of gathering koura (tau koura).

Whanaungatanga - Whanaungatanga is an important process for the reinforcement of whakapapa links and the development of a close relationship with the lakes and the taonga they sustain. Whanaungatanga refers to the reciprocal support relationship between members of the same whānau, hapū and iwi. Through the co-existence and interaction amongst different generations and wider family networks, each of which has experienced different periods and aspects of Te Arawa history, interviewees have a broad knowledge of the social, cultural, environmental, and economic history of the Rotorua Lakes area, and of their own family's connection to the lakes. This knowledge has been generated through a range of social interactions with kaumatua and/or other whanaunga and friends from different generations. Tangihanga, hui and wānanga provide important occasions for comparing experiences, generating

information and affirming whakapapa and whanau ties. Such interactions continue to facilitate the transfer of mātauranga Māori, cultural values and traditions.

Wairuatanga - Te Arawa use different ways to feel spiritually connected with their takiwa.

> *Previously Utuhina or on the shores of Lake Rotorua would be where I would get cleansing and spiritual cleanliness, I can't do that now (Informant J).*

Gathering kai with whanau at a traditional fishing place, that they know was named by their tupuna and utilised by successive generations of their whanau, is one way.

Being able to contribute the kai that their takiwa is renowned for, to ceremonies and to manaaki manuhiri can also bring that connection:

> *I suppose where your wairua is uplifted and where you find strength because you are able to cleanse yourself there, that can't happen anymore. And those are the things that I think that I miss and that I am sad that my children don't have that opportunity to do those things. I mean, as a child, you know, you can spend all day running and just the feel of the water on you, you know, just because it is so cold, and just the freshness and how alive it makes you feel when you emerge yourself from the water (Informant J).*

Manaakitanga - Historically a surplus of food was gathered as surpluses enabled whanau to access other resources through bartering, trading and gifting, thus setting up reciprocal obligations (Makereti, 1938). During the year whanau visited neighbouring hapu, taking surplus food to share. Being able to gather abundant foods and thus able to engage in a range of economic practices ensured whanau had access to a variety of foods. Because of trade, however, people weren't restricted to kai immediately available to them from their local area but had access to a wide range of foods. Degradation of the lakes, however, meant that Te Arawa were denied access to a significant percentage of their traditional sites of kai gathering across Rotorua Lakes and streams.

> *At the large hui at Awahou in 1899 there were six hundred people from the Bay of Plenty and East Coast. The gathering lasted a week and koura was the chief food (Hiroa, 1921)*
>
> *A great present of koura was sent to Kawana Paipai in 1859 (Hiroa, 1921)*

As has already been mentioned –

At the opening of Tame te Kapua at Ohinemutu in 1873 it is said that at the feast were five hundred rohe of dried koura and inanga (Hiroa, 1921)

Durie (2004) contends that mauriora is dependent upon a secure cultural identity, and therefore diet changes can lead to loss of culture and identity. Having the ability to manaaki visitors by supplying kai sourced from one's takiwa means that the activities of fishing, and gathering other foods creates and maintains community ties and reinforces identity. Conversely the inability to manaaki guests and sustain whanaungatanga can lead to cultural loss. As informants explained -

At home we would share them out with all the families along the way and what was left over we dried. We dried for the winter (Informant B).

And that is what it is really about - the sharing, and that is what food gathering was about, or planting your gardens was the same. You didn't just plant for yourself, you planted for everybody.… they always shared everything… I've always had a garden… I always planted something (Informant B).

We dived for our people. We look after our people. Big tangis and all that. We look after our people (Informant C).

But sadly informants believed that the sharing culture is gone:

No, that has gone too. That is gone because in the old days there – because I was brought up by my mother and my grandfather. And every Sunday they used to come around – like the older ones – and drop off a piece of wild pork, some fish, some koura, eh. But that's gone. … now I take my kids; my son, my daughter and now my mokopuna down to the pa whenever there is a hui, whenever there is a tangi. But the rest of the kids – when we moved …they lost that connection (Informant M).

It was always enough to feed the family and then some left over to be able to give to people that came….Yes, so when taking from the lake it was always really important that we didn't just keep it for ourselves, that we shared it, particularly like koura, it was always made sure that my grandmother got some and both my sets of grandparents and aunties and, yes, there was always plentiful, enough for our family and some of our extended family (Informant J).

Matauranga Maori -

> *Yeah, but I think it is the younger generations that are – they are getting worse and worse because their parents aren't giving good – showing the good way. You know, they are obviously, "Oh, well, you know". Because to me, Papatuanuku and, you know, Tangaroa, you know, we are kaitiaki of them and if we don't look after them we can't collect from them or they can't look after us (Informant H).*

As has been previously stated, the activities of gathering and preparing kai serves the functions of passing on traditional knowledge from one generation to the next. Matauranga Maori is developed and transmitted through practices of food management, harvesting and preparation.

> *I suppose I learnt from - and my brother and sister did - we learnt from our father and our uncles, and it was really things that they had learnt. So it is really generational information that comes down, and it was always - the key was sustaining. You know, making it sustainable so that next year you could come back and there was still some more there (Informant J).*

> *As a child, I have never seen a morihana, I didn't even know that they existed until as I have got older and we have spoken about the morihana, but they used to say …they would just pick them straight up and eat them raw, (Informant J).*

A great deal of knowledge is needed in order to obtain kai - knowledge of techniques and also knowledge of ecosystems. If populations of aquatic species do not return, knowledge of the techniques of gathering these foods along with the associated ecological and cultural knowledge and the techniques of gathering will likely also begin to disappear. Historical text and evidentiary statements provide insights to the knowledge held by earlier generations:

> *There were expert men who understood all the movements of a school of fish. These men generally took up a position on the top of a hill near the sea, and looked out for any signs of a school of fish, and then passed on the sign to a party of men who were fishing in a canoe. The seas which surrounded New Zealand were teeming with fish. ..*

> *In Cook's First Voyage, page 57, Cook writes: "The seine, the large net which has already been noticed, is produced by their united labour, and is probably the joint property of the whole town. Their fishing hooks are of shell or bone,*

and they have baskets of wicker work to hold the fish." On page 48, he writes: "Early in the morning, the Indians (meaning Maori) brought in their canoes a prodigious quantity of mackerel, of which one sort were exactly the same with those caught in England. These canoes were succeeded by other canoes equally loaded with the same sort of fish, and the cargoes purchased were so great that everyone of the ship's company who could get salt cured as many as would serve him for a month's provision. These people frequently resort to the bay in parties to gather shellfish, of which it affords an incredible plenty. Indeed, wherever we went, whether on the hills or through the vales, in the woods or on the plains, we saw many wagon loads of shells in heaps, some of which appeared fresh, others very old."

Crozet in his Voyage, pp. 40–41, writes also of the abundance of many kinds of fish caught by the Maori, and of the art of the Maori in all that concerns fishing, and goes on to say: "Their fishing lines, as well as their nets of every description, are knotted with the same adroitness as those of the cleverest fishermen of our seaports. They manufacture seines five hundred feet long, and for want of corks to hold up the nets, they make use of a very light white wood, and for lead to weigh it down, they make use of very heavy round pebbles enclosed in a network sheath which runs along the bottom of the seine, etc."

Te aho hi ika, the lines used for fishing, were made from the finely dressed muka (fibre) of the flax. They were very strong, and often carried hooks to catch very large fish, such as the manga (barracuda), or the hapuku (groper).

In my district manuka grew near Lakes Rotoiti and Rotorua, and this became quite famous for making hooks. People came from the coast on purpose to get these manuka sticks, which the prevailing winds had blown almost into the shape of fish hooks.

As food species disappear from the dining table, the particular knowledge of how to prepare foods is also lost.

I used to also go and get mutton birds on Whale Island…I used to go every year and get mutton birds. I started when I was nine - I used to go over there with the old people. Then when I was 11 I was allowed to go on my own (Informant B).

We were working at six, doing allsorts of things, not just milking the bloody cows, but digging the garden and helping grandma do this and do that, and so

we had a working life, everyday was a working day. And by the time you are 11 you could do anything…Totally independent, you could look after the family, you could cook, do the housework, everything. And that is how it had to be, which I reckon was wonderful, that they taught us all these things. By the time I was 15 I was ready to marry - you know, that is what they said, I could marry at 15, because I could go to work and look after our family and look after children. So that is one of the sad things about today, young people haven't had the opportunity to do all those things (Informant B).

I found that catching fish was the easiest part. I used the long line most of the time. And it's hard to get these young kids, aye, because they were – I used to get them out on that boat; they never played up at me. They knew the rules; they play up, well, we stay another couple of weeks out there and they hated it. A lot of them used to get seasick. They didn't like – don't play up with him or he'll stay another week. And we'll have to eat fish for breakfast, fish for dinner, fish for tea. I've got a change today, boys - more fish! (Informant C).

Because of the continuity and frequency of kai gathering, people were readily able to monitor fluctuations in stock and environmental conditions. They were then able to build up tacit and local knowledge of the environment.

Tikanga Maori - Kai gathering was and is governed by tikanga. Generally, whānau members spanning two, or sometimes three generations, together collected different kai moana species from traditional mahinga kai areas.

Makereti (1938) tells us that historically -

- *When a fishing expedition was arranged, several canoes, each manned by several men, were placed under strict tapu.*

- *If a man was married, he kept away from his wife until all fishing operations were over.*

- *The first inanga caught in the season were always offered to the gods, and the rest of that first catch was used at a ceremonial feast, karakia being repeated by the Tohunga.*

- *Both men and canoes were under tapu, and each canoe would carry a mauri, … in a hidden part to maintain the tapu, and add mana to move the gods when an appeal was made asking protection for the ropu (company) from the many*

dangers at sea, and from the many beings who lived in the deep waters of Moana-nui-a Kiwa, the great ocean of Kiwa.

- *The first fish caught on an expedition was offered to Tangaroa as a thanksgiving, and it was done with the ceremony of karakia.*

- *The fish was then placed in the sea again, and this karakia was repeated asking that abundance of fish might be sent to fill their nets or bite on their hooks.*

- *The men who went on fishing expeditions had no food before they went, and none until after their return, when the tapu was taken off by a Tohunga.*

- *Even when fish was caught, and pulled up into the waka (canoe), it must not touch the top of the gunwale. If it did, it was considered to be an evil omen, aitua.*

- *When fish was placed in the canoe, it was laid in the way of the canoe, and not across it. If the fish were placed across and a man stepped over them, it was thought that some aitua (bad luck) would happen to him.*

- *No Maori went out fishing alone. Fishing … was done by a ropu or company of men.*

- *When men went fishing, and one of them had a new line, none of the others would throw out his line till after the new line had been wetted. When placing his bait on the hook or hooks, he would tuwha, spit on it, and after gathering up his line, he would pass it under his left kuwha (thigh). After this he would turn his face to the bow of his canoe, and throw his line over the left side of it, and as the line went out and got wet, he held it in his left hand, and picking up some sea water in the cup of his right hand, sprinkled this on the line. The first fish he caught would not be eaten, but kept to be given as an offering to the gods. This offering would be cooked on a fire which was specially kindled on his return to land, and the fish, which was divided into two parts, was offered to the spirits of his male ancestors, and to the spirits of his female ancestors.*

From the interviews we extracted skills, knowledge and tikanga that continue to be upheld today:

- location of fishing grounds;

- rights to fishing grounds;
- knowledge, location and impact of thermal resources including natural sources of contamination;
- how to read and understand the waters, and the dangerous places around the area;
- knowledge of the location of different habitats of species, knowledge of life stages of species, such as when to collect or leave to replenish and grow;
- how to get a 'feed' if needed;
- how to remove the skeleton from koura;
- how to make and mend equipment;
- diving – traditionally and with equipment;
- gathering in traditional way e.g., tau koura;
- seasonal information;
- boat handling and maintenance;
- karakia before gathering;
- ika mātua (the return of the first fish to Tangaroa);
- take enough for a 'feed', any excess is to be given away to those who can't get it;
- rāhui in event of accident or death.

Tikanga remains relevant today:

> *I mean, you just didn't go out - if we went out eeling we'd all stand in a group and my grandfather would do a karakia and ask Tangaroa to let us have some luck, and we always got heaps of luck - we had eels everywhere (Informant B).*

But there is also an obligation to teach the next generation:

> *Yes, no, but you've got to teach the ones that do it to share, that is the big issue. Today, if you don't go out and somebody goes - oh, stuff him - part of the whanau, you know, he doesn't go out. But you have got to learn to say – well, he's got to realise that they are not all the same. But the point of going out to get all this kai is to be able to share it with somebody else - there is no sense otherwise, there is no sense in going to get all this stuff because the joy is seeing the joy on other people's faces when you say "here", and that is when it's worth it. Otherwise you can hoard you bloody freezers up and whatever and it doesn't mean a damn thing (Informant B).*

Te Reo - That kai is instrumental to a culture is reflected in the Te Reo that pertain to fishing grounds, their names and the names of the landmarks by which they are located and the different species. Te Reo contains knowledge and is an expression of culture and identity. Yet Te Reo has been declining for many reasons, one of which may be attributed, in part, to changing lifestyles. When a valued species disappears from a local ecosystem, or the activities associated with a species decrease, the associated Te Reo drops out of usage. When 61% of the respondents confirmed that they would stop gathering if advised that species and sites were contaminated, the indirect cultural impacts that would ensue should this happen would represent a significant loss.

Cultural survival - This section of the report has attempted to describe how kai gathering is the glue that binds whanau, hapu and community together, providing a sense of identity that also serves as the vehicle for the transmission of values and knowledge. The degradation of the lakes and consequent impacts on mahinga kai was a significant issue in the Te Arawa claim as evidenced by statements in the Tribunal Report. Archived documents provide in-depth testimony concerning the cultural and spiritual significance of aquatic kai species and of the water bodies across Rotorua Lakes themselves while informants identified the need for education.

> *You have got to teach them, eh? You have got to get them interested (Informant A).*

> *But one of the things is – it is education of our people. Our people need to be educated now about their resources or tools so that our fishermen can test their own catch …They should be made to do that. I mean I don't mind being stopped on the lake and having my fish tested so it is safe for me and my family (Informant A).*

All I would like is for my children to have the opportunity to enjoy the lakes in the same manner that I did, and it is as simple as that. That my children and my grandchildren enjoy the same benefits that I did as a child, that they can grab the tyre from down the road and roll it into the lake and all 10 of them jump on it and I know that - you know, previously you would be worrying about their swimming ability, but now you worry about them putting their head under that water. So to take that away and to watch, you know, the neighbourhood kids, all 10 of them, be able to access that water again, that is what I would like to see (Informant J).

It was our playground, it fed us, it taught us a lot of things about, you know, like especially now, these days, our children don't realise – you know, because you have got to get in touch with nature now and these are like – it was an educational basket. You know, you could investigate and even the species along, you know, like the ducks and the – you know, there was like – the ducks that we used to like were those ones with the bright yellow eyes (Informant H).

Hauora Maori - The presence of kaumatua represents "intellectual capital". They are holders of a wealth of critical information about the past and can draw on this knowledge to provide accurate assessments of environmental condition, including changes over time, at a localised level. The results from the Kai Consumption Survey confirm that differences in behaviours, perceptions and knowledge are found with the different generations. Loss of relationships with the natural world could lead to grief. Many feel whakama when unable to fulfil the social roles expected of their age groups. At stake with the loss of kai gathering is not only cultural survival, but potentially the physical and mental wellbeing of whanau members.

So we walk along the shore to get down to Utahina, to walk along the shore is mainly - it is just covered up in lake weed, so it is really hard to see if they actually still exist on those shorelines.

So my children don't spend the time in the water that I would like them to because the water is what connects you to - you know, it is what makes us well. It is one of the things that makes us well and provides us strength, and so then where do my children go to? (Informant J).

6.4 Perception of the health of the lakes' environs

Questions sought information from interviewees about their perceptions of:

- What environmental impacts that act as barriers to gathering?

- What environmental activities have impacted the condition of sites from which kai is sourced?

- What activities have led them to change their gathering behaviours?

With increasing European settlement around the lakes in the late 1800s, forests were milled, agriculture was established and urban settlements were developed. Numerous conflicts developed between the new settlers and Te Arawa, whose capacity to provide kairoto from the lakes and koha for hospitality was diminished with deteriorating water quality and introductions of exotic species. Today, through degradation Te Arawa have been progressively alienated from the lakes, their taonga and their role as kaitiaki although a number of restorative initiatives are being implemented. In the following paragraphs we identify some of the activities impacting the health of the lakes:

Changing land uses- Native vegetation around the edges of Lakes Rotorua and Rotoiti was milled for timber and cleared for farming, and later septic tanks were installed. These developments resulted in an increased nutrient load flowing from the catchments into the lakes. Excess nitrogen and phosphorous led to the growth of blue-green algae in the lakes. In the paragraphs that follow we summarise many of the impacts of concern to Te Arawa.

Sewage - Pumping sewage effluent into the Kaituna River is offensive on medical, social, spiritual and cultural grounds.

> *I suppose out of all the lakes, I think Rotorua was the most damaged from the sewerage, because when I was growing up - you wouldn't believe, they had the sewerage - the town dump down by the lake (Informant B).*

> *If we believe the lake is polluted then it is, and that the food in it is polluted. But we've been eating it for years so we're probably all immune to it now. But if anybody else from our side probably came in from overseas, they probably get crook (Informant B).*

> *I suppose there always is health risks, when pollutants go into the lake, but the trouble with health risks is that they're not instantaneous, you know, it takes years for it to appear (Informant B).*

They pump the town sewerage up into the forest in towards the Tukurangi Pa and as far back as probably about up to here (Informant H).

It's not right down here with the quality of the kai, then it must be from Te Puke, in which I won't be afraid to say that Te Puke is – they're mongrels, their 'shit' - all right and that's honest (Informant K).

Forest Clearance - Many native fish live within the forests in steep, cold streams with rapids and pools, that still retain a heavy cover of native forest. These habitats support banded kokopu (in pools), short-jawed kokopu (needs plentiful instream cover to hide in), red-finned bully (in wider streams), longfin eel (needs deep pools, large bank overhangs, log piles), koaro (in clear streams), banded kokopu, and giant kokopu. Koaro which are now rare disappear from streams when the forest canopy is removed. In unmodified streams koaro may still be found. Forested streams are probably the habitat required for spawning lamprey.

The trees are gone, some of them are gone, some cut down. Plus we went to a barbecue down the lake, summer this year, and what surprised me was the bareness. Not only bare of, you know it, around the shoreline, but bare of people to when I was – eh? Because it was always covered in kids. And all the kids were actually by us at the barbecue, throwing stones into the lake, even though it was a nice warm day (Informant M).

Deterioration in Water Quality Many native freshwater fish thrive in cold, clear, actively running water as they need a constant, organically clean, thermally and chemically stable water supply (Hine and Boustead, 1974).

Informants described the changes in water quality across the region:

But I remember being able to go down to the rock and when I jumped in the water, the water was cold and it was just what you did on a summer day. Now if I went to jump into that water it would be luke warm, and so what is going on that as a child it used to be able to quench me and be able to sustain me that now actually it's like "I'm not even jumping in there", something is going on with it(Informant J).

I think if I wouldn't drink it, then why would I throw my children in to swim in it, and yet there was a time where I would have been quite happy to have drunk out of the Utuhina River (Informant J).

You can get any shellfish you like out of this one. But …they're slowly disappearing (Informant C).

And I looked down and it looked down and it looked like somebody had done some big, huge, washing, eh, there was all this froth, eh, you know? And I go, "Look at that". All along the shore it was just thick froth. And I said, "Well, nobody got a washing machine this big, so it must be something else". Which I felt sad for because there is a lot of history in those lakes; a lot of people swam, a lot of people died in that lake, a lot of wars on that lake, eh.… It is a lake of memories, good ones; memories of flowers, memories of people. And at the moment now, all they are is memories because you have got a whole lot of rubbish that is stuck in it, (Informant M).

We get 44 gallon drums, we get pallets, we get everything coming down the Utuhina Stream, but in our bay, which is right next to the Saint Faith's Church, I get all the tennis balls.…… He gets all the golf balls, which we can't work out because tennis balls are lighter than golf balls and yet they come further around to the yacht club – that is right next to the yacht club, yeah. And I think one day there we got over a thousand golf balls out of there. And so that is coming down the golf course up here, down the Utuhina (Informant D).

Without your water quality, food will never be sustainable from the lakes, waterways (Informant E).

Especially in summer time when the algae bloom gets at its worst, you know, and you see - because we frequent Lake Tarawera, when you see that yucky horrible greeny colour and Lake Rotomahana that totally, totally looks disgusting now …The colour and all those floating things and heaps of feathers and all that weed and the smell (Informant F).

Even Noho Kakahi get a lot of ugly looking floating algae looking things in there. Yeah, the colours have all changed. In Tarawera you could look over the jetty and look down and you could see the lake weed at the bottom and now you can't see anything full stop (Informant G).

I took my grandchildren for a swim down the lake, and I hadn't been to the lake for a while, and we were swimming around there for ages and I got some kouras and I knew they was hot so I let them go…. we were walking home and I go (sniff, sniff) something was stink, eh, and I smelt it and it was me, from

the lake. So I got home and from then I wouldn't go back in the lake (Informant M).

Yes, the smell from the lake [Rotorua] is so putrid. So, I mean, certainly as I got older as a teenager, I don't think it was just a teenage thing, I just think the quality in the lake just seemed to deteriorate at quite a rapid period, or maybe I became more - because as a child there was no problem in putting your head under the water, but now, and then if you go around (Informant J).

Bio-security – specific to Maketu, one species of concern was identified –

Starfish, but that's fallen off some of these big boaties. Those big boats, when they empty their ballasts and that's where those come from. You know, when they come over and then they collect the logs and they pump all their ballasts out (Informant C).

Irrigation - Extraction of flows to enable irrigation can cause rapid alterations in stream flows resulting in exposure of bank vegetation, and loss of fish habitats.

Disappearance of kaiora - Insects represent a source of food for freshwater fish. Native fish are deprived of this resource by forest clearance, agricultural pesticides, and competition from introduced fish. As early as 1920, the entomologist Tillyard reported to the Government that trout had caused serious declines in aquatic insects in the Rotorua–Taupo streams and lakes (Tillyard, 1920). Informants commented on other changes:

And I remember even getting some paua - oh, about maybe eight years ago I suppose – and you know, they were okay but then you take them out of the shell and you can actually see the discolouration in the shells and it is like it is from the quality of food that is keted and (Informant H).

I missed all that - beautiful, it was just natural. And the croaking of the frogs - we didn't even need a clock to wake us up in the morning. Five in the morning the frogs would croak and they would start in harmony and sing all these beautiful tunes - high and low, and that got us up - the frogs. See, you don't even hear a frog today, you don't see a frog, it must be affecting the environment (Informant E).

I mean the birdlife was one of the most beautiful things to watch and you could always tell with the seagulls when the inanga was running - the birds would tell you. Now you don't see that as often. We've lost that as well. The

birds will go to another area where it's peaceful and quiet, plus if you have the habitat taken away like your swamp lands taken, they will go elsewhere, and that's what's happened to the Ohau Channel because of the dredging and now it's like parkland (Informant E).

But the pauas, they are all stunted; they're all got to a certain size and that's it. They never grew any bigger. Everybody else, they say - oh, we got some big pauas. You can't get big pauas here. They only get to it once, I think, and that's it (Informant C).

Impact on wahi tohu

Maori used tohu within their natural environment as indicators of predictability. By using indicators that have evolved over time through trial and error, through a history of continual use, Te Arawa monitored the condition of the environment, shaped their behaviours accordingly, and if necessary protected it by applying a rahui – using tohu to understand predictability represents a traditional management technique akin to the contemporary practice of adaptive management. Sadly changes to many lakes mean that historical patterns and processes are changing to the extent that rainfall (and other climate patterns) and lakes are being described as unpredictable, meaning the application of tohu may be limited.

Dredging - As swamps have been drained, natural streams have been straightened and dredged, destroying the food resources, refuges, and spawning gravels of native fish. However some informants believed dredging was not necessary at Maketu:

Well, I thought – I told them that. I said, "well, you know, the only way you're going to get to this - is you're going to have to dredge this" He said, "you won't be able to do it." (Informant C).

Swamp Drainage - Before the clearance and drainage of the vast kahikatea forestlands, extensive tracts of swamp, with pools enclosed by flax and raupo, were a feature of the region. These habitats sustained inanga in vast numbers, shortfin eels, and giant kokopu. Maintaining swamps is vital to the productivity of whitebait fisheries. Areas of lowland fisheries have been lost to land clearance, drainage, and trampling by stock. Drainage was identified as a particular concern at Maketu.

Pine Forestry Practices - Pine forests replace native forests and create a new environment around streams that is not a substitute for native forest cover. Forestry practices of burning, bulldozing, road building, and hauling modify streams.

Rapids, riffles, flats, shallow gravels, deep pools, and overhanging banks that provide the habitats in which native fish forage, hide, and breed are modified or lost. Forestry practices can disturb stream banks and stream beds, and load stream flows with sediment. Forestry practices can alter the chemical composition of streams as slashed vegetation rots, as phosphorus, nitrogen, and potash enter streams after burning, as forests are sprayed with chemicals and fertilisers, as mills discharge effluents, and as toxins leach out of sawdust and waste woods.

> *We used to have native trees and native trees don't throw out pollen (Informant E).*

> *Rotorua, Rotoiti, they are all small lakes, they just can't handle it. I say it is caused through pollen, everything else has changed the quality of our water (Informant E).*

> *But it's not only the kai from the lakes that depleted a lot, it was also from the forestry…the trees getting cut down and the poison coming in (Informant G).*

Modifying Estuaries - Many species of native fish pass through estuaries that provide a crucial transitional habitat which reduces the shock to migrating fish of changing from fresh water to salt water (Dinamani and Hickman, 1980). Maketu has been impacted by landuses and the diversion of the Lower Kaituna River.

> *Put it back through the estuary. But you can't – they say, oh, it will open it up and it will just flush it – you'll never flush it because they've left it too long. She's silted up that high now; she'd be, well, you could walk across here; walk across the thing. Before you had to go down a bank; now you can walk straight off the bank and straight into the sea (Informant C).*

Impacts of river management

> *The environmental impacts that have now impacted on Maketu whereby in the early years everything was pristine, beginning from Rotorua/Ohau and then down here, and we have seen the changes over the 50 odd or more years. But what we valued most was, I guess what was coming from Rotorua, the freshwater and the marrying into the saltwater which created within the estuary here. And from that – from a human being sort of observation and within ourselves and our firm belief that the wairua of the water and both mean together it created a uniqueness in terms of Newton's, whatever you call it, the "mixing" and, of course, with the end result, resulted in the food bowl of Te Arawa (Informant K).*

It was the installing of the weir around about '89, we've lost the whitebait (Informant E).

In addition to the adverse effects of the Kaituna Cut, the wall at Rotoiti was identified as a concern:

But I'm not very happy with the wall that they put in. I think it's going to cause problems. Why I say that is that just from my own way of thinking is that when you put a wall up and the wall becomes a barrier between Lake Rotorua and Lake Rotoiti…when the river was flowing down through the lake it dragged Rotoiti with it … The current going down drags the Lake Rotoiti water with it and creates a movement up the top end of the lake, admit it takes a while but it does…But when you put a barrier in, Rotoiti becomes a swamp…And you are not going to have that water dragging the Rotoiti water with it because it's going down against the wall (Informant B).

Game Fish Introductions - Trout and other foreign fish species were introduced into the Te Arawa Lakes from the 1870s onwards by acclimatisation societies, local bodies and government departments.

In lakes and rivers trout compete with native fish for floating insects, aquatic larvae (especially dragonfly nymphs, fly, caddis, mayfly, and stonefly larvae), and native aquatic snails and molluscs, especially in winter when food sources are meagre. Small longfinned eels living amongst the river gravels feed on aquatic larvae (caddis and mayfly), snails, and midges; their food is so similar to those of trout that competition is likely (McDowall, 1989).

But not all introductions were negative:

Morihana was probably one of the most valued fish in Lake Rotorua or in any of the lakes, that was a real delicacy, morihana, but of course that was introduced.

Land intensification

Like other regions around New Zealand land intensification is a concern especially if land use is dairying:

And now the cows – because the cows don't come down but there must be seepage, you know, back into the river. Well, I think if you knocked the blimmen river back to the way it used to run, then you'll get them - they'll

come back. What they did, they blocked off the main river and then they opened up this new one. Well, since they opened that up, then you get very small ones (Informant C).

Informants described the obligations they believe rest with the landowner -

So my whakaaro is, where everybody has got a farm around here, wherever there is an outlet, that should be all tested. And if, say, people have got a farm there, as I was saying, they own that piece, but the land not the water. We do. The people of Rotorua. So what we must be protecting is all this. So if they have got a farm there say, "Okay, you guys, you get plenty of money out of that, so use some of that money to make sure your sediment doesn't reach the lake" (Informant M).

Government and council actions acting as barriers – including the impacts of fisheries regulation - Government regulation required Te Arawa to pay for licences to take trout and certain other introduced species from the lakes. This restricted the ability of Te Arawa to fish in a customary manner (such as with nets), restricted their food supplies and imposed a financial burden.

Informants described how they felt when regulation was introduced –

Once they started bringing in fishing licences. We were saying "well, what about us and our indigenous fish?" We could just take - you know, when we thought we owned the lakes and it was leased out to the Crown, to us it was our traditional fishing rights and it just felt our fishing right was being taken from us (Informant E).

Our old people said – "no way are we going to take compensation, because the day we take compensation we will lose our customary rights, we will lose our customary fishing grounds, we will lose it all", and they are true (Informant E).

As part of the Te Arawa Lakes Settlement Act 2006, however, the Crown has made regulations to empower the Trustees of the Te Arawa Lakes Trust to manage the customary and recreational food gathering of included species in the Te Arawa Lakes (refer to http://www.tearawa.iwi.nz/fisheries-regulations; see also http://www.niwa.co.nz/our-science/freshwater/our-services/freshwater-species-and-habitat-management/te_arawa_lakes).

Other resource laws - The statutes displaced Maori interests in the indigenous fauna and consequently Te Arawa lost their economic and social interests in the flora and fauna. Iwi and hapu lost rangatiratanga over the fauna of their whenua. Statutes protected the conditions for introduced fauna to thrive. As a result predatory game fish displaced native fish from lakes and waterways (Rowe and Kusabs, 2007). Spawning grounds of inanga and kokopu were and continue to be damaged by stock and logging. Maori lost their self-sustaining harvests.

Loss of riparian vegetation -

Historical text describe the natural vegetation around the lake. However informants raised the loss of vegetation as an issue.

Raupo, they've all disappeared around the lakes - it used to all around the lake. Poupou, which they used to use for making their whariki and all that. But it has all disappeared, you know, because when they disappear other things disappear. The homes for koura, they used to live in the poupou, under the roots. Well, they all disappeared so they've had to move somewhere else, and the raupo - they used to live in amongst the raupo and all that (Informant B).

I'd like to see all that stuff growing back again, especially the poupou and the raupo, I'd like to see it all back around the lake, and the lake a bit more cleaner than what it is. There is not really much we can do at the moment because all the silt at the bottom now, it is all built-up and I think it's going to stay murky for quite a long time. But I think once - give it another 20 years, as long as we clean the streams up, it will wash it all out (Informant B).

We used to walk through all the weeds and the raupo…. We used to go with our pitchforks and catch the morihana, eh? And it was like walking through a garden. So the key is, whoever is looking at this and they are trying to figure out how a person got a motor mower into the water …All the dust, the sediment comes up and blocks the view of the koura. But, when I was a kid you didn't have that. Years ago we would have cut a car tyre up, hammer it to a piece of wood, light it, and that is how we used to catch koura. And you could just walk like that and you would still see them (Informant M).

I don't know how they did it, but I am trying to figure out people can get a lawnmower into the water, eh? Because everything around has disappeared. Whereas we used to have to climb though it, eh? You know, you had the little

vines … you used those to swing out over the lake? Well, those are all gone. And, to me, the motor mower goes that far.. (Informant M).

Raupo was the cleanser of the waters (Informant E).

The chemicals were actually killing our raupo and our natural cleansers. When you look at a raupo you will see it has got a sponge like that goes into the water and it sort of sucks in all those nutrients (Informant E).

And this is what I've been telling the Environment Bay of Plenty and RDC. It was just all raupo until they started building homes. And what do the new owners want - a jetty instead. So they pull out all the raupo and up goes the jetties. See, you change your environment (Informant E).

It's one of the things that just sorts of just sneaks up on you though, the vegetation around the lake, just sort of a wee bit disappearing and then a wee bit disappearing (Informant G).

New settlements/subdivision - The lakes were removed from the ownership and management of Te Arawa.

It's absolutely beautiful. And this is why people are spending heaps of money coming to live in the bay, but they bring all their jetskis, they bring all their motorboats and it's just crazy over Christmas. They go round and round in circles - just about hitting each other. The noise is quite threatening too, because you can't hear your phone…(Informant E).

I suppose what you do notice is that as our population increases and as we are not so appreciative of our whenua, the repercussions are that our lakes pay for our non-appreciation. So as Rotorua has got bigger, Lake Rotorua has got - the quality of the water in Lake Rotorua has paid the price for development here, you know, and as our farms have got bigger and as our technology has got bigger and better, the prices have been paid with the whenua, particularly our water (Informant J).

Now the hundreds and hundreds of boats that are getting launched at our lakes. Fuel leaking into the water. Because we're on the jetty and you can just see all the fuel and the oil sitting on top, yeah, still dive through it. Curse them and dive in (Informant F).

All of the changes described above are relevant to this research as changes, directly and indirectly impact cultural practices, principles and tikanga associated with food gathering:

- Young people are growing up not learning the basic knowledge associated with kai species, fishing, boating and gathering.

- Whanau are "losing the taste" of kai.

From 30 down there wouldn't be a huge interest in it because it is not something that they have grown up with, but certainly from my age up, like, you know, if my grandmother was to - if you were to put a plate of koura in front of her, I think she would almost eat the shell from it. You know, that is the sort of level of delicacy it is for her, whereas if I were to put it in front of my son, he actually wouldn't be that impressed with it (Informant J).

- Kai generally was known to be good for health. There is a feeling that the younger generation don't know this, or if they do, they don't practice it.

- Fish and seafood is purchased more now, but often as fish and chips.

- Water quality is a concern for parents and therefore they are reluctant to let kids explore/play in aquatic environments unattended.

- Parents feel their children have missed something not growing up in an active hapū gathering environment.

- The context within which fundamental cultural practices such as whanaungatanga are learned have been impacted -

Generally I go with wider whanau, so we tend to do everything with my mother and father, my brothers and sisters, and even my grandmother. So generally there are four generations of us that are travelling out on these things, so, yes. Like, as an example, we go out to Lake Okataina, … which is where my great grandmother lies is over here, so she was buried over here, so it is sort of like when we are going out to these other areas it is generally like on a historical journey to learn about things about who we are.

Finally, the result of these environmental perceptions is uncertainty as to whether or not kai is contaminated from urban environment.

See, that is another thing we need to be watching to – is the taking of watercress from polluted streams and swamps and things like that. And we have got to be careful of taking watercress (Informant A).

No, no. I think the condition is still the same, except for the pipis. I just didn't like the pipis, whether it is the – I gave these to an old kuia and she said to me, "Oh, I put them in hot water and didn't get enough for a sandwich, they were see-through". But then I cleaned it out (Informant D).

Washed them out in a bucket and it was black, the water, so. But I know they are looking at diverting the cut, or putting it back through the cut. I do not know what they are going to do with the waterways over there. Yes. No, that is about all I really know about that area (Informant D).

It has got a muddy taste - it has to do with the taste, plus the look. I looked at the inanga and it used to be pure black and white when we were children - distinctive, because we used to make fish flies and then we found - there seemed to be a greeny looking yellowy stomach colouring of the inanga. It started to change colour and it didn't look right. I think it has a lot to do with the change - bland change of inangas to - often we see the pollen has got a lot to do, you see it come through here at the Ohau Channel today (Informant E).

I wouldn't take the risk of getting watercress from other areas because too many people are using sprays in the drains, the creeks running into the lakes (Informant E).

Whereas previously you would have quite healthy, and I don't know what healthy means, but they would - like the shell of the koura would be relatively strong and as the time went on the koura - like even when you eat you could, it was similar to a prawn in that when you broke it the flesh was still quite compact and still quite firm after you had cooked it, but recently if you - as you went on, the koura would actually become a lot more soft, like the flesh that you would be eating wouldn't be as firm and as sweet as it had been previously (Informant J).

Despite the level of environmental change and the potential for contamination, it needs to be acknowledged that lifestyles today leave little time for fishing activities.

6.5 Health and wellbeing of whanau members – the mixed methods and contradictions

Te Arawa continues to be dependent upon kai gathering both physically and culturally. Mahinga kai was the primary food source and the basis of an economy based on trade, barter and exchange. The transition from wild sourced kai to a western style of diet comprising commodity/convenience foods consequently impacted Te Arawa socially, culturally, economically and spiritually.

As part of the fisheries redress of the Te Arawa Settlement Act 2006 Te Arawa have their own fisheries regulations to manage their customary food gathering – Te Arawa Lakes (Fisheries) Regulations 2006. A Komiti Whakahaere has been established to coordinate the development of species management plans for each of 5 key mahinga kai species, namely koura, kakahi, koaro, smelt and tuna.

Toxic contamination and the resultant health impact on humans has received considerable research attention over the past three decades (Edelstein, 1988; Freudenburg, 1984; Perrow, 1984). This research seeks to explore the health risks of the changing kai gathering behaviours sourced by whanau and hapu in order to determine the ongoing risk of exposure to contaminants.

Changes to the relationship with the lakes have resulted in a range of health and wellbeing implications. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between the lakes and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

Physical health - Physical health is directly linked to the quantity and quality of food consumed, as well as the cultural, social and economic conditions within which individuals live. In the context of this research programme, physical health consequences arise from four factors:

1. changes in the nutritional value of foods consumed today compared to their traditional diet;

2. being denied access to gather also affects health by limiting the physical exercise associated with the act of gathering;

3. the risk of contamination of kai that is consumed;

4. the risk of contamination from the sites that kai is gathered from.

The loss of access and use of traditional resources is now recognised as being a contributor to a change to a western style of diet and the consequent rise in diet-related illnesses which from an economic perspective could cost society. However the converse is also of concern as for those whanau who still gather kai, there is a risk of exposure to contaminants from eating wild sourced kai.

An important health benefit of kai gathering results from the act of gathering itself – an activity that requires physical activity. The importance of exercise to general physical health is widely recognised.

> *The old man; threw us in the lake and taught us how to swim and we were about seven or eight. We used to come down here but then we were diving when we were about 10, 11. We were going out with the old man and diving, and we dived from then right through but only to feed the, like I say, again (Informant C).*

> *Well, I was lucky, I had the chance to be brought up on the shores of the lake. And during the summer I would go down there at 10 o'clock in the morning, after breakfast, jump off the boat when the whistles come, go back after lunch. That would be hard case. We were all sitting out in the boat, and the whistles all along the lake go. You know, like my cousin Fred, my cousin Johnny Mata, their father and then my mum, my koroua and them would whistle out. And then we would jump off, swim back and go for lunch and then meet you after 1 o'clock, come back down to the lake. And we were still there at night, light our fires and go home sometimes at 10, 11 o'clock at night, after we would get the run of koura (Informant M).*

> *It was our playground. Yeah. There was places – we had the clay rocks… We used to walk those every day, in the water (Informant M).*

> *Every time we went out. It never ran out, eh? We would go down and we would all meet down at the lakefront and play around and what- have-you, and then go out and then just dive, (Informant M).*

The comments confirm that Te Arawa, like other Maori, were physically active in the course of gathering kai. Although the amount of exercise that whanau get now as a result of gathering has declined, those surveyed reported engaging in some activity,

although the frequency of such activity has declined as gathering behaviours have changed.

However, it cannot be assumed that all gathering will be beneficial as the physical act of gathering resources could expose whanau to health risks as the sites where gathering occurs, specifically the waters and sediments, could be contaminated. The levels of contaminants in kai gathered and the environments in which they are found in the Rotorua lakes area, will be reported separately. In addition, models describing possible risk to tangata whenua will be developed as part of the risk assessment and communication component of this project.

> *It is common for those children today to have sore eyes or running eyes, diving into the water that has become contaminated by goodness knows what from up top (Informant A).*
>
> *I shot a lot of ducks. …We shoot the Green Lake and nobody shoots the Green Lake ….I need a mate now. I need a mate with a small boat so we just can put it into the Green Lake and set our maemae (Informant A).*
>
> *See, a lot of our rivers and waters were commonly used for washing clothes and they had their lines along the riverbanks. If you notice, you see their clothes hanging up, and of course if you go down to Kawerau, people are worried about the effects from the mill. Well they are still having that – ongoing problem with the bottom end of the Tarawera River (Informant A).*
>
> *And the safest place to swim is actually down at Tarua Road in the Aquatic (Informant M).*

Wellbeing - The benefits derived from being in natural settings are also gaining increased recognition (Kaplan and Kaplan 1977, 1982). In addition to the data on diseases within the family (using data obtained from the Kai Consumption Survey), the interviewees described the broader social, economic and cultural impacts resulting from the changing patterns of kai gathering and consumption on their wellbeing – as individuals, as whanau and as a collective. The comments of informants describe the contribution of gathering and eating kai on wellbeing.

Continuity of the relationship between tangata whenua and the lakes of the Rotorua region through many generations has been essential in the creation and maintenance of a powerful sense of place and whānau - reinforcing ancestral connections, identity, pride and ownership of the area. This relationship has also been the source of healthy kai that has sustained the whanau of Te Arawa. It also brings responsibility and

obligation for honouring and maintaining the kaitiakitanga, mātauranga, tikanga, and manaakitanga associated with aquatic environments. The lakes were and continue to be, the dominant 'environmental' context for work, leisure, culture, life and death. Indeed, many features of the lake environment provide a daily reminder to past events and people, reinforcing this strong sense of place-centered identity and kaitiakitanga. The lakes of the Rotorua region are both physical and emotional tūrangawaewae.

Having experienced a slow cultural transformation for generations, some hapu members feel/know their collective wairua has been damaged, which brings its own type of frustration and mamae. However, despite the many changes there are those who feel culturally and spiritually sound and have an optimistic view on hapu and cultural health. For them, asserting rangatiratanga is necessary if hapu and cultural health are to improve over the next generations. For many indigenous tribes, the primary goal is simply survival – politically, culturally and physically. While physical survival will always be dependent on the lands, freshwaters and seas within a tribal territory continuing to sustain life, cultural survival is predicated on the assumption that the tribe will continue to have the will and the capacity to preserve practices that sustain, strengthen and revitalize the iwi sense of identity.

> *We have got to treat all these other lakes the same as they are treating Rotorua and Rotoiti (Informant A).*

7. The next steps in the research process

7.1 Next steps

Using the site specific data and the species data that resulted from the Kai Consumption Survey, the next stage of the research has identified the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori. A summary of the sites and species from Te Arawa that were used to develop a sampling programme for investigation of contaminant levels is presented in Appendix 2. The analyses that have been undertaken will then enable the researchers to establish potential pathways of contaminant bioaccumulation via the food web, as well as potential risks based on present kai consumption patterns. This information will then be available to whanau from Te Arawa. It is at this stage that consideration needs to be given to how the data (and implementation) is to be disseminated.

7.2 Disseminating advice about contamination issues

> *Communicating the risks of environmental contaminants in the food chain to northern Aboriginal peoples poses significant challenges for communities at risk and environment and health professionals alike..… communication practice on this issue include increased fear and confusion in northern communities, changes in the dietary behaviour and traditional lifestyles of their residents, and associated impacts on their society, economy, and health. … The importance of this information is increasing as research begins to detect subtle health effects from exposure to these substances among newborns in some northern regions. Thus planning and evaluation are needed for risk communication, and possibly changes to the scale at which communication work is done in northern communities. Furgal et al., (2005).*

Furgal et al (2005) contends that some of the challenges associated with communicating contamination risks are unique to the specific issue and the context of communities. Te Arawa find themselves in a Catch 22 - as a result of trying to balance two potentially conflicting perspectives:

1. the health and wellbeing benefits that results from the continuing practice of gathering kai or conversely the impacts that arise when changing from a traditional lifestyle and diet; and

2. the adverse impacts on health and wellbeing arising from contamination of aquatic ecosystems and potentially the kai species themselves.

The cultural comprehension of what is "risky" behaviour is complex. Maori, like those in other indigenous communities, have limited experience with food safety issues of relevance to contaminants potentially found in foods they gather.

Understanding how indigenous communities perceive contaminants has significant impacts on the reception and effect of messages delivered. Usher et al., (1995) contend that communities may distrust the information they receive about contaminants in foods and their distrust could affect their reception of further explanations or clarifications. Furgal et al., (2003a) found that concerns over contaminants was not a determinant of food choice in one Labrador community, yet Kuhnlein et al., (2003) reported that 42% of women interviewed in five western Arctic communities indicated "concern over contaminants" as a reason why they did not serve more foods to their families. The objective of this research is to effectively convey to Maori the potential risk of gathering kai. Overseas research indicates a number of aspects need to be addressed.

The advice to be delivered - A minimal amount of work has been undertaken to identify the types of messages that elicit certain or desired responses. Usher et al., (1995) indicates that good messages are direct, simple, not condescending, put in a personal context, accurate, translated into local languages, delivered early and often, and build upon local understandings and knowledge of the issue.

> *What needs to happen is, as part of the discussion, is finding the alternative…. we are not simply saying that the message is "here is the problem, deal with it" actually "here's the problem but we have an alternative for you so that you can still continue to do the things that you and your family have always done" (Informant J).*

Materials to be presented - Numerous forms of materials have been used to communicate messages on contaminants and country food in North America including posters, fact sheets, reports, pamphlets, personal letters, radio public service announcements, radio call-in shows, regional video programs, door-to-door or face-to face communication, community meetings, school curriculum materials, and national live television broadcasts (Furgal et al., 2003b). From the Kai Consumption Survey we know that a range of media is likely to be needed.

Delivering the advice - To be effective a message has to be distributed through pathways that ensure it will reach and engage the target audience - in this instance, hapu members who gather kai. Furgal (1999) and Grondin and Carron (1999) in their work with northern hemisphere communities identified the need to consider both formal and informal pathways of delivery and information circulation. Data from the

Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by:

Formal networks: Health Protection Officers and Environmental Protection Officers.

Maori Health Workers.

Informal networks Whanau members.

While Maori have been active in developing relationships with resource management agencies, formalised relationships with the parties that can undertake the research necessary to understand contamination issues and deliver the messages may need to be developed.

> *Apart from the paper and the signs being out there, email is always a good communication tool, a text (Informant F).*

> *I suppose an exercise would good for our people, you know, to know what are the - which are the best weeds for the lake and which are the real pests so that we, yeah - a lot of our people don't know this. In some cases don't know the difference between the native weed and the pest weed (Informant F).Maori learn best by kanohi ki te kanohi, face to face discussion, and also being involved in the discussion. So not just simply saying "this is it, here it is", but saying "okay, this is it, here it is, what do you think the solutions are for you and your family". You know, so - and the other key is finding presenters that actually present in a medium that they take it on board, and that is the key (Informant J).*

Specificity - Vaughan (1995) and Slovic (2000) contend that personal experience, gender, age, socioeconomic status, and profession influence perceptions of risk. Understanding how Te Arawa see the issue is critical to ensure that the communication is best oriented towards their understandings and perspectives.

McGrath (2003) argues for a relationship based approach to exchanging knowledge on issues such as contaminants within and between communities. This will require scientists and communicators to understand the informal paths of information flow in communities so they can develop mechanisms that support and utilise these pathways to communicate information about contaminants.

> *One might argue that little true "communication" on the issues of contaminants, food, and health has taken place between scientists, health professionals, and Aboriginal residents in many northern communities; rather, a great deal of scientific information has simply been disseminated (Leiss, 1997).*

Understanding and developing ways to better communicate information on contaminants and their impacts on health is critical. Reports of contamination can undermine confidence of whanau in their environment and gathering of resources as a source of individual and collective well-being.

7.3 Implications for future management

The results of the Kai Consumption Survey show that the gathering and consumption of kai awa, kai roto and kai moana is highly complex. This is in terms of both the differences in availability of kai awa, kai roto and kai moana between hapu, the diversity of aquatic habitats, and the diversity within and between whanau. There is some indication that consumption levels are also related to the quality of kai awa, kai roto and kai moana that is available and the quality of aquatic ecosystems that they come into contact with when gathering. These results enable us to make a number of observations with respect to future management.

Sites from which kai is gathered - Where and when people gather kai is a function of the location of their work, the proximity of waterbodies, and other activities of a whanau. This is supported by Garaway (2005) who argues in relation to fishing that it is almost always combined with other activities. The Kai Consumption Survey confirmed that whanau are likely to go fishing in a nearby lake or stream thus reducing the time spent travelling between areas of work, home and collecting. For Te Arawa this means gathering from the lakes. Fortunately many in the community, aside from Te Arawa, are putting their hand up to protect the many waterbodies that support kai gathering.

Perceived changes in the abundance of species - If Maori are interacting with aquatic ecosystems on a regular basis they are ideally placed to observe changes – to sites and to species. Guidance is needed to ensure that their observations are part of a structured and robustly designed perception study so that they do not have their observations dismissed as being "anecdotal". However, the challenge will be that few agencies support perception based assessments – let alone prove that a species is at risk and in need of management intervention. The implementation of the Te Arawa Lakes Regulations (2006) includes development of species management plans by Te Arawa iwi members, through a Komiti Whakahaere. As part of these plans a

monitoring programme is likely to be initiated and will allow direct involvement of iwi members in reporting on changes in species abundance and distribution.

Kai gathering behaviours - There is a complex mosaic of uses and users of aquatic resources within a takiwa that collectively shape the livelihoods of whanau and hapu. Kai gathering cannot be classified as one activity. Instead, they are part of a complex combination of activities for a range of members in a household. As the survey shows whanau hunt, and tend fruit and vegetable gardens. The effort afforded to gather kai is not a homogenous activity – it is a flexible activity that is undertaken by different people, at different times, targeting different species from different waterbodies using a range of equipment. Collectively this confirms a complex relationship between humans and their environment. It is important that information continues to be collected to increase our understanding of these range of behaviours, including their aspirations.

Health and wellbeing of whanau members - Some informants explained that kaumatua represent valuable human and cultural capital: knowledgeable about kai gathering. While they may be disempowered by modern technologies they are well connected in the hapu and many continue to utilise their knowledge of mahinga kai.

7.4 Conclusion

This report has confirmed that the lakes and coast are integral to the cultural identity of the whanau of Te Arawa. It has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of both kai awa, kai roto and kai moana in the behaviours of whanau and hapu resident in the Rotorua Lakes Area.

The results from the Kaimoana Consumption Survey clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal that kai awa, kai roto and kai moana are vitally important to whanau and hapu in the Rotorua Lakes Area. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

Although the tendency with some contamination studies is to focus on the negative aspects whanau, despite witnessing degradation to valued taonga, articulated a positive vision for the future and we conclude this report with their words.

It would be wonderful to see the lakes come back to its pristine, clean quality (Informant E).

Nice clean, pristine – what I would like to see happen is my grandchildren or even their grandchildren dive in the lake and they can still see the same sparkle I did. And not put your foot on the bottom and then its dustier on the bottom of the lake than it is out of the lake. You know what I mean? (Informant M).

I think I'd like to see them cleaned up so that my kids don't have to go down every summer and read to see if there is a warning before they go swimming and that, you know. Be like when I was younger, used to just go down, you can swim, and an increase in the koura in our new clean lakes because I know they are getting scarcer and scarcer for those who do still go out and try catch them. I mean, I used to have fun using the scoop to catch them but I think the last time I went out it was a waste of time, didn't even get a pot full (Informant G).

But the amount of restorative work required cannot be overestimated –

That is what my wish is, to help the lakes. Because it is our food basket - treat it like that, and if you do, the quality – it's water, and water is sustainable - without water you can't do anything. You cannot even exist. My father said "take the sewage out of the lakes" and he fought through the Treaty of Waitangi to get the Rotorua District Council to take the sewage out. He proved the point, but when he died he said - it took him a lifetime. And it was so difficult because bureaucracy. He said – "You know, I've got mum to thank me. Mum was the one - she would help me. I would sit up late at night writing to the Crown. Nobody would listen to me". …So, that is my wish, that people will think twice about the environment and put more money into saving our lakes (Informant E).

The need for collaboration is recognised as an important strategy for realising the vision –

I see a positive future if all parties can work together and make sure that they are rowing the same boat and going on the same journey, and I mean, yes, if we get back to some of the fundamentals and, you know, and it can be something as little as starting to recycle properly so that those things aren't going into our lakes, simple stuff that if people within their homes start taking ownership for what is going on in their home and the things that they do as a

person and the impact on the environment, then if everybody started doing that, the benefits for Rotorua, we would see them in as short of a time as it has taken to pollute the lake (Informant J).

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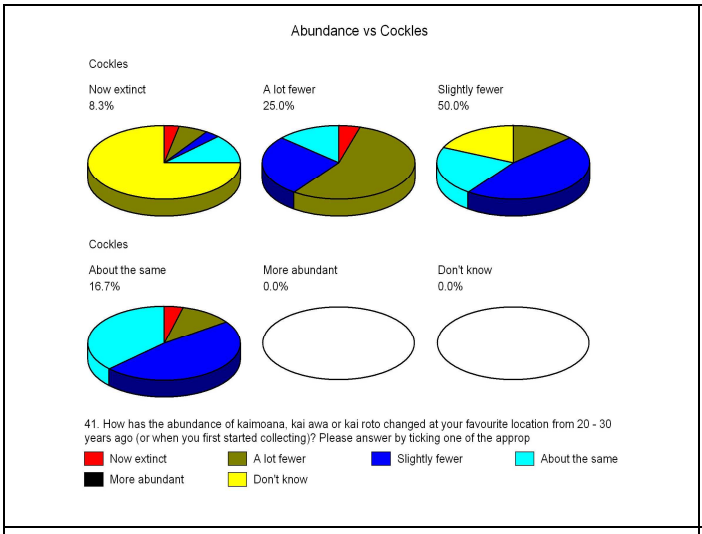
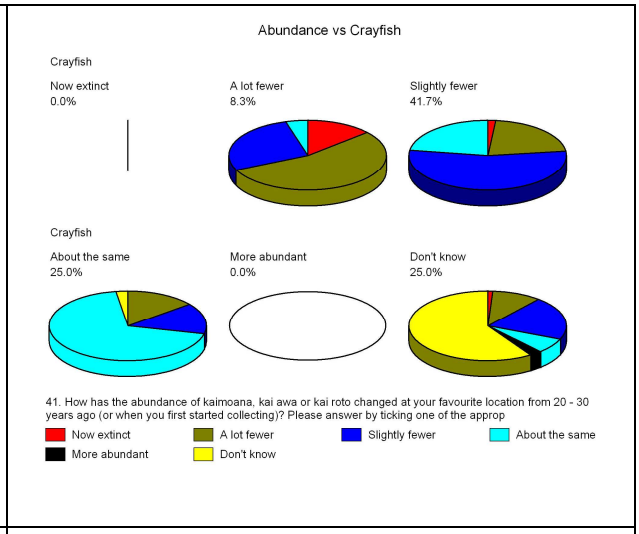
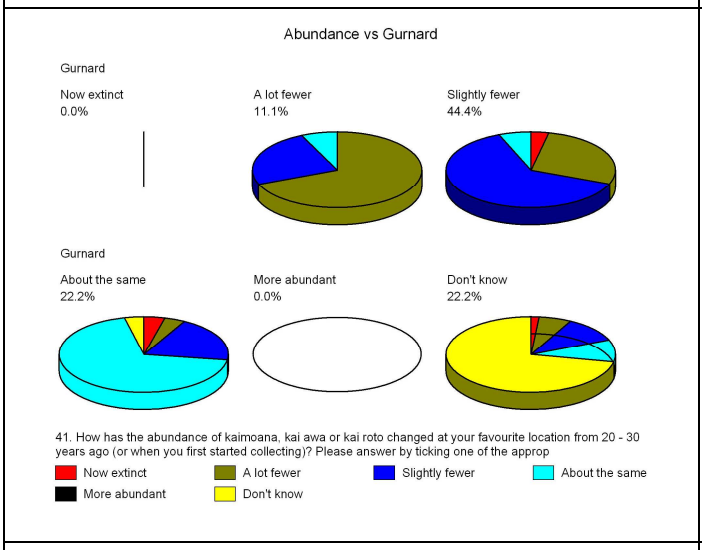
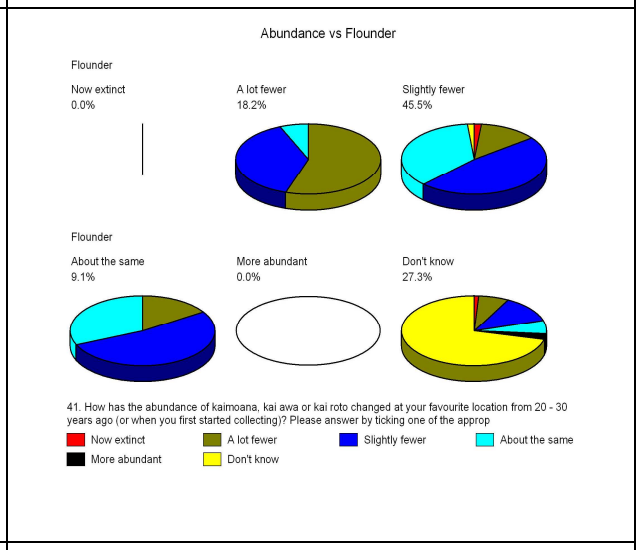
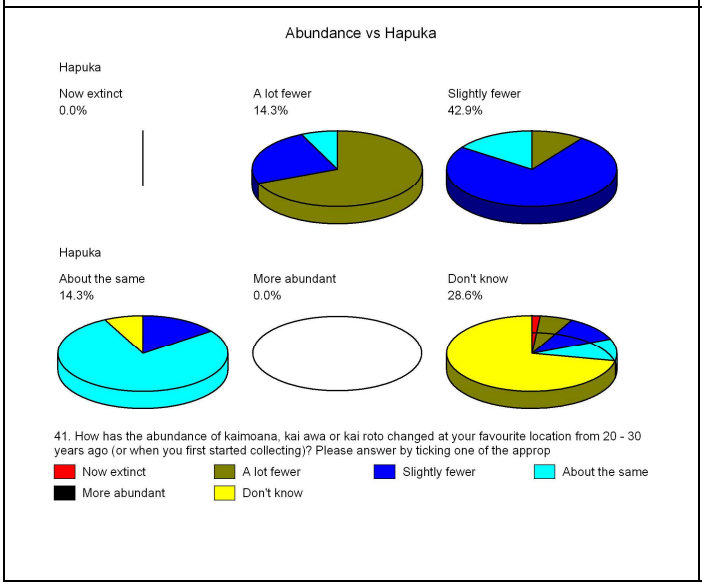
Appendix 1: Perception of changes in abundance of species

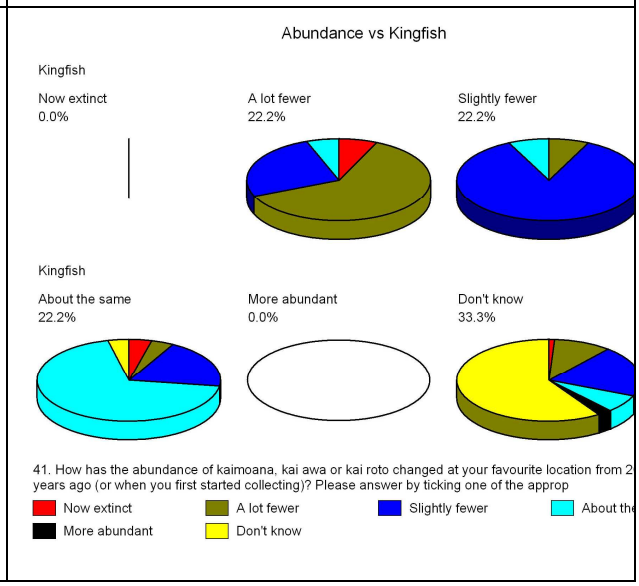


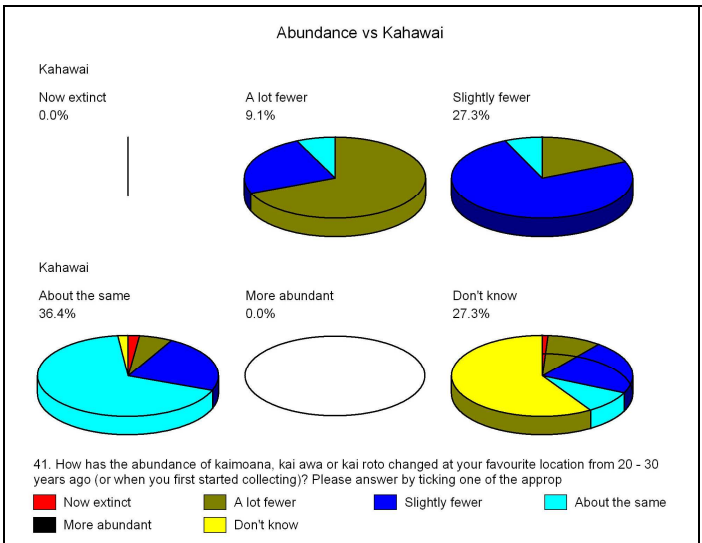


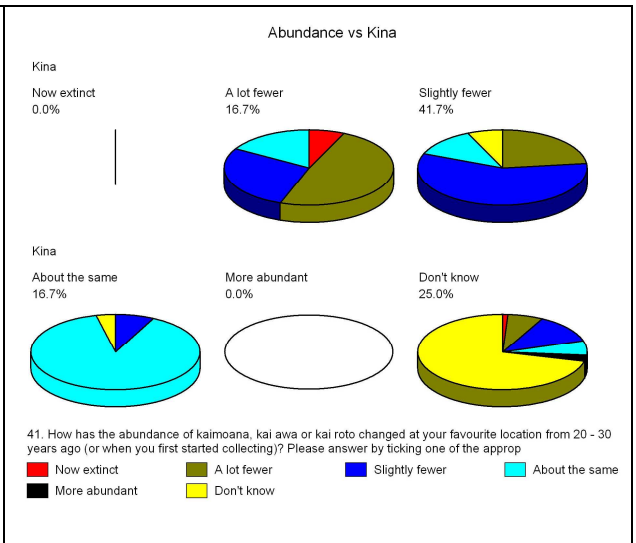


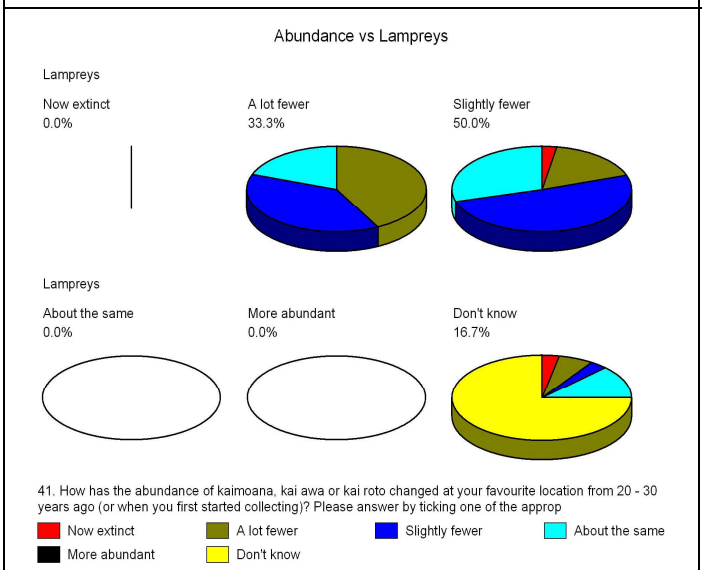


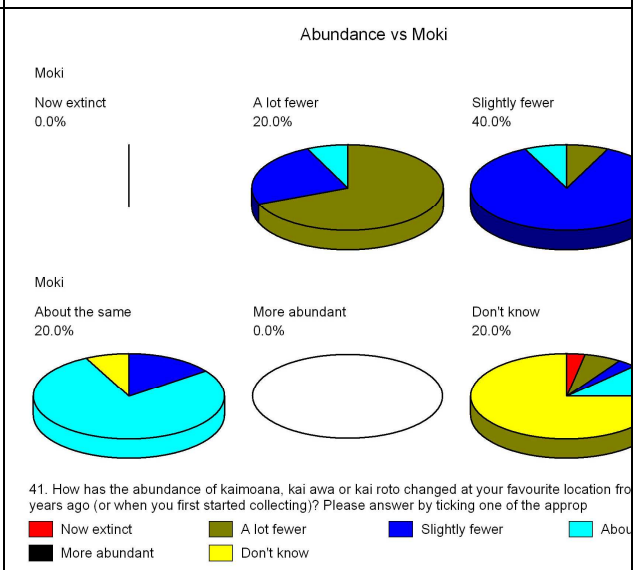


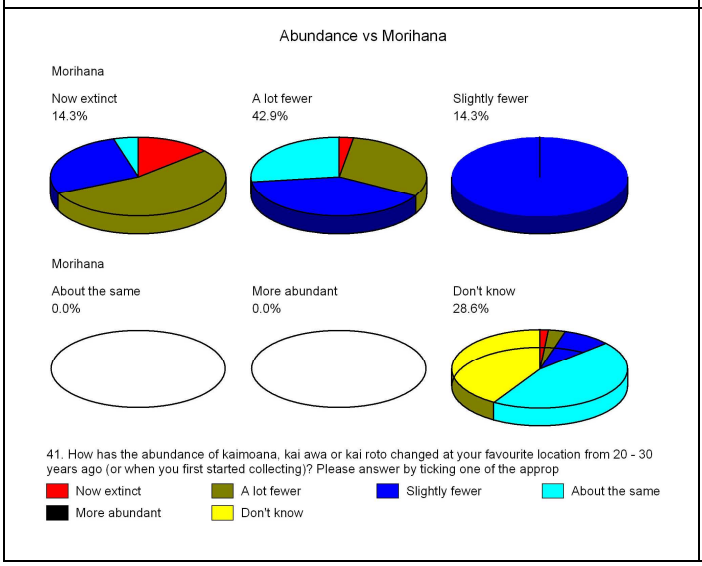


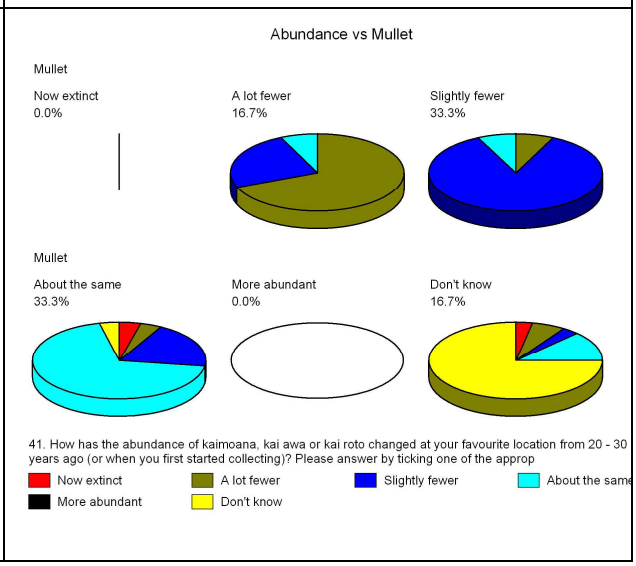

Abundance vs Kahawai
Kahawai
Now extinct
0.0%
A lot fewer
9.1%
Slightly fewer
27.3%
Kahawai
About the same
36.4%
More abundant
0.0%
Don't know
27.3%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

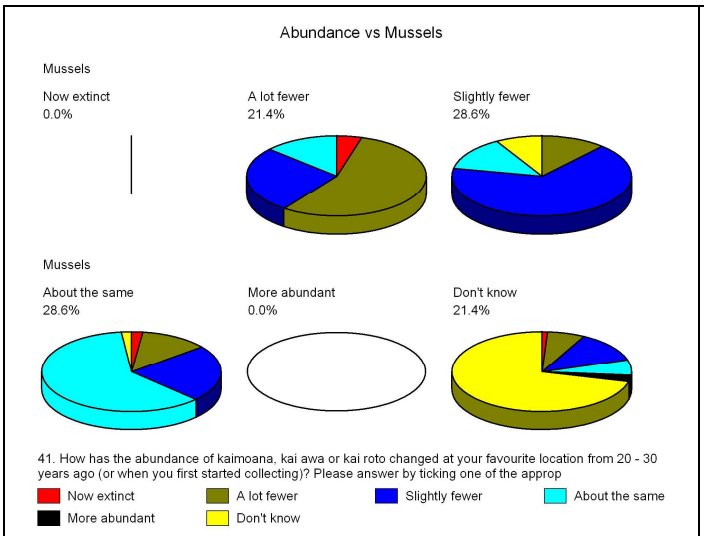

Abundance vs Kina
Kina
Now extinct
0.0%
A lot fewer
16.7%
Slightly fewer
41.7%
Kina
About the same
16.7%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

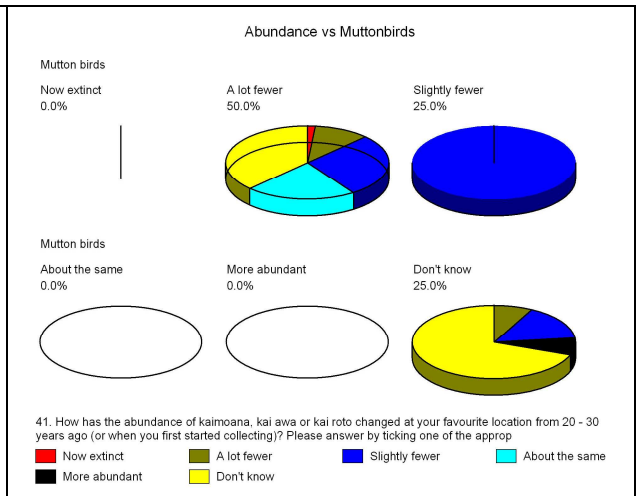

Abundance vs Lampreys
Lampreys
Now extinct
0.0%
A lot fewer
33.3%
Slightly fewer
50.0%
Lampreys
About the same
0.0%
More abundant
0.0%
Don't know
16.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

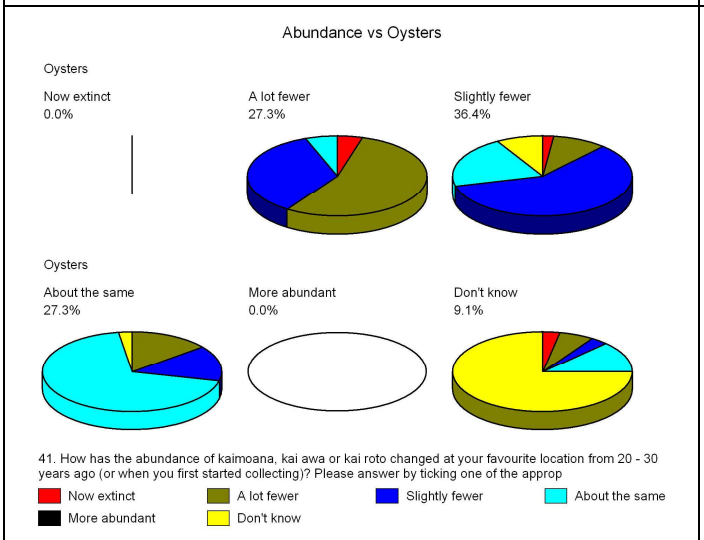

Abundance vs Moki
Moki
Now extinct
0.0%
A lot fewer
20.0%
Slightly fewer
40.0%
Moki
About the same
20.0%
More abundant
0.0%
Don't know
20.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location fro
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

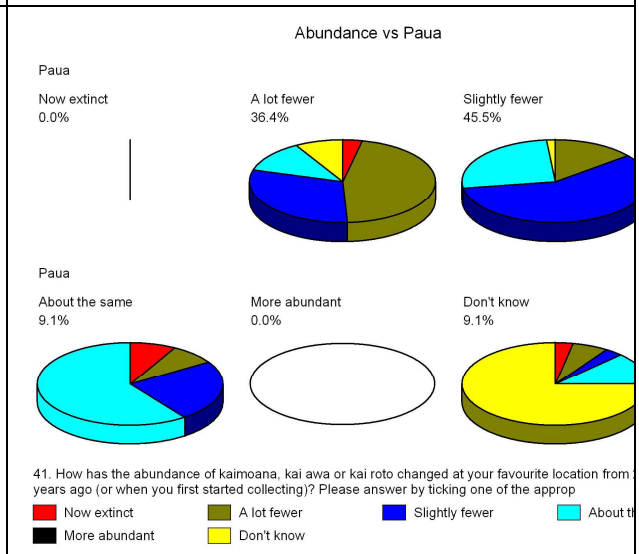

Abundance vs Morihana
Morihana
Now extinct
14.3%
A lot fewer
42.9%
Slightly fewer
14.3%
Morihana
About the same
0.0%
More abundant
0.0%
Don't know
28.6%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

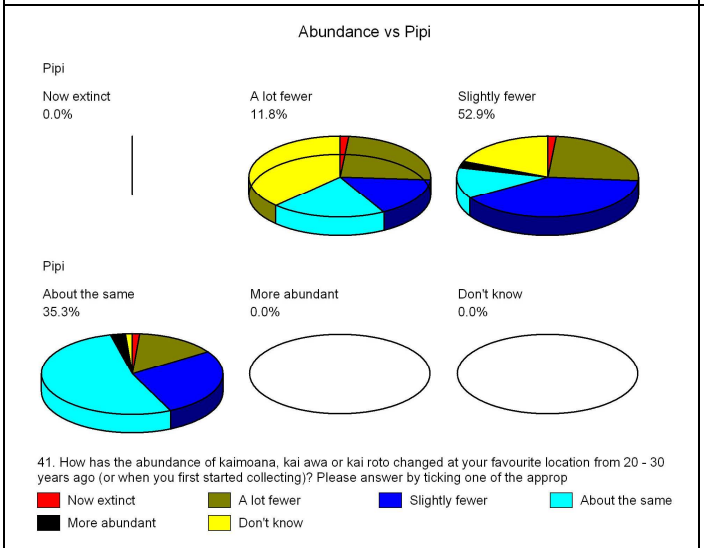

Abundance vs Mullet
Mullet
Now extinct
0.0%
A lot fewer
16.7%
Slightly fewer
33.3%
Mullet
About the same
33.3%
More abundant
0.0%
Don't know
16.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

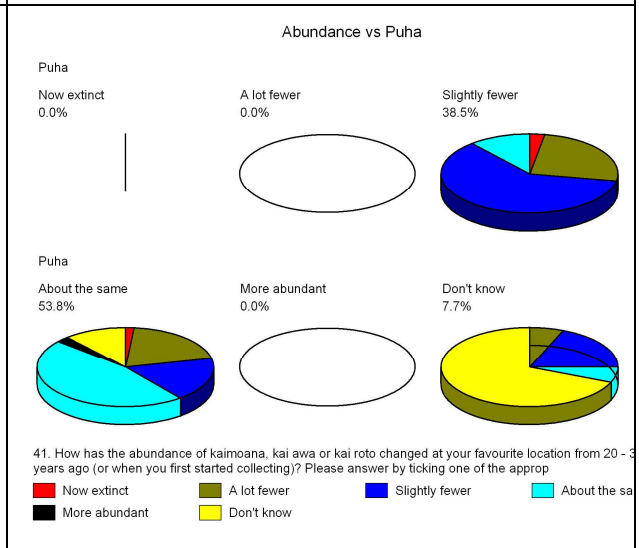

Abundance vs Mussels
Mussels
Now extinct
0.0%
A lot fewer
21.4%
Slightly fewer
28.6%
Mussels
About the same
28.6%
More abundant
0.0%
Don't know
21.4%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Muttonbirds
Mutton birds
Now extinct
0.0%
A lot fewer
50.0%
Slightly fewer
25.0%
Mutton birds
About the same
0.0%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

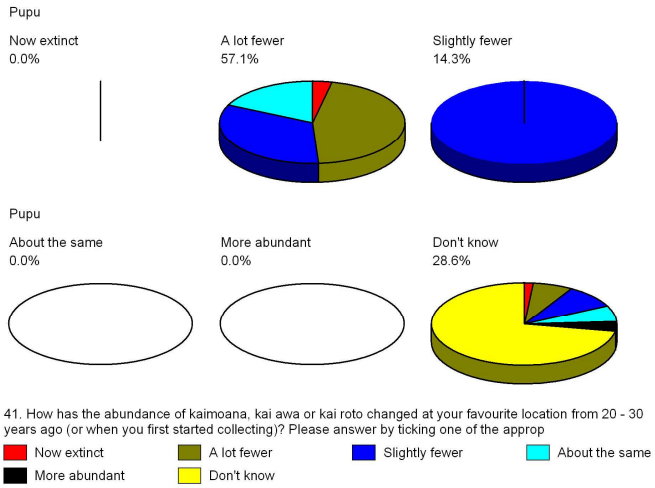

Abundance vs Oysters
Oysters
Now extinct
0.0%
A lot fewer
27.3%
Slightly fewer
36.4%
Oysters
About the same
27.3%
More abundant
0.0%
Don't know
9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Paua
Paua
Now extinct
0.0%
A lot fewer
36.4%
Slightly fewer
45.5%
Paua
About the same
9.1%
More abundant
0.0%
Don't know
9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know


Abundance vs Pipi
Pipi
Now extinct
0.0%
A lot fewer
11.8%
Slightly fewer
52.9%
Pipi
About the same
35.3%
More abundant
0.0%
Don't know
0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Puha
Puha
Now extinct
0.0%
A lot fewer
0.0%
Slightly fewer
38.5%
Puha
About the same
53.8%
More abundant
0.0%
Don't know
7.7%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 -
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

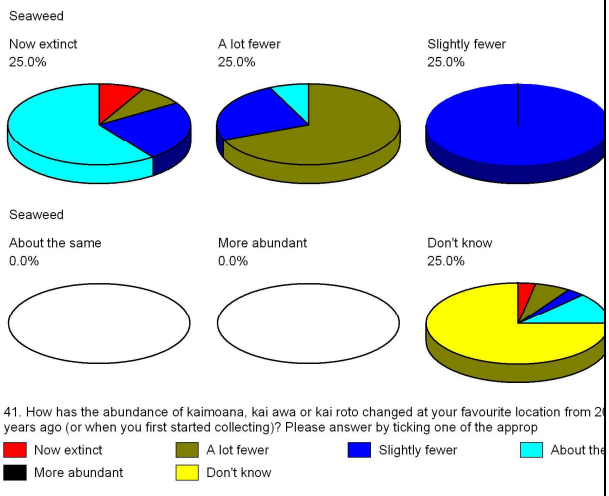
Abundance vs Pupu



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

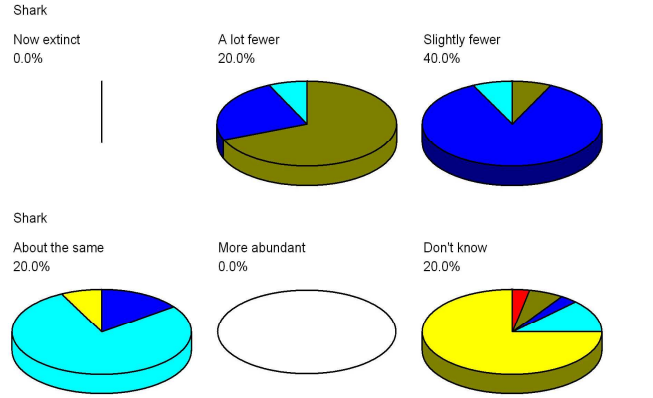
Abundance vs Seaweed



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 2
years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the
More abundant | Don't know

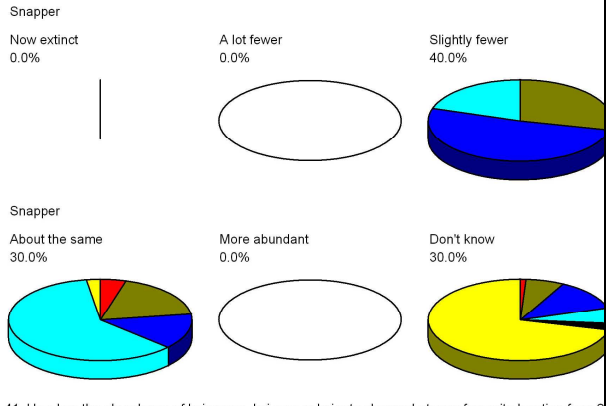
Abundance vs Shark



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

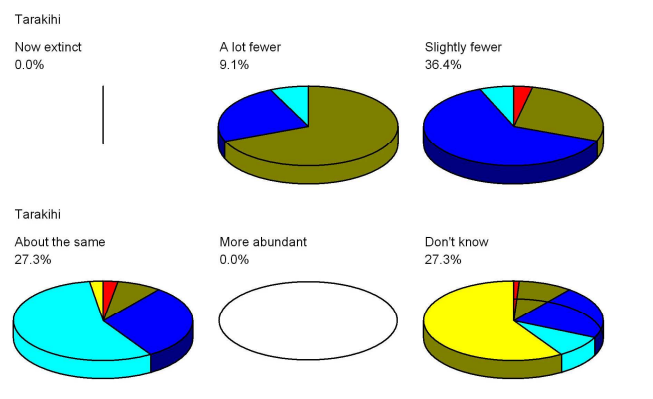
Abundance vs Snapper



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 2
years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About th
More abundant | Don't know

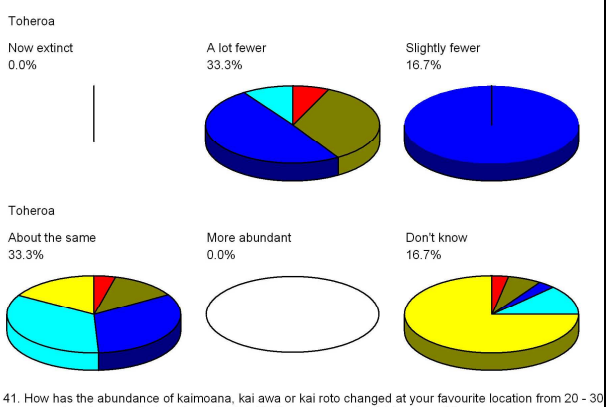
Abundance vs Tarakihi



41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

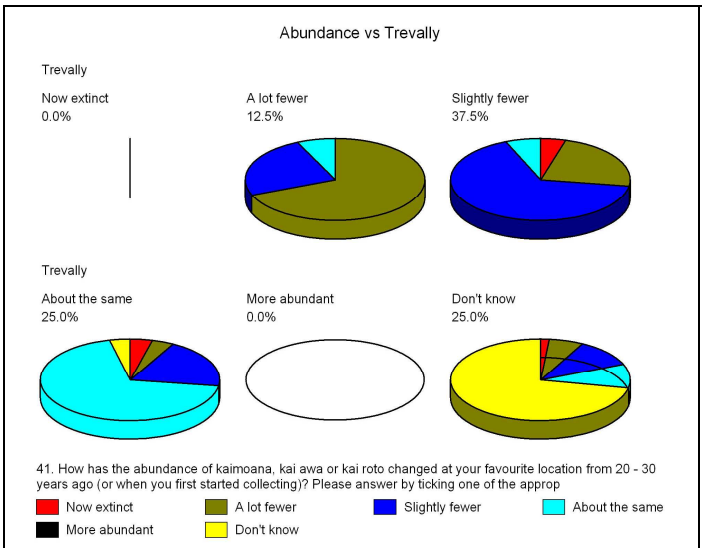
Now extinct | A lot fewer | Slightly fewer | About the same
More abundant | Don't know

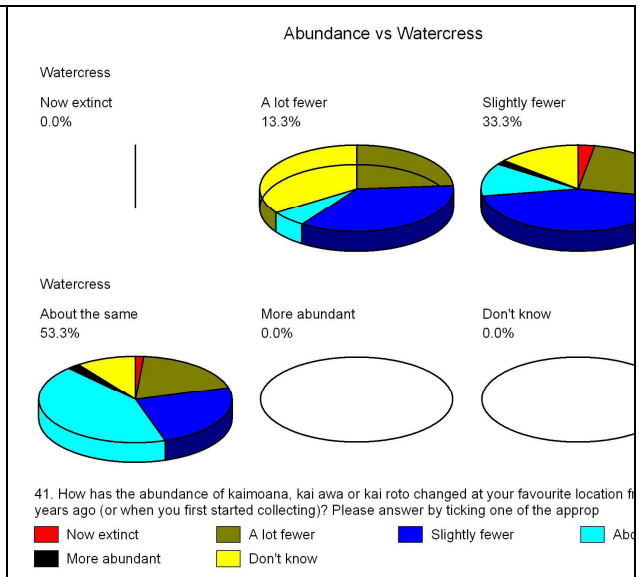
Abundance vs Toheroa

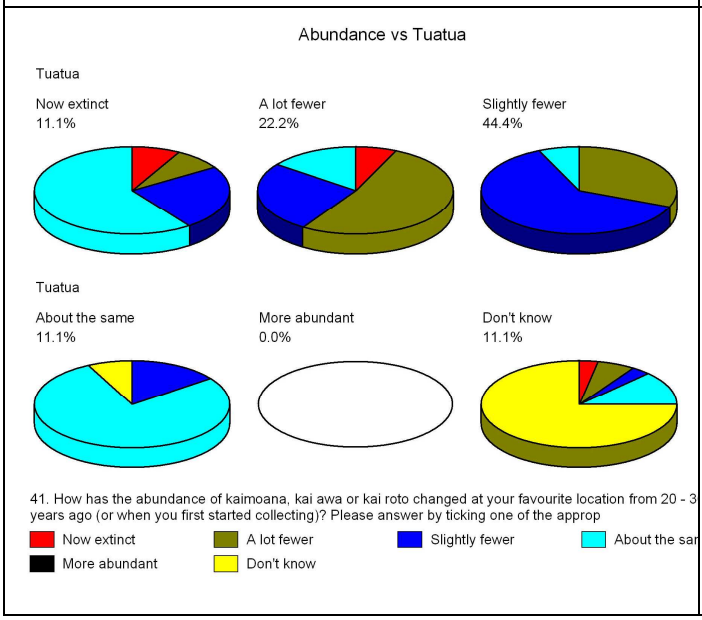


41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp

Now extinct | A lot fewer | Slightly fewer | About the sam
More abundant | Don't know


Abundance vs Trevally
Trevally
Now extinct
0.0%
A lot fewer
12.5%
Slightly fewer
37.5%
Trevally
About the same
25.0%
More abundant
0.0%
Don't know
25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know


Abundance vs Watercress
Watercress
Now extinct
0.0%
A lot fewer
13.3%
Slightly fewer
33.3%
Watercress
About the same
53.3%
More abundant
0.0%
Don't know
0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location fr
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know


Abundance vs Tuatua
Tuatua
Now extinct
11.1%
A lot fewer
22.2%
Slightly fewer
44.4%
Tuatua
About the same
11.1%
More abundant
0.0%
Don't know
11.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 3
years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
More abundant
Don't know

Appendix 2: Sites and species identified by iwi participants (number of respondents)

Kai	Rotorua	Rotoiti	Rotoma	Tarawera	Rotokakahi	Coast (incl Maketu)	Streams (incl Kaituna)	Ohau Channel	TOTAL
Trout	2	3		3	2	1	1	1	**13**
Koura	2	4	1	2				1	**10**
Pipi						7			**7**
Kakahi	1	3						1	**5**
Cockles						5			**5**
Tuatua						5			**5**
Inanga (Whitebait)		3				1	1		**5**
Eel		2				2	1		**5**
Kahawai						5			**5**
Kina						5			**5**
Paua						5			**5**
Mussels						5			**5**
Crayfish						5			**5**
Morihana (goldfish)		1	1	1	1				**4**
Watercress	1	3							**4**
Puha	2	2							**4**
Snapper						4			**4**
Flounder						4			**4**
Tarakihi						4			**4**
Pupu (mudsnail)						2	1		**3**
Kingfish						3			**3**
Moki						3			**3**
Shark						3			**3**
Oysters						3			**3**
Hapuka						2			**2**
Gurnard						2			**2**
Trevally						2			**2**
Seaweed						2			**2**
Lampreys						1			**1**
Mullet						1			**1**

Note: No gathering recorded from lakes Rotomahana, Rerewhakaaitu, Okareka, Okataina, Tikitapu or Rotoehu.